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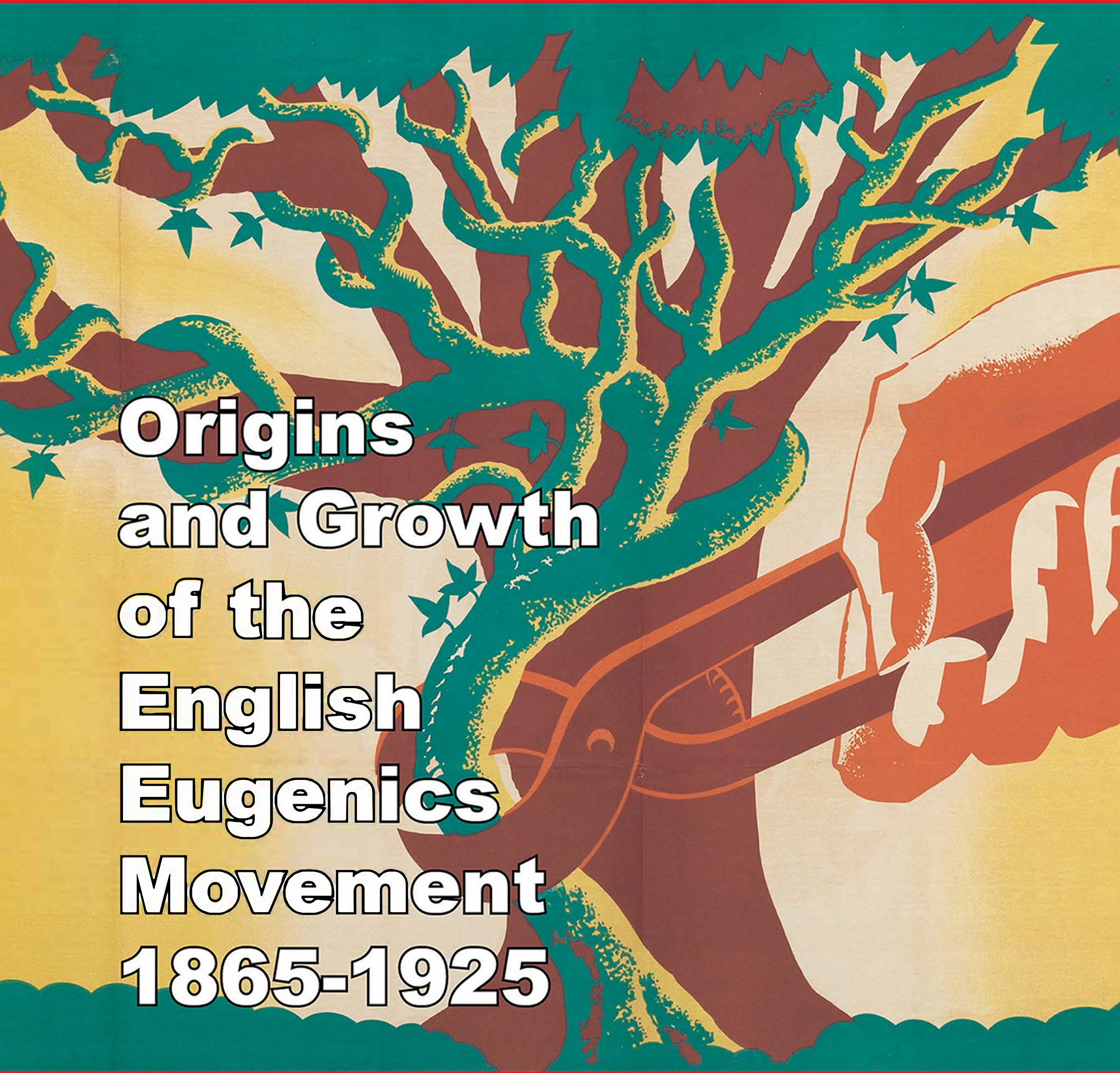

Origins and Growth of the English Eugenics Movement 1865-1925

Lyndsay Andrew Farrall

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Note to readers

This volume contains Lyndsay Farrall's complete doctoral dissertation as submitted in 1969:

> Farrall, Lyndsay Andrew. 1969. "The origins and growth of the English eugenics movement, 1865-1925." PhD, Indiana University.

It is preceded by a new "Foreword," written in 2019 by Cain, and a "Preface," written by Farrall. The Preface first appeared in the 1985 Garland facsimile edition of the dissertation.

The present facsimile is followed by a Vita, which Farrall submitted with the original dissertation. Cain also chose to include as Appendix (2019) items (1) an updated Vita and (2) an updated publications list by the author, both dated August 2019. Both were supplied by Farrall.

The additional 2019 and 1985 elements added to the present volume appear outside the formal contents listing so as to avoid disturbing the original pagination of the dissertation and thereby confusing later citations.

Foreword

Academic writing can seem a closed business. Important work finds itself tucked away in libraries and digital collections accessible only through paid subscriptions and special memberships. This creates a needless divide whereby understanding thrives in some circles, but those without privileged access are kept in ignorance.

Closed knowledge can fuel suspicions of conspiracy or indifference. Truth is, knowledge has never been easier to find than it is today. Yes, much of it stands behind steep paywalls. More suffocates under an avalanche of raw data or gets lost in the blizzard of attention-seeking by other actors. We also must confess that most people today simply fail to show patience enough to persevere in the craft of modern research. If something is not delivered on a plate, or if it cannot be found on the first screen of search engine hits, it's declared "invisible" or "hidden". As they withdraw from the search, alienation finds another happy home.

Lyndsay Farrall's 1969 doctoral dissertation focuses on the history of British eugenics. Sadly, it is almost unknown today. It is an excellent piece of original research. It answers key questions about Francis Galton's patronage in British eugenics, about the development of a "eugenics laboratory" at University College London (UCL), and about the relationship between academic and public campaigns in British eugenics in the first quarter of the twentieth century. For everyone interested in the history of eugenics in London during this period, his work is a hidden treasure.

Farrall's dissertation has been hiding in plain sight. After its original submission to Indiana University, this work was processed using a routine protocol for thousands of projects of its kind: an abstract went to *Dissertation Abstracts International* (number 7014964); an unbound copy went for microfilming to University Microfilms International (UMI); the original went into library storage (call number Q1000.F239). Academics in my discipline learned about it through a 1971 notice in the journal, *Isis*, and from articles about eugenics published in the 1970s and 1980s making reference to it, and in Farrall's (1979) bibliographic review of recent writing on the subject. Farrall's research served as a key source in some of the classic writing on history of eugenics, and it held a strong position in the footnotes of many related studies. In 1985, Garland Publishing reprinted Farrall's dissertation in facsimile as part of their series, History of Hereditarian Thought. Farrall's work struck editors as one of the best dissertations produced on the subject. I agree.

Still, access remained frustratingly hard. Today, in 2019, Farrall (1985, the Garland edition) is long out-of-print, and Farrall (1969, the original dissertation) can be found only in a commercial database available to paying subscribers. Anyone knowing where to look will find the original with ease. "Knowing where to look," is the catch. That simple phrase packs in far too many excluding assumptions for my liking.

In 2019, Farrall (1969) has returned to my list of required reading. Last year, UCL Provost and President Professor Michael Arthur established a "Commission of Inquiry into the History of Eugenics at UCL". Included in the Inquiry's terms of reference were instructions:

1. To examine the historical role of UCL in the study and teaching of eugenics using oral, archived and other necessary pieces of evidence, including, but not limited to a tour of the UCL Estate
2. To examine the current status of the teaching and study of eugenics at UCL
3. To examine the current status of UCL's benefit from any financial instruments linked to the study and teaching of eugenics

The Inquiry's appointment came after numerous efforts to raise awareness about the links between (1) patronage from Sir Francis Galton on the theme of eugenics, and (2) research by academics at the university during the first decades of the twentieth century. There also were reports in the 2010s about some extremely disturbing conferences to discuss the inheritance of intelligence organised by seemingly non-university groups using campus facilities. Ideas associated with those groups required rebuttal and condemnation. "Find out what has been going on," was the informal call to action.

Farrall (1969) speaks directly to the three points above included in the Inquiry's terms of reference. It provides an archivally grounded analysis of eugenics research and eugenics organising by Francis Galton and Karl Pearson in the setting of the University of London and University College. It shows processes of assimilation (making the work part of what universities do) and distancing (asserting independence of control and direction-setting against instruction from the university). It places the activities of Galton, Pearson, and others in their close community, into the context of other eugenics organisations operating in England in the first quarter of the twentieth century, such as the Eugenics Education

Society. For historians, Farrall (1969) proposes the programmes sourced to Galton and Pearson represented an “English Movement” of eugenics: statistical and biometrical in nature and contrasting with groups making using other methodologies and assumptions (e.g., groups that were more Mendelian and pedigree-oriented in their methods). Farrall (1969) is by no means the last word on the early twentieth-century history of eugenics associated with University of London or University College. It doesn’t answer every question we want answering in 2019. Some of its interpretative models reflect historical interests in the 1960s, not 2019. But history builds on the past work of our scholars and investigators. This thesis offers a solid foundation stone. It’s here to build on, not cover over.

I met Lyndsay Farrall, and his wife Stephanie, in May 2019. He very kindly agreed to another facsimile edition of his dissertation. I have the feeling he’ll want me to remind readers of two points. First, I imagine he will want to pay tribute to the work his wife contributed during this project. Second, I imagine he will want to remind readers of the thrill and excitement to be found in original archival research. “People should be encouraged to study this material firsthand,” he told me.

Farrall (1969) will inspire readers. Since its publication, there have been large volumes of archival material collected, digitised, and published around the world. Eugenics has become a subject ripe for a new generation of scholarship, whose questions and concerns will deliver to us further insights and reflections. New questions are coming to the fore to give the subject of eugenics additional importance. With work like Farrall (1969) in hand, we are sure of solid footings. Further building, however, must not stop.

Farrall has written important other work in his professional life. An extended curriculum vitae and bibliography features in the back matter of this volume.

Thanks to UCL Department of Science and Technology Studies (STS) for its support.

Professor Joe Cain
University College London
September 2019

Preface from Farrall (1985)

In the following thesis, the relationships between power and knowledge are taken up in three main ways that continue to demand attention of those of us who seek to understand the nature of science and its role in our societies. First, the knowledge/power relation most easily comprehended is the use of concepts and theories from biology to support a political program and ethical ideal, as was the case with the eugenics movement. Whether eugenics is best understood as an example of middle-class radicalism, the ideology of an emerging professional middle class, or an intellectual defence of capitalism and racism, it is clear that it still holds considerable interest for the examination of how politics and scientific knowledge intersect. A second relationship examined in the thesis is the use of power in the scientific community itself. Whether or not eugenics established itself as a science was a question of considerable importance in the early decades of this century. The way in which power is dispersed within the scientific community continues to be an important topic which still has not been sufficiently researched. Finally, knowledge/power relations are embodied in the very discourse of eugenics. Key concepts such as “evolution,” “selection,” survival of the fittest,” etc., are clearly value-laden and power-laden. The subtle complexities of such discourse need to be examined more closely.

Now, as in 1967, the history of eugenics still seems a good place to investigate further the nature of science and its role in modern society.

Lyndsay Farrall
Deakin University
Victoria, Australia
May 1985

THE ORIGINS AND GROWTH OF THE ENGLISH EUGENICS MOVEMENT 1865-1925

BY

LYNDSAY ANDREW FARRALL

Submitted to the Graduate School in partial fulfillment
of the requirements for the degree Doctor
of Philosophy in the Department of
History and Philosophy of Science
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December, 1969

Accepted by the faculty of the Graduate School, Indiana University, in partial fulfillment of the requirements for the Doctor of Philosophy degree.

Research Committee: ______________________ Chairman

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December 1, 1969

ACKNOWLEDGMENTS

The idea of investigating the English eugenics movement came out of a seminar conducted by Professor Scott Gordon. He has enthusiastically encouraged my study of the movement ever since. Together with my dissertation supervisor, Professor Frederick Churchill, he has read the drafts of this dissertation. To both of them I owe many thanks for their encouragement and for their constructive criticisms which helped to shape this work. The friendship and help of both of them has added joy to what could have been simply an arduous and exacting exercise.

The authorities of University College London and the Eugenics Society offered me every assistance in my researches. I particularly wish to thank Professor Harry Harris, Director of the Galton Laboratory, and Professor Egon Pearson for allowing me part of their valuable time. Miss Margaret Skerl was good enough to guide me through the University College archives. Miss Jean Edmiston helped with the Galton Laboratory archives. The University of London granted me permission to read appropriate sections of the Senate Minutes. Miss Faith Schenk and Mrs. King of the Eugenics Society were very helpful in showing me through the Society's library and records.

I am very grateful to my friends, Hugh and Cherry Collins, John and Jean Neal, and Douglas and Dorothy Steere, all of whom provided accommodation at crucial stages during the writing of the thesis. Cherry Collins and Alex Wearing helped me in wrestling with the theory and practice of modern sampling theory.

Without the financial assistance of Indiana University and the Australian American Educational Foundation this study could not have been undertaken.

My thinking owes much to the many teachers and students with whom I have made contact in the Indiana History and Philosophy of Science Department and the Victorian Studies Program. I would particularly like to acknowledge the help of those who joined with me in discussion over Thursday lunches--Geoffrey Cantor, Roy MacLeod, Steve Straker and Craig Zwerling. Paul Farber helped me clarify my early thoughts about my dissertation and I have spent many happy hours with him discussing the history of biology.

Joyce Chubatow has treated me with greater patience and forbearance than I have deserved in typing from a draft full of inconsistencies and un-American habits of spelling and style. I owe her thanks both for her typing and for assistance in many other ways during my stay in Bloomington.

My wife has helped in more ways than can be easily acknowledged. She not only provided, bountifully and graciously, for my material needs but also gave of her time and energy in acting as research assistant, typist and secretary when her own work was pressing and more interesting. I hope to return the compliment.

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ABBREVIATIONS USED IN TEXT AND NOTES

DNB: *Dictionary of National Biography.*
*Drapers' Report: Report of Karl Pearson to the Worshipful Company of Drapers. (Reports cover the dates indicated in references.)
EES: Eugenics Education Society.
ELLS: *Eugenics Laboratory Lecture Series.*
ELM: *Eugenics Laboratory Memoirs.*
ER: *Eugenics Review.*
*For the Chairman . . .: Document headed "For the Chairman of the University Court: Memorandum on the History, Finances and present Scheme of Reorganization of the Galton and Biometric Laboratories, University of London," by K. Pearson, probably 1932 or 1933.
*GLCM: Galton Laboratory Committee Minutes.
*GLJ: Journal of the Galton Laboratory.
*HBGL: History of the Biometric and Galton Laboratories.
JHB: *Journal of the History of Biology.*
JHI: *Journal of the History of Ideas.*
KP: E. S. Pearson, *Karl Pearson,* Cambridge University Press, 1938.
LLG: K. Pearson, *Life and Letters of Galton,* Cambridge University Press, 1914-30.
QDF: *Questions of the Day and of the Fray.*
QJMS: *Quarterly Journal of Microscopical Science.*
*RC: Report of the Francis Galton Laboratory Committee for Presentation to the Royal Commission on University Education in London (January, 1911).
REES: Annual Report of the Eugenics Education Society.
*RGBL: Document entitled "Report on the Galton and Biometric Laboratories especially with regard to their Income and Expenditure."
SM: Senate Minutes, University of London Senate.
SND: *Studies in National Deterioration.*
THI: *Treasury of Human Inheritance.*

*These are further explained in the section headed *Unpublished Material* in the list of *Works Consulted* at the end of the dissertation.

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I

INTRODUCTION

The English eugenics movement is of interest for a number of reasons. Its history is intimately connected with one of the great controversies of early modern genetics, the clash between the "Mendelian school" and the "Biometric school." It has proved the most durable element of the phenomenon known as "Social Darwinism." Eugenics has been one of the most sustained and vigorous attempts to apply scientific methods in the realms of political theory and social legislation. The scientific revolution wrought in the social and biological sciences by the introduction of sophisticated statistical techniques was largely begun by the men who used statistics to investigate eugenic and allied problems. Moreover, the movement included one of the first English academic institutions to be devoted wholly to post-graduate education and research. Such a movement provides an extremely interesting case study in the relations between science and the wider community in the early twentieth century.

The eugenics movement in England was a complex phenomenon. It involved many people, many ideas, and many events, but was most apparent in two organizations, the Eugenics Education Society and the Francis Galton Laboratory for

National Eugenics.[1] The term "movement" is used, however, to indicate the existence of greater support for eugenics and wider interest than that indicated solely by the activities of the Laboratory and the Society.[2] Although this study will concentrate on the two eugenics organizations as representative of the wider eugenics movement it will also be concerned to investigate more fully the character of that movement, particularly in chapters 2, 7 and 8.

This study was undertaken with the conviction that the social phenomenon known as the eugenics movement was a complex phenomenon. Such a phenomenon can best be understood by a careful examination of the combination of people, ideas, institutions and events which together made it what it was. The task was to unravel the elements of the history of late nineteenth and early twentieth century Britain so that those people, ideas, institutions and events most relevant to the emergence and growth of the eugenics movement could be brought into focus. Accounts of the origins of eugenics have all too often begun and ended by reference to the life and work of Sir Francis Galton.[3] The first part of

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[1]For these two organizations see chapters 4 and 6 below.

[2]The phrase "eugenics movement" was used at least as early as 1911, by James A. Field in "The Progress of Eugenics;" Quarterly Journal of Economics, 26 (1911), p. 3. (Full bibliographical details will be given the first time a work is mentioned and afterwards only if references are widely separated from the first reference.)

[3]See for example chapter II, "European Beginnings" of

this study shows that the story is both more complicated and more interesting.

But the study is not meant simply to tell the story of the eugenics movement in England. Instead, the movement has been investigated with a number of questions in mind. The varied sources of the questions bear witness to the conviction that neither the history of science nor social history can afford the luxury of professional isolation from each other or from other disciplines. Thus the movement is viewed at different times as primarily a socio-political movement or an emerging scientific discipline, or a section of the modern scientific community. At other times it is viewed primarily as the embodiment of an ideology which is examined by way of the writings of its leaders. At still other times the movement is seen as encompassing an incomplete "scientific revolution." The remainder of this Introduction will outline some of these viewpoints and the theses associated with them.

The eugenics movement can be most clearly understood as a socio-political movement when it is represented by the Eugenics Education Society. The analysis of this society

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Mark H. Haller's Eugenics: Hereditarian Attitudes in American Thought (New Brunswick, N.J.; Rutgers University Press; 1963); H.S. Jennings, "Eugenics," Encyclopaedia of the Social Sciences, 5-6 (1937), p. 618. James A. Field's "The Progress of Eugenics" is by far the best account of early discussions of eugenic ideas in England. It is particularly good for the 1860's and 1870's, but less thorough for the period 1875-1900.

presents some puzzling problems. It does not fall easily into the categories of other organizations with which we are familiar in late Victorian and early twentieth century England. It has some affinity and overlap with a number of r kinds of organization: the philanthropic society, t religious sect, the political movement, and the learned society. In their own eyes the eugenists were both radicals and guardians of tradition; radical because they considered themselves to be attacking many hallowed doctrines that had been shown to be wrong by modern science, and guardians of tradition because their aim was to keep Britain mentally and physically ahead of the rest of the world. In this context an analysis of "middle class radicalism" by Frank Parkin proved to be most helpful.[4] In a study described as an "exercise in the sociology of politics" Parkin made an analysis of the social and intellectual backgrounds of people who participated in the British Campaign for Nuclear Disarmament movement. Both the members of the nuclear disarmament movement and of the eugenics movement were drawn largely from the "middle class." Both groups had received above average education. The Eugenics Education Society has been used in this study to test Parkin's thesis,

> that whereas working class radicalism could be said to be geared largely to reforms of an

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[4]See Frank Parkin, Middle Class Radicalism: The Social Basis of the British Campaign for Nuclear Disarmament (Manchester, Manchester University Press, 1968).

> economic or material kind, the radicalism of the middle class is directed mainly to social reforms which are basically moral in content . . . It is argued in fact that the main pay-off for middle class radicals is that of a psychological or emotional kind--in satisfactions derived from expressing personal values in action.[5]

Another aspect of the eugenics movement was the attempt to establish eugenics as a branch of biological science. This was closely related, in England, to the attempt to set up a science of biometry. Galton and Karl Pearson were key figures in both attempts.[6] The Galton Eugenics Laboratory and its associated publications can be viewed as the pioneer disciplinary structure of a new science. The organization of the scientific community has been neglected by historians of science who have been far more interested in the history of ideas.[7] Recently, however, sociologists have been turning their attention to the social organization of science. In his book, The Scientific Community,

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[5]Ibid., p. 2.

[6]Francis Galton (1822-1911), F.R.S., was a cousin of Charles Darwin and a man of wealth able to support himself on an inherited income. He made important contributions to a variety of sciences including meteorology, psychology, statistics and genetics. For further biographical information see D.N.B. and Karl Pearson, The Life, Letters and Labours of Francis Galton (Cambridge, C.U.P., 1914-30, 3 vols.) (hereafter LLG). Karl Pearson (1857-1936), F.R.S., was trained as a mathematician at the University of Cambridge and taught for most of his adult life at University College, London, first as Professor of Applied Mathematics and later as Professor of Eugenics. For further details see D.N.B. and E.S. Pearson, Karl Pearson: An Appreciation of Some Aspects of His Life and Work (Cambridge, C.U.P., 1938) (hereafter, K.P.).

[7]Warren O. Hagstrom, The Scientific Community (New York, Basic Books, 1965), p. 2.

Warren O. Hagstrom has a lengthy discussion on the causes of structural change in the social organization of science. He puts forward the view that the establishment of a new scientific discipline requires,

> leadership, men who are not reluctant to enter into organizational controversy, the development of an ideology that justifies claims on the wider scientific community and facilitates identification with the emerging discipline; and techniques for incorporating the new discipline into organizations that conduct research. . . .[8] [Moreover] The establishment of a new discipline removes the strains that existed when its members were incorporated in other disciplines . . . the autonomy of the scientific community is strengthened with the cessation of claims to the larger community by the formerly deviant specialty. This autonomy is threatened when groups within science seek to have non-scientific groups interfere with the organization of science.[9]

This study uses Hagstrom's account of disciplinary differentiation as a theoretical framework for the study of the attempts to establish eugenics and biometry as new disciplines.

Eugenists claimed to be able to provide a scientific solution for England's social problems. If man controlled his breeding he would surely eliminate the ancient scourges of poverty, disease and crime. Moreover, England would, at the same time, be strengthened for any trial of the nations, whether in war or imperial competition during peace. This eugenic ideology, i.e., the body of ideas forming the basis

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[8] *Ibid.*, p. 209.

[9] *Ibid.*, pp. 221-2.

for the eugenic social system,[10] is examined by reference to the writings of leading eugenists. It is this aspect of the eugenics movement which has been most adequately dealt with by other writers.[11] However, the eugenic writings of Karl Pearson have not been thoroughly analysed.[12] Because of this and because Pearson played such a key role in the development of a eugenic ideology, particular attention has been focussed on his writings. In the realm of ideas, historians must beware of the dangers of representing the thoughts of a whole school by those of one leader. Consequently this study will not focus on Pearson's writings to the exclusion of other eugenists but will attempt to avoid both the error of equating a man with a movement and that of downgrading the quality of an ideological system by ignoring its better spokesmen.

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[10]This is a definition of "ideology" taken from The Penguin Dictionary of English, compiled by G.N. Garmonsway (Baltimore, Penguin Books, 1965).

[11]For the English eugenists see C.P. Blacker, Eugenics: Galton and After (Cambridge, Mass., Harvard U.P., 1952). Mark Haller's Eugenics . . . and Donald K. Pickens' Eugenics and the Progressives (Nashville, Vanderbilt U.P., 1968) concentrate on the American eugenics movement but give good accounts of Galton's ideology and the general outlines of the English eugenics ideology.

[12]Bernard Semmel's Imperialism and Social Reform: English Social-Imperial Thought 1895-1914 (New York, Doubleday Anchor, 1968) contains one chapter devoted to "Social Darwinism: Benjamin Kidd and Karl Pearson." It is a brilliant but narrow view of Pearson's social ideology.

The concept of "scientific revolution," and especially the treatment of that concept in Thomas S. Kuhn's *The Structure of Scientific Revolutions*,[13] has been one of the leading themes in recent historiographical discussions about the history of science in the English speaking world. According to Kuhn, "normal science" is a problem-solving activity carried on in a tradition defined by a "paradigm" which sets the standards for problem-solving activity within that tradition. A scientific revolution then consists of the replacement of an old 'paradigm' by a new one. In the early history of science, however, there may be a number of competing schools. The replacement of these competing schools by one paradigm marks a scientific revolution which brings into being a new science. This particular type of scientific revolution marks the "divide" for any one discipline between "its prehistory as a science and its history proper."[14]

Kuhn emphasizes that the acceptance of a new paradigm is a communal phenomenon. The occurrence of a scientific revolution depends on the acceptance of the new paradigm by the great majority, if not all the members of a given scientific tradition. At this point Kuhn's "scientific revolution" comes into direct contact with the phenomenon which

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[13]Thomas S. Kuhn, *The Structure of Scientific Revolutions* (Chicago, University of Chicago Press, 1962).

[14]Kuhn, *op. cit.*, p. 21.

Hagstrom calls "disciplinary differentiation." But whereas Kuhn has emphasized the new ideas and methods and left largely unexamined the changes in the social structures of a scientific community which accompany a scientific revolution, Hagstrom has examined the sociological phenomena accompanying the emergence of a new scientific discipline and largely left aside the role of new ideas and methods. One of the theses of this study is that Kuhn's historiographical analysis can be wedded with Hagstrom's sociological analysis to give a fuller understanding of the history of modern science.[15] This study provides a case where our understanding of the general nature of science and its practitioners and our understanding of specific parts of modern science--those associated with the English eugenics movement--are each illuminated by the other.

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[15] Hagstrom's work partially supports such a thesis by his acknowledgment that scientific revolutions are often connected with scientific disputes and the emergence of new specialties and disciplines. See especially Hagstrom, *op. cit.*, chapter VI, "The Conduct of Disputes."

II

ORIGINS OF THE EUGENICS MOVEMENT

It has been usual to trace the origins of eugenics to the work and writings of Sir Francis Galton.[1] It seems certain that Galton coined the word "eugenics"[2] but a careful review of British publications between 1860 and 1890 shows that the leading ideas of eugenics had been much discussed by others not only before the founding of the Galton Eugenics Laboratory,[3] but also before the word "eugenics" was invented. The ideology of the English eugenics movement of the early twentieth century should not be seen as the creation of a genius. The movement did owe much to the patronage and enthusiasm of Galton, but the numerous factions and subsidiary contradictions within the movement bear witness to the many people who had already debated both eugenic theory and eugenic admonitions in the years following the publication of Darwin's <u>Origin of Species.</u>[4]

During this period attempts to explain how the theory of natural selection applied to man were legion. A good

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[1]See Chapter I, note 3.

[2]In Francis Galton, <u>Inquiries into Human Faculty</u> (London, Macmillan, 1883), pp. 24-5. See also note 55 below.

[3]Established in 1904. See Chapter IV for further details.

[4]Eugenic ideas had been discussed and possibly practised from ancient times. See, for example, Allen G. Roper, <u>Ancient Eugenics</u> (Oxford, B.H. Blackwell, 1913).

proportion of them were in agreement with the eugenic doctrine that civilized man had largely eliminated the action of natural selection with regard to himself. A second major element in eugenics was an emphasis on hereditarian explanations of social problems and ill health. This view was commonly held before the eugenics movement began and can be found expressed in many books concerned with medical and social problems. The "mid-Victorian Time-Spirit" has been characterized by "belief in science and the scientific method."[5] The eugenics movement capitalized on this spirit by providing both a possible "science of society" and a "scientific" basis for political action and social legislation.

A. Natural Selection and Man

Darwin deliberately avoided a discussion of the application of his theory of evolution to man in The Origin of Species. One short paragraph near the end of his book was the only reference.

> In the distant future I see open fields for far more important researches. Psychology will be based on a new foundation, that of the necessary acquirement of each mental power and capacity by gradation. Light will be thrown on the origin of man and his history.[6]

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[5] Beatrice Webb in her My Apprenticeship, quoted in Walter E. Houghton, The Victorian Frame of Mind 1830-1870 (New Haven, Yale U.P., 1957), p. 11.

[6] Charles Darwin, The Origin of Species (edited by Ernst Mayr, Facsimile of the first edition of 1859, Cambridge, Mass., Harvard U.P., 1966), p. 488.

Darwin's great reticence on this subject was in order to prevent distraction from his main thesis. He had written to A.R. Wallace in 1857 that he would not discuss man.

> I think I shall avoid the whole subject, as so surrounded with prejudices; though I fully admit it is the highest and most interesting problem for the naturalist.[7]

In his excellent survey of the English reactions to Darwin's work, Ellegard notes three main reasons for the separation of "the Darwinian theory's application to Man" from "its application to the lower organic world."

> First, there were some problems, notably those relating to the intellectual and moral spheres, which almost exclusively concerned the human species. Second, the question of man was so closely bound up with religious and other convictions that contemporaries themselves often attempted to set it apart from the problem of evolution in general. And third, the heat and the eagerness with which the question of the theory's application to man was discussed in itself justifies a separate treatment.[8]

The main question raised in the wake of Darwin's work in relation to man was whether man was descended from some animal form usually likened to or identified with the gorilla. Books published by Huxley, Lyell and Darwin in the period,

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[7] Quoted in Alvar Ellegard, Darwin and the General Reader (Göteborg, Gothenburg Studies in English, 1958), p. 293.

[8] Ibid., p. 293.

1863-1871, all dealt with this question which held the centre of stage.[9]

While Huxley and Darwin were gathering their evidence to show "Man's Place in Nature," others were building systems of "social Darwinism" on the assumption that the theory of evolution could be wholeheartedly applied to past, present and future of mankind. Two major reasons can be given to explain this. First, the prestige of science was continually increasing. Second, a number of important social theorists were committed to an evolutionary social theory even before the publication of The Origin of Species. The acceptance of a theory of evolution by outstanding natural scientists helped to give these social theorists added confidence in its use in social science.

Herbert Spencer was the best known of this group of evolutionary social theorists.[10] In two 1852 articles he had

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[9] T. H. Huxley, Evidence as to Man's Place in Nature (Ann Arbor, University of Michigan Press, 1959 reprint of 1863 edition); Charles Lyell, Antiquity of Man (London, J. Murray, 1863); Charles Darwin, The Descent of Man and Selection in Relation to Sex (New York, Modern Library, Reprint of second edition, 1874). For accounts of the debate about man's relation to the animal kingdom see T. D. Stewart, "The Effect of Darwin's Theory of Evolution on Physical Anthropology" in Evolution and Anthropology: A Centennial Appraisal (Washington, D.C., Anthropological Society of Washington, 1959), pp. 11-25 and Loren Eiseley, Darwin's Century (New York, Doubleday Anchor, 1961).

[10] Herbert Spencer (1820-1903), philosopher and social theorist, was the most widely read "thinker" of the mid-nineteenth century. His philosophy is very well outlined in "The Vogue of Spencer," chapter II of Richard Hofstadter, Social Darwinism in American Thought (Boston, Beacon Press, 1955).

attributed human progress to social selection arising from a Malthusian pressure of limited food on the total population. He had also coined the phrase, "survival of the fittest."[11] According to Burrow,

> . . . Maine, McLennan, Spencer, Pitt-Rivers and possibly even Tylor--the founders of the new evolutionary sociology--had all, before 1859, written on or become interested in the subjects which were later to make them famous. Nor was this because they had advance knowledge of Darwin's theory.[12]

Except for Spencer, however, all of these used their evolutionary social theory in pre-history and anthropology rather than in application to the analysis of their own society.

The publication of Darwin's theory did stimulate various writers to try and apply the particular insights of Darwinian evolution to social theory. Darwin, himself, touched on this question in his The Descent of Man in the section, "Natural Selection as Affecting Civilised Nations."

> We civilised men . . . do our utmost to check the process of elimination; we build asylums for the imbecile, the maimed, and the sick; we institute poor-laws; and our medical men exert their utmost skill to save the life of every one to the last moment. . . . Thus the weak members of civilised society propagate their kind. No one

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[11] See his "A Theory of Population, Deduced from the General Law of Animal Fertility," Westminster Review, 57 (1852), pp. 468-501.

[12] J. W. Burrow, Evolution and Society: A Study in Victorian Social Theory (Cambridge, C.U.P., 1966), p. 21.

> who has attended to the breeding of domestic animals will doubt that this must be highly injurious to the race of men.[13]

Before Darwin had published The Descent of Man, W. R. Greg[14] and Francis Galton had independently published articles on the failure of natural selection to apply to man.[15] Greg argued that the middle classes were being discouraged from having families and hence the 'unfittest' were surviving. He painted a picture of a society in which this would not be the case.

> A republic is conceivable in which paupers should be forbidden to propagate; in which all candidates for the proud and solemn privilege of continuing an untainted and perfecting race should be subjected to a pass or a competitive examination, and those only be suffered to transmit their names and families to future generations who had a pure, vigorous, and well-developed constitution to transmit . . .[16]

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[13]Charles Darwin, The Descent of Man . . ., p. 501.

[14]William Rathbone Greg (1809-1881) had turned in his thirties from managing mills to the life of an essayist and later became a high-ranking civil servant. Biographical details are in D.N.B. and John Morley, "W. R. Greg: A Sketch," Critical Miscellanies, pp. 335-362; Vol. VI of The Works of John Morley (London, Macmillan, 1921).

[15][W. R. Greg], "On The Failure of 'Natural Selection' in The Case of Man," Fraser's Magazine (September, 1868). Reprinted in Enigmas of Life (London; Kegan Paul, Trench, Trübner & Co., 1873). Francis Galton, "Hereditary Talent and Character," Macmillan's Magazine, 12 (June & August, 1865), pp. 157-61; 318-27.

[16]Greg, Enigmas of Life, pp. 111-112.

In a similar manner Galton had used the device of a Utopian state putting eugenic principles into practice with an emphasis on the marriage of the ablest men to the ablest women. But whereas there was little reaction to Galton's article, Greg's drew several responses which were duly noted and commented on by Darwin in his Descent of Man.[17]

One stimulus for much of this discussion in the late sixties was an 1864 paper by A. R. Wallace. This paper, "The Origin of Human Races and the Antiquity of Man Deduced from the Theory of Natural Selection,"[18] was an attempt to explain why very little evidence could be found of changes in man's physical make-up compared with other animals. At the same time it attempted to resolve the dispute between the proponents of monogenetic and polygenetic theories of man's origin. Briefly Wallace's argument was that man's evolution had been dependent for a very long time on the action of natural selection on social and mental characteristics rather than physical characteristics. Consequently physical variations had had very little selective value and man's physical characteristics had changed very little during this period of his evolution. The different physical

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[17] For Galton, see Pearson's comments, LLG II, pp. 86-7. For Greg, see Darwin, Descent of Man, p. 501, note 9.

[18] Originally published in Journal of the Anthropological Society of London, 2 (1864), reprinted in Alfred R. Wallace, Contributions to the Theory of Natural Selection (London, Macmillan, 1870), pp. 303-31. Citations are from this latter source.

characteristics of different races were to be explained either by the action of natural selection on physical characteristics before this more advanced stage of evolution had been reached or because of their correlation with various social and mental characteristics which had selective value. Wallace's picture of human evolution was that of a homogeneous proto-human group which was scattered over much of the earth during a period when natural selection acted mostly on physical characteristics. Gradually, however, the different physical 'types' became 'fixed' as mental and social characteristics became more important in the struggle for existence. This change was accompanied by a change from competition between individuals to a competition between groups.

> Tribes in which such mental and moral qualities were predominant, would therefore have an advantage in the struggle for existence over other tribes in which they were less developed, would live and maintain their numbers, while the others would decrease and finally succumb.[19]

Wallace predicted that such inter-group competition together with man's increased mastery of nature would possibly bring about a new human homogeneity in the future as weaker tribes and races perished or became part of the stronger groups.[20]

Wallace's paper was not without contradictions. In one place he appeared to argue that "natural selection" no

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[19] Wallace, Contributions . . ., p. 313.

[20] Ibid., p. 330.

longer acted on man's physical body but only on his mind,

> From the time, therefore, when the social and sympathetic feelings came into active operation, and the intellectual and moral faculties became fairly developed, man would cease to be influenced by 'natural selection' in his physical form and structure . . . [but] . . . his mind would become subject to those very influences from which his body had escaped.[21]

But in a concluding passage, which carried overtones of Darwin's conclusion to the Origin, and which was much quoted,[22] he appeared to argue that 'natural selection' no longer applied to man at all, and, moreover, that man would soon replace natural selection with artificial selection controlled by man.

> Here, then, we see the true grandeur and dignity of man. On this view of his special attributes, we may admit that even those who claim for him a position and an order, a class, or a sub-kingdom by himself, have some reason on their side. He is, indeed, a being apart, since he is not influenced by the great laws which irresistibly modify all other organic beings. Nay more: this victory which he has gained for himself gives him a directing influence over other existences. Man has not only escaped 'natural selection' himself, but he is actually able to take away some of that power from nature, which, before his appearance, she universally exercised. We can anticipate the time when the earth will produce only cultivated plants and domestic animals; when man's

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[21]Ibid., pp. 316-17.

[22]See, for example, John Lubbock, Prehistoric Times as illustrated by Ancient Remains and Manners and Customs of Modern Savages (London, Williams and Morgate, 1869), p. 580.

> selection shall have supplanted 'natural selection;' and when the ocean will be the only domain in which that power can be exerted, which for countless cycles of ages ruled supreme over the earth.[23]

Others did not see such a majestic outcome to the overthrow of the law of 'natural selection.' "The various influences of our social system," argued Greg,

> combine to traverse the righteous and salutary law which God ordained for the preservation of a worthy and improving humanity; and the 'varieties' of man that endure and multiply their likenesses, and mould the features of the coming times, are not the soundest constitutions that can be found among us, nor the most subtle and resourceful minds, nor the most amiable or self-denying tempers, nor the most sagacious judgments, nor even the most imperious and persistent wills, but often the precise reverse--often those emasculated by luxury and those damaged by want, those rendered reckless by squalid poverty, and whose physical and mental energies have been sapped, and whose characters have been grievously impaired, by long indulgence and forestalled desires.[24]

But although civilization had eliminated 'the survival of the fittest' in terms of individual survival it had not destroyed the power of 'natural selection' in inter-group competition.

> The principle of the 'Survival of the Fittest' does not appear to fail in the case of races of men. Here the abler, the stronger, the more advanced, the finer in short, are still the favoured ones; succeed in the competition, exterminate, govern,

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[23]Wallace, Contributions . . ., p. 326.

[24]Greg, Enigmas . . ., pp. 103-4.

> supersede, fight, eat, or work the inferior tribes out of existence.[25]

In their papers both Wallace and Greg had arrived at a conclusion which was implicit in Darwin's theory but which neither they nor Darwin were ever able to express clearly enough to grasp. The conclusion, stripped of its utopian (or alternatively, ominous) prophecies, was that 'natural selection' was essentially a process which applied to populations.[26] Much of the debate which arose from Greg's paper was inconclusive and confused because 'natural selection' had not been defined clearly enough as a population phenomenon.[27]

However, it was not the concept of 'natural selection' which was at the centre of the discussion started by Wallace's paper. Rather it was whether or not natural selection could be applied to man, and if so, how. Both Wallace and Greg had arrived at the conclusion that their civilization prevented the operation of natural selection, but whereas for Greg this would lead to disastrous consequences unless checked, for Wallace it meant a new and potentially glorious stage in human evolution.

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[25] _Ibid.,_ pp. 98-9.

[26] On this point see below, pp. 41-2, 68-9, 75-6.

[27] The history of the various developments in the understanding of "natural selection" as a population phenomenon would make an interesting and important study.

Greg's article provided an explanation for the deterioration of the health and physique of the English nation which was then widely believed to be taking place. This belief in deterioration and degeneration served as a major jumping off point for much discussion during the last third of the nineteenth century. It was supported by theoretical writings such as the book, The Danger of Deterioration of Race from the too Rapid Increase of Great Cities by J. E. Morgan which was published in 1866.[28] Statistical data gathered from the examination of military recruits,[29] figures showing increasing rates of insanity, mental illness, tuberculosis and cancer, and reports that it was virtually impossible to find a family which had survived for three or more generations living in London,[30] all kept the question of the "degeneration" or "deterioration" of the average British town dweller alive in the British periodical press. Greg's article also pointed to one way of stopping this deterioration.

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[28] See also John Henry Bridges, "Influence of Civilization on Health," Fortnightly Review (August, 1869), pp. 140-161.

[29] Henry W. Rumsey, "On a Progressive Physical Degeneracy of Race in The Town Populations of Great Britain," Transactions of the National Association for The Promotion of Social Science (1871), pp. 466-472.

[30] For insanity and mental illness see S. A. K. Strahan, Marriage and Disease; A Study of Heredity and the More Important Family Degenerations (London, Kegan Paul, 1892), pp. 83-5; for tuberculosis, ibid., pp. 194ff; for cancer, ibid., pp. 177-180; for the evidence on London's families, ibid., p. 31, quoting J. Cantlie's Degeneration Among Londoners.

Greg's article was commented on by *The Spectator*, by the *Quarterly Journal of Science*, by E. Ray Lankester in his *On Comparative Longevity in Man and the Lower Animals*, and by Lawson Tait in the *Dublin Quarterly Journal of Medical Science.*[31] In general the commentators felt that Greg had exaggerated his position and that natural selection was still acting upon man. Only *The Spectator* took up the question of what was meant by 'natural selection,' asking whether it was not 'natural' for men to feel sympathy for their neighbours and therefore to attempt to save them from the various scourges of mankind. Lankester[32] made a similar point, emphasizing that social sympathies increased the chances of a group's survival.

> As we have pointed out man is a social animal, and the social virtues, which are urged by some

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[31]In *The Spectator* see "Natural and Supernatural Selection" (Oct. 3, 1868), pp. 1154-5, Greg's reply, "Natural Versus Supernatural Selection" (Oct. 17, 1868), pp. 1220-1, and a further editorial comment, "The Darwinian Jeremiad" (Oct. 17, 1868), pp. 1215-16. In the *Quarterly Journal of Science*, see "Zoology--Animal Morphology and Physiology," Vol. 6 (Jan. 1869), pp. 152-3. E. Ray Lankester, *On Comparative Longevity in Man and the Lower Animals* (London, Macmillan, 1870), footnote 2 on p. 128. Lawson Tait, "Has The Law of Natural Selection by Survival of the Fittest Failed in The Case of Man," *Dublin Quarterly Journal of Medical Science*, 47 (Feb. 1869), pp. 112-113.

[32]E. Ray Lankester (1847-1929), F.R.S., still an undergraduate at Oxford when this essay was written, became in 1874 Professor of Zoology at University College, London, Professor at Oxford in 1891, and finally Director of the Natural History section of the British Museum in 1898. Further details in the *D.N.B.*

> persons as causes of deterioration, are the very strength of the communities in which they have been naturally and necessarily developed.[33]

In 1869 Galton's Hereditary Genius[34] was published and although the overwhelming thrust of the work was to prove that intellectual ability was largely inherited, it contained further support for the idea that human breeding should be artificially controlled. Galton particularly advocated that the vigorous, both mentally and physically, should marry early while the weak should postpone marriage as late as possible. This, he argued, would have "an enormous effect upon the average natural ability of a race."[35] On the whole, the reviews of Galton's work neglected his suggestions about changing marriage patterns and concentrated on his arguments in favour of the hypothesis that intellectual ability was inherited. The reviewers felt that Galton had overemphasized the role of heredity while neglecting the role of family influence and social class. Moreover, most reviewers rejected Galton's contention that worldly success was an adequate measure of intellectual ability. The idea of controlling human breeding was not rejected by everyone, however, and the

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[33]Lankester, op. cit., p. 128.

[34]Francis Galton, Hereditary Genius: An Inquiry into its Laws and Consequences (Cleveland, Meridian Books, 1962, reprint of the second edition of 1892 with an introduction by C. D. Darlington).

[35]Galton, Hereditary Genius, p. 406.

leading article in Nature for December 16, 1869 advocated legislation to bring about the marriage pattern which had been suggested by Galton.

> . . . we may vary the circumstances of life by judicious legislation, so as to multiply the conditions favourable to the development of a higher type; and by the same means we may also encourage . . . the perpetuation of the species by the most exalted individuals for the time being to be found.[36]

Published in 1871, Darwin's Descent of Man contained a wide-ranging discussion of the way in which natural selection was influencing contemporary civilised society. Although he agreed with Wallace, Greg and Galton that civilisation curtailed the action of natural selection,[37] he did not share with Greg and Galton their fears about the deterioration of the British people. For him the advance of civilisation did not depend on natural selection alone.

> With highly civilised nations continued progress depends in a subordinate degree on natural selection; for such nations do not supplant and exterminate one another as do savage tribes. Nevertheless the more intelligent members within the same community will succeed better in the long run than the inferior, and leave a more numerous progeny, and this is a form of natural selection. The more efficient causes of progress seem to consist of a good education during youth whilst the brain is impressible, and of a

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[36]H., "Darwinism and National Life," Nature, 1 (Dec. 16, 1869), p. 183. I have been unable to identify the author of the article.

[37]See earlier quotation on pp. 14-15.

> high standard of excellence, inculcated by the ablest and best men, embodied in the laws, customs and traditions of the nation, and enforced by public opinion. It should, however, be borne in mind, that the enforcement of public opinion depends on our appreciation of the approbation and disapprobation of others; and this appreciation is founded on our sympathy, which it can hardly be doubted was originally developed through natural selection as one of the most important elements of the social instincts.[38]

Darwin's position on this question was complicated. First he pointed out that the action of natural selection had not been completely eliminated. Second he emphasised that the progress of civilization was probably due mainly to social and cultural factors not closely influenced by natural selection. Finally he provided evidence that poorer and weaker people were not multiplying more quickly than the 'fit'[39] and that "civilised man" had been found "wherever compared to be physically stronger than savages."[40] His overall position was far less pessimistic than that of either Greg or Galton. He did not agree that English civilisation faced the crisis outlined by Greg.

Darwin's discussion of the interaction between civilisation and natural selection was overshadowed in the subsequent reviews by the concern shown for the more general question of whether man had evolved by means of natural

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[38] Darwin, Descent of Man, p. 509.

[39] For Darwin's arguments see Descent of Man, pp. 503-7.

[40] Ibid., p. 503.

selection from an ape-like ancestral form. Wallace's 1870 collection of essays, Contributions to The Theory of Natural Selection had not only contained his 1864 paper, "The Origin of Human Races . . .," but also included a new paper entitled "The Limits of Natural Selection as Applied to Man."[41] In this new paper Wallace argued that man's development (i.e., evolution) could only be fully explained with the acknowledgment of the guidance of a superior intelligence.[42]

> A superior intelligence has guided the development of man in a definite direction and for a special purpose, just as man guides the development of many animal and vegetable forms.[43]

This, together with St. George Mivart's contention that natural selection could not account for the evolution of man, caused debate and attention to be centred on Darwin's central arguments about the sufficiency of natural and sexual selection

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[41]See note 18 above. In Wallace's Contributions the title "The Origin of Human Races . . ." was changed to "The Development of Human Races Under The Law of Natural Selection." The new paper, "The Limits of Natural Selection As Applied to Man" followed immediately after the reprinted paper, see pp. 332ff.

[42]In this instance Wallace appears to have taken the analogy of natural selection with artificial selection very seriously. Darwin was to be criticised for doing the same thing in a different context by one of his most acute critics. See John T. Gulick, "Evolution in The Organic World," The Chinese Recorder and Missionary Journal, 16 (July 1885), p. 249. It was all too easy to "personalize," or at least, to see 'natural selection' as a unified 'power' rather than as a technical term describing the outcome of a great number of relations and processes.

[43]Wallace, Contributions, p. 359.

to explain human evolution.[44] Consequently Darwin's counter arguments to Greg and Galton do not seem to have been particularly noticed. Greg reprinted his paper in 1874 in a collection of his essays under the title, Enigmas of Life, and, although he drew attention to the fact that Darwin had commented on his essay he did not attempt to counter any of Darwin's arguments against his own position.

The publication of Darwin's Descent of Man seems to have brought to an end one phase in the public discussion of early 'eugenic' ideas. The 1870's and early 1880's were marked by publications from a number of authors who called for action to prevent people with various afflictions from having children. But none of these publications attempted to meet Darwin's objections to the analyses of Greg and Galton. In particular, Darwin's documentation from censuses to show that poorer and diseased people were not outbreeding "fitter" classes was overlooked as was his evidence that "civilised men" were generally stronger than "savages."

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[44] St. George Mivart (1827-1900), F.R.S., had been a student of Huxley's before teaching biology at St. Mary's Hospital, London. While generally accepting that evolution had occurred he was very critical of Darwin's proposed mechanism. For further detail see Jacob W. Gruber, A Conscience in Conflict: The Life of St. George Jackson Mivart (N.Y., Columbia U. P., 1960) and D.N.B. Mivart's views can best be studied in his review of Darwin's Descent of Man in the Quarterly Review (July, 1871) and in his The Genesis of Species (New York, Appleton 1871, 2nd edition). T. H. Huxley replied to both Wallace and Mivart, denying their claims that natural selection could not have produced man. See "Mr. Darwin's Critics," Contemporary Review (Nov. 1871), 18, pp. 443-476.

Typically, those who advocated what were later to be called "negative eugenic" proposals, were medical men worried by increasing evidence that serious mental and physical disorders were hereditary. Their "negative eugenics" consisted in seeking to prevent the insane, the alcoholic, the deaf-mute, the tuberculous, and often the criminal from marrying and from having children. Sir William Aitken, a distinguished pathologist, asked for legislative action in regard to insanity in his text, The Science and Practice of Medicine, which went through seven revisions between 1858 and 1880.

> Legislative enactments regarding the intermarriage of persons tainted by disordered intellect are greatly to be desired.[45]

Dr. Henry Maudsley, one of the most eminent alienists of the period, felt that only hereditary control would seriously decrease the incidence of mental illness.

> If we are seriously minded to check the increase or lessen the production of insanity, it would be necessary to begin further back, and to lay down rules to prevent the propagation of a disease which is one of the most hereditary of diseases.[46]

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[45]Sir William Aitken (1825-1892), F.R.S., trained in Edinburgh and was later professor of pathology at the army medical school (1860-92). See D.N.B. for further details. The quotation is from The Science and Practice of Medicine (London, Griffin, 1866, 4th edition), Vol. II, p. 490. I have been unable to obtain copies of the other editions of this work to see if it was influenced by contemporary discussions on eugenics.

[46]Henry Maudsley (1835-1918), educated in medicine at University College, London, worked as superintendent of Manchester Lunatic Hospital and editor of the Journal of

The works of two other eminent physicians, Sir Benjamin Ward Richardson's Diseases in Modern Life (1876),[47] and Thomas Smith Clouston's Mental Diseases (1883), are further exemplars of this tradition.[48]

During the 1870's the concept of natural selection was under severe attack.[49] The most important aspect of this attack was based on contemporary theories about heredity.[50] One consequence of this attack was Darwin's increased emphasis on the importance of the inheritance of acquired characters as part of the mechanism of evolution.[51] One implication for 'eugenic' doctrine of this increased emphasis on

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Mental Science and then Professor of Medical Jurisprudence, at University College. See Who Was Who 1916-1928. The quotation is from Henry Maudsley, Responsibility in Mental Disease (New York, Appleton, 1874), p. 275.

[47]Sir Benjamin Ward Richardson (1828-1896), F.R.S., studied at Glasgow and St. Andres before a successful career as a physician in London. See D.N.B.

[48]Sir Thomas Smith Clouston (1840-1915) was educated in medicine at Edinburgh and worked as Superintendent of Asylums. He edited the Journal of Mental Science for a period and also lectured on mental diseases at the University of Edinburgh. See Who Was Who 1897-1916.

[49]See Ellegard, Darwin and The General Reader, chapter XII and Jacob Gruber, op. cit.

[50]See especially Peter Vorzimmer, "Charles Darwin and Blending Inheritance," Isis, 54 (1963), pp. 371-390.

[51]But see Darwin's remark in Preface to Second Edition of Descent of Man that his critics had not taken careful enough notice of the weight he had given "to the inherited effects of use and disuse" in the first edition of the Origin.

Lamarckian mechanisms and of the growth of a neo-Lamarckian school was that heredity could partly be controlled (how much was hotly debated) by the environment. Those who believed in Lamarckian evolution continued to be present in the British eugenics movement long after biologists had generally rejected the theory that acquired characters could be inherited. Clashes between neo-Darwinian and neo-Lamarckian elements in the movement during the early twentieth century[52] were an indication that the biological commitment of some eugenists was to the mainstream of biology in the 1870's and 1880's rather than to that of their own day.

1870-1890 can generally be viewed as the period of the ascendency of neo-Lamarckism.[53] The number of biologists committed to natural selection as the basic mechanism in evolution were few, and the number working at the difficult theoretical problem of finding a successful combination of Darwin's theory of natural selection, his new species concept and a suitable theory of heredity were even fewer. By

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[52]The clash over alcoholism described in chapter VII below is a good example.

[53]See, for example, the criticisms of Darwinism discussed by A. R. Wallace in chapter 14, "Fundamental Problems in Relation to Variation and Heredity" in his Darwinism (London, Macmillan, 1923, 3rd edition). Also Edward J. Pfeifer, "The Genesis of American neo-Lamarckism," Isis, 56 (1965), pp. 156-167, and Yves Delage, L'Hérédité et les Grands Problèmes de la Biologie Générale (Paris, Reinwald, 1904, 2nd edition).

1890, however, Weismann's germ-plasm theory[54] was in the process of refuting the theory of the inheritance of acquired characters and neo-Darwinian schools of thought were of importance in biological and evolutionary theory. Discussion during this period (1870-1890) about the way in which human marriage and breeding patterns affected the future evolution of man was neither completely neo-Lamarckian nor completely neo-Darwinian, for while the medical writings of the seventies and eighties, which were quoted above, were generally Lamarckian, Galton's writings continued to be anti-Lamarckian.

The word, "eugenics," was used for the first time by Galton in 1886 in his Inquiries Into Human Faculty and Its Development.[55] It caught the attention of enough people to

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[54]For Weismann's writings see August Weismann, Essays Upon Heredity (2 vols.) (Oxford, Clarendon Press, 1891). For an outline of Weismann's intellectual biography see F. B. Churchill, "August Weismann and A Break From Tradition," Journal of The History of Biology, 1 (1968), pp. 91-112.

[55]Galton introduced the word "eugenics" with the following comment,

> We greatly want a brief word to express the science of improving stock, which is by no means confined to questions of judicious mating, but which, especially in the case of man, takes cognizance of all influences that tend in however remote a degree to give to the more suitable races or strains of blood a better chance of prevailing speedily over the less suitable than they otherwise would have had. The word eugenics would sufficiently express the idea; it is at least a neater word and a more generalized one than viriculture, which I once ventured to use.

Francis Galton, Inquiries into Human Faculty, pp. 24-5. Galton's neologism was constructed by using Greek roots.

be used and to become well accepted by 1890.[56] The word was used by Romanes in early 1884 in a review of Galton's Life History Album, which was published in Nature.[57] The word was further used, and the concepts it represented discussed in an 1885 book, Scientific Meliorism and the Pursuit of Happiness,[58] and in articles in the Fortnightly Review in 1886[59] and the Athenaeum in 1887.[60] The most interesting of these items is Jane Hume Clapperton's Scientific Meliorism. This was the author's first book and an ambitious attempt to write a complete social philosophy for the times.[61] Unfortunately, it seems to have been largely neglected by the reviewers and critics, for their response to a very competent presentation of views on such social problems as poverty, public education, the rights of women, parliamentary reform, the treatment of

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[56]For some examples see the Oxford English Dictionary, entries under "eugenics" and related words.

[57]George J. Romanes, "Family Records," Nature, 29 (Jan. 17, 1884), pp. 257-8.

[58]Jane Hume Clapperton, Scientific Meliorism and the Pursuit of Happiness (London, Kegan Paul, 1885). For uses see Index.

[59]Grant Allen, "Falling in Love," Fortnightly Review, 1st October, 1886, p. 458.

[60]In both 5th November and 31st December issues; p. 607 and p. 897.

[61]I have been unable to trace any biographical information about Clapperton. She later wrote two utopian novels, Margaret Dunmore or a Socialist Home (London, Swan Sonnenschein, 1888) and A Vision of the Future (London, Swan Sonnenschein, 1904).

criminals and the role of the state would have been most interesting. Miss Clapperton presented a view of man's historical evolution which divided it into three main epochs. The first epoch was that during which a pure Darwinian natural selection acted on man. In the second epoch, a "sympathetic selection" derived from Wallace's writings about man produced the "survival of the unfit" which had been vividly depicted by Greg. The third and future epoch would see "rational, intelligent selection" guide mankind to a state of maximum happiness.

> In the savage epoch of our history, the force of natural selection produced survival of the fittest. From that epoch we have long since passed into a humanitarian semi-civilized epoch, in which sympathetic selection produces a miserable state of indiscriminate survival; and now we wait the solution of the above problem, to pass onwards to a rational, wholly civilized epoch when intelligent selection will systematically secure the birth of the morally, intellectually, and physically fit.[62]

To Galton's and Greg's Utopian visions, Clapperton had added her own. Clapperton called Galton "our most advanced teacher in the field of eugenics"[63] and defined "eugenics" as "the

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[62] Clapperton, op. cit., p. 336. This paragraph repeats some of the ideas that George Arthur Gaskell, a friend of Clapperton's, had written about in letters to Darwin which were published at the end of this chapter, see Ibid., pp. 337-342. Gaskell, an author of works on ancient religion, printed these letters together with a paper that had been rejected by both Nature and the Eugenics Review in A New Theory of Heredity (London, C. W. Daniel, 1931).

[63] Clapperton, op. cit., p. 335.

improvement of the human stock."[64] However, she disagreed with Galton's suggestion that altering the age of marriage would be sufficient to bring about improvement of the race. This she held to be socially cruel as it unnecessarily condemned some to celibacy and others to postponing marriage well past the time they would freely choose. Galton "ignores," she held,

> the fundamental principle of social life, viz. that the happiness of all at all times should be the aim and object of rational man.[65]

She suggested that methods of birth control were the proper way to gain eugenic ends, and in this way no one need postpone marriage either temporarily or permanently. In certain cases she suggested that sterilization might also be a suitable means to attain their common goals.[66] It should finally be noted that whereas Galton's social philosophy was essentially that of the conservative and a conservationist, Clapperton's was that of a communalist and a positivist.[67]

At this time others wrote about the problems which worried Galton and Clapperton without using the word "eugenics."

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[64] Ibid., p. 332.

[65] Ibid., p. 333.

[66] Ibid., p. 373. Sterilization was suggested for habitual criminals whom she regarded as ill and un-reformable.

[67] It is interesting to note that Miss Clapperton believed Lester Ward's Dynamic Sociology to be the most important book on social theory of the period. For Ward's ideas, see Hofstadter, Social Darwinism . . . , chapter IV.

Their solution to the problems was likewise the control of human marriage and procreation according to Darwinian principles. In the Presidential address to the Anthropological Section of the British Association for the Advancement of Science in 1886, Sir George Campbell[68] advocated the scientific breeding of man,

> I have been long in coming to the main object of this address, viz. to recommend the systematic and scientific cultivation of man--what I may call 'homi-culture,' in the same sense as 'oyster-culture'--and that with a view both to physical and mental qualities. . . .[69]
>
> Then as regards man-breeding. Probably we have enough physiological knowledge to effect a vast improvement in the pairings of individuals of the same or allied races if we could only apply that knowledge to make fitting marriages, instead of giving way to foolish ideas about love and tastes of young people.[70]

This address brought forth a witty reply from the novelist and popular scientific writer, Grant Allen. The reply entitled "Falling in Love"[71] maintained that the "inherited instinct" which prompted young people to fall in love was a

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[68]Sir George Campbell (1824-1892) spent his working life as a civil servant in the Indian administration. He wrote a number of works on the ethnology and anthropology of India. On his retirement in 1874 he had reached the rank of Lieutenant Governor of Bengal. See D.N.B.

[69]George Campbell, "Presidential Address to Anthropological Section, British Association," Nature (Sept. 9, 1886), p. 456.

[70]Ibid., p. 457.

[71]Grant Allen (1848-1899) of Canadian birth, was educated at Oxford University. He spent four years in Jamaica

result of natural selection and a far superior mechanism to any artificial means of selection which could be put in its place. In the previous year Allen had published an article "The Recipe for Genius"[72] which was to some extent a parody on Galton's Hereditary Genius. In his attack on Campbell's ideas he called them "eugenic" and so gave further evidence of his familiarity with Galton's writings. Allen published at least two further articles, "Plain Words on the Woman Question" and "The Girl of the Future"[73] in which he wrote of his concern that the "quality" of humanity should not decline from a poor understanding of the way in which evolutionary principles applied to man. He inveighed against

> our existing marriage system . . . [which] makes practically no provision for what Mr. Galton aptly terms eugenics--that is to say, a systematic endeavour towards the betterment of the race by the deliberate selection of the best possible sires, and their union for reproductive purposes with the best possible mothers.[74]

Allen's proposed eugenic solution was to educate and emancipate women so that they would understand how to select suitable fathers for their children. Allen suggested that this

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teaching before returning to England in 1876 to take up a full-time career as author of essays for periodicals (especially popular science) and novels. The article "Falling in Love" appeared in Fortnightly Review, 46 (1886), pp. 452-62.

72 Grant Allen, "The Recipe for Genius," Cornhill (Oct. 1885), pp. 406-15.

73 Grant Allen, "Plain Words on the Woman Question," Fortnightly Review (Oct. 1889), 46, pp. 448-58; "The Girl of the Future," Universal Review, 7 (May 1890), pp. 49-64.

74 Allen, "The Girl of the Future," p. 52.

"Girl of the Future" would reject monogamy and have children by different fathers in her quest for the best possible children. This suggestion drew the attacks of critics including A. R. Wallace who described it as "detestable."[75]

The period from 1889 until 1892 saw the publication of a great variety of books and articles essentially supporting one or other of the eugenic proposals outlined. Galton's Natural Inheritance was published in 1889,[76] the same year as some of Grant Allen's essays and a work entitled Marriage and Heredity by J. F. Nisbet.[77] In 1890 articles by Professor J. B. Haycraft and A. R. Wallace were published on the subject together with a pamphlet of George A. Gaskell's.[78] In 1891 Havelock Ellis' The Criminal and Sir Herbert Maxwell's "Civilization" used eugenic arguments.[79]

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[75] A. R. Wallace, "Human Selection," Fortnightly Review (Sept. 1890), p. 329.

[76] Francis Galton, Natural Inheritance (London, Macmillan, 1889).

[77] J. F. Nisbet, Marriage and Heredity: A View of Psychological Evolution (London, Ward and Downey, 1889).

[78] J. B. Haycraft, "Importance of Ideas of Health, Beauty, etc. towards Race Progress," Edinburgh Health Society, Health Lecture 11, pp. 17-32 (1890); A. R. Wallace, "Human Selection;" G. A. Gaskell, Social Control of the Birth-Rate and Endowment of Mothers (London, 1890).

[79] Havelock Ellis, The Criminal (London, Walter Scott, 1890), Herbert Eustace Maxwell, "Civilization," Blackwood's Magazine, 149 (April, 1891), pp. 546-8.

And in 1892 Karl Pearson's The Grammar of Science served as a more philosophical justification for the kind of eugenic proposals exemplified in the work, Marriage and Disease by Dr. Samuel Strahan.[80]

By the early 1890's, the central doctrine of the eugenics ideology had become commonplace not only to the readers of the English periodical press, but also to those who were professionally concerned with the social problems of poverty, crime and ill health. It had been widely publicised that a number of eminent scientists, writers and medical men seriously believed that the principles of Darwinian evolution could be applied to man in order to improve the health and other qualities of future generations. But the perceptive reader would also have observed widely differing viewpoints among those who accepted this basic doctrine. Not even the biological community had one understanding of 'evolution' or 'natural selection' or 'heredity;' how then could such a wide-ranging group as those who wrote on 'eugenics' be expected to have identical understandings of what eugenics stood for? "The same individual mind," wrote Karl Pearson, "unconscious of its own want of logical consistency, will often exhibit [its] age in microcosm."[81] In a similar

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[80]Karl Pearson, The Grammar of Science (London, Walter Scott, 1892), pp. 32-6 especially; S. A. K. Strahan, Marriage and Disease: A Study of Heredity and the More Important Family Degenerations (London, Kegan Paul, 1892).

[81]Karl Pearson, The Grammar of Science, p. 4.

manner, the same basic ideology of eugenics neglectful of a need for logical consistency reflected many aspects of the late Victorian age in microcosm.

B. Heredity in Theory and in Practice

Between 1870 and 1890 many theories of heredity were devised.[82] Apart from these theoretical formulations the main biological work on heredity was the collection of facts and attempts to generalise about how characters were passed from one generation to another. Theories and generalisations aside, a great many men were convinced that all aspects of the human character, physical, mental and moral, were inherited from generation to generation. This underlying belief provided strong support for hereditarian explanations of physical disease, mental aberrations and moral turpitude.

Darwin had understood that the nature of heredity had important consequences for his theory of evolution. He had been so concerned with this problem that he had put forward the theory of pangenesis to explain heredity.[83] The theory

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[82] Among the major theories were those of Darwin, Galton, Weismann, Nägeli, Spencer and de Vries. For accounts of these theories see Robert C. Olby, Origins of Mendelism, (New York, Schocken, 1966), E. S. Russell, The Interpretation of Development and Heredity: A Study in Biological Method (Oxford, O.U.P., 1930) and Yves Delage, L'Hérédité et les Grands Problèmes de la Biologie Générale.

[83] See Charles Darwin, The Variation of Animals and Plants Under Domestication (New York, Appleton, 1875, 2nd edition) chapter 27. The pangenesis theory held that the ova and sperms were made up of small particles derived from all parts of the adult body.

made allowance for Lamarckian mechanisms of inheritance and evolution. Darwin did this in order to solve the problem of how useful variations could survive from one generation to the next without being swamped by the blending effects of the currently-held theories of inheritance.[84] Galton had immediately objected to the Lamarckian elements in Darwin's new theory and had carried out experiments in order to disprove it.[85] However, it was not until August Weismann had published his anti-Lamarckian germ-plasm theory[86] that a large group of biologists were won over to a view that rejected the inheritance of acquired characters. This occurred so rapidly that by 1895, Haycraft could write of a "neo-Darwinian" school of biologists led by Galton and Weismann, which rejected Lamarck's views on inheritance. He claimed that the new school had completely ousted the old views.

> . . . those scientific men who have given much attention to the study of life in its widest manifestations in plants, in animals, and in man himself, have with great show of unanimity, come to a conclusion which appears to indicate that, although we may improve an individual during his or her lifetime, both in physical capacity or mental and moral power, this improvement is not transmitted in appreciable degree to their offspring, who have therefore to begin again in their lives just where the parents began in theirs. This teaching strongly indicates that parents

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[84] Vorzimmer, op. cit.

[85] See LLG, II, pp. 156-184.

[86] August Weismann, The Germ Plasm, A Theory of Heredity (London, W. Scott, 1893), originally in German in 1892.

> cannot pass on to their offspring in any but the most limited degree the improvements they themselves have made in their own physical or mental condition, in the same way that they can bequeath to them the purses they have filled.[87]

The overthrow of Lamarckian mechanisms of heredity by Weismann and Galton was accompanied by a new awareness that Darwin's understanding of 'species' and 'natural selection' carried an implicit population dimension which had never been fully investigated. Species were to be understood as ever changing populations of inter-breeding members. Hence natural selection has to be understood as "a population phenomenon, a shifting of statistical averages owing to differential reproduction."[88] Galton, Weldon, Pearson and Gulick began to provide some of the insights and statistical tools necessary for measuring changes in biological populations.[89] Pearson, Weldon and Galton developed their

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[87]John Berry Haycraft (d.-1922) D.Sc., F.R.S.E., was Professor of Physiology at University College, Cardiff. He had previously been Interim Professor of Physiology at the University of Edinburgh. For biographical information see Who Was Who 1916-1928. The reference to a "neo-Darwinian school" is in his Darwinism and Race Progress (London, Swan Sonnenschein, 1895), p. 28. The quotation is from the same work, p. 16.

[88]Ernst Mayr, "Agassiz, Darwin and Evolution," Harvard Library Bulletin, 13 (1959), p. 191, "Darwin and the Evolutionary Theory in Biology," in Evolution and Anthropology: A Centennial Appraisal, pp. 1-10.

[89]Galton, Weldon and Pearson in their endeavour to apply statistical techniques to biology. Gulick developed a concept akin to the later idea of "genetic drift" as found in Sewall Wright's papers. See L. Farrall, "Evolutionary Thought in the Writings of John T. Gulick" (unpublished paper).
For biographical details of Weldon see chapter III below. John Thomas Gulick (1832-1928) was born in the Hawaiian

'biometrical school' in the 1890's as an outgrowth of their understanding that population biology needed statistical tools and techniques.[90] The biometrical school saw itself as establishing a true Darwinism at the expense of a popular Lamarckism.

The decline of Lamarckism gave those eugenists who did not believe in the efficacy of environmental social reforms a powerful new weapon. As early as 1892, Pearson had clearly spelt out the implications of Weismann's germ-theory as he saw it in application to eugenics. "If," he maintained,

> the bad man can by the influence of education and surroundings be made good, but the bad stock can never be converted into good stock--then we see how grave a responsibility is cast at the present day upon every citizen, who directly or indirectly has to consider problems relating to the state endowment of education, the revision of the administration of the Poor Law, and, above all, the conduct of public and private charities . . .[91]

No longer was it possible, he argued, to avoid consideration of the way in which society either encouraged or discouraged different segments of its population to have small or large

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Islands, where he collected and studied land-snails from 1851 until 1853. After College training in the U.S. he went as a missionary to China and Japan from 1862 until 1899. His biology was done in spare time, during furloughs and after retirement. For biographical information see Addison Gulick, "John T. Gulick, A Contributor to Evolutionary Thought," The Scientific Monthly, 18 (Jan., 1924), pp. 83-91 or Dictionary of American Biography.

[90] For further information about the "biometrical school" see chapter III below.

[91] Pearson, The Grammar, p. 33 (my emphasis added).

families, for in reproduction and heredity was determined what kind of society the next generation would be.

For the greater part of the period from 1870 to 1900 theories of heredity had little practical effect on beliefs about what characteristics were inherited and the patterns of such inheritance. Theory and practical observation were not absolutely estranged but the connections between them were in general terms and lacked the specificity to convince questioners that the hereditary mechanisms were really understood. Consequently there was a wide variety of beliefs about which particular characters were inherited and the pattern of inheritance followed by those characters. One school of thought held that all facets of human nature, physical, mental, moral and psychical, would eventually be fully explained in terms of the inheritance of underlying physiological mechanisms.[92] A second group concentrated on establishing the "laws of heredity"--usually descriptive generalizations of four or five patterns of inheritance.[93] Other writers tried to establish the way in which particular diseases or characters were inherited according to their own interests and specialties.[94] All of these varied approaches

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[92] On this point see Haller, Eugenics, pp. 14-17 and Haller, "Social Science and Genetics: A Historical Perspective" in Genetics: Biology and Behavior Series (ed., D.C. Glass) (New York, Rockefeller U. P. and Russell Sage Foundation, 1968), pp. 215-20.

[93] See, for example, Strahan, op. cit., pp. 67ff.

[94] See, for example, Maudsley on mental illness, Maudsley, op. cit., and Ellis on crime, Ellis, op. cit.

were followed by different sections of the eugenics movement in the early twentieth century and serve as further evidence for the historical continuities between that movement and its nineteenth century origins.

Haycraft's Darwinism and Race Progress, published in 1895, was typical of earlier attempts to explain all social problem groups in terms of hereditary factors, and was a forerunner of a similar strand of twentieth century eugenic thinking. Three of the eight chapters in his book dealt with these problems under the headings, "Causes and Signs of Physical Deterioration," "Insanity and Alcoholism," and "The Criminals, Incapables and Those in Distress."[95] It was a common feature of this tradition to associate a number of conditions and see them all as the result of the same inherited temperament. Haycraft assented to this explanation and saw drunkenness as probably "but one manifestation of the same careless or vicious temperament, which shows itself also in idleness and crime."[96] It was not that the desire for alcohol was inherited but rather a general temperament which might lead to crime or alcoholism or poverty or to some other social disease. Haycraft was also of the opinion that there were many "innate criminals." And their criminality would be inherited,

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[95] Haycraft, Darwinism, pp. 44-110.

[96] Ibid., p. 74.

> These beget children, and the suffering they inflict and have to endure is continued from parent to offspring.[97]

In this context he mentioned the American case-study of the Jukes family as an example of "innate want of moral backbone."[98] The Jukes family study was frequently used as an illustration of the inheritance of criminality in late nineteenth century writings on crime. The study showed how over a period of a number of generations many members of the one impoverished family had been found guilty of criminal acts and imprisoned.[99] Hereditarians claimed that this showed that degeneracy could be passed from generation to generation. This idea of general hereditary degeneracy can be traced back to the Traité des Dégénérescences of Dr. B. A. Morel which held:

> that alcoholism, criminality, various forms of insanity, epilepsy and feeble-mindedness were different manifestations of a single entity: hereditary degeneration.[100]

The then-fashionable Italian professor, Cesare Lombroso, based his "criminal anthropology" on a similar theory.[101]

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97 Ibid., p. 92.

98 Ibid., p. 94.

99 Richard L. Dugdale, The Jukes, A Study in Crime, Pauperism, Disease and Heredity (New York, Putnam's, 1877).

100 Haller, Eugenics, p. 14.

101 Ibid., pp. 15-16.

The existence of views similar to those expressed by Haycraft in late nineteenth century England can be attested by reference to other works and articles.[102]

"Laws of heredity" were believed by many nineteenth century writers to give an accurate summary of the various patterns of inheritance which had been recognised. Nevertheless the laws had not been firmly enough established for all to agree on what they were. The most honest writers candidly admitted the existence of different versions and the lack of a sure scientific basis. In his Marriage and Disease, Strahan admitted that:

> These laws are not based on any very scientific foundation, but they are nevertheless most useful when we leave the broad theory and come down to the very interesting study of individual facts.[103]

Strahan outlined five "laws" of heredity which are typical of the "laws" which were then being put forward. The first law he termed "Direct Heredity," by which was meant cases where parental characters occurred in the children. The second law, "Reversional Heredity or Atavism" was when a character 'jumped' generations. A child might resemble a grandparent or more remote ancestor, but not the parents in respect to this law. The third law was termed "Indirect or Collateral Heredity." In this case certain elements of the child's

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[102]See, for example, Helen Zimmern, "Professor Lombroso's New Theory of Political Crime," Blackwood's Magazine, 149, 1891, pp. 202-11.

[103]Strahan, op. cit., p. 67.

character resembled those of a relative such as an aunt or uncle who was not in the direct ancestral line. Strahan held that this law was merely a variation of the second law. His fourth law "Initial Heredity" referred to the effects of the mood or fortune of a parent at the time of copulation or birth. Although this law was not accepted by some authorities, Strahan held that it was "perfectly well established."[104] Strahan's fifth and final law was the "Heredity of Influence." This referred to the resemblance of a child to a previous spouse of his mother or father.[105]

Laws such as those outlined by Strahan which contained a mixture of careful observation, common-sense and folklore coloured the hereditarian beliefs of many medical practitioners, social workers, philanthropists and social theorists. Nor had some of the more doubtful of the laws been convincingly overthrown. Only the establishment of a sophisticated science of the study of heredity would eliminate speculative "laws" of heredity from general circulation among educated and professional groups.

The confident pronouncements at the end of the century by some prominent biologists to the effect that acquired characters could not be inherited set at nought part of the answer

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[104]Ibid., p. 75.

[105]For Strahan's outline of the laws see ibid., pp. 67-80. Strahan presents the laws without reference to any biological writing or to any biological authority.

Darwin had given to the arguments of Greg and Galton. It now appeared that changes wrought in individuals by education and environmental manipulation could not be passed on to their descendants directly. The rediscovery of Mendel's work in 1900 added weight to the likelihood that much could and should be achieved by controlling human breeding. All of these happenings explain in part the emergence of organizations devoted to the study and propagation of eugenics in the first decade of the twentieth century. But enough has been said to show that the eugenics movement cannot be accurately described as the single-handed work of Sir Francis Galton. Enough has been said too, to show that those holding to basically eugenic positions were unlikely to be homogeneous in outlook and beliefs.

C. Science, Society and Politics

One aspect of eugenics which, to some extent, accounted for its support, was its claim to be based on science at a time when the prestige of science was high. Arthur Marwick has shown in his very important study, The Deluge,[106] that the experience of the First World War greatly accentuated a number of changes that had been taking place in Edwardian England. One of these was increasing support from public

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[106] Arthur Marwick, The Deluge: British Society and the First World War (Harmondsworth, Pelican Books, 1967).

funds for science and scientific research, which was a reflection of the prestige and trust science had gained from its nineteenth century successes.[107] It was greatly to the advantage of the eugenics movement to be able to claim that it was scientific, both for the winning of adherents and for the gaining of public funds in support of eugenic research.

Prestige was not, however, something that science gained only in the twentieth century. The early Victorian age was described by one eminent Victorian as "the age of science."[108] W. H. Mallock noted that scientific justifications seemed to be necessary for all social doctrines[109] and W. S. Jevons advocated that the British parliament would become truly progressive only when it adopted the experimental methods of modern physical science in its social legislation.[110] Bagehot based an analysis of international relations on natural science, while Herbert Spencer's system

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[107] Ibid., chapter 7.

[108] John Morley in his Recollections, vol. 1, p. 100. Quoted in Walter E. Houghton, The Victorian Frame of Mind, 1830-70, p. 11.

[109] W. H. Mallock, "Civilization and Equality," Contemporary Review, 40 (Oct. 1881), pp. 659-60.

[110] W. Stanley Jevons, "Experimental Legislation and the Drink Traffic," Contemporary Review, 37 (Feb. 1880), pp. 177-92.

of synthetic philosophy was founded on science.[111]

It cannot be said that the emergence of the eugenics movement was coincidental with a great rise in the prestige of science. But the eugenists did claim that their science could be used as a basis for the analysis of England's social problems and that it could provide scientific solutions to those problems.[112] These claims were strongly supported by the use of theory derived from biology and of mathematical techniques which had often been said to be the mark of the physical sciences.

Galton himself and some of the lesser known eugenists expressed the hope that eugenics could be set up as a religion based on scientific grounds.[113] Such a hope shows the extent to which a "scientific creed" had replaced the more traditional forms of religion and further illustrates that the claim of eugenics to be a science was an important reason for its emergence as a movement.

The period, 1890-1905, provided a congenial atmosphere for the emergence of an English eugenics movement in yet another way. During this period British commercial and

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[111]See Walter Bagehot, Physics and Politics or Thoughts on the Application of the Principles of 'Natural Selection' and 'Inheritance' to Political Science (London, P.S. King, 1873). For Spencer, see Hofstadter, Social Darwinism, chapter 2.

[112]See Sociological Papers, Vols. 1, 2 & 3. (1904-6)

[113]Francis Galton, "Eugenics: Its Definitions, Scope and Aims" in Essays in Eugenics (London, Eugenics Education Society, 1909), p. 42.

military supremacy was being challenged particularly by Germany and the U.S.A. The early setbacks of the Boer War[114] helped to create a new enthusiasm for nationalism and imperialism in Britain. This enthusiasm was often combined with the conviction that Britons were representative of a naturally superior race. Pearson and Galton were representative of the eugenics movement in believing in the innate superiority of the white races over all other human populations.[115] Such racist views were often combined with a vigorous nationalism in the writings of many eugenists in the years immediately before the First World War.[116]

The concepts of "national efficiancy" and "social imperialism" were frequently associated with the new imperialistic nationalism. Bernard Semmel in his Imperialism and Social Reform[117] has shown how both of these concepts gained popularity in the political atmosphere of pre-war Britain. Such pre-war nationalism was justified by a "Darwinian" like Pearson on the grounds that natural selection was now acting

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[114]Pearson's most outspoken defence of nationalism, National Life from the Standpoint of Science, was delivered as a lecture during the period of great anguish over the British military performance in the Boer War.

[115]For Pearson see National Life, passim; for Galton see LLG II, pp. 32-3, 106-9.

[116]A number of expressions of such views are to be found in the pages of the Eugenics Review.

[117]See especially pp. 1-20.

on nations[118] and that only the most efficient in both military and commercial struggles could hope to survive. The call for efficiency justified internal social reform because no nation engaged in the "struggle for survival" could afford to have internal differences lowering its efficiency.

Social imperialism was not a necessary corollary to eugenics. It was another form of "social Darwinism" which could mesh quite closely with the views of one who was already a eugenist. As a political program it reached its peak influence in Britain at the same time as the eugenics movement was being established. No doubt the popularity of one made the other more attractive. They both probably owed some of their support to the renewed strength of the theory of natural selection and the weakening of neo-Lamarckism in England at the turn of the century.[119] But whereas the international political situation was a major element in the growth of social imperialism it was probably a lesser element in the emergence of the eugenics movement. Social imperialism was favoured by politicians right across

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[118] I.e., that there was competition and selection between groups and nations, an inter-specific type of selection.

[119] Here it should be made clear that biologists of the Mendelian school did not necessarily accept natural selection as wholeheartedly as the followers of Galton and Weismann. On this point see Garland E. Allen, "Thomas Hunt Morgan and the Problem of Natural Selection," Journal of the History of Biology, 1 (1968), pp. 113-39.

the spectrum of contemporary parties[120] but eugenics remained anathema to many Liberals and to many church members.[121]

The origins of the English eugenics movement of the early twentieth century are to be found in a number of intellectual, social and political currents which can be traced back into the nineteenth century for varying lengths of time. The most obvious of these is the current stemming from the biological theories of evolution and heredity and the subsequent debate about man's place in nature. To this must be added the ideas and practices of those dealing with the social problem groups of society, the changes taking place in the English political milieu and some less obvious but important long-range changes such as the rise of science in public esteem, and the desire to create a social science to deal effectively with social problems.

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[120]The men studied by Semmel include socialists, Liberals, Conservatives and fascists.

[121]C. K. Chesterton and Leonard T. Hobhouse both attacked eugenics from their different perspectives, for example.

III

THE BIOMETRIC SCHOOL

One feature of the English eugenics movement was an attempt to develop the study of eugenics as a scientific discipline. This attempt consisted of the establishment of a university chair of eugenics and of an associated research institute at University College, London, which is described in chapter IV of this dissertation. The work of the Francis Galton Laboratory for the Study of National Eugenics cannot, however, be fully understood without a preliminary examination of the growth of the English "biometric school."[1] The "biometric school" was important for the work of the Galton Eugenics Laboratory because its theories provided a scientific justification for the research work undertaken by the Laboratory. Some such justification was necessary if eugenics was to be accepted as a science by the scientific community.

In 1883 Galton had defined "eugenics" in cumbersome fashion as,

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[1]The phrase, "biometric school," is used in the sense in which it was used by Karl Pearson (K.P., p. 53) to indicate the, at first, loosely organised group interested in applying statistics to biological problems, which was later associated with the journal Biometrika and the Eugenic and Biometric Laboratories of University College, London. For these laboratories see chapter IV below.

> the science of improving stock, which is by no means confined to questions of judicious mating, but which, especially in the case of man, takes cognizance of all influences that tend in however remote a degree to give to the more suitable races or strains of blood a better chance of prevailing speedily over the less suitable than they otherwise would have had.[2]

In 1904, he gave a more succinct definition,

> Eugenics is the science which deals with all influences that improve the inborn qualities of a race; also with those that develop them to the utmost advantage.[3]

From his writings it is apparent that "the influences which improved the race" were to be understood by a thorough examination of the way in which Darwinian evolution applied to man. Eugenics was in reality applied biology based on the central biological theory of the day, namely the Darwinian theory of evolution. Hence the study of eugenics demanded the application of methods similar to those used by biologists studying evolution. Galton and Pearson, the two key figures in the establishment of the Galton Eugenics Laboratory, were both convinced that the best way to study evolution was the statistical analysis of large organic populations. This belief they shared with W. F. R. Weldon,

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[2]Francis Galton, Inquiries into Human Faculty (London, Macmillan, 1883), pp. 24-5.

[3]Francis Galton, "Eugenics: Its Definition, Scope and Aims" in Essays in Eugenics (London, Eugenics Education Society, 1909), p. 35. The paper was originally read to the Sociological Society in 1904.

together with whom they formed a triumvirate leading a school which advocated the use of such statistical methods in biology, the "biometric school." The Galton Eugenics Laboratory used biometric methods to the virtual exclusion of all others. Consequently, an examination of the biometric school, apart from its interest as an important new development in the history of biology, serves as a necessary introduction to the research carried out by the Galton Eugenics Laboratory.

This chapter will consist of an examination of the development of the biometric school between 1890 and 1905 with emphasis on the work of W. F. R. Weldon. A discussion of the way in which the attempts to establish biometry as a new scientific discipline fit in with the views of Hagstrom on "disciplinary differentiation" and Kuhn on "scientific revolutions" will form part of chapter V.

A. The Formation of a Biometric School

In 1907, Vernon L. Kellogg published a comprehensive account of the various scientific criticisms of Darwinian theory and of the various auxiliary and alternative theories which had been proposed. In this work he spoke of two "conspicuous new kinds of biological investigation" which were changing the face of biology. One of these new directions was "the statistical or quantitative study of variations,"[4]

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[4]Vernon L. Kellogg, Darwinism Today (New York, Henry Holt, 1908). For this and previous quotation see pp. 1-2.

which was advocated by the biometric school. Kellogg's emphasis on biometry[5] is indicative of the impact it made on contemporary biologists. From 1890 until 1905, the biometric approach to biology was one of the most controversial issues facing English biologists. In retrospect the "biometric school" has chiefly been remembered because of its clash with Bateson[6] and other early supporters of Mendelian theory.[7] The importance of biometry, however, is more properly seen in the overall context of evolutionary theory.[8]

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[5]Ibid., p. 378.

[6]William Bateson (1861-1926) F.R.S. had studied morphology at Cambridge at the same time as Weldon. He was a Fellow of St. John's College, Cambridge, 1885-1910, professor of biology at Cambridge 1908-9, and director of the John Innes Horticultural Institution, 1910-1926. Bateson's first major academic appointment did not come until after he had introduced the Mendelian theory and methods into English biology and had established the first experimental program in modern genetics in England. For further details see DNB and J. G. Crowther, British Scientists in the Twentieth Century (London, Routledge & Kegan Paul, 1952), chapter 6.

[7]See L. C. Dunn, A Short History of Genetics (New York, McGraw-Hill, 1965), p. 64; A. H. Sturtevant, A History of Genetics (New York, Harper & Row, 1965), pp. 58-9; Lancelot Hogben, Statistical Theory (London, George Allen & Unwin, 1957), pp. 248ff.

[8]Biometry has been treated in this way, though fairly briefly in the following works: Cyril D. Darlington, Genetics and Man (New York, Schocken, 1969), pp. 176ff; Charles B. Davenport, "A History of the Development of the Quantitative Study of Variation," Science, 12 (Dec. 7, 1900), pp. 864-70; Vernon L. Kellogg, op. cit; E. S. Pearson, "Studies in the History of Probability and Statistics, XIV. Some Incidents in the Early History of Biometry and Statistics 1890-4," Biometrika, 52 (1965), pp. 3-18; "Studies in the History . . . XVII. Some Reflexions on Continuity in the

British biology of the nineteenth century can be divided into two basic divisions, anatomy and physiology. Darwinian theory had little immediate impact on physiology, which continued, until the 1890's to be largely concerned with finding physico-chemical explanations for vital functions and with the implications of cell theory for these vital functions.[9] In anatomy, on the other hand, the impact was immediate and pervaded the whole science. Taxonomy was now seen as the rational reconstruction of genealogical tables or "trees" and not as an arbitrary system devised for the convenience of biologists. The branches of anatomy known as embryology and palaeontology received special impetus. The theory that an organism recapitulated its phylogenetic history in its own development became a dominant theme in the works of zoologists such as Balfour and Lankester who sought to discover the original ancestor of all vertebrates. While the embryologists searched for the ancestors of contemporary species in the developing organism, palaeontologists searched for such ancestors among fossil

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Development of Mathematical Statistics, 1885-1920," Biometrika, 54 (1967), pp. 341-55; Sewall Wright, "The Foundation of Population Genetics" in Heritage from Mendel (ed. R. A. Brink) (Madison, U. of Wisconsin Press, 1967), pp. 245-8.

[9]For this overall picture see Everett Mendelsohn, "The Biological Sciences in the Nineteenth Century: Some Problems and Sources," History of Science, 3 (1964), pp. 39-59, "Physical Models and Physiological Concepts: Explanation in Nineteenth Century Biology," British Journal for the History of Science, 2 (1965), pp. 203-18. For an interesting survey of the impact of Darwinism on British science, see A. C. Seward (ed.), Darwin and Modern Science (Cambridge, C.U.P., 1909).

remains. Anatomists were generally content, however, to retain their pre-Darwinian methods. Species and families were still represented for them by ideal types. And it was the type which was important to them, not the range of variation from the type.[10] In neither physiology nor anatomy for the twenty or thirty years after 1859 was there much serious biological attention given to variation, selection and heredity, three of the key elements of Darwin's theory.[11]

The writings of Galton and Weismann,[12] however, provided the background against which increasing attention was paid by professional biologists to these elements of evolutionary theory. In particular biologists became more

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[10]The best account of the anatomy and morphology of this period is in E. S. Russell, Form and Function: A Contribution to the History of Animal Morphology (London, John Murray, 1916), chapters 13-20.

[11]Darwin's own works must, of course, be excluded from this generalization. There were other zoologists who worked in these areas (Galton, Gulick, Romanes and Wallace, for example) but in general it was true that the mainstream of British biology took Darwin's accounts of variation, selection, heredity as written or engaged in polemical argument about them, rather than serious biological experiment and observation.

[12]Galton's main contributions were Hereditary Genius (1869), English Men of Science: Their Nature and Nurture (London, Macmillan, 1874), Inquiries into Human Faculty (1883) and Natural Inheritance (London, Macmillan, 1889). Weismann's main contributions were "Die Continuität des Keimplasmas als Grundlage einer Theorie der Verebung" (1885) published in English translation with other essays as Essays Upon Heredity and Kindred Biological Problems (2 vols., 1891 and 1893), also The Germ-Plasm; A Theory of Heredity (1893).

concerned to demonstrate the process of selection and to see if they could increase their understanding of how particular variations were selected and inherited. It was in this changing atmosphere that W. F. R. Weldon began his professional career.

Walter Frank Raphael Weldon[13] was born in the year after the publication of Darwin's Origin of Species. In 1876 he began studies at University College, London, with the aim of entering the medical profession. In 1877 he transferred to Kings College, London, and in 1878 to the University of Cambridge. At Cambridge he prepared for the Natural Science Tripos under Balfour and graduated with first-class honours in 1880. By this time he was committed to a career as a naturalist and after a time working at the Naples Zoological Research Station he returned to Cambridge to take up a demonstratorship. At the end of 1884 he was appointed Lecturer in Invertebrate Morphology at Cambridge and a Fellow of St. John's College. He continued to be interested in marine biology and carried out field research at Plymouth, on the island of Guernsey and in the Bahamas. In 1890, while completing a year of study leave he was appointed Professor of Zoology at University College, in the place of his former

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[13]Weldon (1860-1906) F.R.S. Biographical details are from D.N.B. and Karl Pearson, "Walter Frank Raphael Weldon: 1860-1906," Biometrika, 5 (1906), pp. 1-52. A condensed version of Pearson's obituary is also in the Proceedings of the Royal Society, Series B, 80, (1908), Appendix, pp. xxv-xli.

teacher, E. Ray Lankester. In 1899 he again succeeded Lankester, this time to the Chair of Comparative Anatomy at Oxford, which position he retained until his sudden death in 1906 at the early age of forty-six.

Weldon's earliest published papers were in the tradition of the morphological school of his teachers. He reported on the anatomy and embryology of marine organisms.[14] By 1888, however, his interest had begun to turn to the question of how larval and adult characters were correlated and particularly to the question of how such characters changed as new species evolved. In the following year a reading of Galton's Natural Inheritance convinced him that new approaches needed to be taken in the study of variation and selection. The first-fruits of this new conviction were contained in a paper published in the Proceedings of the Royal Society for

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[14] His published papers in marine invertebrate anatomy and comparative anatomy were: "On the Head Kidney of Bdellostoma, with a suggestion as to the origin of Suprarenal bodies," QJMS, 24 (1884), pp. 171-182; "Note on the Origin of the Suprarenal bodies of Vertebrates," Proc. Roy. Soc., 37 (1884), pp. 422-5; "Note on the Placentation of Tetraceros quadricornis," Proc. Zool. Soc. London (1884), pp. 2-6; "Notes on Callithrix gigot," Proc. Zool. Soc. Lond. (1884), pp. 6-9; "On the Suprarenal Bodies of Vertebrata," QJMS, 25 (1885), pp. 137-50; "On Dinophilus gigas," QJMS, 27 (1886), pp. 109-21; "Preliminary Note on a Balanaglossus Larva from the Bahamas," Proc. Roy. Soc., 42 (1887), pp. 146-50, 473; "Haplodiscus piger, a new pelagic organism from the Bahamas," QJMS, 29 (1889), pp. 1-8; "Coelom and nephridia of Palaemon serratus," U.K. Mar. Biol. Ass. J., 1 (1889-90), pp. 162-8; "Functions of Spines of Crustacean Zooea," U.K. Mar. Biol. Ass. J., 1 (1889-90), pp. 169-70.

April 1890.[15]

In his 1890 paper Weldon attempted to measure the amount of variation in the same organs of different populations of the same species. "It is well known," he wrote

> that two sets of animals, belonging to the same species, but living in different places, exhibit differences from one another by which they can, in many cases, be easily distinguished.[16]

Hence it should be possible to measure the differences between the "two sets of animals." In making this measurement, Weldon decided to use a method which had previously been used by Galton to describe the variation of groups of men or domestic animals.[17] This method was to draw a frequency distribution curve for the sizes of the organs measured. In each of the three samples measured, Weldon found that the curve obtained was the curve for a distribution in accord with the "law of error," or what would today be called a "normal distribution." Moreover, the median and probable error[18] of the different samples were different from each other. Each different population of animals could

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[15]"The Variations Occurring in Certain Decapod Crustacea -1. Crangon Vulgaris," Proc. Roy. Soc., 47 (1890), pp. 445-53.

[16]Ibid., p. 445.

[17]Galton, Natural Inheritance, chapters 5 and 7. Galton derived the method from the Belgian astronomer and statistician, Quetelet.

[18]For the method of calculating the probable error see note 21 below.

thus be identified by the parameters of a normal distribution curve. Weldon presented his conclusions as a verification of Galton's theories.

> It seems, therefore, that Mr. Galton's prediction is fully justified; and that (1) the variation in size of the organs measured occur with the frequency indicated by the law of error; and (2) the 'probable error' of the same organ is different in different races of the same species.[19]

In a second paper on the same organism, the common shrimp, Weldon tested some of Galton's hypotheses about the extent of correlation between various organs. The work again involved the measurement of the same organs in large numbers of the shrimp gathered from five different places.[20] Using a formula developed by Galton,[21] Weldon calculated the

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[19]Weldon, _op. cit.,_ p. 453.

[20]Weldon, "Certain Correlated Variations in Crangon Vulgaris," _Proc. Roy. Soc., 51_ (1892), pp. 2-21. The sizes of the five samples were 1000, 800, 500, 300 and 300. _Ibid.,_ p. 9.

[21]Galton's formula measuring the degree of correlation, r, was:

$$r = \frac{x_m/Q_b}{Y/Q_a} = \frac{y_m/Q_a}{X/Q_b}$$

where Q_a is the probable error of the distribution of organ A about its average.
Q_b is the probable error of the distribution of organ B about its average.
x_m is the mean deviation from the average of organ B for a constant deviation Y from the average for organ A.
y_m is the mean deviation from the average of organ A for a constant deviation X from the average

correlation between the length of the carapace and the length of the post-spinous portions of the different samples of shrimp. He found that, despite large differences in the mean lengths and probable errors (a measure of the amount of deviation) of the different samples, the correlations obtained for different samples were approximately the same (0.81, 0.85, 0.80, 0.85 & 0.83).[22] A comparison of further correlations obtained for two of the samples confirmed that different races of the same species had similar correlations between the same organ pairs. Weldon's results are summarised in the following table:

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for organ B.

Galton calculated the probable error Q by the use of the formula

$$Q = \frac{1}{2}(Q_2 - Q_1)$$

where Q_1 and Q_2 are the respective values of the variable, whose distribution is being examined at the twenty-fifth and seventy-fifth per centiles of the distribution.

The formula for r is from Weldon, "Certain Correlated Variations . . .," p. 3; that for Q from Galton, Natural Inheritance, p. 53.

[22]Weldon, op. cit., p. 9.

TABLE 1

Correlations Obtained by Weldon for Various Pairs of Characters in Different Races of Crangon Vulgaris

Source of Sample	Carapace Length & Tergum vi	Carapace Length & Telson	Telson & Tergum vi
Plymouth	0.09	0.18	-0.11
Southport	0.06	0.14	-0.09

Source: W. F. R. Weldon, "Certain Correlated Variations in Crangon Vulgaris," Proceedings of the Royal Society, 51 (1892), p. 10.

The results obtained in this and his previous paper made Weldon confident that the statistical reduction of precise measurements was a powerful new tool for the study of animal species and races in their natural habitat. It appeared to him that this, in fact, might be a new way in which to typify a species or a race. Rather than construct an 'ideal' type for a species, in which variations tended to be ignored, biologists could now define species by a whole series of statistical parameters in which not only the average type would be represented but also the amount and kind of deviation from that type would be known. Moreover, the constancy of the correlation between the same organs within a species suggested that such measurements might lead to unknown physiological relations. The enthusiasm with which he regarded these prospects is clearly seen in his conclusion to his second paper,

> . . . the results recorded lead to the hope that, by expressing the deviation of every organ from its average in Mr. Galton's system of units, a series of constants may be determined for any species of animal which will give a numerical measure of the average condition of any number of organs which is associated with a known condition of any one of them. A large series of such specific constants would give an altogether new kind of knowledge of the physiological connexion between the various organs of animals; while a study of those relations which remain constant through large groups of species would give an idea, attainable at present in no other way, of the functional correlations between various organs which have led to the establishment of the great sub-divisions of the animal kingdom.[23]

In a third paper,[24] Weldon verified that his conclusions for Crangon Vulgaris also applied to Carcinus Moenas. He made eleven separate measurements on each of two 1000-member samples, one from Plymouth and one from Naples. The frequency distribution curves were found to be approximately normal in twenty-one of the twenty-two cases and the twenty-three correlations calculated for each sample were also in general agreement with each other. Weldon suggested that the one non-normal distribution might be a mixture of two normal distributions indicating the presence of two groups within the 1000-member sample.[25] He sought the assistance

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[23] Ibid., p. 11.

[24] Weldon, "On Certain Correlated Variations in Carcinus Moenas," Proc. Roy. Soc., 54 (1893), pp. 318-29.

[25] Weldon did not discuss why, if this were the case, only one of eleven measurements showed the uneven distribution.

of Karl Pearson to demonstrate this in an acceptable mathematical fashion and together they did this.[26] The results of this investigation confirmed Weldon's views that many of the problems connected with evolutionary theory could be elucidated using these new methods. His concluding paragraph made very strong claims for the new method going so far as to state that "the problem of animal evolution is essentially a statistical problem." He further spelt out the kinds of measurements that needed to be made to demonstrate the effects of variation, selection and heredity,

> . . . before we can properly estimate the changes at present going on in a race or species we must know accurately (a) the percentage of animals which exhibit a given amount of abnormality with regard to a particular character; (b) the degree of abnormality of other organs which accompanies a given abnormality of one; (c) the difference between the death-rate per cent. in animals of different degrees of abnormality with respect to any organ; (d) the abnormality of offspring in terms of the abnormality of parents and vice versa.[27]

Such measurements he claimed would show "the direction and the rate of change in . . . species at the present day" and this was the "only legitimate basis for speculations" about the past history of evolution and its future course.[28]

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[26]This cooperation led to Pearson's first biometric paper, "Contribution to the Mathematical Theory of Evolution," Phil. Trans. Roy. Soc. A, 185, pp. 71-110.

[27]Weldon, "On Certain Correlated Variations . . .," p. 329.

[28]E. S. Pearson has a brief but similar explication of this paper of Weldon's in his "Studies in the History . . . XIV . . .," pp. 8-9 and "Studies in the History . . . XVII . . .," p. 346.

The impact of these papers was considerable. The first two were said to have been the main cause of Weldon's election as a Fellow of the Royal Society.[29] In 1894, the Royal Society established a "Committee for Conducting Statistical Inquiries into Measurable Characteristics of Plants and Animals" largely as a result of Weldon's papers.[30] The papers can also be said to be the occasion for the formation of the "biometric school" as they drew Weldon, Pearson and Galton together for the first time to work on similar problems. A number of Weldon's own pupils and assistants also published similar work in the following years.[31]

By mid-1894 it could be said that sound foundations had been laid for a whole new approach to the study of biology. The new approach was based on the insight that Darwin's conceptions of "species" and "race" in the _Origin of Species_ were "population" concepts and not "type"

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[29] K. Pearson, "Walter Frank Raphael Weldon . . .," p. 329.

[30] _Ibid._, p. 23. Members of the committee were Galton (chairman), Francis Darwin, and Professors Macalister, Meldola, Poulton and Weldon.

[31] E.g., E. T. Browne, "On the Variation of the Tentaculocysts of Aurelia aurita," _QJMS_, _37_ (1895), pp. 245-51; Herbert Thompson, "Correlation of Certain External Parts of Palaemon serratus," _Proc. Roy. Soc._, _55_ (1894), pp. 234-40; "On Certain Changes Observed in the Dimensions of Parts of the Carapace of Carcinus Moenas," _Proc. Roy. Soc._, _60_ (1897), pp. 195-8. Ernest Warren, "Variation in Portunus depurator," Proc. Roy. Soc., 60 (1897), pp. 221-43; "An Investigation on the Variability of the Human Skeleton . . .," _Phil. Trans. Roy. Soc._ B, _189_ (1898), pp. 135-227.

concepts.[32] Further, the new approach was based on the idea that organic "populations" could be accurately measured and represented by statistical techniques. Although Galton had gone a long way toward developing this new approach, he had not applied it to natural animal populations. Moreover, despite the high respect in which he was held by scientists, he was an amateur at a time when professionalism was becoming increasingly important in British biology.[33] Weldon's adoption and enthusiastic development of the new approach enabled it to be supported by the resources of a university department and by his own students. His co-operation with Karl Pearson gained for the new approach a very competent mathematician to deal with statistical problems which arose. Furthermore the new approach to biology had been sanctioned by the Royal Society at a time when that body was regaining the ancient prestige which it had lost in the earlier part

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[32]The reasons for the slow acceptance of Darwin's population concept of species require further investigation. On the population concept of species, see Ernst Mayr, "Darwin and Evolutionary Theory in Biology," _Evolution and Anthropology_ (Washington, D.C., 1959).

[33]An examination of the main contributors to the _Proceedings of the Zoological Society of London_ during the period, 1838-1900, showed a significant increase in the proportion of papers submitted by full-time zoologists. See L. Farrall, "Educational Backgrounds and Occupational Opportunities of Nineteenth Century British Zoologists," unpublished paper. An examination of the new professorships and positions created in zoology at British universities during the period 1850-1900 leads to the same conclusion.

of the nineteenth century.[34]

The new biometric approach to biology generated a great deal of controversy between 1895 and 1900. In the early winter of 1894 Weldon completed a memoir entitled "An Attempt to Measure the Death-Rate due to the Selective Destruction of Carcinus Moenas with Respect to a Particular Dimension"[35] which was published under the auspices of the Royal Society's Committee that had been set up to encourage the new method. When published it was accompanied by a two page commentary, also written by Weldon, headed "Remarks on Variation in Animals and Plants."[36] In establishing a death-rate due to the selective destruction of certain crabs marked by a particular range of variations, Weldon worked with figures obtained by measuring the carapace length and frontal breadth of 7000 females obtained from the one locality. As he could not be certain of the age of the crabs he used the carapace lengths as an index of age. The crabs were divided into thirty-five groups according to the lengths of the carapace. Frequency distribution curves for each group were then drawn, based on the frontal breadths of the crabs. Each curve was found to be approximately normal.

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[34]See D. S. L. Cardwell, The Organization of Science in England (London, Heinemann, 1957), pp. 46ff, 77f.

[35]Proc. Roy. Soc., 57 (1894-5), pp. 360-79.

[36]Ibid., pp. 379-81.

The mean quartile deviation was then established for each group. Because of the small differences involved, the thirty-five groups were reduced to seven larger groups, each made up of five contiguous groups from the original thirty-five. The figures obtained showed a general increase in the mean quartile deviation with increase in carapace length but a falling off of mean quartile deviation in the two groups with the longest carapace group. (See Table 2.)

TABLE 2

Results of Weldon's Measurements on 7,000 Crabs

C^1	7.5	8.5	9.5	10.5	11.5	12.5	13.5 (Adult)
Mean Q^2	9.42	9.83	9.51	9.58	10.25	10.79	10.09	9.96

1. Median carapace length of five groups collected together.
2. Mean quartile deviation of frontal breadths for five groups.

Source: W. F. R. Weldon, "An Attempt to Measure the Death-Rate . . .," Proceedings of the Royal Society, 57 (1894-5), p. 367.

Taking the carapace length as an adequate guide to age, Weldon interpreted the general increase in deviation during growth as confirmation of Darwin's statement "that many variations appear at a late period of development."[37] The drop in deviation at maturity was interpreted as evidence

[37] Weldon, "An Attempt to Measure the Death-Rate . . .," p. 367.

of the selective destruction of the most extreme variations. Weldon then proved mathematically (given the normal distribution of all samples used) that the ratio of animals destroyed by selection in relation to their frontal breadth to those which survive selection is equal to $\frac{Q_1 - Q_2}{Q_1}$, where Q_1 is the maximum quartile deviation obtained for frontal breadths during growth, and Q_2 is the quartile deviation of frontal breadths at maturity.[38] In the case cited in Table 2, this gives $\frac{10.79 - 9.96}{10.79}$ or approximately 0.077. According to Weldon this meant that seventy-seven crabs per thousand died of selective causes between the age corresponding to a carapace length of 12.5 mm. and maturity. The selective death-rate measured was:

> a consequence of deviation in frontal breadths, and in the group of structures, whatever these may be, which are directly correlated with it.[39]

Weldon noted that this method of establishing a selective death-rate would hold only for variations which were distributed symmetrically and only where selective destruction was minimal at the mean point of the variations. He emphasized, however, the importance of a method which would enable the selective death-rate associated with various abnormalities to be demonstrated and to be demonstrated without prior

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[38] *Ibid.*, pp. 368-70.

[39] *Ibid.*, p. 370.

information about the functional importance of the character under examination. Furthermore a numerical estimate of the death-rate could be obtained.

The right dentary margins of the same 7,000 crabs were also measured, and the results were treated in the same manner as the measurements of the frontal breadth. This time, however, the maximal mean quartile deviation was obtained for the adult specimens. Weldon concluded that there was no evidence of selective destruction in relation to the size of the dentary margin.

In the "Remarks" which accompanied this paper, Weldon justified his interest in small and continuous variations by reference to Darwin's belief that "specific modifications" were due to "the accumulation of innumerable slight variations."[40] He stated categorically that questions arising out of Darwin's theories could only be solved by use of the methods he was introducing into biology,

> The questions raised by the Darwinian hypothesis are purely statistical, and the statistical method is the only one at present obvious by which that hypothesis can be experimentally checked.[41]

Weldon concluded his "Remarks" by putting forward the view that "biometric" methods could be used to test many contemporary theories associated with evolution without an

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[40]Weldon, "Remarks on Variation . . .," p. 380.

[41]Ibid., p. 381.

understanding of the underlying physiology or of the mechanism by which characteristics were inherited.

> It is to be observed that numerical data of the kind here indicated, contain all the information necessary for a knowledge of the direction and rate of evolution. Knowing that a given deviation from the mean character is associated with a greater or less percentage death-rate in the animals possessing it, the importance of such a deviation can be estimated without the necessity of inquiring how that increase or decrease in the death-rate is brought about, so that all ideas of 'functional adaptation' become unnecessary. In the same way, a theory of the mechanism of heredity is not necessary in order to measure the abnormality of offspring associated with a given parental abnormality. The importance of such numerical statements, by which the current theories of adaptation, &c., may be tested, is strongly urged.[42]

In this manner Weldon nailed the biometric colours firmly to the mast. The pages of Nature attest to the controversial nature of Weldon's claims in that they recorded four series of exchanges involving Weldon in the "Letters to the Editor" section in the years from 1895 until 1898.

The first series of letters was the result of the discussion at the meeting of the Royal Society during which the paper described immediately above was presented. The director of the Kew Botanical Gardens, W.T. Thiselton-Dyer,[43]

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[42] Ibid., p. 381.

[43] Sir William Turner Thiselton-Dyer (1843-1928) F.R.S., a graduate of Oxford University, had held various professorial appointments in botany before becoming assistant director of Kew Gardens in 1875. From 1885 until 1905 he was director of Kew Gardens and editor of important botanical works. For biographical details, see D.N.B.

commenced the correspondence with a very interesting letter under the heading "Variation and Specific Stability."[44] Thiselton-Dyer had taken a degree in mathematics at Oxford in 1865 before going on to take another degree in the natural sciences in 1867. This may explain why his letter presented a much clearer explication of the population conception of species than Weldon had and quoted 1873 papers[45] by Charles Darwin and his son, George, which had put forward the view that the organisms of a species would vary in accord with "Quetelet's law." Thiselton-Dyer's conception of species was presented by analogy with the bullet-marks on a target, in which a central area would contain the greatest density of marks which would become less common at greater distances from the centre of the target. By analogy, according to Thiselton-Dyer,

> We may picture the aggregate [of a species] . . . as grouped with respect to any discriminating character like the shots on the target.[46]

He argued that the general way of representing a species by one or two specimens in a museum was really an abstraction which should be based on the average of each character for that species. To this abstraction he gave the name, the

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[44] Nature, 51 (March 14, 1895), pp. 459-61.

[45] For Charles Darwin, see Nature, Sept. 25, 1873, p. 432, and for George Darwin, Nature, Oct. 16, 1873, p. 505.

[46] Thiselton-Dyer, *op. cit.*, p. 459.

"mean specific form." In just the same way that a change of conditions could change a marksman's pattern on the target so a new condition could change the population pattern of a species and give rise to a change in the mean specific form. Thiselton-Dyer held that Weldon had not demonstrated a selective effect which would change the mean specific form of crabs but rather a mechanism which would stabilize this species, because it eliminated extreme variations from the mean. But Weldon's was still a great accomplishment.

> The actual statistical demonstration of this fact [the elimination of deviant forms], in my opinion, deserves to rank amongst the most remarkable achievements in connection with the theory of evolution.[47]

Mathematical analysis in a case where evolution was actually occurring, would, he predicted, be much more complex and "be beset with very great difficulties." He also felt that Weldon was inclined to under-estimate the power of experimental work to solve problems in relation to evolutionary theory.

Thiselton-Dyer's complimentary letter was followed by one from J. T. Cunningham[48] much less willing to accept

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[47] Ibid., p. 460.

[48] J. T. Cunningham, "The Statistical Investigation of Evolution," Nature, 51 (March 28, 1895), p. 510. Joseph Thomas Cunningham (1859-1935) graduated from Oxford in 1881 and was a Fellow of University College, Oxford, for some years after. From 1887 to 1897 he was Naturalist to the Marine Biological Association and afterwards a lecturer in zoology at various colleges. See Who Was Who 1929-40.

Weldon's work as epoch-making. He argued that Weldon's demonstration of selective destruction depended on the acceptance of certain assumptions about the growth of crabs which had not been proved. He was strongly opposed to Weldon's view that evolutionary investigations could best be advanced by statistical methods without too much attention to underlying physiological mechanisms. Weldon's statements could not prevent such investigations.

> he cannot shut out others from the most interesting and most important fields of biology in this way. . . . If a certain deviation is shown to be associated with an increased or decreased chance of life, we want to know how it acts, and no statistical Gallio can prevent us trying to find out.[49]

These two letters set the fashion for much of the commentary on Weldon's papers. Usually the commentary came from biologists and it seldom questioned the details of Weldon's mathematical techniques. Often, however, commentators questioned the large claims Weldon made for the statistical method. Biometry did not win over the great majority of biologists in dramatic fashion, but the papers of Weldon and his followers were read with much interest by many in the biological community.

The series of letters in Nature following Weldon's 1895 Royal Society paper degenerated into an acerbic controversy between himself and Thiselton-Dyer on the one hand and

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[49] Ibid., p. 510.

William Bateson,[50] on the other. Between April 25 and June 6, 1895, nine letters[51] argued whether or not the evolution of the domesticated flower, cineraria, was due to the accumulation of continuous variations or the appearance of sudden large variations known as "sports." In a debate that shed much more heat than light, neither side would give ground and Weldon remained as convinced as ever that evolution depended on the action of selection on continuous variations, while Bateson remained convinced of the efficacy of the de Vriesian mutation mechanism.

The next series of letters to Nature involving Weldon's work arose out of a discussion at a meeting of the Linnaean Society following the reading of a paper, "Are Specific Characters Useful," by A. R. Wallace.[52] In this

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[50]This seems to have been the first public clash between Bateson and Weldon. Weldon had previously written a critical (but not abusive) review of Bateson's Materials for the Study of Variation. See W. F. R. Weldon, "The Study of Animal Variation," Nature, 50 (May 10, 1894), pp. 625-6

[51]W. Bateson, "The Origin of the Cultivated Cineraria," Nature, 51 (April 25, 1895), pp. 605-7; W. T. Thiselton-Dyer, Ibid., Nature, 52 (May 2, 1895), pp. 3-4; W. Bateson, Ibid., Nature, 52 (May 9, 1895), p. 29; W. F. R. Weldon, Ibid., Nature, 52 (May 16, 1895), p. 54; W. T. Thiselton-Dyer, Ibid., Nature, 52 (May 23, 1895), pp. 78-9; W. Bateson, Ibid., Nature, 52 (May 30, 1895), pp. 103-4; W. F. R. Weldon, Ibid., Nature, 52 (May 30, 1895), p. 104; W. T. Thiselton-Dyer, Ibid., Nature, 52 (June 6, 1895), pp. 128-9; Weldon, Ibid., Nature, 52 (June 6, 1895), p. 129.

[52]Alfred R. Wallace, "The Problem of Utility. Are Specific Characters always or generally Useful?" Linn. Soc. J. (Zool.) 25 (1896), pp. 481-96.

discussion Weldon had clashed with Lankester, when the latter had suggested that a given character might survive not because of its own usefulness or selective advantage but because it was correlated with another character which did possess selective advantage.[53] According to Lankester, Weldon had declared that it was impossible to say which of two correlated growths was the cause of survival because it was "logically impossible to separate two correlated phenomena." Lankester used this as the basis for an attack on Weldon's papers on crabs emphasising that numerical results are of little use if the underlying physiological mechanisms are not investigated and understood.

> [Weldon's mathematical] methods of attempting to penetrate the obscurity which veils the interactions of the immensely complex bundle of phenomena which we call a crab and its environment, appear to me not merely inadequate, but in so far as they involve perversion of the meaning of accepted terms and a deliberate rejection of the method of inquiry by hypothesis and verification, injurious to the progress of knowledge.[54]

In marked contrast to the previous controversy with Bateson, the tone of the subsequent letters from Weldon and Lankester was conciliatory. Weldon quoted Kant, Hume and Mill to justify his position on cause and effect.[55] Lankester

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[53] E. Ray Lankester, "Are Specific Characters Useful?" Nature, 54 (July 16, 1896), p. 245.

[54] Ibid., p. 246.

[55] W. F. R. Weldon, "The Utility of Specific Characters," Nature, 54 (July 30, 1896), p. 294.

sidestepped this invitation to indulge in the history of logic but pointed out that in his view biological phenomena could only be explained when fully placed "in their true order and relation" to the "complex group of related phenomena."[56] This involved finding out how a change in the size of the frontal portion of a drab could affect its survival. Weldon agreed that it was important to do this and to understand all the physiological phenomena related to evolution. But he emphasised again that such an understanding, in his view, was not necessary for the rate and direction of evolution to be ascertained. This could be done using the method of hypothesis and experiment and the techniques of statistics to assist in that method.[57]

Further contributions to this series of letters came from Thiselton-Dyer, Karl Pearson and J. T. Cunningham.[58] Thiselton-Dyer supported Weldon's advocacy of statistics. Pearson also supported statistical methodology, but said that he did not think that Weldon had actually demonstrated the presence of a selective death-rate in his crab samples.

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[56] E. Ray Lankester, "The Utility of Specific Characters," Nature,54 (July 30, 1896), p. 294.

[57] W. F. R. Weldon, "Utility of Specific Characters," Nature, 54 (Sept. 3, 1896), p. 413.

[58] W. T. Thiselton-Dyer, "The Utility of Specific Characters," Nature, 54 (Sept. 10, 1896), pp. 435-6; Karl Pearson, "The Utility of Specific Characters," Nature, 54 (Sept. 17, 1896), pp. 460-1; J. T. Cunningham, "The Utility of Specific Characters," Nature, 54 (Oct. 1, 1896), pp. 522-3.

This was in part because he doubted whether Weldon's statistical techniques had been sufficiently well developed and in part because of Weldon's failure to show that his assumptions about the growth and age of the crabs were correct. Moreover, Lankester was correct in demanding some kind of explanation of how changes in frontal breadth brought about increased or decreased survival value. In conclusion, Pearson condemned Weldon's interpretation of correlation--it could not be equated with causation as Weldon had appeared to do. Cunningham acknowledged the value of Weldon's investigations but pointed out that not until a selective death-rate had actually been proved to exist and the physiological basis of it explained, would natural selection have been demonstrated to occur. In a later letter Cunningham questioned the validity of changes in the size of crabs from 1893 to 1895 reported by Weldon's assistant Herbert Thompson.[59] He claimed that the differences observed were probably due to distortions caused by the action of preservatives in which the crabs had been stored, noting that the reported rate of change was much more rapid than that usually accepted by evolutionists. Both Weldon and Thompson replied[60] to

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[59] J. T. Cunningham, "Measurement of Crabs," Nature, 54 (Oct. 29, 1896), p. 621. Thompson's paper was "On Certain Changes Observed in the Dimensions of Parts of the Carapace of Carcinus Moenas," Proc. Roy. Soc., 60 (1897), pp. 195-8.

[60] H. Thompson, "Measurement of Crabs," Nature, 55 (Nov. 12, 1896), p. 30; W. F. R. Weldon, Ibid., Nature, 55 (Nov. 12, 1896), p. 30.

these criticisms showing that it was chemically impossible for the preservatives to have distorted the calcareous carapaces of the crabs.

The general tenor of the debates in Nature was agreement that Weldon had indeed discovered an interesting new approach to the study of evolution, but that he had not yet convincingly demonstrated its worth and that he had made claims for it which were far too sweeping. Even his strongest supporter and collaborator, Karl Pearson, had shown himself to be unsatisfied that Weldon's mathematical techniques were fully enough developed to measure "the rate and direction of evolution." In such a climate, Weldon renewed his efforts, both to improve his statistical techniques with the help of Pearson, and to illustrate that the selective death-rate of crabs associated with the variation of their frontal breadths could be explained in terms of function. This led to his next major public statement, the presidential address to the Zoology Section of the British Association in 1898.[61]

Weldon's address was devoted to a discussion of how his own work supported the "theory of Natural Selection." He began by discussing the concept of "chance" saying that it should not be equated with lack of law but rather with man's ignorance about which natural laws were acting. He then showed how probability theory could be used as a basis for

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[61] W. F. R. Weldon, "Presidential Address to Section D, Zoology," British Association Report (1898), pp. 887-902.

the mathematical treatment of chance events paying particular attention to the generation of frequency distribution graphs. Next he pointed out that Pearson had developed a technique by which asymmetrical distributions could be represented graphically and analysed statistically. In many cases such asymmetrical curves proved to be better fits to distributions which Weldon had previously presented as symmetrical. Weldon then passed on to the application of Pearson's newly-developed techniques to the crab measurements he had collected. He showed that the mean frontal breadth for each of those samples gathered in 1893, 1895 and 1898 at the same place, had decreased substantially. The rate of diminution was much more rapid than that commonly supposed to occur in evolutionary changes. In response to the pressure from his professional colleagues to demonstrate the physiological process by which decreased frontal breadths increased the chance of survival Weldon had carried out a number of experiments. He had verified to his own satisfaction that the diminution was connected with increased silting of the beach at Plymouth where the samples had been collected. This was done by placing crabs in tanks of sea-water in which large quantities of silt were kept in suspension by agitation. The crabs which died earlier were on the whole of greater frontal breadth than those which lived on. Further evidence of the cause of death was the presence of silt in the gills of the dead crabs. A control experiment in clear water and optimal living conditions resulted in an increase in the size of the mean frontal breadth. Weldon concluded that the survival of crabs with narrower fronts was due to their smaller gill openings and better filtration systems. Thus he had illustrated and measured the rate of evolutionary selection in regard to one character and its underlying physiological basis.[62] But despite this concession to his opponents he concluded his address by calling for numerical measures of the amount of variation in animal populations, the selective death-rate associated with different variations, and the proportion of variation passed by inheritance from generation to generation.

Weldon's address once again drew correspondence to the pages of Nature in the form of critical letters from J. T. Cunningham and George Henslow.[63] Henslow's rather cryptic

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[62] It should be noted that Weldon had here demonstrate a different kind of selective phenomenon from that in his previous work. Previously he had claimed to show that the extreme variations from the mean were selectively destroyed. In this case he claimed to demonstrate a continuous decrease in the mean size of an adult character due to selection. The first kind of selection tended to conserve the species as it was whereas the newer kind caused a change in the form of the species. Weldon did not differentiate these two kinds in his writings.

[63] J. T. Cunningham, "Organic Variations and Their Interpretations," Nature, 58 (Oct. 20, 1898), pp. 593-4; George Henslow, Ibid., Nature, 58 (Oct. 20, 1898), pp. 594-5. Rev. George Henslow (1835-1925), son of Prof. J. S. Henslow, of Cambridge, graduated in both divinity (2nd class) and in natural sciences (1st class) from Cambridge. While pursuing a clerical career in the church of England he retained interest in botany and lectured at St. Bart's Medical School 1866-90. See Who Was Who 1916-28.

style enabled Weldon to dismiss his criticisms as irrelevant. They seem to have been largely those of a proponent of "mutationstheorie" who did not regard slight variations in the size of an organ as the kind of "new variations" necessary to evolution. Henslow also repeated the criticism that Weldon seemed to be trying to replace the experimental method by statistics. Cunningham claimed that the diminution in size observed by Weldon could be accounted for by the different water temperatures of the summers of 1893, 1895 and 1898. He also repeated the criticism that Weldon had not yet established his assumptions about the relationship between age and length of the carapace which he continued to use as an index of the age. He strongly urged the measurement of crabs in clearer waters near Plymouth to test further Weldon's conclusion that silting was the cause of death. Weldon agreed that this suggested investigation should be carried out but held that Cunningham's other points could be met. Water temperature was not as crucial as Cunningham suggested, because crabs spent large periods of time on the shore. Walter Garstang supported Weldon's contention that the lengths of carapaces were a good index of a crab's age.[64]

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[64] W. F. R. Weldon, "Organic Variations and Their Interpretations," Nature, 58 (Oct. 20, 1898), pp. 595-6. Walter Garstang, Ibid., Nature, 58 (Oct. 27, 1898), p. 619. Garstang (1868-1949) was a marine biologist who had been appointed Naturalist in charge of Fisheries Investigation by the Marine Biology Association from 1897 until 1907 and professor of zoology at University of Leeds 1907-33. For further details see Who Was Who 1941-1950.

Weldon's more thorough treatment had helped to still criticism of his methods and results. But his new study had implicitly accepted the necessity of demonstrating the physiological basis of the selection rate he was measuring. He appeared, however, to see this demonstration as an expedient rather than as a scientific necessity. Physiologists would not take his new methods seriously unless he demonstrated that his conclusions had a valid physiological basis. That this was necessary is an indication of the extent to which Weldon's frame of reference differed from many of his contemporaries. He was in this way the leader of a new school distinct enough from the traditions of his own discipline to bring about a crisis of disciplinary identification.[65]

Weldon's position differed from that of Cunningham, Henslow or Bateson in terms of theory, methods and goals. Weldon's theoretical position was built around his commitment to the theory of evolution by natural selection. For him natural selection worked by the cumulative selection of small variations. Cunningham, Henslow and Bateson, on the other hand, were committed to the theory of evolution by large and sudden mutation--de Vries's "mutationstheorie." Weldon's theoretical view carried with it the implication

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[65] What I have here called "frame of reference" has some affinities with Kuhn's concept of "paradigm." The question of how different frames of reference or paradigms are related to institutional changes within the scientific community is discussed in relation to the "biometric school" in chapter V below.

that organic populations were the proper focus of study rather than individuals. The "mutationstheorie" carried the implication that the study of individual variations was very important. Weldon's methods were those of traditional morphology, accurate observational description rather than controlled experiment, combined with the new technique of statistical analysis of a great number of observations. His critics objected to the use of statistical analysis partly because of their commitment to the detailed analysis of individual cases. But their objections to statistics were often made without an understanding of statistical methods. This irrational reaction can be taken as a sign of the lack of mathematical training among British biologists of the day. Lack of mathematical training was in its turn a result both of the British educational system and of a tradition among naturalists that the biological realm was not amenable to mathematical treatment. Thiselton-Dyer's support of Weldon can be linked with the fact that his first university degree was taken in mathematics unlike most British biologists. A natural consequence of these differences in theory and methods was that Weldon's scientific goals differed from those of his opponents. Whereas he took the mechanism of evolution for granted and was primarily interested in measuring the rate and direction of evolution, they were still concerned to show that natural selection could not bring about evolution unless combined with the appearance of the mutations.

of de Vries. Weldon's work was carried out within a frame of reference which accepted assumptions that his opponents regarded as unproven or disproven. The profound difference between these frames of reference served as a basis for great tension within the biological discipline in England; a tension which showed its strength in the biometric-Mendelian controversy.

B. The Establishment of "Biometrika"

The difficulties of creating suitable statistical techniques for use in the study of animal evolution had led Weldon to consult Karl Pearson in the early stages of his biometric researches.[66] Subsequently, between 1893 and 1904 Pearson devoted much time to the development of suitable statistical tools for this task. A long series of his papers, many published under the general title "Mathematical Contributions to the Theory of Evolution,"[67] developed a number of

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[66] The best evidence for the earliest stages of co-operation is in E. S. Pearson, "Studies in the History . . . XIV . . .," pp. 8-10.

[67] Karl Pearson, "Mathematical Contributions to the Theory of Evolution."

I "Contribution to the Mathematical Theory of Evolution," Phil. Trans. A, 185 (1894), pp. 71-110;

II "Skew Variation in Homogeneous Material," Phil. Trans. A, 186 (1896), pp. 343-414;

III "Regression, Heredity and Pannixia," Phil. Trans. A, 187 (1897), pp. 253-318;

IV (with N. G. Filon) "On the Probable Errors of Frequency the standard tools since used in statistical work of all kinds (chi squared test, standard deviation, correlation and regression coefficients, and various mathematical tables, for example),[68] and laid the basis for the development of modern statistics.[69] Although Pearson's papers were written with

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Constants and on the Influence of Random Selection on Variation and Correlation," Phil. Trans. A, 191 (1898), pp. 229-311;

V "On the Reconstruction of the Stature of Pre-historic Races," Phil. Trans. A, 192 (1899), pp. 169-244;

VI "Genetic (reproductive) selection: Inheritance of Fertility in Man and of Fecundity in thoroughbred Racehorses," Phil. Trans. A, 192 (1899), pp. 257-78;

VII "On the Correlation of Characters Not Quantitatively Measurable," Phil. Trans., A, 195 (1901), pp. 1-47;

VIII (with Alice Lee) "On the Inheritance of Characters Not Capable of Exact Quantitative Measurement . . .," Phil. Trans., A, 192 (1899), pp. 279-90, 195 (1901), pp. 79-150;

IX "On the Principle of Homotyposis . . .," Phil. Trans., A, 197 (1901), pp. 285-379.

[68]The chi squared test was first put forward in "On the Criterion that a given System of Deviations from the Probable . . . can be reasonably supposed to have arisen from Random Sampling," The London, Edinburgh and Dublin Philosophical Magazine and Journal of Science, 50 (1900), pp. 157-175. Reprinted in Karl Pearson's Early Statistical Papers (Cambridge, C.U.P., 1948). Standard deviation was first used in "Contribution to the Mathematical Theory of Evolution." This is also reprinted in the collection just referred to. On Pearson's contributions to the development of correlation coefficients see G. Udny Yule, "Karl Pearson, 1857-1936," Obituary Notices of Fellows of the Royal Society, (1936), 2, pp. 81-4. The whole notice is a good survey of Pearson's contributions to statistics. For Pearson's contributions to the construction of mathematical tables see Ibid., pp. 87-8.

[69]Note, for example, the judgment of J.B.S. Haldane, "It is not too much to say that the subsequent developments of mathematical statistics are largely based on Pearson's work between 1893 and 1903," in his "Karl Pearson," New Biology, No. 25 (1958), pp. 7-26. Similarly E. S. Pearson

biological problems in mind, they were often mainly mathematical in content, the mathematics being based on biological assumptions very similar to those held by Weldon. One of the central assumptions was that evolution normally occurred by the action of natural selection on small variations which, in large numbers, took on the form of a mathematically continuous distribution. This assumption was the target of a sharp attack by William Bateson on one of the papers published in 1901,[70] and the events surrounding Bateson's attack led directly to the establishment of Biometrika.[71]

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describes the period, 1890-1905, as the first great formative period of modern mathematical statistics, and sees Karl Pearson as the dominant figure in that period. See his "Studies in the History . . . XIV . . .," p. 3.

[70]Pearson's paper was "Mathematical Contributions to the Theory of Evolution IX. On the Principle of Homotyposis and Its Relation to Heredity, to the Variability of the Individual, and to that of the Race," Phil. Trans. Roy. Soc., A, 197 (1901), pp. 285-379. Bateson's attack was contained in "Heredity, Differentiation, and Other Conceptions of Biology: a Consideration of Professor Karl Pearson's paper 'On the Principle of Homotyposis'," Proc. Roy. Soc., 69 (1901-2), pp. 193-205. Pearson replied to this criticism in "On the Fundamental Conceptions of Biology," Biometrika, 1 (1902), pp. 320-44; Bateson could not get a reply to this published in either Biometrika or Nature and so he published privately "Variation and Differentiation in Parts and Brethren," (Cambridge, 1903). This last paper is reprinted in Scientific Papers of William Bateson (ed. R. C. Punnett) (Cambridge, C.U.P., 1928), Vol. 1, pp. 419-95.

[71]The account given here is based largely on K. Pearson, LLG, IIIa, pp. 100, 241-3, 282-3 and E. S. Pearson, KP, pp. 39-40.

The paper, "On the Principle of Homotyposis," which was the target of Bateson's attack had come to his notice when he was asked by the Royal Society to act as a referee in relation to its publication. It was well known that Bateson was a proponent of the view that evolution depended on discontinuous or large variations and that he had previously clashed with Weldon on this point.[72] He went to the meeting of the Royal Society at which Pearson's paper was read and was very critical of it.[73] He then wrote a criticism[74] of the paper which was circulated to Fellows of the Royal Society before Pearson's paper had been published. Pearson objected to this procedure but Sir Michael Foster, Secretary of the Royal Society would not back up Pearson's objection. A short time after the publication of his homotyposis paper in November 1901, Pearson was asked by the Council of the Royal Society to divide any future papers into two parts, a biological part and a mathematical part, so that they could be published separately in the series of the _Philosophical Transactions_ appropriate to each part.[75] The original suggestion for a biometrical journal seems to have come from Weldon[76] when it was still doubtful whether Pearson's paper

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[72]See above, pp. 77-78, and notes 50 and 51.

[73]_LLG,_ IIIa, p. 241.

[74]See note 70.

[75]E. S. Pearson indicates that Karl Pearson received this notification in 1902; see _KP,_ p. 40.

[76]_KP_, p. 39.

would be accepted for publication because of Bateson's attitude as referee. At about this time Pearson wrote to Galton,

> . . . [it] is clear that if the R[oyal] S[ociety] people send my papers to Bateson, one cannot hope to get them printed.[77]

Plans were immediately discussed for the establishment of a new journal, and though Pearson had heard by the beginning of February, 1901,[78] that his homotyposis paper would be published by the Royal Society, the plans for a new journal went ahead. Sixty promises for subscriptions had been gathered by mid-April and shortly afterwards a sum of £400 was collected from five guarantors to enable publication to begin.[79] The five guarantors were Weldon, Pearson, Galton, R. J. Parker and Dr. W. R. MacDonnell.[80]

The clash which thus led to the establishment of Biometrika was part of a continuous controversy which can be

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[77]The letter is dated Dec. 13, 1900; see LLG, IIIa, p. 241.

[78]LLG, IIIa, p. 243.

[79]LLG, IIIa, pp. 244, 250.

[80]LLG, IIIa, p. 250. Robert John Parker (1857-1918) was a friend of Pearson's from student days. He became a chancery judge in 1906 and a life peer in 1913 after which he was a judge of final appeal in the House of Lords. For further details see D.N.B. Dr. W. R. MacDonnell (?-1916) LL.D. was a graduate in mathematics of the University of Aberdeen (M.A. 1872) and Oxford (1st class 1875), who worked in India before returning to study at Pearson's Biometric Laboratory in approximately 1900. He returned to the University of Aberdeen soon after to be lecturer in biometry. See Uni. of Aberdeen Calendar and University of Oxford Calendar.

traced back to 1894 and which certainly continued after Biometrika began publication. In 1894 Weldon had reviewed Bateson's Materials for the Study of Variation in one of the leading articles for an issue of Nature.[81] Weldon's review was generally favourable, particularly complimenting Bateson's industry, but was critical of the emphasis that Bateson put on "sports" or discontinuous variations as the source of new species. In accord with his population conception of species, Weldon also recommended the study of "variation" by collecting random samples of about five hundred members of a species. In the years that followed Weldon continued to emphasize the statistical study of large samples of continuous variation whereas Bateson emphasized the importance of the thorough investigation of "exceptions" and large individual variations.[82] In 1895, there was an exchange of letters in Nature on this topic in relation to the evolution of a cultivated flower.[83] After 1896, Bateson and

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[81]See Note 50 above.

[82]A very good account of Bateson's views and methods is given in William Coleman, "Bateson and Chromosomes: Conservative Thought in Science," unpublished paper, Bateson's common advice to younger scientists was "Treasure your exceptions," the importance of which is underlined in the following quotation: "Exceptions are like the rough brickwork of a growing building which tells that there is more to come and shows where the next construction is to be," from Bateson, "The Methods and Scope of Genetics," B. Bateson (ed.), William Bateson . . . Essays . . . ., p. 324.

[83]See Note 50 above.

Weldon frequently clashed at meetings of the Evolution Committee of the Royal Society to which they both belonged.[84] Bateson's attack on Pearson's homotyposis paper was a continuation of his controversy with Weldon.

In these attacks Bateson made no pretence of understanding the mathematical techniques of Pearson and Weldon.[85] Nevertheless he dismissed their work as misguided. Pearson wrote to Galton that Bateson had told him that "it was a fundamental error to suppose that number had any real existence in living forms."[86] Bateson held that it was possible for "specific variation" to be distinguished from "normal variations." The first led to the "differentiation" of varieties and eventually to the formation of separate species. "Normal variations," on the other hand, were never different enough from the species average to lead to differentiation. Bateson suggested that Pearson's series of papers should have been called "Mathematical Contributions to the Theory of <u>Normality</u>" not ". . . the Theory of <u>Evolution</u>."[87] Pearson's reply was certainly not conciliatory. He claimed that

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[84]Bateson at first refused to join this committee (see R. C. Punnett, "Early Days of Genetics," <u>Heredity</u>, <u>4</u> (1950), p. 4). There is evidence that when he did join, it was with a plan in cooperation with others to overthrow the biometricians' control of the committee (see <u>LLG</u>, IIIa, p. 287).

[85]Bateson, "Heredity, Differentiation. . . ," p. 195.

[86]<u>LLG</u>, IIIa, p. 241.

[87]Bateson, "Heredity, Differentiation . . .," p. 203.

Bateson did not understand mathematics, that he used terms inconsistently and that his theory of evolution was wrong.

The well-known controversy between the Mendelians and the biometricians which followed the rediscovery of Mendel's works in 1900, was a continuation of this drawn-out academic feuding between Bateson and the biometricians.[88] Bateson became Mendel's champion and argued that his own approach to biology was vindicated by Mendelism. Not only did the success of Mendel prove that it was correct to pay attention to individual "exceptions" but also Mendel's laws provided an explanation of how "sports" or "mutations" (in de Vries's sense of a large and sudden change in an organism) were inherited and became the starting-points for species differentiation.[89]

The controversy between Bateson, on one side, and Weldon and Pearson, on the other, was so bitterly contested that it has been blamed for delaying the development of both experimental and population genetics in Britain.[90] Whether

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[88] This point has often been overlooked in historial accounts of the clash.

[89] See Bateson, Mendel's Principles of Heredity (Cambridge, C.U.P., 1902).

[90] Lancelot Hogben has written: "Being a skillful manipulative mathematician equipped with a vigorous command of the English language, he [Pearson] had no difficulty in recruiting a militant following to spread a gospel which handicapped the progress of experimental genetics in Britain for at least half a generation." Statistical Theory, p. 235. On the other hand Sewall Wright has written: "Unfortunately, such bitter antagonism had developed between the British

or not these judgments are correct, it certainly appears that the controversy was as much the result of the personalities involved as of any scientific principle at stake.[91] The beginning of the public controversy over Mendelism was an article in the first volume of Biometrika in which Weldon discussed Mendel's original paper and its importance.[92] Weldon began his examination by carrying out statistical tests to see if Mendel's results were consistent with his theory. Thus Weldon anticipated Fisher's famous paper of the 1930's,[93] and like Fisher he discovered that Mendel's results were better than could really be expected. Unlike Fisher, however, Weldon praised Mendel all the more for the excellence of his results rather than seeking further explanations for the very good fit obtained between expected and observed numbers. Weldon next sought to show that Mendel's laws did not apply to all characters in peas, nor to all races of peas. In relation to the controversy which followed, three points about Weldon's paper should be emphasized. First, Weldon like de Vries and other biologists of the period spoke of

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Mendelians, under Bateson's leadership, and the biometricians, led by Pearson, that recognition of population genetics as a valid field for theoretical and experimental research was greatly delayed in England;" "The Foundation of Population Genetics," p. 248.

[91]For further comment on this point see chapter V below.

[92]W. F. R. Weldon, "Mendel's Laws of Alternative Inheritance in Peas," Biometrika, 1 (1902), pp. 228-234.

[93]R. A. Fisher, "Has Mendel's Work been Rediscovered?" Annals of Science, 1 (1936), pp. 121ff.

Mendel's "law of dominance,"[94] a "law" which was really de Vries's own embellishment on Mendel's work. The "law of segregation" which Weldon[95] outlined is today usually presented as two laws,the law of segregation and the law of independent assortment. Second, Weldon did not find any fault with Mendel's experiments and laws, but he did say that he did not believe the laws applied universally. Third, Weldon criticised work based on Mendel's methods which did not take account of the ancestry of the organisms being bred. This last point was in part due to Weldon's belief in Galton's "Law of Ancestral Inheritance"[96] and in part due

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[94]Robert C. Olby, Origins of Mendelism (New York, Schocken, 1966), notes that this was a common misunderstanding of Mendel's work. See pp. 137-141.

[95]The two Mendelian laws as outlined by Weldon were: (i) Law of Dominance: "If peas of two races be crossed, the hybrid offspring will exhibit only the dominant characters of the parents; and it will exhibit these without (or almost without) alteration, the recessive characters being altogether absent, or present in so slight a degree that they escape notice." (ii) Law of Segregation: "If the hybrids of the first generation, produced by crossing two races of peas which differ in certain characters, be allowed to fertilize themselves, all possible combinations of the ancestral race-characters will appear in the second generation with equal frequency, and these combinations will obey the Law of Dominance, so that characters intermediate between those of the ancestral races will not occur." See Weldon, op. cit., p. 229.

[96]For an account of Galton's law see R. G. Swinburne, "Galton's Law--Formulation and Development," Annals of Science, 21 (1965), pp. 15-31. The law states that a person will bear resemblance to his forebears according to the mathematical expression $(\frac{1}{2})^1 + (\frac{1}{2})^2 + (\frac{1}{2})^3$ . . . where the first term represents the parental generation, the second the grandparental, etc. Pearson noted that the law was purely a

to the common observation that parental organisms which are identical in external appearance do not necessarily give rise to identical offspring. Weldon's review of Mendel, while critical of various aspects of Mendel's work, was certainly not the all-out attack which it would appear to be from a reading of Bateson's defense of Mendel.

Bateson's book, Mendel's Principle of Heredity: A Defense, was published as a reply to Weldon's article on Mendel's Laws. The feeling which gave rise to the book was indicated in the preface where Bateson described his reaction to Weldon's article.

> It was . . . with a regret approaching to indignation that I read Professor Weldon's criticism.[97]

In the same preface, Bateson spoke of Weldon as Mendel's only critic and expressed "regret" that Pearson and Galton "were not trained in the profession of the naturalist."[98]

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statistical description:

> ancestral heredity in its most general form is not a biological hypothesis at all, it is simply a statement of a fundamental theorem in the statistical theory of multiple correlation applied to a particular type of statistics. If statistics of heredity are themselves sound the results deduced from this theorem will remain true whatever biological theory of heredity be propounded.

K. Pearson, "The Law of Ancestral Heredity," Biometrika, 2 (1903), pp. 211-229.

[97] Bateson, op. cit., p. vi.

[98] Ibid., p. xii.

Eschewing caution, Bateson determined to rouse the slumbering Weldon and bring him to his scientific senses.[99] Bateson maintained that there was no possibility of Galton's Law being reconciled with Mendel's Laws.[100] He attacked Weldon's statement that Mendel had put forward a "law of dominance,"[101] and he held that a knowledge of all the ancestry was not needed in Mendelian work.[102] Bateson certainly succeeded in 'rousing' Weldon and a long exchange continued in the pages of Biometrika, in Nature, and at the meeting of the British Association in 1904.[103] Bateson's means of continuing the controversy were somewhat hampered when neither Biometrika nor Nature would print his responses to

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[99]His preface concluded with this comment on his self-appointed task,

> In many well-regulated operations there are persons known as 'knockers-up', whose thankless task it is to rouse others from their slumber, and tell them work-time is come round again. That part I am venturing to play . . . and if I have knocked a trifle hard, it is because there is need. (p. xii)

[100]*Ibid.*, p. 105.

[101]*Ibid.*, pp. 117-8.

[102]*Ibid.*, p. 114.

[103]See W. F. R. Weldon, "On the Ambiguity of Mendel's Categories," Biometrika, 2 (1902), pp. 44-55, "Mr. Bateson's Revisions of Mendel's Theory of Heredity," Biometrika, 2 (1903), pp. 286-298; W. Bateson, "Mendel's Principle of Heredity in Mice," Nature, 67 (March 19, 1903), pp. 62-3, (April 23, 1903), pp. 585-6, 68 (May 14, 1903), pp. 33-4; W. F. R. Weldon, Ibid., Nature, 67 (April 2, 1903), p. 512, (April 30, 1903), p. 610; 68 (May 14, 1903), p. 34.

the latest article by Weldon.[104]

Weldon died in 1906 at a time when he was moving much closer to a reconciliation of Mendelism and biometric population studies. He appeared to have already essentially accepted chromomeres (i.e., tiny sections of the chromosomes) as the units of heredity,[105] a theory which Bateson never really accepted.[106] Furthermore, Weldon suggested that all the chromomeres on one chromosome would be retained in one group during mitosis.[107] Weldon's death brought this work to an end and Pearson did not follow it up. Weldon's death did not prevent the continuation of controversy between Pearson and Bateson, and relations between them remained very strained.[108] It is not my purpose here to write a complete account of the clash between the

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[104] See R. C. Punnett, op. cit., p. 4. I have been unable to discover why Nature terminated the discussion in its pages.

[105] Karl Pearson, "On a Mathematical Theory of Determinental Inheritance, From Suggestions and Notes of the Late W. F. R. Weldon," Biometrika, 6 (1908), p. 81.

[106] For Bateson's objections to the chromosome theory see Coleman, op. cit.

[107] Pearson, op. cit., pp. 82-3. Weldon was working on the manuscript of a book about inheritance when he died. It would be worthwhile finding out if any of this manuscript still exists. Weldon's interpretation of reduction division was similar to Weismann's.

[108] In 1909 Bateson's new edition of his Mendel's Principles of Heredity carried an attack on Pearson in its preface. Pearson replied in "Darwinism, Biometry and Some Recent Biology," Biometrika, 7 (1910), pp. 368-85. For the continued controversy see KP.

biometric school and Bateson over Mendelism.[109] But it is important for this work that adequate recognition should be given to the effects of the controversy on the biometric school.

At the time of Weldon's death, Francis Galton was in his eighty-fifth year and unable to assist Pearson in the work involved in editing a journal. In this way Biometrika, the journal of the biometric school, came under the complete control of Pearson, and the biometric school came to be identified with him. At the same time, Pearson turned his attention largely to the direction of the Eugenics Laboratory which was later to take Galton's name.[110] Both Pearson and Galton looked to the methods of the biometric school as the suitable methods for the study of human evolution to which Galton had given the name, "eugenics." Pearson's direction of the Galton Eugenics Laboratory was marked by a number of features which grew out of his experience with the biometric school from its foundation. The methods used were the statistical methods that he had developed in response to Weldon's questions. Much of the eugenics research was devoted to attempts to measure the rate and direction of human evolution. Selective death-rates were calculated. The

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[109]Such an account should certainly be written as available accounts are too brief. The best available account is in Cyril Darlington, Genetics and Man, pp. 176ff.

[110]See chapter IV below.

variability of human populations was measured. Correlations between sets of relatives were established for physical, mental and temperamental characteristics. Bateson's severe attacks on the use of statistical techniques probably increased Pearson's sensitivity to criticism and criticism of the work of the Eugenics Laboratory often brought forth withering replies. His own experience with the Royal Society undoubtedly helped to provide the motivation which saw virtually all of the Laboratory's work published under its own auspices. The attempt to establish eugenics as a scientific discipline was a natural growth for Pearson's interests after Weldon's death. He had always been more interested in the study of man than the study of other organisms. Without Weldon to turn his attention to crabs or mice or shrubs the application of biometry to man became a logical way to continue his interest in both evolutionary theory and the development of statistics.

IV

THE GALTON EUGENICS LABORATORY

Many of the elements which made up the ideology of eugenics were well established in English life in the last third of the nineteenth century. Eugenic ideas were debated in the British quarterlies and eugenic solutions to the problems of criminality, poverty, and disease were put forward in the journals and at the congresses devoted to the study of those problems. In the first decade of the twentieth century the growth of this movement was marked by the formation of two distinct organisations which both used "eugenics" in their titles. These were the Eugenics Record Office, later to become the Galton Eugenics Laboratory, at University College, London[1] and the Eugenics Education Society. Both organisations can be seen as formal but partial embodiments of the "eugenics movement" in Britain.

Although Sir Francis Galton was associated with both eugenics organisations they were closely related to each other for only a short period of time after the formation of the Eugenics Education Society.[2] The Eugenics Laboratory

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[1]Its full title was the Francis Galton Laboratory for the Study of National Eugenics.

[2]Karl Pearson did not join the Eugenics Education Society and regarded it as an organisation likely to damage eugenics in the eyes of the scientific community because of the enthusiasm with which some of its members advocated eugenic reforms that Pearson felt had not been sufficiently

represented an attempt to establish eugenics as a science. The Society, on the other hand, represented an attempt to establish eugenics as a social and political ideology. It is conceivable that close cooperation would have occurred with the Laboratory providing the scientific and social theory on which the Society based its actions. Such was not the case, however, and there is little point in continued speculation about that possibility. The two organisations did agree about certain general propositions. Both felt that political action should take note of eugenic principles where they were appropriate. Both felt that more eugenic research should be carried out. But whereas research was a small element in the Society's program it was the very reason for the Laboratory's existence. For these reasons I have treated the two organisations separately. The Laboratory is examined in this chapter and the Eugenics Education Society is the subject of a later chapter.

The Galton Eugenics Laboratory is of historical interest not only because of its association with the eugenics movement but also because it was one of the first biological

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investigated scientifically. He discouraged the staff of the Eugenics Laboratory from joining in the activities of the Eugenics Education Society especially after his clash with some of its members about the findings of a Eugenics Laboratory study on alcoholism (see below chapter VII). For Pearson's account of the relations between the Galton Laboratory and the Eugenics Education Society, see LLG, IIIa, pp. 335-6, 339, 362, 369-72, 379, 397-408, 426-7, 431.

research institutions established in Britain.[3] The patterns of organisation, financial support, recruitment of staff and relations with the scientific and wider communities which were developed at the Laboratory were to some extent representative of patterns developed by other scientific research institutions connected with universities. Scientific research institutions, while not a twentieth century innovation, certainly did not exist in large numbers in nineteenth century Britain. The Galton Eugenics Laboratory is of interest as an example of one of the key social innovations of industrial society, the scientific research institution, which has been exploited more and more as the twentieth century has proceeded.[4]

The nineteenth century saw science begin to emerge in the form in which it exists today. Professional scientists replaced gentlemanly amateurs. Specialism became the rule rather than the exception. University training in a chosen science became a professional pre-requisite. Professional organisations and publications were established in

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[3]The Galton Eugenics Laboratory differed from institutions such as the Natural History branch of the British Museum and the University of Cambridge Department of Comparative Anatomy, both of which had done much biological research before 1900, in that it was exclusively devoted to research. The Marine Biological Association's Experimental Station at Plymouth, established in the late 1880's, is one example of an earlier biological research institution.

[4]On this point see Kenneth Boulding, The Impact of the Social Sciences (New Brunswick, Rutgers Uni. P., 1966), pp. 6, 10, 40, and also his The Meaning of the Twentieth Century (London, George, Allen and Unwin, 1964).

large numbers. Original research was recognised as the highest form of professionalism in science. It was natural that the attempt to establish eugenics as a science should include an attempt to establish an institution devoted to both research and the training of professional scientists. The history of that institution is part of the story of the development of the complex professional organisation of science which exists today.

A. Formation and Growth of the Eugenics Laboratory

Galton's Original Benefaction

On October 10th, 1904, Galton wrote a letter to Sir Arthur Rucker, Principal of the University of London, offering a gift of £1500 for three years and £500 per year thereafter to establish a research fellowship in eugenics. In his letter Galton outlined the nature of the research he wanted the Fellow to carry out.

> I desire to forward the exact study of what may be called National Eugenics, by which I mean the influences that are socially controllable, on which the status of the nation depends. These are of two classes: (1) those which affect the race itself and (2) those which affect its health. It is the numerous influences comprised in (1), whose several strengths are as yet only vaguely surmised, that I especially want to have submitted to exact study. Class (2) is already the subject of much research, but I fear that here also the results arrived at require much more exact analysis by the higher methods of statistics than they have yet received.

> . . . One part of his [the Fellow's] duties would be to establish a collection of records relating to those families of England who are remarkable for the number of near kinsfolk whose deeds have been noteworthy.[5]

The university immediately set up a committee[6] to consider Galton's offer. This committee drew up a list of the Fellow's duties,[7] which the University Senate accepted as well as Galton's offer at its meeting on October 17.[8] The same committee[9] was asked to recommend a Fellow and afterwards to oversee his work.[10]

In January 1905 Edgar Schuster was chosen from ten applicants as the first Fellow in National Eugenics. Schuster was a student of Professor W. F. R. Weldon, the prime mover in the foundation of the "biometric school." Miss E. M. Elderton was appointed as an assistant to Schuster and together they made up the staff of the Eugenics Record Office which was under Galton's general oversight. The office was situated in rooms belonging to University College. In

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[5] LLG, IIIa, p. 222.

[6] In addition to Galton and Pearson the committee included Sir Arthur Rucker, Principal of the University of London, Sir Edward Busk, a lawyer who represented University College London on the University of London Senate and Halford Mackinder, then Director of the London School of Economics.

[7] For this list see Appendix 1.

[8] LLG, IIIa, p. 223.

[9] Without Sir Arthur Rucker among its members.

[10] LLG, IIIa, p. 223.

October, 1906, Schuster resigned the Eugenics Fellowship.[11] At the time Galton was not well and he sought Karl Pearson's advice about the future of the Eugenics Record Office, urging Pearson to take over its direction. In a series of letters between October and December, 1906,[12] Pearson outlined how he thought the Office should be run and Galton indicated that he would be prepared to continue his financial support of the Office if it were run along such lines. A letter from Pearson to Galton, dated December 22, 1906,[13] included a "Proposed Draft Scheme for the Francis Galton Laboratory for the Study of National Eugenics." Galton was very happy to accept Pearson's "Draft Scheme" and asked him to take over the direction of the Eugenics Record Office which Pearson renamed "The Francis Galton Laboratory for the Study of National Eugenics."

Karl Pearson, The Biometric Laboratory and University College

The history of the Galton Eugenics Laboratory from 1907 until 1933 was intimately connected with the personal history of Karl Pearson who was the Director of the Laboratory during the whole of that period. To fully understand Pearson's role as Director it is necessary to understand his

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[11] LLG, IIIa, p. 291.

[12] LLG, IIIa, pp. 291-306.

[13] Ibid., pp. 304-6.

position at University College before he became Director.[14]

Karl Pearson had a mathematical education at Cambridge where he graduated as third wrangler in 1879. For the next five years he mixed law studies with long periods in Germany where he studied a wide variety of subjects including history, folklore and evolutionary theory. In this same period he became associated with socialists and often spoke on behalf of socialist groups in London. In 1884 he turned aside from a legal career to accept the Goldsmid Professorship of applied mathematics and mechanics at University College, London. His duties included the teaching of astronomy and engineering subjects. In 1891 he was appointed to the Gresham Lectureship of geometry in the City of London.[15] In this and succeeding series of lectures he expounded and investigated statistical and probability theory. His <u>Grammar of Science</u>[16] which was a widely-read and influential treatise on the philosophy and methodology of science was based on his Gresham lectures. In 1895 he gave a course of lectures on

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[14]Material for the following account of Pearson's background comes from the <u>Dictionary of National Biography</u>, KP, and G. Udny Yule & L. N. G. Filon, "Karl Pearson 1857-1936" in <u>Obituary Notices of Fellows of the Royal Society</u>, <u>2</u> (Number 5) (1936), pp. 73-110.

[15]The Gresham lectureships were directly descended from Gresham College, famous for its association with the Royal Society in the seventeenth century.

[16]Karl Pearson, <u>The Grammar of Science</u> (London, Walter Scott, 1892) was revised and enlarged for a second edition in 1900 and revised and enlarged still further for a third edition in 1911.

the theory of statistics for the first time.[17] Thereafter this course was repeated annually and became the basis for undergraduate and post-graduate study done under Pearson's direction. In the early 1890's Weldon had drawn Pearson's attention to the possible use of statistics in problems related to evolutionary theory. Together they founded the English "biometric school." In 1901 this led to the founding of Biometrika for which Pearson carried the heaviest burden of editorial and organisational responsibility.

By 1901 Pearson found himself almost completely committed to biometry in terms of his primary research, teaching and administrative interests. Yet he was professionally employed to teach mathematics in a department oriented mainly towards engineering. Despite the basic orientation of Pearson's department he had already attracted students whose interest was in statistics.[18] The quality of Pearson's contributions to mathematical statistics was acknowledged by University College when it awarded him a research grant made available to the College by the Worshipful Company of Drapers. Pearson used this grant to establish a small team of researchers which he was later to call the Biometric Laboratory.[19]

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[17] HBGL, p. 1.

[18] G. Udny Yule, later Reader in statistics at the University of Cambridge, was the outstanding example.

[19] The title, "Biometric Laboratory," was not used to describe this group at first but was in use by 1906. See LLG, IIIa, pp. 224, 297 and KP, Appendix 4.

The research carried out by the Biometric Laboratory was mainly but not exclusively concerned with the application of biometrical methods to man. Two general areas of research were of particular interest to the Biometric Laboratory. These were the inheritance of pathological conditions such as tuberculosis and insanity in man and the comparative influence of heredity and environment on school children.[20] Research on these topics was obviously well within the area of eugenics as that subject had been defined by Galton.

When Pearson agreed to Galton's request to become Director of the Eugenics Record Office at the end of 1906 he did so knowing that this new responsibility would not change his position or other duties at University College. Nor would it increase his salary. Thus it was quite natural that he should tell Galton that he would accept the position only if the Record Office adopted research projects and methods similar to those that he had developed in the Biometric Laboratory.[21] As the Biometric Laboratory was already carrying out work which Pearson felt was important research in eugenics it was also quite natural that the two laboratories of which he was director, the Biometric and the Galton Eugenics Laboratories, should come to be seen by him as part of the one institution.

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[20]See Pearson's letter to Galton, LLG, IIIa, pp. 298-9 for an account of some of the research undertaken by the Biometric Laboratory.

[21]LLG, IIIa, pp. 298-9.

Galton's Death and the Foundation of a Chair of Eugenics

Pearson retained the direction of the Galton Laboratory and worked in close consultation with Galton until the latter's death in January 1911. Galton's will provided for the establishment of a professorship of eugenics and recommended that Pearson be offered the position. In the words of his will,

> . . . I hereby declare it to be my wish but I do not impose it as an obligation that on the appointment of the first Professor the post shall be offered to Professor Karl Pearson and on such conditions as will give him liberty to continue his Biometric Laboratory now established at University College.[22]

Pearson was appointed as first Galton Professor of Eugenics and retained his position as well as his directorships of the Eugenics and Biometric Laboratories until his retirement in 1933.

Galton's will makes it clear that he had in mind a multi-purpose institution.[23] The will had been drawn up in consultation with Pearson, who had, in fact, drafted the section on the professorial duties of the new Professor of Eugenics. Thus Pearson, as it turned out, was responsible for drawing up the duties of the Professorship he was later to hold. The institution would not only undertake research but would also serve as a consultative agency, a teaching

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[22] LLG, IIIa, pp. 437-8.

[23] See the appropriate sections of the will in Appendix 2.

department and to a lesser extent as a means of education of the general public about eugenics.[24] The research which Galton envisaged was not primarily of an experimental nature as is apparent from his placing of such research as the last item under the list of professorial duties in his will. Primarily the research would be the collection and analysis of materials which would throw light on the way in which modern society was influencing the evolution of man. This was in line with the work that both Pearson and Galton had already done in biometry, in which they had concentrated on the statistical analysis of material collected by historical or sociological research. It placed the Eugenics Laboratory, together with the Biometric Laboratory at the forefront of the development of a new technique in science, the use of statistical analysis.

The main change brought about by Galton's will was that Pearson was able to give up his various responsibilities in the Department of Applied Mathematics and become head of a new Department of Applied Statistics and Eugenics including the Biometric and Galton Laboratories. This enabled him to devote his full time to statistical, biometric and eugenic reserach and teaching which had become his central interest. The Galton benefaction also enabled an increase in the size of the Galton Laboratory staff, though the number

[24] See Pearson's introduction to the copy of the will in LLG, IIIa, p. 437.

of research staff was still only four including Pearson. The endowment was not large enough to provide for a building to house the laboratory. Consequently accommodation for the Galton Laboratory continued to be provided by University College.

The detailed history of the Biometric and Galton Laboratories after 1911 is examined in various ways in the remainder of this chapter. This history is the story of an attempt to establish institutions which would undertake research and teaching in two areas, eugenics and biometry, which their supporters held to be new and important sciences. The history not only tells us much about biometry and eugenics but also about the nature of science and scientific institutions in Britain in the early twentieth century. Before passing on to that detailed account it is helpful to outline briefly the main changes that took place in the laboratories.

Four events stand out as the major influences on the history of laboratories between 1911 and 1925. Of overwhelming importance was the war. From 1914 until 1918 the laboratories were engaged in work to support the British was effort. The team of workers under Pearson carried out a number of statistical projects related to that effort. As a result biometric and eugenic research were laid aside during the war years. And after the war only one of Pearson's researchers remained with him to carry on the research that had begun before the war. A second important event, the transfer of the laboratories to a new building especially designed for them was delayed by the war. The building was completed in 1914 and almost immediately turned into a military hospital. It was not until late in 1919 that the laboratories moved into their new quarters. The years immediately after the war saw two other important changes. There was a great increase in financial support of the research work undertaken by the laboratories. This increase came mainly from government sources. There was also an increased demand for undergraduate courses in statistics by University College and the staff of the Department of Applied Statistics and Eugenics were expected to provide such courses. These changes should be kept in mind as the activities, finances and organisation of the laboratories are examined more closely.

B. Karl Pearson as Director of the Galton Eugenics Laboratory

Karl Pearson was director of the Galton Eugenics Laboratory from 1907 until 1933. During that time the work and administration of the laboratory developed along lines which were largely under his control. Pearson understood the primary task of the Galton Eugenics Laboratory to be research and as far as possible he restricted teaching to a few post-graduate students. He did not keep the work of the Eugenics Laboratory strictly separate from that of the

Biometric Laboratory and in reports of the work of either he freely refers to work going on in the other and to the close relationship between such work. The real bond between the two laboratories was the technique of research used rather than the subject matter of the research. In both laboratories the basic technique of research was the statistical analysis of large masses of observations or collected data. Pearson's understanding of the work of the Eugenics Laboratory was worked out in the letters which passed between him and Galton late in 1906. In a later discussion of these letters Pearson indicated that he felt Galton had not clearly enough differentiated between eugenics as a science and eugenics as a social creed.[25] As a result Galton was too anxious for quick results. Pearson, on the other hand, believed that worthwhile scientific work using statistical analysis took a great length of time.

> Our experience in the Biometric Laboratory had taught us the serious length of time it takes to collect statistical data and afterwards to reduce them fully by modern statistical methods, whereas Galton was undoubtedly eager for quick returns; he approved brilliant essays in the monthlies, and wanted to see marked progress in the acceptance of Eugenics in his own day; he had not yet fully differentiated Eugenics as a science from Eugenics as a creed of social action.[26]

Pearson told Galton of these views in a letter in which he

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[25] LLG, IIIa, p. 296.

[26] *Ibid.*, pp. 296-7.

went on to outline his own ideas about the work of the Eugenics Record Office. He particularly emphasised the need for long-term projects and continuity in direction.

> . . . my personal idea of the Eugenics Record Office is that it should continue steadily to collect data bearing on the effect of environment, of heredity and of intercaste marriage upon man; that the Fellow should go on with annual or biennial appointment . . . that the results accumulated should be published . . . I think great results could be obtained ultimately in this way, but it would have to depend on my idea of "secular" accumulation. You will understand what I mean when I say that our investigations on school-children took five years to collect and two to reduce; and our measurements of families took four years to collect and two to reduce; . . . No Fellow in his one or two years of work could attempt to complete a six years' research of this kind, but he could . . . publish during his period of office such researches as happened to be nearing completion. . . . the scheme is essentially based upon the "secular" accumulation of data and continuity in the direction of the office such as we have had here in our biometric work.[27]

Galton agreed with Pearson's suggestions about the future of the Eugenics Record Office and Pearson turned to the task of drawing up more specific plans.

Pearson readily admitted that Galton's "generosity and large-mindedness" allowed him to go ahead freely pursuing his own ideas about the organisation and work of the laboratory.[28] Thus the research projects on man being

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[27] *Ibid.*, pp. 298-9.

[28] *Ibid.*, p. 299.

undertaken in the Biometric Laboratory, and mentioned in the letter quoted above, were all taken over by the Eugenics Laboratory when it was set up. Papers on the health and condition of school-children, the inheritance of disease, albinism in man, tuberculosis and insanity were published between 1907 and 1914 by the Galton Eugenics Laboratory. This clearly indicates the extent to which the area of future work of the Laboratory had already been determined in 1906.

Pearson's plans emphasized two elements that had already been apparent in his previous letters; his desire to base eugenic research on statistical methods and his desire to have the laboratory recognised as an institution carrying out serious scientific research. His desire for the laboratory to be recognised as a serious scientific institution showed itself in the suggestions which would give it a number of characteristics normally associated with such institutions; a series of Eugenics Laboratory publications, training for professional and research work, and an advisory committee of established scientists as consultants. Such characteristics have been shown by Hagstrom to be normally regarded by the scientific community as essential features of a scientific discipline.[29] All of these characteristics are mentioned in Pearson's December

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[29] See Hagstrom, <u>The Scientific Community</u>, passim.

22, 1906 letter to Galton.

> . . . I have been trying to put into form my thoughts on the Eugenics Laboratory work, . . . I want to make the Eugenics Laboratory a centre for information and inquiry. I want to extend the tendency which is growing up for outside social and medical workers to send their observations to the Biometric Laboratory. But to do this I think we ought to try and associate some half dozen men with the Laboratory as an advisory committee . . . if we are to get really good workers, we must give them a method of insuring to some extent their future. . . . It is most desirable that people trained in the Eugenics Laboratory should pass into work in public or municipal service of some type, as in dealing with mental defectives or invalid children . . . My next point is that the office should if possible have a paid computer. . . .
>
> I should suggest a continuous series of Eugenics Laboratory Publications. . . .
>
> I think the Eugenics Laboratory ought through its Fellow, and with our aid in the Biometric Laboratory to give instruction and aid to students and research workers in Eugenics.[30]

This letter illustrates how the multi-purpose nature of the Laboratory put forward in Galton's will had already been established by Pearson in his letters to Galton in late 1906. Pearson clearly mentioned in this letter the following activities which he felt the Laboratory should undertake: a) Research, b) The storage of data, c) The provision of information and of a consultation service, d) The training of research workers, e) The education of "practical eugenic" workers, f) The provision of general courses for undergraduates,

[30] LLG, IIIa, pp. 304-6.

g) The publication of reports, and memoirs. Not only was the Laboratory to serve as a centre for research but also as an archival depository, as a consultative agency to government and research workers, as a centre for education of at least three distinctive kinds, and as a publishing centre. Not only were a large number of activities involved but they covered a wide range of subjects. These included social work, anthropometry and medicine.

After his appointment as Galton Professor of eugenics in 1911, Pearson was able to devote all his time to the direction of the Eugenics and Biometric Laboratories. The peculiar combination of interests brought together in the two laboratories, and Pearson's continuing desire to increase their size spurred him to write a number of apologies for its particular organization. In these writings the two Laboratories were sometimes associated together in his thinking as an "Institute of Applied Statistics."[31] His understanding of eugenics as a science based on statistical method justified its presence in an "Institute of Applied Statistics." This, he claimed, was a natural continuation of Galton's ideas. To back up this claim he referred to a correspondence between Galton and Florence Nightingale in 1891 in which she had put forward the idea that a professorship of statistics

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[31]Pearson wrote a short "History of the Biometric and Galton Laboratories" which is included in the Minutes of the University of London as an Appendix to the Minutes for May 18, 1920, in which this concept is mentioned. See HBGL, pp. 1-2. See also <u>LLG,</u> pp. 414-24.

should be established at one of the English universities.[32] She advocated such a chair because "most social problems failed of their fitting solutions because there was no adequate training in statistical science." Pearson claimed that Galton had widened Florence Nightingale's idea of "applied statistics."

> He realised three fundamental principles: (i) that statistics are an essentially mathematical science --a branch of applied mathematics--and that no safe progress is possible except on a mathematical basis; (ii) that once such a science should be established it must and would invade as a new technique almost every branch of existing science; (iii) that, even in the narrower field of adequate statistical theory as applied to social problems . . ., there was a new factor which had to be recognised with the advance of our knowledge, namely the hereditary factor. He asserted that national progress was only possible provided you studied not only the effects of environment but the laws of genetics. He defined a new science, Eugenics, . . . For Sir Francis there could be no safe progress in Eugenics unless it was based on sound statistical theory, and on <u>quantitative</u> study of both heredity and environment. Such is the essential bond between the two laboratories, which for the first time aim at some fulfillment of Florence Nightingale's dream of an academic Institute of Applied Statistics.[33]

Pearson's emphasis on statistics can be understood in the context of his philosophical analysis of the nature of science. For Pearson the object of science was the discovery of scientific laws.[34] A scientific law was "a brief

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[32]<u>LLG</u>, II, pp. 414-24, gives an account of the correspondence.

[33]HBGL, p. 2.

[34]See Karl Pearson, <u>The Grammar of Science</u>, chapter 1.

description in mental shorthand of as wide a range as possible of the sequences of our sense-impressions."[35] Science did not explain why things happen, it described how they happen.[36] There were two ways in which Pearson saw the statistical method as important given his view of science. Firstly the concept of "causation" was seen as equivalent to an "overwhelming probability" that one perception in a sequence would follow another.[37] Statistical method was important for science if this was the nature of scientific causation because the calculus of probability was one basic element of statistical theory. Causation in this sense was merely the highest possible measure of correlation between two events. Thus the calculus of correlation, according to Pearson,[38] could take its place with the calculus of probability as a statistical method available to discover and express scientific law. A second, less important reason for the use of statistical method in science was that scientific

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[35] Ibid. (1892 edition), p. 135.

[36] Pearson's views were close to those of Ernst Mach whose inspiration he acknowledged in his preface to William Kingdon Clifford's The Common Sense of the Exact Sciences (New York, D. Appleton and Company, 1888), p. ix. For a concise and accurate account of Pearson's leading philosophical ideas, see John Macquarrie, Twentieth-Century Religious Thought (London, SCM Press, 1963), pp. 98-9.

[37] See Karl Pearson, The Grammar of Science, chapter 4, especially the summary at the end of the chapter.

[38] This idea was more fully developed in the third edition of The Grammar of Science where a new chapter entitled "Contingency and Correlation--The Insufficiency of Causation" was included.

laws needed to be both brief and elegant in their expression. Mathematical formulae obviously fulfilled both these needs and as statistics was one branch of mathematics it could also fulfill both needs.

When Pearson took over the supervision of the Galton Laboratory he was convinced that his major task was to establish the study of eugenics as a serious science and an academic discipline.[39] This was no simple matter, for eugenics differed from the established sciences not only in subject matter but also in methodology. Pearson's philosophical justification of the use of the statistical method in science had more impact on philosophers than scientists. The scientific community, particularly the biological part, did not readily accept the new method. But Pearson held that eugenics necessarily involved the statistical methods of biometry. Consequently biometrical methods needed to be developed and biometricians trained if eugenics was to become established as a science. There was yet another reason for Pearson to associate the Galton Eugenics Laboratory with his Biometric Laboratory. The latter could develop the methods of biometry and train biometricians. The former could give employment to the biometricians so trained and their work in eugenics would reveal the power of the new scientific methodology. Whereas for Galton biometry had been a useful new tool in

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[39] See especially a letter from Pearson to Galton dated February 7, 1909, and printed in LLG, IIIa, pp. 371-2.

his study of heredity, evolution and eugenics, for Pearson eugenics became a testing ground for the new scientific methodology of biometry.[40]

In 1920 Pearson wrote that the aim of the "Biometric School" and of the Biometric Laboratory with which it was identified was to establish statistics as a scientific discipline.

> The object of this school was to make statistics a branch of applied mathematics with a technique and nomenclature of its own, to train statisticians as men of science, to extend, discard or justify the meagre processes of the older school of political and social statisticians, and in general to convert statistics in this country from being the playing field of dilettanti and controversialists into a serious branch of science, which no man could use effectively without adequate training, any more than he could attempt to use the differential calculus, being ignorant of mathematics. This task was a very arduous one, for statistics in one form or another are fundamental in nearly every branch of science in precisely the same manner as mathematics are fundamental in astronomy and physics.[41]

The views expressed in this extract greatly influenced Pearson's direction of the Galton and Biometric Laboratories. In the first place all the work undertaken by the Laboratories used statistical methods. Secondly, the problems investigated were usually problems already under debate and about which large amounts of data existed or could be collected.

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[40]On the primacy of the application of statistics in Pearson's thinking, see KP, p. 54.

[41]KP, p. 53.

They were also usually problems concerned with social welfare and were often being considered by Parliament or Parliamentary committees. By choosing such problems Pearson was able to show how sophisticated statistical analysis could enable a scientific approach to social and political problems, and therefore to national welfare.

Pearson's own convictions and ideas were very strongly impressed on the Galton and Biometric Laboratories during his Directorship. His conviction that

> The efficiency of the Laboratories . . . must be judged by their publications and the influence they have had on the general development of science.[42]

meant that there was an almost exclusive emphasis on research when the terms of the Galton bequest left room enough for much greater emphasis on teaching. The choice of topics for research reflected his own interests. Much of the work undertaken in the Galton Laboratory after 1907 had already been in progress in Pearson's Department of Applied Mathematics before then.[43] He supervised very closely the actual

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[42]HBGL, p. 5.

[43]In a letter to Galton dated October 25, 1906, Pearson listed the following as areas in which research was under way: "Investigation of school children," "measurements of families," "inheritance of disease," "albinism in man" and "inheritance of tuberculosis and insanity." All these areas were investigated later in the Eugenics Laboratory. The letter referred to is printed in LLG, IIIa, pp. 298-9.

research and the writing up of the research.[44] This close supervision was made more evident by his readiness to engage in controversy defending the results of Laboratory publications which did not originally carry his name.[45]

C. Financial Arrangements of the Galton and Biometric Laboratories

Karl Pearson's attempt to establish an "Institute of Applied Statistics" had to be carried out within the limits of the financial support available to him. The income of the Galton and Biometric Laboratories during the period 1903-1925 was provided mainly by two kinds of support. Until the end of the war the support was almost entirely in the form of benefactions from private sources. After the war governmental grants provided a second major kind of financial support.[46] At no time was financial support from either University College or the University of London of equal importance to that derived from other sources. The assistance of University College in providing the site and some of the cost of the new Laboratory buildings was all that came near to matching the support from private donors before the war and govern-

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[44]See KP, pp. 70-7?, 97, 103; GLJ, p. 39.

[45]See chapter VII below for examples of this in relation to the controversy which followed the Galton Laboratory's publications on alcoholism.

[46]See Table 3 and Figure 2a.

mental agencies after the war.

In this matter Pearson's "Institute of Applied Statistics" exemplified the position of scientific research in Britain. The last third of the nineteenth century had seen much debate about the need for governmental support of scientific research in the pages of Nature, at the annual meetings of the British Association, and in the general press. On the whole, however, laissez-faire principles had triumphed and scientific research remained dependent on individual and private financial support.[47] In the early years of the twentieth century a resurgent nationalism emphasised "national efficiency" and called for more support of science and technology.[48] It was the war, however, which "released purse-strings and encouraged politicians to found institutions for the practical applications of science."[49] The institutions founded included the Department of Scientific and Industrial Research, the Medical Research Committee and the University Grants Commission. Wartime experience of governmental support for science and technology strengthened the

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[47] See, for example, E. Ray Lankester's 1906 Presidential address to the British Association, reprinted in his The Kingdom of Man (New York, Henry Holt, 1907), pp. 149-57. For secondary accounts of the organisation of science at this time see Joseph Ben-David, Fundamental Research and the Universities (Paris, OECD, 1968), pp. 29-44 and D. S. L. Cardwell, The Organisation of Science in England (London, Heinemann, 1957), pp. 124-168.

[48] See Bernard Semmel, Imperialism and Social Reform, passim.

[49] Arthur Marwick, The Deluge (Harmondsworth, Pelican, 1967), p. 245.

movement towards state support of science and research.[50] The Biometric and Galton Laboratories shared in this general increase of public support for science.

The financial affairs of the laboratories can be divided into three main periods during the time under consideration.[51] The first period from 1903 until 1911 was marked by the award of the original benefactions which brought the Laboratories into existence. The period from 1911 until 1920 saw the establishment of the Laboratories as a joint institution under the direction of Pearson. This period was also marked by fund-raising and planning for the building of an adequate home for the "Department of Applied Statistics and Eugenics, including the Biometric and Galton Laboratories." The final period from 1920 until 1925 was marked by a substantial increase in the income of the Laboratories, almost all of which came from governmental sources so that in 1925 more than half their annual income was from such sources. These three periods in the history of the Laboratories are clearly marked in Figure 1 showing the approximate annual income of the laboratories during this period.

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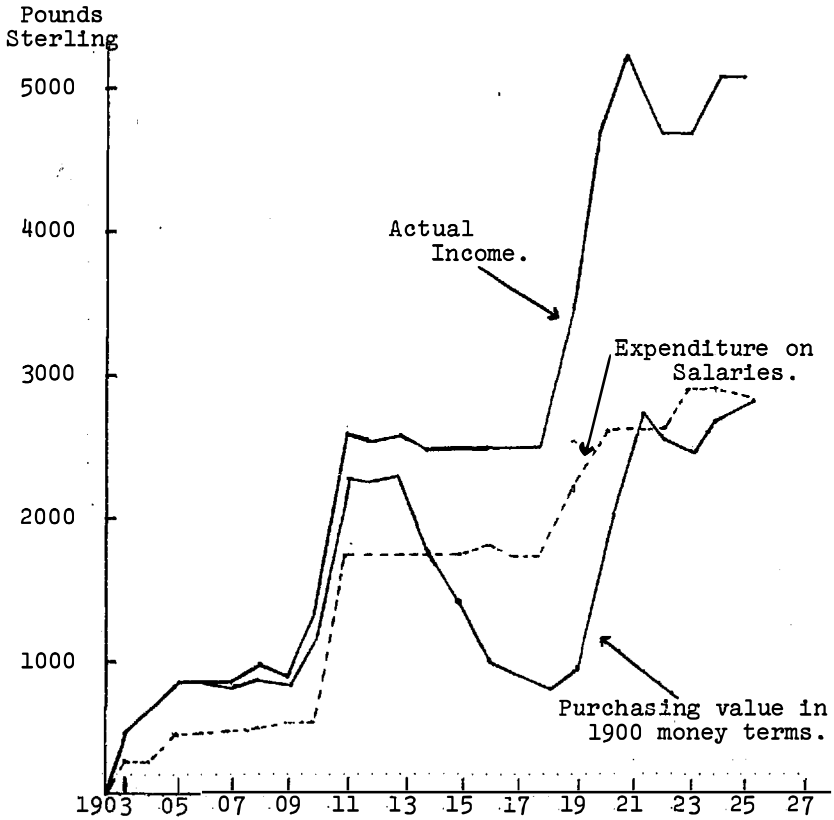
[50] _Ibid._, p. 249.

[51] Both Table 3 and Figure 1 clearly illustrate these three periods.



The purchasing value in 1900 money terms was calculated by using the Board of Trade Wholesale Price Indices covering this period. These were taken from B. R. Michell and Phyllis Deane, Abstract of British Historical Statistics (Cambridge, C.U.P., 1962), Prices Table 5, pp. 476-7.

Figure 1. Income of the Galton and Biometric Laboratories

1903-1911

In 1903, Karl Pearson's research in statistics and biometry was acknowledged by the award of a grant from the

Worshipful Company of Drapers. The award of £1000 had been made available to University College[52] and the College authorities passed it on to Pearson and his Department of Applied Mathematics. The award was probably one of many grants made by the Drapers Company to educational institutions in London.[53] I have found no evidence that the Company made the grant specifically to Pearson, and he noted in his first report to the Drapers' Company that the grant was completely unexpected.[54] There is no mention in this report of the title "Biometric Laboratory" but by 1906 the title was definitely in use.[55] In later years Pearson traced the origin of the Laboratory back to a course of lectures on the theory of statistics which he had given in 1895.[56] From these lectures and those in succeeding years and from his biometrical discussions with Weldon and Galton grew research in both theoretical and applied statistics. This was the research assisted by the Drapers' Company Grant and continued in the Biometric Laboratory. The Drapers' Company Grant was used to pay salaries, to buy instruments, to finance publications and to pay for incidental research

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[52] RGBL, p. 1; "For the Chairman . . .," p. 3.

[53] See Tom Girtin, The Triple Crowns: A Narrative History of the Drapers' Company 1364-1964 (London, Hutchinson, 1964) which gives an account of such awards in ~~chapter~~ 21.

[54] KP, Appendix 4, p. 163.

[55] LLG, IIIa, p. 224 and p. 297.

[56] HBGL, p. 1.

expenses. Of the original £1000 grant, which covered a period of two years, £500 was used on salaries, approximately £150 on instruments (including calculating machines, microscopes, and photographic equipment), about £50 on incidental research expenses and the remainder to subsidise the publications of the Department.[57] The Drapers' Company awarded a second grant of £2000 to Pearson's Biometric Laboratory in 1905 to cover the next five years. From 1910 until 1932 an annual grant of £500 was made by the Company to the Biometric Laboratory.[58]

In late 1904 Francis Galton made his offer to provide a Research Fellowship in eugenics. The account for the Eugenics Record Office was opened in February 1905 with Galton's £1500 gift as its first entry.[59] Until his death he provided £500 annually for research in eugenics. By far the largest part of this money was spent on salaries with the greater part of what was left being spent on the Eugenics Laboratory's publication program. In the period, 1905-1911, ending when Pearson assumed the Galton Professorship of eugenics, the total expenditure of the Eugenics Record Office and the Galton Eugenics Laboratory was £3899. This was divided in the following way: Salaries, £2468;

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[57] KP, Appendix 4, pp. 160-163.

[58] KP, p. 46.

[59] These figures come from a copy of the audited accounts of the Galton Laboratory (1905-1913) found in the archives of the Galton Laboratory.

Printing and Publishing Costs, £979; Petty Cash, £166; Furniture and Equipment, £139; Rent and Services, £105; Other, £42. The total expenditure was slightly greater than the income provided by Galton. The difference was made up from the proceeds of sales of the Laboratory publications, donations and a small grant from the University of London.

1911-1920

The reorganization resulting from Galton's bequest in 1911 saw Pearson elected as Galton Professor of eugenics and the Galton and Biometric Laboratories formed into a new Department of Applied Statistics under his direction. The annual income of the two laboratories was more than doubled, rising from an average of approximately £1000 to an average of about £2500.[60] The increase of £1500 p.a. was mainly provided by the difference between the income from Galton's bequest (£1500p.a.) and his previous contributions (£500p.a.) amounting to £1000. University College and the University of London agreed to provide the money necessary to increase the income from the Galton bequest to £1800 annually.[61] The remaining £200 increase in the annual income came from a

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[60] See Figure 1 for an account of figures in relation to income and salaries.

[61] £200 of this money came from University College and was added so that the salary offered to Pearson would be £1000 rather than £800. See SM 1897-1908, March 29, 1911; 2785, 2918, 2921-3, June 14, 1911; 3074-5, July 12, 1911.

variety of sources including donations, increased sales of publications and a small grant from the Royal Society. As can be seen from Figure 1 a large proportion of the increased income (£1100) was spent on salaries of those already working at the Galton Laboratory. The remaining £300 of the annual increase was spent in roughly equal amounts on publishing costs, building up a laboratory library, and costs for the housing of animals used in breeding experiments. As Karl Pearson was later to point out,

> . . . it is desirable to emphasize that the chief result of Sir Francis' death and his bequest was to free the then professor of Applied Mathematics in University College [Pearson himself] from his onerous teaching duties and allow him to devote his whole time to the direction of the two laboratories . . . It provided very little increased endowment for staff or publications, and that little came from University funds.[62]

From the academic year, 1911-12, until 1918-19, virtually no changes occurred in the pattern of income and expenditure. The war years of 1914-18 did, however, have a serious effect on the financial position of the laboratories. Inflation greatly decreased the purchasing power of money. If the purchasing value of the laboratories' income is converted to 1900 values, their annual income decreased from a 1900 equivalent of £2175 in 1913-14 to one of £809 in 1918-19.[63]

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[62] HBGL, p. 2.

[63] See Figure 1 for these figures and explanation of the calculations involved.

The impact of this decrease in buying value on the laboratories was lessened by the fact that salaries were not increased. The salaries made up more than 75% of the expenditure in these years.[64] This meant that the greatest effect of the war was on the publications programme of the Laboratories, which would have been severely curtailed in any case by the decision of the staff to do work relevant to Britain's war effort.

The other major financial business of the Laboratories during this period was concerned with the provision of new accommodation for the Laboratories. The University Senate had approved the request of the Galton Laboratory Committee to launch an appeal for funds at the time of the news of the Galton bequest.[65] In late 1911, Sir Herbert Bartlett anonymously offered to meet most of the costs of a building to house the Department of Applied Statistics on University College grounds. Arrangements were made for the funds from the appeal to meet the costs of the building's furniture and equipment. Bartlett's offer was worth about £12,000 and University College provided about £3000 towards the cost of the building. The funds from the public appeal provided about £3800 for the equipment and furniture of the laboratories.[66] Because of the war the building was not occupied

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[64]See Figure 2b.

[65]SM 1899-1908, March 29, 1911.

[66]KP, p. 77; RGBL, p. 6. Both give relevant figures.

until October 1919.[67]

1920-1925.

In the period from 1920 until 1925 the average annual income of the laboratories showed a substantial increase over its previous level. There was an increase in the annual income of just over £2000. Apart from a sum of £1100 in 1919-1920, which came equally from the University and the College, and which may have originally come from the Treasury also, all of the increases in this post-war period came from government agencies.[68] £1000 p.a. was supplied by the Treasury on the recommendation of the University Grants Commission[69] beginning in 1921. A similar sum was awarded by the London County Council to the Department of Applied Statistics beginning in 1920.[70] This award was to supply the salary of a medical officer (£800 p.a.) and an assistant (£200 p.a.). In 1921, the Medical Research Council awarded Dr. Julia Bell, one of the laboratory's workers, a Fellowship of £300 p.a.[71] A similar amount was granted by the Department of Scientific and Industrial Research to pay the salary of a personal assistant for Pearson.[72] In 1920-21

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[67] See official programme for opening, June 4, 1920, p. 4.

[68] For the various sources of support for the laboratories from 1903 until 1925, see Table 3.

[69] SM 4305, July 20, 1921; SM 21, October 19, 1921.

[70] SM 16, October 20, 1920.

[71] SM 3373, May 25, 1921.

[72] SM 3657, June 21, 1922; RGBL, p. 2.

TABLE 3

List of Main Sources of Support for the Galton and Biometric Laboratories, 1903-1925

Date of Initial Award	Source of Support	Amount (£)	Period of Award
1903	Worshipful Company of Drapers	500 p.a.	1903-1925
Oct. 1904	Francis Galton	500 p.a.	1905-1911
Jan. 1911	Estate of Sir Francis Galton	1500[a] p.a.	1911-1925
Oct. 1911	Sir Herbert H. Bartlett	12000 approx.	Lump Sum
1915	Public Appeal for Funds	4000 approx.	Lump Sum
1919	University of London	550	1919-1920
1919	University College	550	1919-1920
1920	University College	2000	1920-1921
1920	London County Council	1000 p.a.	1920-1925
1921	University Grants Commission	1000 p.a.	1921-1925
1921	Medical Research Council	300 p.a.	1921-1925
1921	Department of Scientific & Industrial Research	300 p.a.	1921-1925
1922	Mr. Lewis Haslam M.P.	1000[b]	Lump Sum

Sources. See Text.

a) This sum was made up to £1800 p.a. by University College (£200 p.a.) and the University of London (£100 p.a. approx.) by an arrangement made when Pearson accepted the Galton Professorship. (S.M. 3074-5 July 12th, 1911).

b) £500 of this gift was to finance the publication of Pearson's Life of Francis Galton and the other £500 to subsidise other Laboratory publications.

University College had given a non-recurrent grant of £2000 to the Department of Applied Statistics which was probably part of a larger Treasury Grant to the College.[73] The result of these various governmental grants was that in 1925-6 the laboratories were supported almost entirely by these grants together with the income from the Galton bequest and the Drapers' Company award.[74]

The largest segment of the increased income was spent on the upkeep and servicing of the new building into which the two laboratories had moved. Before 1920 the most that had been spent in this way in any one year was £56 in 1914-15 but in the three years beginning in 1920-21, the amounts spent were £1048, £1580, and £1205.[75] This expenditure on the upkeep of the new building accounted for about half the increased income. £1600 of the new income was provided on the understanding that it would be used for salaries. But expenditure on salaries did not actually increase by this much as the grants from D.S.I.R., M.R.C., and the smaller of the two from the L.C.C. were used to pay people previously employed, releasing the sources of their previous salaries for other areas of the laboratories' expenditure. The increased income also allowed the amount of money spent on publishing to be raised to £400 p.a. from £200 p.a. These trends are clearly indicated in Figure 2b.

[73]SM 3067-8, May 25, 1921; RGBL, p. 6.

[74]See Figure 2a.

[75]RGBL, pp. 9-11.

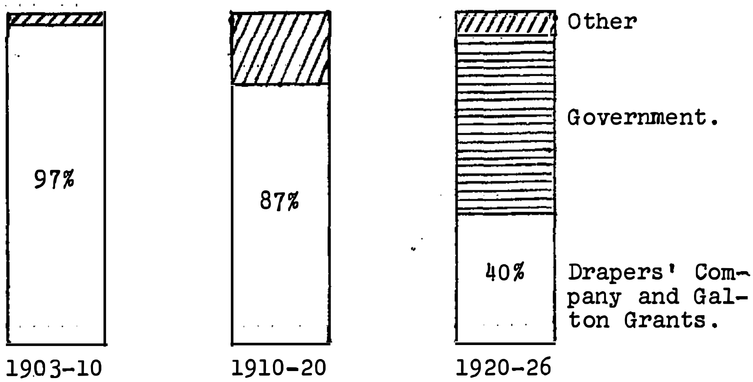

Figure 2a. Sources of Income

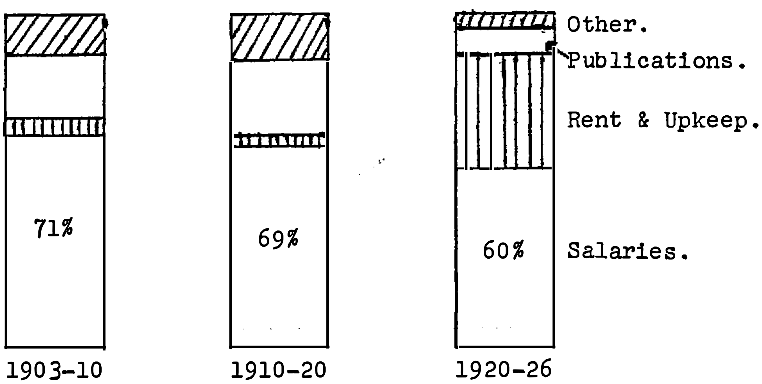

Figure 2b. Division of Expenditure.

Figure 2. Sources of Income and Division of Expenditure of the Galton and Biometric Laboratories.

The post-war period also saw some measure of deflation. By 1925-6 the purchasing power of the English currency had risen to over 55% of its 1900 value compared with the low of 27% in 1919-20. But the decline in the purchasing power of money compared with pre-war years meant that the income of 1925-6 represented only a 22.5% increase in purchasing power over the income of 1911-12 when the purchasing power of the laboratories' income had reached its pre-war peak.[76] Although the income of the laboratories had been £2600 in 1911-12 and was £4900 in 1925-6 the purchasing power of these sums expressed in 1900 values was £2263 and £2772 respectively. This reduction in the value of money had its impact in two main ways. Firstly, a great deal of the increased income in post-war years had to be spent on service and maintenance of the new building. Secondly, the salaries of the laboratories' staff did not rise to meet the increased cost-of-living. Pearson's salary as Professor increased by only £200 from £1000 to £1200 between 1911-12 and 1925-6. In this last year the average salary of the assistants working in the laboratories was £275, or less than that of teachers in elementary schools.[77]

Financial Support of the Laboratories as a Reflection of the Financial Support of Scientific Research Generally.

Although the changing pattern of financial support

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[76] See Figure 1 for trends outlined here.

[77] RGBL, pp. 14-15.

of the laboratories reflected general changes in early twentieth century Britain, it should not be considered that increased support came automatically to the laboratories simply because they were in existence. The money from the University Grants Committee may have come in this manner because the two laboratories were part of University College's Department of Applied Statistics. But there were other reasons for the various grants. The laboratories had worked in close contact with two different arms of government during the war and had also provided statisticians for other government departments.[78] Moreover, Pearson and his staff had sought the co-operation of the medical profession during the whole time of the existence of the two laboratories. This co-operation with two different professional groups helped to strengthen support for Pearson's claim for the vital importance of statistics and the training of statisticians. The work of the laboratories for the Board of Trade and the Admiralty drew attention to the usefulness of statisticians but the great need for accurate knowledge about manpower, supplies and food during the war years emphasized the necessity of statisticians in a modern state. The war made a civil service without statisticians inconceivable. In a similar, but less dramatic manner, medical officers of health, particularly those dealing with school children and public institutions, had become aware of the usefulness of

[78] Drapers' Report 1914-1918, pp. 4-5.

statistical analysis by the pre-war studies of the two laboratories. Increased appreciation of the utility of statistical analysis in modern government and modern medicine and the subsequent demand for courses in statistics and for trained statisticians gave Pearson's laboratories a strong case for governmental financial support.

In another way the experience of the Galton and Biometric Laboratories was typical of the time. The lack of University funds in support of a research institute of the kind that Pearson envisaged can be explained by reference to traditional practice. It would, indeed, have been exceptional for any university, but more especially for the University of London with its limited resources, to give a significant measure of financial support to research. Moreover, the research which Pearson advocated was very controversial. His laboratories claimed to be establishing the foundations of a new science but the nature of that science was not clear. Was it eugenics or biometry or applied statistics? Against such a background it is perhaps more helpful to liken Pearson to an entrepreneur who was able to persuade some people of the benefits of his research and so to benefit from their financial support. This pattern of "entrepreneurial" activity was, according to Ben-David, more common in the United States than in Britain.[79]

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[79] Ben-David, op. cit., pp. 33-44.

D. The Relationship of the Galton Laboratory to University College and the University of London

In 1910 the University of London was a degree-granting body made up of little more than the bureaucracy necessary to examine candidates for those degrees. Virtually all the teaching and all the physical facilities necessary for teaching were provided by colleges associated with the University of London. University College, London was one of these associated colleges.[80] The Galton Laboratory, a research institution, became associated almost by accident with University College, a teaching institution.[81] The research orientation of the laboratory together with Karl Pearson's strong independence of mind led to friction between the laboratory and the administration of a college familiar only with teaching departments. The importance of such friction is difficult to assess. To some extent the laboratory was insulated from the College administration by the source of its finances which were always largely from non-university funds. Nevertheless the relations between the Galton Laboratory, University College and the University of London throw further light on the role of a scientific research institution in Edwardian and post-war Britain.

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[80] For the relation of University College to the University of London, see Hugh Hale Bellot, University College London 1826-1926 (London, U. of London Press, 1929).

[81] See letter of Galton to Sir Arthur Rucker, dated October 10th, 1904 in LLG, IIIa, p. 222; KP, p. 54.

Francis Galton's original offer to finance a Fellowship for the study of "National Eugenics" was made to the University of London. Galton's offer included the condition that the University should provide office accommodation for the Fellow.[82] The Eugenics Record Office was set up in rooms provided by University College. The College was not, however, responsible for the oversight of the Office. Supervision was delegated by the University of London Senate to a committee,[83] consisting of Galton, Pearson, Sir Edward Busk, a lawyer who represented University College on the Senate,[84] and Halford Mackinder, then Director of the London School of Economics.[85] This supervisory committee met only four times in two years and then mainly to consider reports from the Research Fellow. In fact, the real direction of the office remained in the hands of Galton. The resignation of the first Research Fellow in October 1906 caused Galton to turn to Pearson for advice about the long-range plans for the office. The result was to bring the office under the direction of Karl Pearson and, in many

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[82]*LLG*, IIIa, p. 222.

[83]SM 1815-1816, June 7th, 1905.

[84]The biographical information about Busk is from the University of London *Calendar* for 1910.

[85]Mackinder (1861-1947) was a pioneer in the study of economic geography. A prominent Liberal, he is one of the 'social imperialists' studied in Bernard Semmel's *Imperialism and Social Reform.* For further biographical information see *D.N.B.*

ways, to join it with the Biometric Laboratory as a single institution. The supervisory committee appointed by the University Senate was retained and a new committee of consultants was set up. This advisory panel consisted of an actuary, an anthropologist, a zoologist and four medical men.[86] Neither the supervisory committee nor the advisory panel played an active role in the affairs of the laboratory leaving first Galton and later Pearson to direct the research as they saw fit. Supervision by Pearson and shared accommodation with the Biometric Laboratory in the University College Department of Applied Mathematics made it difficult for the Galton Laboratory not to be perceived as part of University College even though, legally, Galton's money had been given to the University of London.

The next major change in the organisation of the Galton Laboratory came in 1911 after Galton's death when his will revealed his final benefaction to the University of London. It came at a time when the University Senate had just received a "Report of the Francis Galton Laboratory Committee for Presentation to the Royal Commission on University Education in London." The Report included a section

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[86]The members of the advisory panel were W. Palin Elderton, an actuary, John Macpherson M.D., a commissioner in lunacy, Dr. F. W. Mott F.R.S., a pathologist, E. Nettleship F.R.C.S., an ophthamologist, Edgar Schuster, first Galton Research Fellow, R. J. S. Simpson, a professor of tropical medicine, and J. F. Tocher, an anthropologist.

on "Future Policy" which held,

> that it is now for the Senate to decide what policy they will adopt with regard to the future of the Laboratory. Two alternatives seem to us possible: (i) to continue the Laboratory upon the existing lines with such additions only as are required for urgent need; (ii) to establish the Laboratory upon such a permanent basis as would enable it adequately to fulfil the purposes for which it was founded.[87]

The committee went on to outline two such alternative schemes. The first alternative involved the provision of substitute teachers for Pearson to enable him to devote full-time to the laboratory, and the provision of a small building for the laboratory. It was estimated that this would cost £3,600 in capital expenditure and £1000 in recurrent annual expenditure. The second alternative involved provision of a much larger building and an increase in the staff of the laboratory by five, including a trained actuary and a medical officer. This was estimated to cost £20,000 in capital expenditure and £4000 in recurrent annual expenditure.[88]

The consideration of Galton's will and the changes it would make to the laboratory enabled the Galton Laboratory Committee to reconsider future plans. An annual income of £1500 from the Galton bequest assured that the less ambitious

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[87] RC, p. 4.

[88] This scheme had originated in Pearson's report to the Galton Laboratory Committee for 1909-1910 and had been inserted in the University of London's report to the Royal Commission on University Education in London. See RC, p. 4.

plan for the future of the laboratory would be accomplished. At the same time it was an auspicious moment to launch an appeal for more funds which was duly done.[89] It was also, presumably, a time at which the Galton Eugenics Laboratory would have carried the promise of prestige and perhaps other side benefits. For whatever reason, the University College authorities attempted to place themselves firmly in administrative control of the Galton Laboratory.[90] Over the next three or four years University College gradually attained its aim to have the Galton Laboratory recognised and administered as an ordinary department of the college. Pearson resisted the move to absorb the laboratory into University College holding that it was contrary to Galton's will.[91]

The position of the University College authorities strengthened as time passed. The college continued to provide accommodation for the laboratory. In October 1911 an anonymous benefactor offered the college money to construct a building to house both the Galton Laboratory and the Department of Architecture. Pearson could hardly reject such an offer yet it was a benefaction offered to University College and not to the Galton Laboratory or to the University of London.[92] The college also created a new department, the

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[89] SM 1899, March 29th, 1911.

[90] SM 2918, June 14, 1911.

[91] GLJ, p. 3.

[92] The design and furnishings of the building became another source of friction between Pearson and the officers of University College.

Department of Applied Statistics for Pearson to head. The department incorporated both the Biometric and Galton Laboratories.[93] Although Pearson had been elected Galton Professor of eugenics by a board of the University of London he remained a member of the University College Faculty of Science and of the College Professorial Board. With Pearson, his department and his laboratories so firmly entrenched in the college organisation and beholden to it for their accommodation he was held to be exceedingly contrary when he complained that an undergraduate teaching college was not a suitable place for a graduate and research "Institute of Applied Statistics."[94]

In 1913 the University of London Senate approved a plan which was a compromise between the positions of Pearson and the University College authorities.[95] The plan called for the supervisory committee of the Galton Laboratory to be appointed by and to report to the University College Committee. The College Committee would, however, contrary to usual practice, have to pass on the Laboratory Committee's reports in extenso. The compromise was decidedly in favour of the college and against the independence of the Galton Laboratory. Pearson was unable to prevent the college becoming the main administrative control over the laboratory.

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[93]KP, p. 76.

[94]RGBL, p. 3.

[95]See SM 3201-3210, June 18, 1913.

Occasionally he was able to win a point about the use of certain funds[96] but his "Institute of Applied Statistics" did not win the administrative independence he had hoped for.

In the 1920's Pearson was able to gain a measure of independence from the University College authorities when his laboratory and its workers were recipients of awards from the London County Council, the Medical Research Council, and the Department for Scientific and Industrial Research.[97] However, these extra sources of income sometimes caused the college to suggest that the Department of Applied Statistics would no longer need funds that they had been regularly receiving from college sources. This problem, and increased pressure by the college to provide undergraduate courses[98] were the main sources of friction between Pearson and the college authorities in the 1920's.

It is difficult to assess the significance of the history of the relations between the Galton Laboratory, University College and the University of London. A strong case could be made for interpreting the whole story in terms of the personalities of the leading figures involved. Setting aside personalities, a number of interesting points

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[96] SM 932, January 26, 1916.

[97] See Table 3.

[98] See KP, p. 95.

arise. It is of significance that Galton endowed research at a university, especially when his own researches had not been carried out at universities. The fact that neither university nor college seemed to have precedents on which to model their actions indicates that the idea of a research institute was a novelty. Pearson's own models were drawn from foreign countries.[99] Yet in spite of novelty and in spite of the way in which the Galton Laboratory was placed in the same administrative category as undergraduate teaching departments Pearson and his staff had surprising freedom to undertake research and advanced teaching of their own choosing.

E. Personnel, Research and Teaching at the Galton Laboratory

The Personnel of the Laboratory.[100]

When the Eugenics Record Office was established in 1905 provision was made for two full-time workers. At the time of its transfer to Pearson's direction in 1907 the number was

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[99] RC, p. 4, where the Solvay Institute of Brussels is mentioned. In a typescript headed "Appeal for funds to maintain and extend the Institute of Applied Statistics . . . ," (possibly as late as 1925), Pearson referred to institutes at Zurich, Lund, Rome, Berlin and Baltimore as similar to the one he wanted to create.

[100] For a list of the personnel at the Galton and Biometric Laboratories, 1905-23, see Appendix 3.

increased to three.[101] Galton's bequest in 1911 added Pearson to the full-time staff. The two staff members financed by the Drapers' Company Grant worked in close harmony with the Galton Laboratory. At the outbreak of the war in 1914, the staff consisted of Pearson as Director, Heron as Assistant Director, Miss Elderton as Galton Fellow, Miss Barrington as Librarian and three other assistants. The war years saw a very rapid turnover in staff together with the loss of Heron and Barrington who had been working with Pearson since the early years of the Biometric Laboratory.[102] In April, 1918, the laboratories virtually closed down when the war work they were doing was transferred to the Admiralty. All of the workers except Pearson and Elderton also went to the Admiralty. In post-war years increased income enabled the staff to be increased by two or three. The most notable aspect of this increase was the addition to the staff of a full-time physician who was able to assist with the medically-oriented research of the laboratories.[103]

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[101] RC, p. 1.

[102] Both had worked in the Biometric Laboratory before their appointment to the Galton Laboratory in 1907.

[103] Information about laboratory staff was gathered from GLCM, Drapers' Company Reports, GLJ and laboratory publications. For a list of the names and positions, see Appendix 3.

In 1910 Pearson drew up a statement on "Future Policy" for the annual Galton Laboratory Committee Report. In this he outlined a scheme which would serve "to establish the Laboratory upon such a permanent basis as would enable it adequately to fulfill the purposes for which it was founded."[104] Using the Solvay Institute of Brussels as a model,[105] he advocated a staff of nine which would involve an annual income of £4000. The staff and salaries would be:

Director	£800	Assistants:	Two at £300
Trained Actuary	£600		Two at £200
Medical Officer	£600		Two at £100

Writing to Mrs. Weldon at Christmas time in 1912, Pearson expressed the hope that he would "see a doubled staff with a zoologist and a medical officer and a biometric farm."[106] In his final report to the Drapers' Company, written in 1930, he mentioned the need for "readers in anthropometry, biometry, and genetics, especially human genetics."[107] From these references can be projected an idealised model of Pearson's staff. Apart from the director it would have workers trained in six fields; medicine, insurance statistics, zoology, biometry, human heredity and anthropometry. In only

[104]RC, p. 4.

[105]The Solvay Institute of Sociology was founded in 1902 by Ernst Solvay, the chemical industrialist. It was attached to the University of Brussels.

[106]Pearson to Mrs. Weldon, Dec. 25, 1912, quoted in KP, p. 77.

[107]KP, p. 119.

the first three fields were there already well-established schools producing graduates, but even these, in the cases of medicine and zoology were liable to neglect training in statistics. So to some extent the laboratories would have to train those who would later join their staff. Pearson expressed this need in 1918 by describing the Biometric Laboratory as a training school for the staff of the Galton Laboratory.[108] Pearson favoured long-term appointments because most members of staff needed training in statistics and because of the long-term nature of much of the research.[109]

In the periods of comparative stability before and after World War I, Pearson endeavoured to provide the laboratories with a staff as close to his ideal as the financial exigencies would allow. From 1907 until 1916 the three chief assistants in the Galton Laboratory were David Heron, Ethel Elderton and Amy Barrington. All had received their statistical training in the Biometric Laboratory. Only Heron had a university degree, an M.A. from St. Andrews.[110] Barrington had spent some time at Girton College, Cambridge, undertaking work in the mathematical tripos, but had not graduated.[111] Elderton had spent some time at Bedford

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[108] Drapers' Report, 1914-1918, pp. 3-4.

[109] GLCM, June 25, 1909.

[110] University of London Calendar (1910).

[111] Drapers' Report 1914-1918, p. 2; RC, p. 1.

College, University of London. Heron and Elderton were awarded London D.Sc.'s for their work undertaken at the laboratories.[112] Ethel Elderton was to stay with the laboratory until after Pearson's retirement at which time she had attained the rank of Assistant Professor. Heron left the laboratory in 1916 to become statistical advisor to the London Guarantee and Accident Company.[113]

Three other persons who regularly worked in the laboratories before the war were H. E. Soper, Dr. Julia Bell and Dr. Alice Lee. Dr. Bell was the only staff member of the laboratories in the pre-war years who had medical qualifications. She was employed intermittently by the Biometric and Galton Laboratories over the whole period, 1907-1925. H. E. Soper, a Cambridge graduate in mathematics,[114] worked at the laboratories from 1908 until 1915 when he left to take up war work with the Ferranti Company in Manchester. Later in the war he had a statistical post in the Ministry of Munitions. Dr. Alice Lee received her D.Sc. from the University of London for statistical work. She had been the first person employed by Pearson to carry out computing work in the Biometric Laboratory.[115] Although not employed

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[112]Heron's was awarded in 1912. See Directory of British Scientists, 1963.

[113]Drapers' Report, 1914-1918, p. 2.

[114]For details on Soper see KP, p. 110, GLJ, p. 61, and Drapers' Report 1914-1918, p. 3.

[115]See KP, Appendix 4, p. 160.

by the laboratory after 1906 she continued to do much calculation and helped with the co-operative production of statistical tables.

Students of the laboratories also assisted in research, as did a variety of other people who came to the two laboratories to carry out different research projects. Among these students and visitors before 1918 were G. Udny Yule, later Reader in statistics at Cambridge; Ernest Warren, later Director of the Natal Government Museum; Raymond Pearl, later Professor of biometry at Johns Hopkins University; Henry Moore, Professor of political economy at Columbia University; M. Greenwood, Reader in medical statistics at London; J. F. Tocher, Reader in statistics and biometry at Aberdeen; Gustav Jaederholm, Lecturer in psychology at the University of Lund; Dr. Charles Goring, a physician in the British Prison Service; John Blakeman, Head of the Mathematical Department, Leicester Technical Institute; Professor William Brown of the Psychology Department, King's College, London; E. C. Snow, Head of the Mathematical Department at the Sir John Cass Institute; L. Isserlis, Head of Mathematical Department, West Ham Polytechnic; Dr. Frank Rock, Medical Officer of Health for Tottenham; Dr. F. M. Turner, Medical Officer in Charge of a fever hospital; and Dr. D. H. de Souza, Medical Staff of Westminster Hospital.[116] This is not an exhaustive list but it illustrates the extent to which

[116] For this list see Drapers' Report 1914-1918, pp. 1-2.

Pearson's laboratories had already established themselves as a centre for statistical studies by the time of the First World War.

The war period was beset by difficulties for Pearson as he tried to keep together the nucleus of a staff to carry on after the war. Statisticians could get much higher salaries than he could afford to pay.[117] The laboratory staff had decided in August 1914 to undertake work to help the war effort. This meant that the work of the laboratories changed in a fairly haphazard manner from one project to another and that the staff were receiving training that could be used by a variety of government departments in better-paying jobs. Consequently the rate of turnover in staff members was high. Of the eight new workers at the Laboratory during the war, only J. O. Irwin returned after the war. The laboratories' work was assisted during this period by a number of volunteers[118] and during this time Pearson probably had the direction of a larger number of workers on co-operative projects than during peace time.[119]

Following the war Pearson was able to return to his policy of long-term appointments. Five of the members of staff in 1922 were still on the laboratories' staff in 1933,

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[117]HBGL, p. 4; Drapers' Report 1914-1918, p. 4.

[118]KP, p. 86.

[119]This amounted to twenty people working on a gunnery project in 1917. KP, pp. 91-2.

the year of Pearson's retirement. They were Ethel Elderton, Dr. Percy Stocks, Egon Pearson, Julia Bell and Mary Karn.[120] Dr. Percy Stocks was a Medical Officer and so fulfilled one of the positions in Pearson's idealised laboratory scheme. The two other members of this group who were new to the staff after the war, Mary Karn and Egon Pearson, had both been trained in the Biometric Laboratory continuing the pre-war tradition. Both went on to do very eminent work in their respective fields.[121]

The majority of those who worked at the laboratories had been trained as mathematicians. This accentuated the bias that Pearson's own training and interests brought to the laboratories. It was unlikely that many graduates of zoology or anthropology, particularly from schools with an emphasis on experiment or field work, would be attracted by such an atmosphere. On the other hand, medical and social workers already had a "live" statistical tradition. Moreover, some of the newer positions in poor law and education administration brought them face to face with large collections of statistics. Consequently they were ready to respond to Pearson's call to use the new calculus and joined his laboratories as students and staff. Finally it should be noted how large a proportion of the personnel of the

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[120]For the staff in 1932-1933 see "For the Chairman . . .," p. 19.

[121]Karn in genetics and Pearson in the theory of statistics.

laboratories were women. This can be explained partly by the fact that they were cheaper to employ. Pearson took full advantage of this so that the income of the department could be stretched as far as possible. In doing so he probably incidentally helped to break down the barriers against women being accepted as equals in science.

Pearson was not able to realize the "ideal" staffing of the Galton and Biometric Laboratories that he had put forward in 1910. In part this can be explained by lack of finance. An actuary was unlikely to accept or seek a post with Pearson's department unless his salary was equal to what he could get elsewhere. But in part, at least, Pearson's failure was due to the strange assortment of skills that he tried to gather together. He had himself expressed the idea that two professorships, one for eugenics and one for biometry and statistics, could well have been associated with the laboratories.[122] It was this kind of division which was made after Pearson's retirement in 1933, except that biometry and eugenics were placed together.[123] Karl Pearson was correct in his view that statistics would become the basic calculus of many new areas of investigation in the biological and social sciences. He was correct in predicting the great need for applied statistics and for

[122] KP, p. 76; Drapers' Report 1914-1918, p. 4.

[123] This department is now known as the Department of Human Genetics and Biometry.

workers trained in this field. He was wrong, however, in assuming some necessary connection between applied statistics, biometry and eugenics, as had been the case in his own idiosyncratic experience. Modern statistics had grown up in Britain largely among men convinced of the central importance of Darwinism but this did not mean that all later statisticians would be Darwinians, or even biologists. A research institution committed to solving problems of human heredity and human evolution would not necessarily continue as a centre for the development of statistical theory and of statistical applications.

Research and Publications

When the duties of the first Galton Research Fellow in eugenics were drawn up the emphasis was on research, but the possibility of giving "short Courses of Lectures on Eugenics" was included.[124] Galton's will emphasised research as the primary function of the Galton professor but included the possibility of instruction.[125] Pearson himself mentioned a number of activities apart from research which he felt should be undertaken by the laboratory. Among these were the training of research workers, the education of "practical eugenic workers," and the provision of general

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[124]See Appendix 1.

[125]See Appendix 2.

courses for undergraduates. The exact manner in which teaching and research were to be combined was not clearly formulated. This was largely because Pearson's Department of Applied Statistics was, in fact, a research institution placed inside the administrative framework of an undergraduate teaching college. Pearson was happy to undertake teaching and training which he felt to be necessary to the long-term success of the Galton and Biometric Laboratories. He was not, however, happy to have too many teaching demands thrust on his department by University College authorities. This tension needs to be kept in mind as the research and teaching programmes of the laboratories are examined.

The first Galton Fellow, Edgar Schuster, worked on "The Inheritance of Ability," "The Promise of Youth and the Performance of Manhood" and the compilation of pedigrees of "Noteworthy Families" in different fields.[126] All these topics show the very close influence of Galton; the first following in the lines of his Hereditary Genius, the second being an investigation designed to find out whether positive eugenics was possible by identifying during their youth those who would later be most successful; and the third being an extension of Galton's work in English Men of Science. The methods used in the last of these enquiries was similar to that of Galton in his earlier works and the resultant book

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[126] See list of Galton Laboratory publications in Appendix 5.

was published under the co-authorship of Galton and Schuster. The first two inquiries, however, involved a great deal of statistical calculation along the lines of work already being done in the Biometric Laboratory. It is unlikely that this kind of method would have been used if Galton had not been in touch with Weldon and Pearson and the development of the "Biometric School." This last point does not, however, change the fact that Galton was largely responsible for the choice of topics and methods for research.[127] By his patronage he was able to determine to a large extent what research was undertaken and how it was to be done.

When Pearson took over as Director of the Galton Laboratory in 1907, he brought with him his own program of research which required long-term statistical analysis.[128] The results of this research were published in various publications emanating from that laboratory or the closely related Biometric Laboratory. The titles of the relevant series were: Eugenics Laboratory Memoir Series, Eugenics Laboratory Lecture Series, Studies in National Deterioration, Questions of the Day and of the Fray, and Tracts for Computers. Much work from the Eugenics Laboratory was also published in the journal, Biometrika. Papers were also occasionally published in other journals such as the British

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[127] On this see LLG, IIIa, p. 259.

[128] See note 43 above.

Medical Journal[129] and the Journal of the Royal Statistical Society.[130] A few studies were published as separate books or pamphlets.[131]

The research undertaken by the workers in the Eugenics Laboratory was primarily published in the Eugenics Laboratory Memoir Series. The Treasury of Human Inheritance was issued in parts which were included in the Memoir Series. It came to a virtual halt during the war with only one title issued between 1914 and 1920. In 1925, a new journal, Annals of Eugenics, was founded. It replaced the various previous laboratory series which had been published separately as single papers or memoirs. The authors of most of the pre-war memoirs were Pearson, Edgar Schuster, Ethel M. Elderton and David Heron. Schuster's work has been described above.

During the period, 1907-1914, Karl Pearson's publications were numerous and covered the fields of astronomy, engineering, theory of statistics, and biography, as well as those that could be listed as eugenic writings.[132] He engaged, as was his habit, in a number of controversies, and

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[129] E.g., Heron, "On Class Incidence of Cancer," B.M.J., 1907.

[130] E.g., K. Pearson, A. Lee and E. M. Elderton, "On the Correlation of Death Rates," J.R.S.S., 73, p. 534.

[131] E.g., C. Goring, The English Convict. A Statistical Study (London, H.M.S.O., 1913).

[132] For Pearson's writings on eugenics, see Appendix 5 below. For his other writings see G. Morant, A Bibliography of Statistical and Other Writings of Karl Pearson (Cambridge, C.U.P., 1939).

despite his objections to the members of the Eugenics Education Society making propaganda, he gave a number of lectures and wrote pamphlets which can hardly be construed as anything but propaganda on behalf of eugenics as a social creed.[133] Pearson did do some detailed work on heredity, notably on the heredity of albinism.[134] His main contribution to serious eugenics research was a series of papers on alcoholism.[135] Otherwise his eugenics publications had to do with the development of the statistical tools used by eugenists, and the more popular and polemical articles published in the two series, Eugenics Laboratory Lecture Series and Questions of the Day and of the Fray. The great majority of the numbers of these two series were by Pearson. The Lecture Series contained the texts of lectures which Pearson had given to general audiences. Nearly all of them are concerned with outlining what eugenics was and why it was important as is indicated in the title of the first of the series, The Scope and Importance to the State of the Science of National Eugenics.[136] The Questions of the Day and of the Fray series

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[133]In contradiction to his own commentary on Galton, see LLG, IIIa, pp. 296-7.

[134]K. Pearson, E. Nettleship, and C. H. Usher, "Albinism in Man," Drapers' Company Research Memoirs (Biometric Series), No. 6, 1913.

[135]See chapter VII below for a discussion of the papers on alcoholism.

[136]This lecture was originally given as the Boyle Lecture at Oxford.

was frequently used as a means of answering critics of earlier Eugenics Laboratory publications. It was used in this way by Pearson to continue a controversy about the effects of alcoholism of parents on the physique and intelligence of their children. Similarly the series was used to continue Pearson's controversial commentary on the Mendelian theory of heredity.[137]

The research of the Galton Eugenics Laboratory from its foundation in 1907 until 1914 when the war curtailed its normal activities was dominated by the personality and ideas of Karl Pearson. Convinced that "social problems" were due to inherited characters rather than to environmental factors and convinced also that data about such problems needed to be subjected to statistical analysis, Pearson directed research based on these convictions. He expected to confirm that "environmentalism" was not the way to eliminate the social problems under investigation. The social problems with which the laboratory was concerned were alcoholism, insanity, tuberculosis, mental defect and criminality. In addition to this concern for social problems, the laboratory carried out research to see what changes were taking place in British vital statistics, helped to develop statistical techniques and gathered a great deal of information about human inheritance, which was published in the <u>Treasury of Human Inheri-</u>

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[137]For the titles in this series, see Appendix 5 below.

tance.[138]

The work of Ethel Elderton was in three main areas. Most of it was concerned with the question of determining the relative importance of the contributions of heredity and environment to the fashioning of physical and mental characteristics in man.[139] A second area of research for her was the measurement of resemblance between different sets of relatives.[140] She also carried out some work analysing vital statistics of the British population.[141] Miss Elderton's The Relative Strength of Nurture and Nature is a good introduction to her thought and methodology and shows how closely she agreed with Karl Pearson in such matters. She was also committed to the use of statistical analysis and especially to the analysis of correlations between various factors to find what were the most likely sequences of cause and effect in complex problems.

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[138] See publications listed in Appendix 5 below.

[139] Ethel M. Elderton, "The Relative Strength of Nurture and Nature," ELLS 3, (1909); "A First Study of the Influence of Parental Alcoholism on the Physique and Ability of Offspring," ELM 10, (1910); Karl Pearson and Ethel M. Elderton, "A Second Study of the Influence of Parental Alcoholism on the Physique and Ability of Offspring," ELM 13, (1910).

[140] Ethel M. Elderton, "On the Marriage of First Cousins," ELLS 4, (1911); "On the Measure of Resemblance of First Cousins," ELM 4, (1907).

[141] Ethel M. Elderton, "Report on the English Birth Rate," ELM 19, (1914).

> What guide can we take to indicate the path of true social reform through such a tangle of cause and effect as we find involving the relative influence of nature and nurture on human life? It is not enough to show that results are associated with this or that factor; we have a vast complex of associated factors, and out of this complex we have in some way to pick out the more important and in a certain sense the fundamental factors. The only effective method by which at present it seems possible to approach such a problem is that of correlation. Taking the social conditions we wish to modify, we must study their correlation with as many factors as we can possibly measure. In the choice of these factors we must of course be guided by the reasonable probability of association and by the limits of human life and energy. The correlations of a multiplicity of factors being known we may justifiably assume that the factors with the highest correlations are, among those dealt with by us, the most important, and then the process of "partial correlation" will guide us still further towards a final judgment of what fundamentally are social cause and effect.
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> We admit to the full . . . that spurious correlation may have arisen from all sorts of disregarded selective processes . . . But . . . in the present state of our knowledge the calculus of correlation is the sole rational and effective method available for attacking these urgent social problems.[142]

Elderton used the method of calculating correlations in her investigations of the influence of parental occupations, home conditions, and parental alcoholism on the physique and intelligence of offspring. In these investigations the correlations obtained between some particular aspect of the environment (parental occupation, for example) and some physical measurement of the offspring (e.g.,

[142] Ethel M. Elderton, "The Relative Strength of Nurture and Nature," pp. 5-7.

height or weight) were compared with the correlations between some characteristic of the parent and the same characteristic in the children which was taken to measure the degree to which that characteristic was inherited. Whereas the correlation between parents and their children for a number of characteristics was approximately .5, the correlation between environmental factors and the characteristics of offspring were usually less than .1.[143] This was taken to indicate that the force of heredity was at least five times as strong as the force of the environment.[144] This finding was the basis for an attack on social legislation which concentrated on improving the environment.

> Practically all social legislation has been based on the assumption that better environment meant race progress, whereas the link between the two is probably that a genuine race progress will result in a better environment.[145] The views of philanthropists and of those who insist that the

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[143]Various methods were used for calculating measures of correlation, the details of which can be found in Pearson's various statistical papers. In each case the coefficient of correlation could take any value between -1 and +1. A value of 0 indicated no correlation between the two things being compared, whereas +1 indicated perfect positive correlation and -1 perfect negative correlation.

[144]This was, of course, a very strange way to compare the 'forces' and showed little sign of a sophisticated analysis of the terms 'heredity' and 'environment,' or how they might be precisely measured.

[145]L. T. Hobhouse used this sentence as a take-off point for a severe criticism of the Eugenics Laboratory publications in his Social Evolution and Political Theory. See pp. 55ff.

> race can be substantially bettered by changed environment appeal to our sympathies, but these reformers have yet to prove their creed. So far as our investigations have gone they show that improvement in social conditions will not compensate for a bad hereditary influence; the problem of physical and mental degeneration cannot be solved by preventing mothers from working, by closing public-houses, or by erecting model dwellings. The only way to keep a nation strong mentally and physically is to see to it that each new generation is derived chiefly from the fitter members of the generation before.[146]

The phrases 'race progress,' 'national efficiency,' and 'national fitness' which occur in Elderton's writings as they do in those of the other research workers from the Eugenics Laboratory clearly indicate an ideological commitment of these eugenists to nationalism and racism.[147]

Elderton's other research work, while fitting into the general pattern of eugenic theory very well, was of a less controversial nature. The measurement of the resemblance between various categories of relatives involved the straightforward calculation of correlations once data had been gathered about equivalent characteristics in the sets of relatives being investigated. Similarly her work on the changes in the British birth and death rates involved mainly the analysis of figures gathered during the British censuses. Here she was concerned to see if particular social classes or professional groups had different birth and death rates to those of

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[146] Ethel M. Elderton, "The Relative Strength . . .," p. 33.

[147] See the final section of chapter II above.

the whole population and to see if such differences could be explained by the calculation of still more correlations.

David Heron's research work at the Eugenics Laboratory covered much the same areas as that of Ethel Elderton's. He differed from her in having more emphasis on work which investigated the inheritance of specific characters and considering the results of such work in relation to theories of heredity. His work included studies of the influence of home environment[148] and alcoholism[149] on the physique and intelligence of children, the methods and results of which are much the same as those of Elderton in her similar studies. Heron also did work on the census figures from a eugenic point of view publishing his results under the title, <u>On the Relation of Fertility in Man to Social Status and on the Changes in this Relation in Fifty Years.</u>[150] Heron's papers also included some work in the theory of statistics which was published in <u>Biometrika.</u>[151] He also published some papers on the inheritance of specific characters and reviews of similar works in which he vigorously attacked statistical errors in a way which suggested that he was not prepared to accept

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[148] David Heron, "The Influence of Defective Physique and Unfavourable Home Environment on the Intelligence of Schoolchildren," ELM 8 (1910); "Mental Defect, Mal-Nutrition, and the Teachers' Appreciation of Intelligence," QDF 2 (1911).

[149] David Heron, "A Second Study of Extreme Alcoholism in Adults," ELM 17 (1912).

[150] SND 1 (1909).

[151] <u>Biometrika, 7</u> (1910), p. 411.

Mendelian theory as late as 1910.[152]

One of the series of publications which carried much research on eugenics was Studies in National Deterioration. Though published with the aid of the grant from the Drapers' Company and hence under the auspices of the Biometric Laboratory, the origin of the series was in "the general interest taken in the Government Commissions on National Deterioration and on the Feeble-Minded,"[153] an interest central to the research undertaken by the Eugenics Laboratory. This close relation to the interests of the Eugenics Laboratory was further emphasised by Pearson's description of the series' aims.

> The object of this series was to study the separate factors as to health, fertility and inheritance in man, which make for National fitness and racial welfare.[154]

This object fitted very well with Pearson's general idea of the kind of research that should be undertaken by the Eugenics Laboratory. The main contributor to the series was William Palin Elderton, the brother of Ethel Elderton, and an actuary who made a number of contributions to the publications associated with the biometric school. His work

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[152] David Heron, "Inheritance in Canaries," Biometrika, 7 (1910), pp. 403-10.

[153] Drapers' Report 1903-9, p. 6.

[154] Ibid.

was an analysis of records kept at a sanatorium for the treatment of patients suffering from pulmonary tuberculosis.[155] In his analysis, Elderton tried to assess the different roles of hereditary and environmental factors in causing tuberculosis, concluding that hereditary factors were more important as causal factors.

Pearson acted as editor for all of the laboratory's publications. His "imprimatur" was necessary before a paper was published and he often rewrote large sections of the papers of other laboratory workers.[156] Pearson's decision to publish so many series under the auspices of the laboratories was influenced by his own experience in having had biometrical papers rejected by the Royal Society and his desire to see the laboratory established as a scientific research institution.

The early history of the research undertaken by the Galton Laboratory can be divided into four quite different periods. The earliest period, 1904-7, saw the establishment of a small office with a staff of two to carry on some of the work which had interested Francis Galton. In the second period, 1907-14, great emphasis was placed on the use of

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[155] See the complete list of this series in Appendix 5.

[156] See J. B. S. Haldane, *op. cit.*, p. 21. In the Galton Laboratory Journal Pearson wrote: "How far is one justified in writing other people's papers up when both Heron's and my time would be more valuable on our own work?" (GLJ, pp. 39-40, February, 1914).

applied statistics as developed by Pearson, and the research carried out was more in the realm of social science than biological science. The third period, 1914-19, coincided with World War 1 when the statistical skills of the laboratory were used in a variety of projects carried out as part of the national war effort. These projects included the preparation of statistics to do with employment, imports and exports, rates of exchange on the international money market, the construction of aeroplanes, and problems of ballistics.[157] This period saw the departure of Heron and Barrington to other positions and Pearson's new recruits during the war mostly found their way into the civil service by the end of the war as the government discovered the many uses to which statistics and statisticians could be put.[158] Consequently a fourth period in the laboratory's life began in 1919, when Pearson gathered together a new team of researchers; a team which was larger because of the new support that national and local government were prepared to give to scientific research after the end of the war. The

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[157] An account of this work was given in Pearson's Report to the Drapers' Company for 1918.

[158] In his report to the Drapers' Company for 1918, Pearson mentioned that the following ex-members of his staff were working at various civil service jobs; Leslie Ince in the Ministry of Food Control, H. E. Soper in the Ministry of Munitions, Beatrice M. Cave at the Admiralty, and A. Firth at the Contracts Department, War Office.

post-war research followed along the lines established before 1914.[159]

Teaching

At no time before or during the war did the Department of Applied Statistics undertake a formal teaching programme on behalf of University College. Instruction was provided, however, with three different ends in mind. The first of these was to provide a training for graduates who wished to do the University of London D.Sc. (a research degree) in statistics or who wished to become professional statisticians. A second aim was to provide statistical training for professional workers and academics in other disciplines. A third and less important kind of instruction was provided for the general public.

With the first and second ends in mind Pearson gave an annual course of lectures on the theory of statistics.[160] The rest of the instruction for these two purposes was given informally by means of discussion of problems and research projects which the students undertook. This involved research serving for D.Sc. requirements and problems raised during previous professional work. If possible the research was published, often in *Biometrika* or one of the other publications originating from the laboratories. During most of

[159] See especially the first volumes of *Annals of Eugenics.*

[160] HBGL, p. 1.

the period, Pearson's Biometric Laboratory was the only place in Britain providing a thorough training in statistics. Before the war the number of students was usually between five and ten with a number of these coming from overseas.[161]

In 1915 the University of London, acting on representation by Karl Pearson, introduced an honours B.Sc. degree in statistics.[162] This meant that a formal syllabus had to be drawn up. Pearson's lectures on the theory of statistics were divided into two courses each taking a full year. They remained the basic core of instruction for any student at the laboratoreis, graduate or undergraduate, although other courses were added for the undergraduate honours students. While this meant more commitment to teaching, the undergraduate honours programme did not attract more than five students in any one year until after Karl Pearson's retirement. There were, however, an increased number of graduates who came for further study; up to ten a year seeking to study at the laboratories in the early 1920's.

The increased emphasis on formal teaching after the war was marked by the appointment of two Assistant Lecturers in 1921.[163] But the main emphasis in both laboratories con-

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[161] E. S. Pearson, "The History of the Department of Statistics," p. 4; and Drapers' Report 1903-1909, p. 5.

[162] For the whole of this paragraph see KP, p. 95 and E. S. Pearson, op. cit., p. 5.

[163] J. O. Irwin and E. S. Pearson. See E. S. Pearson, op. cit., p. 5.

tinued to be on research. The teaching continued to be regarded as a means of providing future research workers for the laboratories and as a means of spreading the new methods of biometrical statistics. Pearson's reasons for providing training were reinforced by his recognition of the fact that it was necessary for statistics to be accepted by at least one or two sectors of the scientific community for it to be established as a serious scientific discipline. He was less concerned to train people in eugenics because, in his view, eugenics could only be established as a respectable science when its basis, statistics, was so established. Consequently, Pearson was far more concerned to provide adequate training in statistics for medical men than he was to propagandize them on behalf of eugenics as a social creed. If they could be given an adequate grounding in statistics, they would be in a position to see the great importance of the hereditary factor in social problems without him having to convert them to such a view.

The Archival and Storehouse Role of the Laboratory

Galton's original plans for the Eugenics Record Office had included the idea that it should serve as a central storehouse of records about noteworthy families. This function was carried out in a number of ways under Pearson's direction. Most successful was the publication of the series entitled Treasury of Human Inheritance.[164] The Treasury was designed to bring together in one place a bibliographical guide to published work about the inheritance of human characteristics and diseases plus pedigrees of the same characteristics and diseases which had been collected by the Galton Laboratory. Its editorial policy was to exclude theoretical and controversial matter[165] and to serve solely as a reference work for those carrying out investigations into human heredity. The laboratory also collected a great deal of data from Medical Officers of Health all over Britain, particularly those whose duties included the examination of school children or the care of patients in hospitals and welfare institutions.[166] This data served as the raw material of many of the papers published in the Eugenics Laboratory Memoirs and Studies in National Deterioration. The laboratory also served as a storehouse for a collection of skulls which numbered about 7000 by the time of Pearson's death.[167]

The Laboratory as Consultative Agency and Educator of the Public

The laboratory acted as a consultative agency in two main ways. Firstly, it answered queries and drew up reports

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[164] Described as "indispensable" by J. B. S. Haldane as recently as 1958. See New Biology, No. 25, p. 21.

[165] See preface to Vol. I of Treasury of Human Inheritance.

[166] KP, pp. 77-78.

[167] See KP, p. 67 & pp. 104-5.

for various individuals and organisations. Secondly, it encouraged workers in various fields to use its facilities and expertise in the analysis of data they had previously collected. A report covering 1903-1909, noted that,

> . . . a report was drawn up on the Scottish Pauper Lunacy Rates; a report on the variability owing to meteorological conditions of the time Fuses for the Royal Artillery; a report on the effect of Inoculation against Enteric Fever in the Army (India and South Africa).[168]

It also noted that authors of statistical papers frequently worked for two or three weeks at the laboratory to complete memoirs. In Pearson's report for 1914-1918, similar examples were given. In some cases the consultation was carried on over a period of a year or more while researchers worked full-time at the laboratory. In this way Dr. Charles Goring produced his very extensive criminological study, The English Convict,[169] which demonstrated the fallacies of Lombrosian criminal anthropology.

A good deal of the personal consultation was with medical practitioners.[170] This kind of consultative work was emphasised in a 1911 document in support of the appeal for funds to build the Galton Laboratory.

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[168] Report to Drapers' Company, 1903-9, p. 5.

[169] Charles Goring, The English Convict: A Statistical Study (London, H.M.S.O., 1913).

[170] RC, pp. 3-4.

> Already the Laboratory is consulted very largely by medical officers of health, by school medical officers and by independent medical men engaged in statistical problems who have not a staff adequate in numbers and training to deal with these matters.[171]

The association of the laboratory with the medical profession and with governmental officers served to emphasise the acceptability of eugenics and statistics to prestige groups in both the scientific and general communities.

General education undertaken by the Galton Laboratory was strictly in accord with Pearson's views on the use of such education. Lectures and papers were not to "obtain a popular audience" but to serve the needs of those "capable of profiting by the instruction."[172] Pearson frequently used such lectures and papers to serve the function of his self-appointed role as "censor scientiarum."[173] The main purpose of his role as "censor" was to expose "quackery in science" and guard against "ignorance which paraded as knowledge." In this role Pearson frequently became embroiled in bitter controversies. One consequence of his strong feelings about the need to expose "quackery" was that his public lectures and non-technical writings sometimes took on the appearance of unbalanced propaganda. The subjects on which he

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[171]Document pasted in GLJ, p. 6.

[172]RC, p. 1.

[173]For this concept see K. Pearson, "Mendelism and the Problem of Mental Defect, III . . .," QDF, 9 (1914), p. 3.

lectured were also frequently areas of controversy in contemporary political debate and social welfare policy. The controversial nature of the laboratories' attempts at education of the public was summed up in the title of the series, Questions of the Day and of the Fray.

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The history of the Galton Eugenics Laboratory during its first twenty years was dominated by the figure of Karl Pearson. He supervised the research and publications of the laboratory very closely. The dominance of the laboratory by its director was similar to the traditional role of a professor in his own department in an English university. Scientific research institutions placed in such an academic environment might have been expected to follow the usual academic pattern. But Pearson and the laboratory had to carry on within the limits of support provided by the wider community as well as the academic community. The laboratory was brought into existence by the action of one wealthy man, housed at the expense of another and only able to increase its income when the First World War had convinced Britain that scientific research needed to be supported with public money. This experience was typical for British science in the early twentieth century. The laboratory's program of post-graduate training was important because Britain had no other university department devoted to the production of professional statisticians. The formal courses taught at the laboratory were a result of this general situation, which differentiated the Galton Laboratory post-graduate program from others such as the Cavendish where students would have previously taken undergraduate honours degrees in the field of their post-graduate work.

In many ways the institutional history of the Galton Laboratory points to its acceptance as a normal part of the British scientific community. But neither eugenics nor biometry have passed into the standard canon of twentieth century science. In contrast, Pearson's "Institute of Applied Statistics" has been continued as two highly successful but separate departments--a Department of Statistics[174] which concentrates largely on teaching, and a Department of Human Genetics and Biometry[175] which concentrates mainly on research. The apparent discrepancy between the success of the Galton Laboratory as an institution and the failure of the sciences with which it was most intimately connected to become established is taken up in chapter V.

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[174] This department was set up in 1933 after Karl Pearson's retirement and was headed from then until very recently by Professor Egon Pearson, his son. The very important joint work of Egon Pearson and Jerzy Neyman was carried out in this department when both worked there from 1934 until 1938. The journal, Biometrika, has continued to be very closely associated with the department.

[175] This department which includes the Galton Laboratory was set up in its present form in 1943 under Professor J. B. S. Haldane. Between 1933 and 1943, R. A. Fisher had been professor of eugenics and Haldane, professor of biometry, a chair created by the will of the widow of W. F. R. Weldon. The publication, Annals of Eugenics, continues to be issued by the department under the new title, Annals of Human Genetics.

V

BIOMETRY AND EUGENICS: TWO NEW SCIENCES?

The attempt to establish eugenics as a new science was centred, in England,[1] at the Galton Eugenics Laboratory. As with the earlier attempt by the "biometrical school" to found a new science of biometry, it was not, in the long run, successful. Neither biometry nor eugenics became recognised scientific specialties. Both have been described as if they were pathological phenomena in an otherwise healthy scientific community.[2] Yet both made important contributions to the emergence of other specialties; particularly statistics, population genetics and human genetics. Eugenics and biometry were very closely related in England. Their scientific supporters overlapped considerably. They were based on similar interpretations of Darwinian evolutionary theory. Together they form an interesting case study of the

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[1]This chapter is based on events which occurred in England. Much of what is said about the establishment of a new science could be applied to other places and other times. But the extent to which generalizations need to be limited by place and time would form an interesting study in itself. I hope to investigate some of the differences associated with different places in a future study comparing the Galton Eugenics Laboratory in England and the Eugenics Record Office at Cold Spring Harbor in the U.S.A.

[2]See, for example, Lancelot Hogben, Statistical Theory (London, George Allen and Unwin, 1957), pp. 248ff; Dangerous Thoughts (New York, Norton, 1940), pp. 44-58; Ashley Montagu, Man's Most Dangerous Myth: The Fallacy of Race (Cleveland, Meridian, 1965), pp. 224-37.

way in which new sciences come into being, the more so for not having been thoroughly and successfully established.[3]

The dramatic increase in the size of the scientific community during the twentieth century has been documented in the work of Derek Price.[4] Increase in size has been accompanied by increasing complexity. New disciplines and new specialties have been formed in quick succession. To understand the history of one small segment of the scientific community such as the "biometric school" or the Galton Eugenics Laboratory it is helpful to relate that history of generalizations about the behaviour of the whole community and its various component groups. Thomas Kuhn and Warren Hagstrom have made two attempts at such generalizations.[5] Kuhn's work is written from the point of view of a historian of ideas while Hagstrom looks at science as a sociologist concerned with the influence of scientists on each other. This chapter uses both sets of generalizations in examining eugenics and biometry. The procedure is not, however, one-sided. Not only is the history of the particular illuminated by the generali-

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[3]The significance of this point is perhaps more strongly made in the question, why did eugenics not establish itself as a scientific discipline?

[4]Derek J. de Solla Price, Little Science, Big Science (New York, Columbia U.P., 1963); Science Since Babylon (New Haven, Yale U.P., 1961).

[5]Thomas S. Kuhn, The Structure of Scientific Revolutions (Chicago, U. of Chicago P., 1962); Warren C. Hagstrom, The Scientific Community (New York, Basic Books, 1965).

zations used, but also the theses of Kuhn and Hagstrom are tested in their application to historical examples.

Both biometry and eugenics were seen by their supporters as new sciences.[6] Leaving aside, for the moment, the question of whether these claims can be substantiated, the theories of Kuhn and Hagstrom about the establishment of new sciences will be outlined. A new science is formed, according to Kuhn, when one paradigm replaces a number of competing schools. Such a revolution marks the emergence of a modern scientific discipline from its pre-history.[7] On the other hand, Hagstrom presents the emergence of a new scientific discipline as the ultimate result of an unresolved conflict within an already established discipline.[8] The two accounts contain contradictory elements.

Kuhn presents a picture of science alternating between periods of "normal" and "revolutionary" activity.[9] In the periods of "normal science" a discipline sometimes divides into specialties because groups of scientists become preoccupied with a deeper analysis of a narrower set of problems than those covered by the whole discipline. There appears to

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[6]Karl Pearson, "Walter Frank Raphael Weldon: 1860-1906," Biometrika, 5 (1906), p. 17; "The Scope and Importance to the State of the Science of National Eugenics," ELLS, 1 (1909).

[7]Kuhn, op. cit., p. 21.

[8]Hagstrom, op. cit., pp. 208-221.

[9]For the account given in this paragraph, see Kuhn, op. cit., chapter XIII.

be no indication in Kuhn's analysis that such specialisation may be due to a "scientific revolution,"[10] or that it may lead to the formation of a new discipline. Kuhn's analysis recognises only one process for the formation of a new discipline; a scientific revolution in which a number of competing schools are replaced by one universally accepted "paradigm" within the new discipline. Kuhn presents a picture in which all specialties within a discipline are in general agreement about the "paradigm" for that discipline. In a "revolutionary" period the paradigm change sweeps across the whole discipline and is not confined to certain specialties.

In contrast to Kuhn's view, Hagstrom's account of the formation of a new discipline is dependent on some specialties within a discipline having different attitudes to the traditional goals, methods and theories of the discipline. Moreover he sees the formation of new disciplines as the direct result of the breakaway of one or more specialties from the parent discipline. It is possible that these differences between Kuhn and Hagstrom are really semantic differences due to different usage of "discipline" and "specialty."[11] This is, I think, partly true, but the differences are also partly

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[10]The phrase is used in this work with the same sense as it is used by Kuhn. See _op. cit._, pp. 6-8.

[11]It could also be argued that Kuhn's work does not really apply to twentieth century science which is the object of Hagstrom's analysis, but Kuhn, himself, definitely intended his analysis to include the twentieth century.

the result of Kuhn's superficial analysis of the social structures of the scientific community.[12] Further analysis of the social and institutional structures of the scientific community shows that Kuhn's scheme of the history of science as alternative periods of "normal" and "revolutionary" activity is too simple. Sciences and parts of science change in ways which are intermediate between normal and revolutionary.

Kuhn's historiography[13] of science can be replaced by a new historiography which incorporates many of his fruitful insights. It admits scientific revolutions to its scheme but its focal point is equally the structure of the scientific community and the network of scientific ideas. The new historiography is sketched out in the remainder of this chapter following a more detailed consideration of Hagstrom's account of the formation of new disciplines. It is then considered in relation to both eugenics and biometry.

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[12]In the introduction to his The Structure of Scientific Revolutions Kuhn wrote that "Section XIII will ask how development through revolutions can be compatible with the apparently unique character of scientific progress. For that question, however, this essay will provide no more than the main outlines of an answer, one which depends upon characteristics of the scientific community that require much additional exploration and study." (p. 8).

[13]"Historiography" is used here in the sense of an overall way of viewing history or a theory about the way in which historical events can be ordered.

A. Hagstrom's Account of Disciplinary Differentiation

Professional scientists usually identify themselves with one discipline only.[14] Within a discipline are many specialties. The specialty usually provides an informal social control over its members. There is usually agreement within a discipline about the comparative prestige of different specialties and what legitimate goals, methods and theories can be associated with it. However, intra-disciplinary conflict may arise in relation to goals, methods or theories. Often this is because the supporters of particular goals, methods or theories think that they do not have the prestige which should be theirs. Such conflict may lead to the formation of deviant specialties which will attempt to reform a discipline. Adaptations to such conflicts are often made by informal arrangements to allow the deviant specialty a certain proportion of space in journals, control of certain research facilities and supervision of research students. If conflict continues despite these adaptations, the deviant specialty may become "rebellious," set up its own journal, appeal to authorities outside the discipline, and develop a disciplinary utopia justifying its own position. A new scientific discipline is formed when this process has led to the formation of a self-conscious community with its own means of

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[14]The following paragraph is based on Hagstrom. See Hagstrom, *op. cit.*, chapter 4.

communication (journals and societies, for example), its own means of training potential recruits and means of carrying out its own research (university departments and research institutes for example). Such structural changes are accompanied by the development of a disciplinary 'ideology', that is, "a formula legitimating a distinct type of organization."[15] This whole process is illustrated in Figure 3.

B. Disciplinary Differentiation in the Case of Biometry and Eugenics

The history of the biometrical school generally followed the pattern outlined by Hagstrom, at least until the formation of what has here been termed a "proto-discipline."[16] Biometry first emerged as a specialty within the discipline of zoology. Its definition as a separate specialty was largely dependent on the claim that the method peculiar to it, the numerical analysis of large populations, would lead to the elucidation of evolutionary processes. To throw light on evolutionary processes was certainly an acceptable goal within the discipline of zoology. The first signs of intra-disciplinary conflict were largely concerned with the wide scope of Weldon's claims for the biometric method.[17] Nevertheless, Weldon's otherwise orthodox position and his

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[15] Hagstrom, op. cit., p. 209.

[16] This is my term, not Hagstrom's.

[17] See above, chapter III, section A.

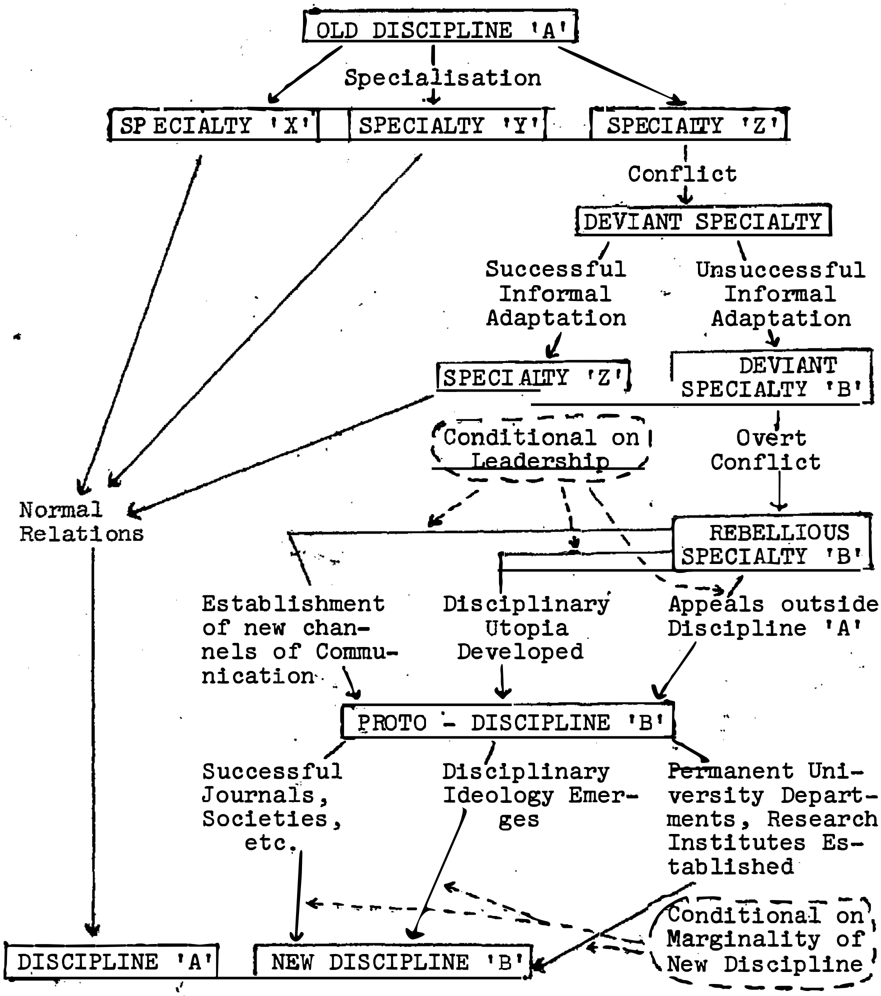

Figure 3. Diagrammatic Representation of Hagstrom's Account of Disciplinary Differentiation.

(Adapted from Hagstrom, The Scientific Community, p. 225.)

prestige as head of a university department meant that the discipline was quite prepared to allow Weldon's work to go forward unhindered in any way. The level of conflict rose when Weldon lost control of the Evolution Committee of the Royal Society.[18] It became acute with Bateson's attack on Pearson's homotyposis paper and the subsequent decision of the Royal Society to ask Pearson to divide his papers into separate biological and mathematical sections.[19] In the years from 1900 until 1904 biometry rapidly moved from the stage of "deviant specialty" through that of "rebellious specialty" to that of "proto-discipline." The foundation of Biometrika provided it with a channel of communication. Pearson's Grammar of Science[20] and to a lesser extent, Weldon's 1898 Address to the British Association provided it with a disciplinary utopia. The Drapers' Company grant[21] provided funds from an outside authority for the establishment of a research institute and graduate school in biometry.

Biometry did not develop beyond the stage of a "proto-discipline" for a number of reasons. W. F. R. Weldon died in 1906 and Karl Pearson's energies were diverted to eugenics.

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[18]This may well have involved loss of funds as Weldon's work on crabs had been financed partly by the Royal Society. See LLG, IIIa, p. 291.

[19]See above, chapter III, section B.

[20]Karl Pearson, The Grammar of Science (London, Walter Scott, 1892). See also the second edition published in 1900 by Black.

[21]See chapter IV above for an account of this grant.

Weldon's death in particular, removed the biometrical leader who not only still headed a department concerned with general zoology but whose main interest was centred in the statistical analysis of zoological problems which was biometry proper. Pearson's interests on the other hand, were mainly to do with the development of statistical theory per se and the analysis of problems of human evolution. In order for biometry to pass from the status of "proto-discipline" to that of established new discipline it needed to educate its recruits in both biology and statistics.[22] When Pearson's own Biometric Laboratory provided only statistical training the "proto-discipline" changed into something which was not biometry.

Eugenics as it was defined by the Galton Eugenics Laboratory had a similar history to biometry; a history which was, in fact, very much influenced by the previous experience of the biometrical school. Eugenics, like biometry, first emerged as a specialty within zoology. Unlike biometry, however, it had already been widely discussed in relation to evolutionary theory before the attempt to establish it as a

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[22] Hagstrom puts forward the view that success in finally establishing a new discipline is partially dependent on the "marginality" of the new discipline to two older disciplines. The more that the new discipline seems to fall between the two older disciplines rather than into one or the other of them the more likely the new discipline is to become firmly established. If this is the case then biometry was more likely to have become established if its recruits were trained in both biology and statistics. On this point see Hagstrom, op. cit., pp. 215-6, 224.

science.[23] Nevertheless when it did emerge as an embryonic specialty it was in close connection with biometry. It became even more closely associated with biometry after Galton's Herbert Spencer Lecture at Oxford in 1907,[24] and after Pearson took over the direction of the Galton Eugenics Laboratory. One result of the close association with biometry was that eugenics received some of the same criticism as biometry had. Pearson's earlier experience had already inclined him towards setting up an independent "proto-discipline." Further criticism merely reinforced this inclination. By 1910 eugenics as represented by the Galton Laboratory had associated with it the characteristics of a "proto-discipline." The various papers and pamphlets produced by the laboratory served as means of communication and a place to publish professional research. Galton's writings[25] and Pearson's contributions to the Eugenics Laboratory Lecture Series[26] outlined a disciplinary utopia. Appeals outside the

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[23]See chapter II above.

[24]Francis Galton, Probability, the Foundation of Eugenics (Oxford, O.U.P., 1907). This was reprinted in Galton's Essays in Eugenics (London, Eugenics Education Society, 1909).

[25]Francis Galton, Hereditary Genius (London, Macmillan, 1869); Inquiries into Human Faculty (London, Macmillan, 1883); Natural Inheritance (London, Macmillan, 1889); Essays in Eugenics (London, Eugenics Education Society, 1909).

[26]Especially his "The Scope and Importance to the State of National Eugenics," ELLS, 1 (1909) and "The Academic Aspect of the Science of National Eugenics," ELLS, 7 (1911).

discipline of zoology were made to the public for money and to the medical profession and social workers for recognition.[27] In many ways it appeared that eugenics had actually reached the status of a new discipline by the late 1920's. A journal had been established, a permanent research institute had been set up and Pearson had developed a justification for the study of eugenics which seemed to have gained wide support.[28] But as with biometry so with eugenics, Pearson's training program for recruits at the Eugenics Laboratory was oriented towards mathematical statistics to the virtual exclusion of biological or evolutionary teaching.

The result of Pearson's emphasis on statistical training and on statistical research in the publications he controlled (especially <u>Biometrika</u>) was the emergence of a group of young scientists trained in statistics.[29] In the long run this group became the centre of the new discipline of statistics and it was this discipline which appropriated much of the "proto-disciplinary" structure associated with biometry and eugenics. The journal, <u>Biometrika</u>, has become one of the chief journals in statistics, the Biometric

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[27]On these points see chapter IV above.

[28]The increased financial support of eugenic research by various government agencies such as the London County Council, the Department of Scientific and Industrial Research and the Medical Research Council was indicative of the wide support.

[29]Among the more prominent members of this group were G. Udny Yule, Egon Pearson, W. S. Gossett (Student) and J.O. Irwin.

Laboratory and the statistical courses taught there have been succeeded by the University College Department of Statistics and many of Pearson's early arguments to justify the use of statistics in biological and eugenic research have been generalized to justify statistics in the whole range of social and biological science. Other elements of the biometric school and the Eugenics Laboratory were passed on to the specialties now known as population genetics and human genetics. This connection is continuous not only in terms of theory and methods but also in institutional terms. Annals of Eugenics has become Annals of Human Genetics. The Galton Laboratory has become part of a Department of Human Genetics and Biometry. And the two key figures in British population genetics in the first half of the twentieth century, R. A. Fisher and J. B. S. Haldane, both held chairs at University College London in the departments that came down from Karl Pearson's "Institute of Applied Statistics."[30] In so far as human genetics and population genetics have succeeded eugenics and biometry they indicate that the two rebellious specialties have returned to the mother discipline with the cessation of overt conflict between their practitioners and other scientists in the discipline of zoology.

The emergence of statistics as a new discipline instead of biometry or eugenics does not seem to fit Hagstrom's

[30]From 1933 until 1943, R. A. Fisher was Galton professor of eugenics. J. B. S. Haldane was Weldon professor of biometry from 1936 onward.

account of disciplinary differentiation as well as the establishment of one of these as a new discipline would have done. Statistics, it might be argued, is really a specialty within the discipline of mathematics, and not a discipline itself. This is apparently still a moot point among statisticians today.[31] Although further research is necessary to clarify the kind of social structures around which modern statisticians have built their self-identity it does seem that the very significant contribution made to that process by Karl Pearson and his students took place by their defining statistics outside the context of the discipline of mathematics.[32] Such a beginning to a new discipline fits with another point made by Hagstrom; that a new discipline is more likely to become established the more marginal it is to already established disciplines.[33] Finally it should be pointed out that the resistance of biologists and medical men to the use of statistical methods was interpreted by Pearson as resistance by the scientific community in general[34] so that the conflict which Hagstrom holds to be associated with disciplinary

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[31] See Hagstrom, op. cit., pp. 192-4.

[32] On this point see especially the two papers by E. S. Pearson published under the general title, "Studies in the History of Probability and Statistics." XIV. "Some Incidents in the Early History of Biometry and Statistics 1890-4," Biometrika, 52 (1965), pp. 3-18; XVII. "Some Reflexions on Continuity in the Development of Mathematical Statistics, 1885-1920," Biometrika, 54 (1967), pp. 341-55.

[33] See note 22 above.

[34] HBGL, p. 1.

differentiation was present even if not restricted to just one discipline.[35]

C. Intellectual and Social Elements in the Historiography of Science

Hagstrom suggests that conflict occurs within a discipline because of disputes about goals, methods or theories. These three elements are similar to the elements contained in Thomas Kuhn's concept of "paradigm." A "paradigm" is an

> accepted example of actual scientific practice-- . . . which includes law, theory, application, and instrumentation together--[and which provides] a model from which springs a particularly coherent tradition of scientific research.[36]

Kuhn's "particularly coherent tradition of scientific research" can probably be equated with Hagstrom's "discipline."[37] If

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[35]Hagstrom was probably not intending to argue that there is just one way in which a new discipline can be formed, but it is worth pointing out how closely the formation of the discipline of statistics comes to the way he has outlined even if it does not fit perfectly into his pattern.

[36]Kuhn, op. cit., p. 10.

[37]One difficulty in this interpretation is that Kuhn's "coherent tradition" might be more nearly equivalent to Hagstrom's "specialty." I think not, but further empirical work needs to be done to see how clearly a scientific "discipline" can be distinguished from a scientific "specialty." Mark Adams has suggested to me that the two might be distinguished from each other by determining the rate of flow of ideas between the different groups. Specialties within the one discipline would be expected to have a comparatively high rate of interchange of ideas compared with specialties in different disciplines. A discipline could then be distinguished from a specialty according to the degree of isolation which groupings have.

the two are equated we have a way of relating Kuhn's insights about the intellectual elements of science which he developed in his concept of the "paradigm" to those of Hagstrom about the social structures of science.

I want to suggest that it is more useful to "unpack" Kuhn's concept of "paradigm" than to use it as a primary tool of analysis. The elements which make up Kuhn's "paradigm" concept are theories, observations and laws, methods, goals and ideology.[38] Changes in science can come about by a group of scientists accepting a change in any one of these elements. A revolutionary change, as Kuhn has pointed out, usually involves change in all of these elements. But science has many non-revolutionary periods during which evolutionary changes (increased specialisation, for example) take place. These evolutionary changes are due, I suggest, to changes in one or more of the intellectual elements which guide the practice of scientific research. Further, I would suggest that such changes are more or less continually being suggested in all branches of science. The changes which succeed in becoming established do not depend on some inner scientific logic. Their success is very closely related to

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[38]Kuhn's own definition of "paradigm" quoted above, is phrased differently and does not include the elements of "ideology and goals." But his exposition of the concept in his book does contain these elements. "Ideology" includes all that legitimates or justifies a particular tradition of research and usually includes philosophical, religious or metaphysical elements which may, however, be far from obvious if they are part of the general cultural inheritance in which the research tradition is placed.

the social organization of science which controls the means of communication between scientists, which controls the recruitment and training of scientists, and which has evolved methods of allocating prestige to different scientific specialties and to different scientists as well as methods designed to modify or prevent conflicts.[39] The intellectual elements of science are always placed in a particular social context within the scientific and wider communities and the interaction between these social and intellectual elements deserves careful attention from historians of science.

This view of the history of science provides a very definite connection between the social organization of science and the theories and methods of science.[40] It holds: (i) that the scientific community can be divided into a number of disciplines and specialties each of which has its own "coherent tradition of scientific research." (ii) that modifications of elements of these traditions are more or less continually being suggested in all specialties. (iii) that changes in research traditions will often lead to new social groupings within the scientific community such as new

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[39]It should be emphasised that as these social structures of the scientific community are always placed within the wider context of the social structures of society there will always be interaction between the scientific community and the society in which it is placed.

[40]This thesis about the history of science is primarily applicable to modern science. It is not meant to apply to the pre-history of science before the establishment of scientific disciplines.

specialties. (iv) that the replacement of virtually all the elements in a particular tradition of scientific research by substantially different elements is a prerequisite for a "scientific revolution." (v) that conflicts involving rival views within one tradition are subject to social controls by the scientific community. (vi) that if the conflicts cannot be controlled new social structures may emerge.

This theory of the history of science shows how changes in science can be both evolutionary and revolutionary. Neither evolution nor revolution is asserted to be the normal mode of scientific change. The theory holds that the key factors in understanding the history of science are the traditions of scientific research within scientific specialties and the social organization of science. The first can be broken down into the elements of ideology, theories, observations and laws, methods, and goals. The second is most important in its functions of minimizing conflict, providing channels of communication, support for research, and means of recruiting and training prospective scientists, by which the discussion of the intellectual elements is controlled.

Using this theory as a basis for analysis, biometry and eugenics can be viewed as attempts to introduce into zoology new methods backed up by philosophical and theoretical justifications. Both specialties, in common with the rest of zoology, involved commitment to the theory of evolution and to the goal of elucidating the mechanisms of evolution. The methods associated with biometry and Pearsonian eugenics, the numerical analysis of large samples of animal and human populations together with certain theoretical tenets such as the theory of the accumulation of particular variations by the action of natural selection on continuous variations were not shared with all of the zoological community. Both of these elements led to dispute within the discipline of zoology.

Nevertheless, biometry and eugenics might have retained their places as specialties within zoology if the social structures of English zoology had been able to keep the conflicts between Bateson and the biometricians within acceptable limits. Hagstrom has suggested[41] that dispute becomes unacceptable to the scientific community when arguments are directed against the integrity and competence of the disputants, i.e., when arguments become personal and not substantive. This clearly occurred in the dispute between Bateson and Pearson over homotyposis and between Bateson and Weldon over Mendelism. Moreover, Bateson was in a position of comparative power vis-a-vis the biometricians. He was able to persuade the Evolution Committee of the Royal Society not to support their work and, as a referee, to discourage the Royal Society from publishing their work. Not only was abusive argument involved in this dispute but also possible

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[41]Hagstrom, op. cit., pp. 264-75.

abuse of power.[42] The virulence of the dispute led to the alienation of the parties from each other. This alienation masked the substantive basis of the dispute and despite the expressed belief of both Bateson and Pearson in the good effects of forceful arguments[43] there is much evidence that the alienation spread "in a vicious circle."[44] Alienation undoubtedly hastened the emergence of biometry as a "proto-discipline." The alienation resulting from the dispute about the use of statistical method carried over into eugenics and also hastened its emergence as a "proto-discipline."

The biometric school has often been represented as an alternative school to Mendelism in the search for a science of heredity.[45] In Kuhnian terms the two have been seen as

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[42]It is possible that Weldon used his power as leader of the Royal Society Committee in 1894-6 in ways which Bateson regarded as abuse of that power. The rejection of Bateson's contributions (letters) to Biometrika and Nature might have been regarded similarly. I have not as yet found evidence that Weldon was directly connected with the Nature incidents.

[43]For Bateson see his Mendel's Principles of Heredity, passim. For Pearson see chapter IV above under the section, "The Laboratory as Consultative Agency . . ."

[44]On alienation between scientists see Hagstrom, op. cit., pp. 264-72. The original dispute between Weldon and Bateson, for example, spread to involve Pearson, various pupils of all of them, and was possibly responsible for Pearson's later hyper-critical attitude which led to the famous dispute with R. A. Fisher which in turn led to dispute between Fisher and Neyman. For this latter dispute see Hagstrom, op. cit., pp. 265-9. For the attitudes of Bateson's student, Punnett, and of his student, Hogben, see R. C. Punnett, "Early Days of Genetics," Heredity, 4 (1950), pp. 1-10; Lancelot Hosben, Statistical Theory.

[45]See works cited in note 7 of chapter III.

competing paradigms (along with Darwin's pangenesis and Weismann's germ-plasm theory) in the pre-history of genetics.[46] This interpretation is completed by the account of the victory of Mendelism in the scientific revolution which brought the modern science of genetics into being. The foregoing account has illustrated that this is not accurate. The biometric school was concerned with the whole problem of evolutionary biology. Heredity was certainly an important part of that problem but not the only part. Whether or not the dispute between the biometricians and the "Mendelians" helped those who observed it to understand the underlying substantive questions, it certainly has not helped historians to see the combatants in their true colours.

All the eugenic research carried out at the Galton Laboratory between 1905 and 1925 was statistical analysis of problems in the evolution of man. To carry out this research a combination of skills in biology and mathematics was necessary. The occurrence of such a combination was not a freakish scientific accident or mere coincidence. It followed in a perfectly understandable way from certain insights contained in Darwin's biology. Darwinian biology gave rise to the biometrical approach because Darwinian evolution was based on a population concept of species and on the action of natural

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[46]This is not an interpretation that Kuhn has made himself, but rather my conjecture of how his theory could be applied to biometry and eugenics.

selection on immense numbers of tiny variations occurring in organic populations. Population biology based on these Darwinian concepts was slow in emerging but it was the part of biology where the need for statistical analysis became increasingly obvious. A number of attempts to introduce statistical methods were made at approximately the same time as the emergence of the biometric school.[47]

Eugenics and biometry were two specialties which became isolated from the discipline of zoology largely because of conflict about their use of statistical method. In the long run zoologists became reconciled to the use of such methods and biometry and eugenics in the form of population genetics and human genetics became acceptable specialties within the discipline of zoology. The conflict and controversy which surrounded biometry and eugenics in Britain were centred largely on methods of research, a fact which underlines the crucial debates about methods occupying biologists

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[47] John T. Gulick speculated about the possibility of trying to carry out statistical analysis of biological populations and tried to use this method. See his Evolution, Racial and Habitudinal (Washington, D.C., Carnegie Institution, 1905). Bumpus and Davenport, two other American biologists, had also used statistical methods before 1900. See Charles B. Davenport, "A History of The Development of the Quantitative Study of Variation," Science, 12 (Dec. 7, 1900), pp. 869-70. G. Udny Yule, who had earlier been a student of Pearson's, and R. A. Fisher used statistical approaches to biological problems in the first decades of the twentieth century as did Sewall Wright and his co-workers in the U.S.A. Statistical method also spread rapidly to other disciplines --psychology, medicine, economics and sociology had all begun to use the methods advocated by Pearson by the 1920's. A study of the diffusion of the statistical method to these different disciplines would be very useful.

of the early twentieth century. It has become fashionable for historians of biology to speak of the existence of two different approaches, experimental biology and the natural history tradition, as alternative or rival methods in early twentieth century biology. It would be better to speak of three different approaches, the biometrical being the third.[48] It was these three different approaches which were brought together in the synthetic evolutionary theory of the 1930's as typified by R. A. Fisher's work.[49]

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[48] This point has become much clearer to me through personal conversation with Mark Adams.

[49] R. A. Fisher, The Genetical Theory of Natural Selection (Oxford, Clarendon Press, 1930).

VI

THE EUGENICS EDUCATION SOCIETY

Eugenic thought was the intellectual basis of an ideology for social and political action. A socio-political movement, the eugenics movement, formed round this ideology. It emphasised that the physical, mental and moral character of each person was overwhelmingly dependent on heredity and only minimally affected by environment. It argued that many of the social and health problems of the day--poverty, alcoholism, crime, mental illness and tuberculosis--had been passed down from previous generations by biological inheritance. Thus it was argued that these problems could be eliminated only if those who suffered from such hereditary "diseases" were prevented from having children. Some eugenists advocated sterilization in order to accomplish this end, but it was more common to advocate the segregation of the sexes in special institutions for the treatment of the poor, the alcoholic, the criminal, the insane or the sick. Eugenists also supported programs designed to increase the frequency of good qualities in the general population since these were also thought to depend on heredity. They suggested that the more intelligent and healthier members of the community should be encouraged to have large families by means of taxation concessions and government grants. Often eugenic thought interpreted contemporary social and international structures in hereditary terms. Eugenists suggested that the middle and upper classes had superior social position and greater wealth because they were endowed with superior intellectual and physical gifts by inheritance. Similarly, Britain was the dominant world power because of the superior hereditary qualities of the Anglo-Saxon race. Through such arguments the eugenics movement came to be identified with a nationalistic and racist position. All of the above elements can be found in the eugenics movement. They arose from the central conviction that nature was stronger than nurture and that heredity was far more important than environment.

The eugenics movement supported one organization, the Eugenics Education Society whose history gives evidence of the way in which eugenic thought provided an ideology for political and social action. It has already been pointed out[1] that the society can not be easily identified with other types of contemporary organisations. It was neither simply a political party nor a social reform group. Its history is further complicated by changes of emphasis in the short period here reviewed. By 1920 it was taking more the role of a learned society and less that of a socio-political movement.

The eugenics movement, as exemplified by the Eugenics Education Society, can be understood as an example of "middle

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[1]See Introduction, p. 3.

class radicalism." Frank Parkin[2] has analysed British "middle class radicalism" as exemplified by the Campaign for Nuclear Disarmament, a movement separated by fifty years and two world wars from the eugenics movement. Nevertheless, there are enough features in common between these two examples of "middle class radicalism" for the study of the later to inform the study of the earlier. In particular it seems that membership of both movements was drawn heavily from the "welfare and creative" professions rather than the "commercial" professions and that members of both groups were widely active in other voluntary organizations.[3] Moreover, "middle class radicalism" tries to bring about social reforms which are largely moral in character; a feature shared by both the eugenics movement and the Campaign for Nuclear Disarmament.[4]

The examination of the Eugenics Education Movement which follows shows how the radicalism of the middle classes is eager to make use of scientific arguments and findings to reinforce its moral arguments. It may well be that in the twentieth century it has become necessary to be scientific

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[2]Frank Parkin, Middle Class Radicalism: The Social Basis of the Campaign for Nuclear Disarmament (Manchester, Manchester U.P., 1968).

[3]The "welfare and creative professions" include such professions as teaching, social work, medicine and writing. The "commercial professions" include all forms of management in an industrial and commercial undertaking and private entrepreneurial activity. See Parkin, op. cit., chapter 8.

[4]See Parkin, op. cit., p. 2. This whole subject is taken up again in chapter VIII below.

or at least to appear so in order to be considered moral.

A. Origins and Formation of the Society

The Eugenics Education Society was founded at a London meeting in November, 1907. Its formation was partly the result of the breakaway of a group of committee members from the older Moral Education League.[5] It was also partly in response to the interest in eugenics which had been demonstrated at meetings of the newly formed Sociological Society in 1904, 1905 and 1906 when papers on eugenics had been read.[6] The earliest of these meetings, in May 1904, had been addressed by Galton on the topic, "Eugenics, Its Definition, Scope, and Aims." Eugenics was presented as a science which would bring about a utopian state of society. "The general tone of domestic, social and political life would be higher," if eugenics was practised, claimed Galton. "The race as a whole would be less foolish, less frivolous, less excitable and politically more provident."[7] Galton went on to express

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[5]I have been unable to find out anything about this organization except that it was founded in 1897 as the Moral Instruction League. F. J. Gould's Moral Instruction (London, Longman's, 1910) was written by a full-time lecturer for the league. From the contents of the book the league's title seems adequately descriptive of its aims and activities.

[6]See Francis Galton, "Eugenics: Its Definition, Scope, and Aims," Sociological Papers, 1 (1904), pp. 43-99; "Eugenics," Sociological Papers, 2 (1905), pp. 1-54. These papers were reprinted in Galton, Essays in Eugenics (London, Eugenics Education Society, 1909).

[7]Galton, Essays in Eugenics, pp. 37-8.

the hope that eugenics would soon be accepted so that man could do "providently, quickly and kindly" what nature did "blindly, slowly and ruthlessly."[8] Such an acceptance would only come if eugenics were to become both a serious academic study and a "new national religion." This address aroused much interest and discussion, and a number of those participating in the discussion were later prominent members of the Eugenics Education Society.[9]

The members of the Sociological Society were interested in eugenics because it could be seen as a scientific sociology. From the time of Comte and Herbert Spencer there had been strong supporters of the view that sociology could be established as a science by borrowing theories and methods from the more established sciences. Eugenics could be seen as a science of this kind.[10] It used a biological theory and a mathematical method. But Galton had also presented eugenics as a system of ideas, an ideology, which would bring about a new social order. The history of the Eugenics Education Society shows that Galton's claim, that eugenics was both a

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[8] Ibid., p. 42.

[9] A. C. Haddon, F. W. Mott, A. E. Crawley, Havelock Ellis, Professor Poulton, Archdall Reid, C. W. Saleeby and Dr. Alice Vickery.

[10] Discussion of this point was taken up by the Sociological Society. See G. Archdall Reid, "The Biological Foundation of Sociology," Sociological Papers, 3 (1906), pp. 3-52; J. Arthur Thomson, "The Sociological Appeal to Biology," Sociological Papers, 3 (1906), pp. 157-196.

science and a socio-political ideology, was accepted by many people. However, that history also shows that the openness and objectivity normally associated with science lived in uneasy peace with the dogmatism and partisan views normally associated with political ideology.

Against this background, the Eugenics Education Society was formed.[11] Meetings in November and December of 1907 drew up rules and nominated a council of twenty-one members to organize the society. At a General Meeting on February 14, 1908, the rules were ratified and the council affirmed. The aims of the new organization were:

> 1. Persistently to set forth the national importance of Eugenics in order to modify public opinion and create a sense of responsibility, in the respect of bringing all matters pertaining to human parenthood under the domination of eugenic ideals.
>
> 2. To spread a knowledge of the laws of heredity so far as they are surely known, and so far as that knowledge might effect improvement of race.
>
> 3. To further eugenic teaching at home in the schools, and elsewhere.[12]

'Moral education' was still a very strong element in the aims of the newly-established society. The basis of that morality was not, however, the teachings of Christianity, but the

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[11] For accounts of the foundation see "Origin and Work of the Society," ER, 1 (1909), pp. 51-4 and REES, 1 (1908), pp. 16-17.

[12] REES, 1 (1908), p. 21.

'science of eugenics'.

In the first flush of enthusiasm the society's activities were primarily propagandistic and political. Public meetings and lectures were held both to educate and proselytise. A journal was published to carry the eugenic message far and wide. Sub-committees were established to 'lobby' local government councils and parliamentarians. These activities showed the society to be part of a socio-political eugenics movement.

There was enough support for eugenics in Britain for several provincial branches to be set up in the years before the outbreak of the first World War. Branches were also established in Australia and New Zealand. Contact was made with similar organizations in other countries and an international committee was set up for the purpose of organizing international congresses. The second annual report of the society stated that branches might be formed in a number of provincial towns, particularly those with universities, and in overseas cities of the British Empire.[13] Branches were actually established at Dunedin (N.Z.), Liverpool, Haslemere, Southampton and Glasgow in 1910-11; Christchurch (N.Z.), Wellington (N.Z.), Cambridge and Belfast in 1911-12; Manchester, Birmingham and Sydney (Australia) in 1912-13; Brighton and Oxford in 1913-14.[14] Most of the branches in

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[13] REES, 2 (1909-10), pp. 17-18.

[14] For details see the appropriate number of REES.

Britain did not function during the war years and nearly all were unsuccessful in re-establishing themselves after the war.[15]

An International Eugenics Congress was organised by the Eugenics Education Society in July 1912. At the congress an International Eugenics Committee was appointed to plan for the next congress. The committee included representatives from Britain, France, Germany, Denmark, Belgium, the U.S.A., and Norway.[16] Plans for a second International Congress had to be postponed until after the war when it was held in New York.[17]

B. Membership of the Society

The membership of the Eugenics Education Society grew rapidly and reached a peak in 1913. After 1913, the total number of members declined slowly. (See Table 4.)

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[15]Only Liverpool and Brighton seemed to have been re-established for any length of time. See REES, 11-16 (1918-1919 - 1923-4).

[16]REES, 5 (1912-13), pp. 12-3 and 6 (1913-14), p. 3.

[17]*Scientific Papers of the Second International Congress of Eugenics held . . . at New York . . . 1921* (Baltimore, Williams and Wilkins, 1923).

TABLE 4

Membership of Eugenics Education Society 1909-1920.

Year	Members	Associate Members	Total
1909	112	229	341
1910	155	300	455
1911	196	331	527
1912	294	323	617
1913	406	307	713
1914	383	241	624
1915	377	237	614
1920	319	175	494

Figures for 1916-1919 were not available.

Sources: Annual Reports of the Eugenics Education Society.

It can be seen that the decline was greater among associate members than among full members. Associate members paid smaller subscriptions than full members and were not eligible to vote on society business or in its elections. Women made up a far higher proportion of the associate membership than they did of the full membership.[18] The figures given in Table 4 for the London-based society should be supplemented by the membership of branches at provincial centres. The totals for these branches in 1914[19] were 196 members and 227

[18] In 1913 there were 243 male members compared with 162 women. But women outnumbered men among the associate members 209 to 98. The figures were obtained from a count of the members' list in REES, 5 (1912-13), pp. 34-50.

[19] This was the year in which provincial membership reached its maximum from counts of the lists of members printed in the annual REES.

associate members. Birmingham was the largest of these branches with 60 members and 165 associate members in 1914. It is difficult to gauge the significance of the number of members. The total of more than 1000 members and associates throughout Britain in 1913-14 might be compared with the 800-strong membership of the Fabian Society in 1900.[20]

If we cannot learn much from the actual size of the society's membership we can learn a great deal more from its composition. A comprehensive survey of the total membership using a composite list constructed from the available annual lists[21] would require a great expenditure of time and money. Consequently the whole membership list has been surveyed solely for the purpose of identifying well-known people. Greater effort has been made to gain information about all the members contained in two different samples. The first sample was a list of all members of the council of the society between 1909 and 1920. The second was a random sample of forty members and twenty associate members[22] taken from

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[20]Figure given in Bernard Semmel, Imperialism and Social Reform (New York, Doubleday, 1968), p. 59.

[21]Membership lists were published in each of the first seven annual reports (1908-15) and another list was published in the report for 1919-20.

[22]The random sample was made up as follows: 1) All members and associate members were placed on separate lists in alphabetical order. 2) Each list was numbered consecutively, i.e., there was a list of members numbered 1 to 406 and of associate members from 1 to 307. 3) A table of random numbers was used to find numbers between 000 and 999. When a number between 001 and 407 was drawn the appropriately numbered member was included in the sample. This process

the membership list printed in the annual report for 1912-13.

Members of the Society Eminent in Their Own Right.

Forty-seven of the members[23] of the Eugenics Education Society were eminent enough to have their biographies published in the Dictionary of National Biography. At least half a dozen more will probably be included in future supplements of the Dictionary.[24] Twenty-nine of the fifty-three people included in this group held university positions for most of their adult lives, six were politicians, six practised medicine and three were clergymen. The remaining members of the group were two social workers, two research scientists, two authors,[25] one businessman and a patron of literature and the arts.[26] The academics specialised in a wide variety of

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was continued until a forty member sample had been constructed. 4) The same procedure was used to select a twenty member sample of associate members, continuing to draw numbers in the tables from the point reached in selecting the first sample.

[23]It is possible that I have overlooked a few members who were also included in the DNB.

[24]For purposes of this section I included Professor Cyril Burt, Sir A. M. Carr-Saunders, Neville Chamberlain, Sir Ronald Fisher, J. B. S. Haldane and Sir Charles Sherrington in the DNB list. They have died since the last supplement to the DNB was published and are very likely, in my view, to be included in future supplements.

[25]Havelock Ellis is included under this heading though he equally well might be called a social scientist or a psychologist.

[26]The full list of the forty-seven members whose names are in the DNB are:

Professor John George Adami (vice-chancellor of Liverpool University, 1919-26)
Sir Robert Armstrong Jones (a leading psychiatrist)

disciplines but a majority were in the biological sciences (ten)[27] and the social sciences (nine). The remainder were in the medical sciences and physical sciences (four each) and two were in the humanities. Three non-academic scientists, Galton, Mond and Geikie were in this <u>DNB</u> sample. Twenty-two

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A. J. Balfour (Prime Minister 1902-5)
Sir C. Hubert Bond (psychiatrist)
Prof. Gilbert Charles Bourne (professor of zoology, Oxford, 1906-21)
Prof. Frederick Orpen Bower (professor of botany, Glasgow, 1885-1925)
V. A. G. Bulwer-Lytton (Second Earl of Lytton and politician)
Sir James Crichton-Browne (physician and psychologist)
Charles Frederick D'Arcy (Archbishop of Armagh 1919-38)
Sir Francis Darwin (reader in botany, Cambridge, 1888-1904)
Sir Horace Darwin (scientific instrument maker)
Goldsworthy Lowes Dickinson (lecturer in political science, Cambridge, 1896-1920)
Prof. Georges Dreyer (professor of pathology, Oxford, 1907-34)
Havelock Ellis, Sir Francis Galton
Sir Patrick Geddes (professor of botany, Dundee, 1889-1914)
Sir Archibald Geikie (director, Geological Survey of Great Britain 1882-1901)
A. C. Haddon (reader in ethnology, Cambridge, 1909-25)
Frederic Harrison, William Joynson-Hicks (Home Secretary 1924-9)
John Maynard Keynes, Sir Joseph Larmor (Lucasian professor of mathematics, Cambridge 1903-32)
H. J. Laski (professor of political science, London, 1926-50)
Sir Oliver J. Lodge (principal of Birmingham University, 1900-19)
Rev. Edward Lyttleton (headmaster, Eton College, 1905-16)
William McDougall (reader in mental philosophy, Oxford, 1903-20)
William C. McIntosh (professor of zoology, St. Andrews, 1882-1917)
Sir Robert Ludwig Mond (industrial chemist)
Lady Ottoline Morrell (patroness of the arts)
Sir Frederick W. Mott (neuro-pathologist)
Baron John Fletcher Moulton (Liberal M.P. 1894-1906 and Lord Justice of Appeal 1906-12)
Edward Nettleship (ophthalmic surgeon)
Sir William Osler (professor of medicine, Oxford, 1904-19)
Dame Ellen F. Pinsent (pioneer worker in mental health)
Edward B. Poulton (professor of zoology, Oxford, 1893-1933)
Dame Mary A. Scharlieb (gynaecological surgeon)
F. C. S. Schiller (philosopher and Fellow of Corpus Christi College,, Oxford, 1897-1925)
Sir Arthur Schuster (professor of physics, Manchester, 1888-

of the academics were professors in British universities and four were vice-chancellors. Four of the academics played a prominent role in politics in various ways. Lowes Dickinson was one of the early proponents for a League of Nations.[28] The role of John Maynard Keynes, both as theoretical economist and advisor to British governments during both world wars is well-known. H. J. Laski was chairman of the British Labour Party in 1945 and a prominent member of that party over a long period. Sir Joseph Larmor, Lucasian professor of mathematics at Cambridge was also a Unionist Member of Parliament representing Cambridge University from 1911 until 1922.

Eugenic or hereditary aspects played an important role in the studies of at least eight of these academics.

1907, secretary of the Royal Society, 1912-19)
C. G. Seligman (professor of ethonology, London, 1913-34)
A. C. Seward (professor of botany, Cambridge, 1906-36)
Lady Henry Somerset (philanthropist who worked for the cause of temperance)
Sir William Somerville (professor of rural economy, Oxford, 1906-25)
Prof. E. A. Sonnenschein (head of classics department, Birmingham, 1883-1918)
Charles E. Spearman (professor of philosophy of mind and logic, London, 1911-28)
Sir Edgar Speyer (financier and philanthropist)
Sir Arthur H. D. R. Steel-Maitland (Conservative Minister of Labour 1924-9)
James E. C. Welldon (Dean and suffragan bishop of Manchester 1906-18).

[27]This includes Professor Sir Patrick Geddes, Professor of botany at Dundee, 1889-1914 who also later held an appointment as a professor in civics and sociology at Bombay, 1920-3.

[28]Unless otherwise stated biographical details come from the DNB.

Sir Ronald A. Fisher and J. B. S. Haldane devoted much time to the study of genetics, especially population genetics.[29] Edward Poulton and Patrick Geddes did significant work on evolutionary theory.[30] Cyril Burt and Charles Spearman were concerned with the inheritance of intelligence.[31] William McDougall's "instinct psychology" was based on the belief that heredity rather than environment determined human behaviour. A. M. Carr-Saunders, a life-long supporter of the Eugenics Education Society, carried out a number of studies concerned with growth and changes of human populations.[32] Fisher and Carr-Saunders were the two members out of this group who most consistently supported the Eugenics Education Society. They did much to turn it more and more into a learned society as time passed, but their influence was just beginning at the close of World War I.

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[29] R. A. Fisher, Genetical Theory of Natural Selection (Oxford, Clarendon Press, 1930); J. B. S. Haldane, New Paths in Genetics (London, G. Allen & Unwin, 1941) and K. R. Dronamraju (ed.), Haldane and Modern Biology (Baltimore, Johns Hopkins Press, 1968).

[30] Patrick Geddes and J. Arthur Thomson, The Evolution of Sex (London, W. Scott, 1889), Evolution (London, Williams and Norgate, 1911); E. B. Poulton, The Colours of Animals (London, Kegan Paul, 1890), Essays on Evolution 1889-1907 (Oxford, Clarendon Press, 1908).

[31] Cyril L. Burt, The Factors of Mind (London, U. of London Press, 1941), Intelligence and Fertility (London, Cassell, 1952); Charles E. Spearman, The Abilities of Man: Their Nature and Measurement (London, Macmillan, 1927).

[32] A. M. Carr-Saunders, The Population Problem: A Study in Human Evolution (Oxford, Clarendon Press, 1922), World Population: Past Growth and Present Trends (London, Royal Inst. of International Affairs, 1937).

Undoubtedly the two most prominent members of this group of eminent members of the society were A. J. Balfour and Neville Chamberlain, who were both Prime Ministers, although at times separated by thirty years. Balfour's membership was honorary, but Chamberlain was a member of the Birmingham branch committee.[33] Two other politicians who were members of the Eugenics Society held ministerial appointments in Baldwin's 1924-9 Conservative Government. They were William Joynson-Hicks, Home Secretary, and Sir Arthur Steel Maitland, Minister of Labour. Baron Moulton, an ex-Liberal M.P. and Lord Justice of Appeal, 1906-1912, was a vice-president of the society.

Four of the medical members of the group under examination worked in psychiatric fields. Havelock Ellis's interests were of a similar nature. The two people who have been classified as "social workers" were not professionally trained but rather, voluntary philanthropists. One of these, Lady Henry Somerset, made a number of innovations in the treatment of alcoholics and was president of the World Women's Christian Temperance Union. The other, Dame Ellen Pinsent, was concerned with the treatment of mental illness. She was a member of the Royal Commission on the Treatment of the Feeble-Minded in 1904-8 and was afterward a Commissioner for the Board of Control of the Feeble-Minded.

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[33]See <u>REES</u>, <u>5</u> (1912-13), p. 60.

Two of the clergymen were also schoolmasters. Edward Lyttleton was headmaster of Eton and James Welldon, later Dean of Manchester, was headmaster of Harrow. Two other prominent clerical supporters of the eugenics movement were Charles D'Arcy, Archbishop of Armagh, and William Inge, professor of divinity at Cambridge and later Dean of St. Paul's Cathedral, London.[34]

This brief survey of the more eminent members of the society by no means covers all members whose names would have been well-known in the early years of twentieth-century Britain. Nor does it include all whose positions or influence were of importance. Among those not included in the DNB sample were leaders of the medical profession, professors, military men of the highest rank, members of parliament, scientists and prominent clergymen. But the above survey does indicate that the eugenics movement was able to gain the support of many eminent and powerful men and women. This was particularly true in academic circles and in the medical profession. Both social and biological scientists were among the keenest supporters of eugenics.

The Members of the Council of the Eugenics Education Society.

In the period between 1908 and 1920, one hundred and twenty people served on the council of the Eugenics Education

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[34]Dean Inge's biography is not included in the DNB.

Society.[35] The council consisted of the elected officers of the society and up to thirty other members who were also elected annually.[36] Membership of the council did not necessarily involve much time or energy as an executive committee and sub-committees directed the activities of the society. But the Council did meet monthly so that membership was not in theory merely nominal.

Nine of the one hundred and twenty council members were vice-presidents resident outside Great Britain and no attempt was made to gather information about them. Of the one hundred and eleven council members who lived in Britain no information is available for twenty-eight. For forty others available information is minimal. Eleven are known to have had medical qualifications and a further five were listed as "Dr." Another eight were listed as having graduated B.A. or M.A. Two more had the title "Professor." A further ten were listed with the titles "Sir" or "Lady" in front of their names. These forty members also included an admiral, an alderman, a Justice of the Peace and a lady who had been awarded the O.B.E.

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[35]The four honorary members, Balfour, Geikie, the Duchess of Marlborough, and August Weismann, whose names appeared on lists of the council, are not included in this number.

[36]See "Rules of the Eugenics Education Society," clause IX, <u>REES</u>, <u>1</u> (1908), p. 22.

More information is available about the remaining forty-three members of the council.[37] Their occupations are indicated in Table 5 below. Once again it will be noted that academics and doctors made up more than half the sample.

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[37]Twenty of these forty-three have already been included in the DNB sample above (see note 26), viz., Armstrong-Jones, Bond, Carr-Saunders, Crichton-Browne, D'Arcy, Ellis, Fisher, McDougall, Mond, Mott, Moulton, Nettleship, Pinsent, Poulton, Schiller, Arthur Schuster, Seligman, Seward, Spearman and Welldon. The other twenty-three together with the main source of biographical information are:

Major W. P. Colfox, M.P. (REES)
Montague Crackanthorpe K.C. (ER, 5 (1913-14), p. 342.)
Major Leonard Darwin (ER, 34 (1942-3), p. 109)
Mrs. S. Gotto (Neville Rolfe) (Er, 47 (1955-6), pp. 194,214.)
Dr. M. Greenwood (Uni. of London Calendars)
David Heron (Directory of British Scientists 1963)
Major H. E. Hills (Who's Who 1914)
Dean William R. Inge (Oxford Dictionary of the Christian Church)
T. N. Kelynack M.D. (British Journal of Inebriety 1909-14)
Miss A. H. T. Kirby (ER 1909-20)
Prof. James A. Lindsay (Who Was Who 1929-40)
Prof. E. W. MacBride (Who Was Who 1929-40)
Mrs. G. Pooley (see George H. Pooley in Who's Who 1914)
Walter Rea M.P. (Who's Who 1914)
G. Archdall Reid (Who's Who 1914)
Dr. C. W. Saleeby (British Journal of Inebriety 1909-14)
Dr. Ettie Sayer (Who Was Who 1916-28)
Edgar H. J. Schuster (LLG)
Dr. J. W. Slaughter (ER 1908-14)
Dr. W. C. Sullivan (ER 1 (1909), pp. 56-8)
Sir John Arthur Thomson (Who Was Who 1929-40)
W. C. Dampier Whetham (Who's Who 1914)
Arnold White (Who Was Who 1916-28)

TABLE 5

Occupations of the Members of the Council of the Eugenics Education Society

Occupation	Well-documented number	Total
Medical	26[a]	10
Academic	18	16
Politicians	4	3
Clergy	3	3
Social Work	3	3
Scientists	2	2[b]
Writers	2	2[c]
Military Officers	2	1
Lawyers	1	1
Housewives	2	2
Not Known	48[d]	0
Total	111	43

a. Includes five who had the title "Dr." but about whom no further information was available.

b. Includes Col. H. E. Hills F.R.S., who was a military officer specializing in military engineering.

c. Includes Havelock Ellis whose writings were largely scientific.

d. Includes eight people who had university degrees and ten with the title, "Sir" or "Lady."

Ten of the academics had already achieved eminence in their various fields when they served on the council in the years before 1920. Four of the remaining six were involved in biometric work. Dr. M. Greenwood, David Heron and Edgar Schuster all worked at the Galton Eugenics Laboratory in the early years of its existence. Heron was for a considerable period Karl Pearson's chief assistant. His membership on the

Eugenics Education Society council was probably curtailed by the clashes between the society and Pearson.[38] Heron's basic training had been in mathematics and he went on to a career as an actuary. Greenwood had received a medical training and lectured on vital statistics at the University of London. Schuster studied under Weldon and had been the first Galton Research Fellow in eugenics. R. A. Fisher was the other person who was interested in biometry, about which he wrote articles in the Eugenics Review.[39]

The majority of the academic members who had already reached important positions in their fields were in the biological and social sciences. Those in biology were Professors MacBride, Poulton, Seward and J. Arthur Thomson. The social scientists were McDougall and Spearman who were psychologists and Seligman who was an anthropologist. Also included among the academic members of the council were F. C. S. Schiller, who wrote a number of articles and books on eugenics, as did W. C. D. Whetham, F.R.S. Sir Arthur Schuster, a prominent physicist, and Professor J. A. Lindsay, professor of medicine at Queen's College, Belfast complete this group.

The medical members of the council included a number of prominent psychiatrists.[40] At least four of the other

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[38]See LLG, IIIa, pp. 398-409.

[39]See R. A. Fisher, "Biometrika," ER, 8 (1916-7), pp. 62ff and "The Biometrical Study of Heredity," ER, 16 (1924-5), pp. 189ff.

[40]Armstrong Jones, Bond, Crichton-Browne and Mott.

doctors on the council were concerned professionally with social problems that interested the society as a whole. Dr. Ettie Sayer, a strong supporter of the women's suffrage movement, was also a member of the National Society for the Welfare of the Feeble-minded. Drs. T. N. Kelynack and C. W. Saleeby were prominent members of the British temperance movement. Dr. W. C. Sullivan was a prison medical officer and much concerned with the problems of crime.[41] The three women social workers were concerned with similar problems. Mrs. (later Dame) E. F. Pinsent and Miss A. H. T. Kirby did much work on behalf of the mentally ill and Mrs. S. Gotto (later Mrs. S. Neville-Rolfe) who was the first secretary of the society and one of its prime movers, received an O.B.E. for her work in the war time movement against venereal diseases.

Two of the politicians on the council, Major W. P. Colfox and Mr. Walter Rea were not of outstanding prominence, but both played active roles in helping to further the society's political aims. A third politician, Baron Moulton, appears to have had an almost honorary position as one of the society's vice-presidents. Other members of the council included three prominent clargymen, Bishop Welldon, Archbishop D'Arcy and Dean Inge. Two professional writers,

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[41] See his "Eugenics and Crime," ER, 1 (1909-10), pp. 112ff,

Havelock Ellis and Arnold White, also served on the council.[42]

In 1911 Major Leonard Darwin, son of Charles Darwin had been elected president of the society. He retained that position throughout the period under consideration. The society was one of his greatest interests. He seldom missed committee or council meetings and for years was the usual chairman at the public meetings and lectures conducted by the society. He wrote many articles in the Eugenics Review and represented the society at both national and international conferences. His influence on the society probably removed it more from public controversy than might have been the case if others had been in his position. Although he encouraged the society to work for certain political goals he did not present eugenics as the one and only answer to the whole range of Britain's social problems--a fault of some enthusiastic eugenists.[43]

The members of the council of the Eugenics Education Society were, in general, active supporters rather than well-known people whose names were used to bolster its image. Fifty-three of the one hundred and eleven council members

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[42]For White's eugenic interest see Arnold White, "Nomad Poor of London," Contemporary Review, 47 (May 1885), pp. 714-26, "Colonization and Emigration," Contemporary Review, 49 (March 1886), pp. 375-381, and "A Typical Alien Immigrant," Contemporary Review, 73 (Feb. 1898), pp. 241-50.

[43]See, for example, C. W. Saleeby, Parenthood and Race-Culture: An Outline of Eugenics (London, Cassell, 1909), The Progress of Eugenics (London, Cassell, 1914) and The Eugenic Prospect: National and Racial (London, T. Fisher Unwin, 1921).

contributed articles to the *Eugenics Review.* Many of the remainder addressed meetings on behalf of the society or worked on various sub-committees. The makeup of the council membership reinforces the finding from the *DNB* sample that the society was supported strongly by members of the academic and medical professions. The council members were also, in general, very well educated, the great majority having university or professional training.[44] The leadership of the Eugenics Education Society was dominated by well-educated members of the middle-class professions of medicine, university teaching and science.

Random Sample of the Members of the Eugenics Education Society

When the random sample[45] is examined it confirms the general pattern which has emerged from the previous samples. Although the figures are small,[46] the random sample also

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[44] This was true of the thirty-seven members of the council about whom enough biographical evidence was available to check if they had received higher educations.

[45] See note 22 above.

[46] Biographical information was discovered for twenty of the forty members in the sample and for five of the twenty associate members:

Mrs. M. B. Busk, wife of E. H. Busk, chairman of the Galton Laboratory Committee (*REES* members' lists)

Mrs. T. H. Carson, wife of T. H. Carson K.C., barrister (*Who Was Who 1916-28*)

Mrs. Henry Croft, wife of H. P. Croft, Conservative M.P. (*Who's Who 1914*)

Dr. Binnie Dunlop, physician very interested in the Malthusian shows medicine and university teaching to be the two professions most commonly represented among the members of the society. (See Table 6.) Four of the six academics in this sample worked in biology and two of them had quite close

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League (birth-control proponents) (Medical Who's Who 1914)
Thomas C. Horsfall, president of Manchester Art Museum (Who's Who 1914)
Captain C. Morley Knight (List of Officers of the Royal Regiment of Artillery)
Henry R. Knipe, author of Evolution in the Past (British Museum Catalogue)
J. H. Koeppern, zoologist (possibly Swiss) (REES Membership lists)
Dr. John Rudd Leeson, consulting physician (Medical Who's Who 1914)
Eden Philpotts, novelist (Who's Who 1914)
Mrs. George Pooley, wife of G. H. Pooley, ophthalmic surgeon (Who's Who 1914)
Mrs. E. B. Poulton, wife of Prof. Poulton (DNB)
M. R. Pryor, Deputy-Lieutenant, Hertfordshire (Who's Who 1914)
Dr. Ettie Sayer, physician who strongly supported women's suffrage (Who's Who 1914)
Dr. Ernest Joseph Schuster, prominent barrister (Who Was Who 1916-28)
Dr. J. W. Slaughter, American social scientist (ER)
Lady Henry Somerset, philanthropist and leader of the temperance movement (DNB)
J. F. Tocher, lecturer in biometry, Aberdeen, 1911-41 (Who Was Who 1941-50)
Arthur Trewby, author of Healthy Boyhood (British Museum Catalogue)
Arnold White, writer and novelist (Who Was Who 1916-28).

The five associate members of the random sample about whom biographical information was unearthed were:

A. D. Darbishire, lecturer in genetics, Edinburgh (Edinburgh University Calendar, 1913)
W. Nielson Jones, head of Botany Department, Bedford College (Who's Who 1914)
The Rev. Thomas E. de V. Laurence, Anglican priest (Crockford's Clerical Directory, 1914)
Miss Blanche Leppington, author of works on moral education (Wellesley Index to Victorian Periodicals; British Museum Catalogue)
Lewis Fry Richardson, meteorologist and later psychologist (Who Was Who 1951-60).

contacts with the biometric school,[47] again confirming previous trends. Among the other members of the random sample were two novelists, two social workers, a clergyman and the director of an art museum.

TABLE 6

Occupations of the Members of the Random Sample

Occupation	Number	Occupation	Number
Academic	6	Wife[a]	5
Medical	3	Lawyer	1
Social Work	2	Director of Art Museum	1
Writer	2	Local Government	1
Clergy	1	Part-time author[b]	2
Military Officer	1	No Information	35
		Total	60

a. All were wives of prominent people.

b. These two members are known only because of the one or two books they each wrote.

This survey of the membership of the Eugenics Education Society indicates that a high proportion of members had

[47] A. D. Darbishire had been one of Weldon's Oxford students. He published a number of papers on the genetics of mice in Biometrika between 1900 and 1905. He accepted Mendelism as the basic mechanism of physiological inheritance soon after. He died during the first world war. His death saw the further removal of a zoologist who had tried to combine biometry and Mendelism rather than seeing the two as mutually exclusive. James Fowler Tocher (1864-1945) had been trained in chemistry, but in the early years of the twentieth century turned his attention to statistics. He worked at Karl Pearson's Biometric Laboratory in London before taking up an appointment as lecturer in statistics and biometry at the University of Aberdeen in 1911. He published a number of anthropometric papers.

received advanced education and were pursuing professions which allowed a great deal of individual freedom. Membership was not only drawn almost exclusively from the middle classes but also heavily from the intellectual, creative and welfare professions. Of those whose profession has been discovered only three military officers and one businessman would be excluded definitely from this category. Those active in the eugenics movement, as far as they can be judged from the membership samples examined, fit into the pattern outlined by Parkin for a middle class radical movement.

Parkin also found, contrary to much contemporary sociological theory, that members of such a radical movement did not act because of their alienation from their own society. Rather they acted because of their strong identification with the ideals of their society, particularly the ideals of freedom of expression and of individual participation in democratic processes. Whether the members of the eugenics movement acted from similar motivations is difficult to tell. They are not available to fill in questionnaires. But the fact that many members of the eugenics movement were leaders in their community and active in voluntary organizations indicates that they were not alienated from their own society. Although the eugenics movement aimed to change Britain's treatment of social problems in a radical manner, its supporters were not alienated from their own national society. On the contrary, their identity with class and profession, and with the ideal that their action could change government policies indicates that they were very firmly integrated into the existing structures of British society.[48]

One special feature of the eugenics movement was its claim to have a scientific basis. The Eugenics Education Society was certainly well supported by scientists and the medical profession many of whom would have studied science at university level. Support of eugenics from such a large segment of the scientific community was an indication that many took seriously its claims to be scientific. It is worth noting, however, that support for eugenics did not come evenly from all scientists. Biologists, as might have been expected, were more prominent than chemists and physicists. Among social scientists strongest support came from psychologists. Economists, sociologists and political scientists were much less numerous[49] among the supporters of eugenics. One of England's leading sociologists, L. T. Hobhouse, was possibly the strongest academic critic of the movement.[50]

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[48]See Parkin, op. cit., chapter 2, and see also chapter VIII below.

[49]Keynes, Laski, Carr-Saunders and Lowes Dickinson were members of these disciplines who did show some support for the eugenics movement.

[50]Hobhouse (1864-1929) was professor of sociology at the University of London (1907-29). For further biographical details see DNB. His Social Evolution and Political Theory (New York, Columbia U.P., 1911) contained a chapter attacking eugenic explanations of social and political phenomena. Hobhouse's position heralded a vigorous attack by social scientists on biological explanations of social phenomena.

Lack of support from social scientists can probably be explained in part as the beginning of a reaction against the excesses of Social Darwinism and the use of biological explanations in social science.

The emergence of a "scientific" ideology in the early twentieth century and its espousal by a middle class radical movement seems, on reflection, to be quite natural. Science had been thought by many to be the engine of progress. During the nineteenth century those advocating radical change had looked to science as a natural ally. Science was rational and was increasingly taken as the undergirding for a modern "world view." Given such currents it is not surprising to find scientists strongly supporting a radical movement based on a scientific ideology.[51]

C. The Eugenics Review

In a recent article on "The Activities of the Eugenics Society" two of its present office-bearers note that: "The Society was started by reformers more concerned with social evils than with human genetics."[52] Such a concern with social evils was evident in all aspects of the society's early activities and can be seen clearly in an examination

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[51]The general relations between science and society are taken up in more detail in chapter VIII below.

[52]Faith Schenck and A. S. Parkes, "The Activities of the Eugenics Society," ER, 60 (1968), p. 142.

of its journal, Eugenics Review.

The Eugenics Review began publication in 1909, less than eighteen months after the formation of the society. From the beginning there was confusion about what kind of journal it should be. A recent editor has written that Eugenics Review "set out to be all things to all men--a news sheet, a scientific journal and an organ for eugenic propaganda."[53] Despite the problems of mixing these different aims, the journal became financially self-supporting within three years.[54] The trend of the journal over the period 1909-1920 was toward longer and more academic articles[55] with an increasingly thorough book review section. Indeed the latter serves as an excellent introductory bibliography to the eugenic writings of the period.

The articles in the Review covered a very wide range of subjects and were written in very different styles with a number of differing objects. The following table with the total number of articles in the different volumes will help to put discussion about the number of articles devoted to one topic or written in a particular style into perspective.

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[53]Kathleen Hodson, "The Eugenics Review 1909-68," ER, 60 (1968), p. 162.

[54]Ibid., p. 164. The council minutes of the society for May 13, 1919, show, however, that the Review had gone into deficit during the war.

[55]Table 7 indicates the increase in length, since each of the volumes contained about the same number of pages but there was a definite decrease in the number of articles per volume.

TABLE 7

Number of articles in volumes of the Eugenics Review

Volume Number[a]	1	2	3	4	5	6	7	8	9	10	11	12	Totals 12
No. of Articles	22	17	19	19	18	13	13	12	16	13	9	10	181

a. Volume 1 was published in 1909-10, 2 in 1910-11, etc.

A first class of article is that dealing with what was regarded as a "social evil" or "social problem." In the first two volumes there were six articles discussing poverty and the reform of the poor law, stimulated by the Royal Commission on the Poor Law which was then meeting. The Eugenics Education Society appointed a committee to draw up a submission to be presented on its behalf to that commission and some articles arose out of the discussion of that committee.[56] Only two more articles on the Poor Law appeared in the remaining ten volumes under discussion. There were seven articles on feeble-mindedness and mental deficiency evenly scattered over the whole period. Three of these were to do with the functioning of the Mental Deficiency Act which was passed during this period. These articles illustrate that the society was concerned about political action. Five articles were devoted to the subject of crime and criminality. Four articles were concerned with the

[56]See "Report of the Committee appointed to consider the Eugenic Aspect of Poor Law Reform," ER, 2 (1910-11), pp. 167-203.

problem of venereal diseases. Single articles dealt with the problems of insanity, epilepsy, and alcoholism. Two articles advocated the use of sterilization as a method to bring some of these social evils under control. Several other articles dealt with what the authors regarded as social problems, but problems which were defined by eugenic theory rather than by general agreement of the populace. These included all those articles written about vital statistics and factors likely to alter the makeup of the population from generation to generation.

Altogether there were thirty-three articles in the first twelve volumes which were concerned in one way or another with factors that could change the overall pattern of the British population. In particular there were eight articles about either the birth rate or infant mortality. The majority of these were concerned lest decreases in the birth rate and in infant mortality increase the proportion of the "less fit" in the general population. A minority of these articles were more in the nature of straight-forward analyses of the way in which birth rates and infant mortality rates were changing. This kind of article was published toward the end of the period under review and is another indication of a general tendency for the Eugenics Review to become more of an academic journal as time passed.

There were seven articles to do with eugenic aspects of marriage and three to do with divorce. A number of these were to do with the question of whether or not marriages should be subject to laws which would lower the likelihood of the birth of less "fit" offspring. Others were devoted to the question of how to increase the size of suitable families and so reverse some of the population changes that eugenists regarded as undesirable. Two of the articles to do with divorce were published in the volume for 1912-13 following closely upon the Report of the Royal Commission on Divorce and Matrimonial Causes, again illustrating the watch the society kept on matters of interest to eugenists which were being discussed by parliament.

Five articles were published on migration, three of which were mainly concerned with the way in which both emigration and immigration were changing such aspects of the population as the sex ratio and birth rate. The other two were, however, concerned with questions such as the purity of race as is illustrated by the title of one of them, "The Menace to the English Race and to its Traditions of Present-Day Immigration and Emigration."[57] Three articles commented on the sex ratio, particularly paying attention to the way in which it differed in different age-groups. There were two articles each on the topics of human fertility and depopulation. The final two articles in this category were a report on the effect of parental age on the health of the offspring

[57]By G. P. Mudge, <u>ER</u>, <u>11</u> (1919-20), pp. 202ff.

and a discussion of the selective effects of immunity from disease. There were also two articles during this time on birth-control and planned parenthood.

There were thirteen articles during the period concerned with the introduction of eugenic ideas into educational curricula. Five of these occurred in Volume 1. There were also during and directly after the war thirteen articles concerned in one way or another with either the eugenic or dysgenic effects of the war or the effects of the war on eugenics as a movement. Even before the war there had been three such articles. In 1919, under the title, "A Biologist in a New Environment,"[58] there was an account of how war service and experience had caused one pre-war eugenist to have serious doubts about eugenic theories. He had become convinced that the social and cultural environment played a much more important role in causing the war, in the fighting, and in victory than the biological qualities of the combatants. This article was replied to by two well-known eugenists[59] and brought forth at least one letter bitterly condemning the editor for allowing such anti-eugenic propaganda in the Review.[60]

The great bulk of the remaining articles were discussions of the theory of eugenics and its applications in

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[58]By F. A. E. Crew, ER, 11 (1919-20), pp. 119ff.

[59]Professors E. W. MacBride and J. A. Lindsay, ER, 12 (1920-1), pp. 141-7.

[60]Letter from George Pitt Rivers, ER, 12 (1920-1), pp. 72-3.

various areas. As many as forty-six articles could be included in this group with titles ranging from "Eugenics and the Church" and "Eugenic Ideals for Womanhood" to "The Relation of Eugenics to Economics," "Psycholgoy in the Service of Eugenics," "Eugenics and the Doctrine of the Super-Man," "The Problem of our Racial and National Safety," and "Eugenics and National Efficiency." Thirty of these forty-six articles were published in the first five volumes. The concept of 'race' and 'nation' along with 'national' or 'racial efficiency' occur frequently enough for them to be emphasised as characteristic of the English eugenics movement before 1920.

A further group of fifteen articles were devoted to the description of the inheritance of a particular characteristic or to theories of heredity. Three articles were about the measurement of intelligence. Three more discussed the evolution of sex and the part it was playing in further evolution. There were four articles about the nature-nurture controversy. The remaining articles covered a variety of topics, four or five having direct or indirect reference to race with the general implication that the English belonged to a superior race.[61]

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[61] The 181 articles in the first twelve volumes were contributed by 115 different authors, which is indicative of the wide support received by the Eugenics Education Society.

A main theme running through the *Review* was that a number of social problems--poverty, mental illness, criminality and alcoholism--were the result of the hereditary constitutions of the individuals found in these problem classes. Sometimes all social problems were associated with the inheritance of a general physiological degeneracy which might manifest itself as feeble-mindedness, criminality, alcoholism, or some other infirmity. Eugenists argued that there was an increase in the proportion of the British population afflicted by such hereditary disorders, and that this increase was due to changes in the birth-rate among different social groups. They argued that those suffering from hereditary disorders, particularly the alcoholic, criminal and feeble-minded, had much larger families than "sound stock" and that this increased the proportion of "degenerate stock" in the British population. Many eugenists also thought that the poor were recruited almost exclusively from this "degenerate stock" and that poverty was essentially a result of heredity.

Over one-third of the articles in the *Eugenics Review* between 1909 and 1921 were devoted to arguing the case for the hereditary basis of social problems. An equal number of articles were devoted to showing how various groups within the community could be made aware of these problems and urged to support eugenic solutions. A few articles outlined recent advances in human genetics or discussed contemporary scientific theories of heredity. Although the proportion of such articles increased with the passage of time they made up only one-sixth of all articles in the first twelve volumes. The contents of the Eugenics Review confirm the opinion that the Eugenics Education Society was more interested in social reform than in the study of human genetics.

D. The Eugenics Education Society and Political Action

Eugenic proposals for the elimination of various social evils were taken very seriously by the Eugenics Education Society. It set up a number of committees to lobby both local and national government on such issues. The society took political action of this kind in relation to the reform of the poor law, the treatment of alcoholics, the reform of the divorce law, the treatment of the feeble-minded, the prevention of venereal diseases and changes in the structure of income taxes.

The society's committee on poor law reform held that "the scientific investigation of human heredity" had shown that environment had little effect on the mental or moral characteristics which people inherited from their parents. It was therefore important that citizens "of little social value" did not leave a larger number of children than those of higher social value. According to this committee, traditional social theory suffered from two main faults. The first was that traditional theory assumed that all men were responsible for their actions by an act of free will.[62] The eugenists argued that this was not so in the case of many criminals for their criminality was often due to hereditary tendencies. Secondly, traditional theory argued that problems such as pauperism were the result of environmental influences. The committee report, on the other hand, argued that the environmentalist was blinded "to the fact that a great part of pauperism lies outside the operation of normal economic processes"[63] because it was due to hereditary degeneracy. Although the report pointed out that not all paupers were of this kind, it maintained that a large section of the poor had been born without the necessary "independence" to carry out even a days work. It argued that such paupers should be classified together with the feeble-minded. The committee further recommended that the feeble-minded and paupers should be placed under permanent care of the state in such a way that they would not be able to have children. If the paupers and feeble-minded could not be segregated from the community because of costs then the committee recommended that they be refused permission to marry. The committee closed its report with the suggestion that its recommendations would lead to the extinction of the perhaps one thousand family "stocks" which were probably responsible for the greater

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[62] "Report of the Committee Appointed to Consider the Eugenic Aspect of Poor Law Reform," ER, 2 (1910-11), p. 168.

[63] Ibid., p. 169.

part of Britain's degeneracy.[64]

The eugenists' analysis of the roots of poverty was based almost entirely on supposed biological findings. Their certainty that pauperism was inherited as part of a syndrome of general degeneracy led them to view the existing poor law and its suggested replacements as dysgenic. The proposed new law did not provide a solution to the problem, which they felt would only be solved by the breaking of the hereditary chain. A problem which rested on biological grounds, required, according to the Eugenics Society, a biological solution. Poverty, insanity and alcoholism could be largely eliminated in their view if it were recognized that degeneracy was passed from one generation to another by heredity and was not environmentally determined. The eugenic belief that most aspects of a man's character were determined by his genetic makeup was used as the basis for suggested new solutions to old social problems and as the basis for new theories in psychology, anthropology and sociology. In this way eugenics was one of numerous attempts which have been made from time to time to put social science on what natural scientists would regard as a sound basis.[65]

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[64]This alleged degeneracy consisted of lower average standards in physical and mental health than had been the case in earlier times. It was often associated with an alleged increase in the frequency of insanity, feeble-mindedness, criminality, alcoholism, etc.

[65]The initiative for these attempts has not always come from natural scientists, but often from social scientists who

The report of the Eugenics Society's committee on poor law reform was one way in which it attempted to influence legislators to consider social legislation from the point of view of eugenics. Deputations and letters were also sent to individual legislators and to parliamentary committees. The first of these actions had been taken in February, 1908, when protests were sent to both the London County Council and to the Home Secretary to object to:

> the recent administration of the Inebriates Act, whereby, through the closing of inebriates' homes some hundreds of chronic Inebriate Women will be set adrift in London with an inevitably detrimental result to the race.[66]

This letter was followed up in early March by the visit of a deputation from the society to the Home Office arranged through the good offices of Mr. Bertram M.P.[67] Later in March a letter was sent to The Times presenting the views of the society.[68] In May the council of the society appointed a sub-committee to arrange for the presentation of the society's views to a Committee of Inquiry which had been set up to investigate the administration of the Act.[69]

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have been impressed by the results of the natural sciences. Social Darwinism provides a number of such examples, e.g., Walter Bagehot, Physics and Politics (New York, Appleton, 1873) and William McDougall, An Introduction to Social Psychology (Boston, J. W. Luce and Co., 1909).

[66] REES 1 (1908), p. 16.

[67] EESMB, Council Meeting, March 4, 1908.

[68] Ibid., Council Meeting, April 1, 1908.

[69] Ibid., Council Meeting, May 6, 1908.

The society's actions in relation to the Inebriates Act show the range of political action it took in its attempt to press eugenic views. Letters and deputations to politicians and administrators, letters to the public press, persuading M.P.'s to take up its causes, and giving evidence before parliamentary committees were all techniques used by the Eugenics Education Society to get its views considered and acted upon. In the period up to 1920 action of this kind was taken in relation to poor law reform, reform of laws to do with divorce, the treatment of the feeble-minded, the prevention of venereal diseases, and changes in the basis of the income tax structure.[70] In addition the society appointed a special parliamentary "watchdog" committee[71] to keep a close watch on all legislation and to make sure that the society took action on any legislation where the committee felt that eugenic interests needed to be represented. The two kinds of action which were emphasised in the political activities were: a) to prevent the breeding of those people

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[70] On poor law reform see EESMB, Council Meeting, November 3, 1909; on divorce, see EESMB, Council Meeting, April 6, 1910; for the treatment of the feeble-minded see ibid., July 6, 1910 and REES, 4 (1911-12), p. 21; 5 (1912-13), p. 22; for venereal diseases, see EESMB, Council Meeting, November 1, 1911, Executive Council, January 16, 1914, REES, 4 (1911-2), pp. 22-3, 5 (1912-13), p. 20, 6 (1913-14), pp. 7-8, 7 (1914-15), p 5; for the income tax structure see EESMB, Council Meeting, June 17, 1919, REES, 11 (1918-19), p. 6, 12 (1919-20), p. 6. Reports on these activities can also be found in the pages of the Eugenics Review at approximately the same dates.

[71] EESMB, Council Meeting, November 1, 1911.

thought to be inferior or suffering from diseases likely to be passed on to their children and b) to make sure that any change in social and economic legislation encouraged the "fitter" sections of the population to have more children and the "unfit" sections to have less.

The most direct political action taken by the society was in relation to the treatment of the "feeble-minded." In his 1911 presidential address Major Leonard Darwin referred to five points which formed the basis of the society's political and propaganda campaign. One of these points assumed that a nation would become decadent if "inferior classes" were survived by more children than "superior classes." In Darwin's words:

> . . . if the least naturally gifted sections of a nation are reproducing their kind more rapidly than are those more highly endowed in mental and physical qualities, then the higher are being swamped by the lower, and the nation is decadent; and that decadence, whether at first perceived or not, will before long leave its mark in falling reputation or diminishing success.[72]

He went on to argue that the most obvious cause of such decadence was the proliferation of the "feeble-minded." The need for legislation concerning the care of the feeble-minded was therefore urgent.

> . . . the most obvious and crying need for reform is in connection with the segregation of the feeble-minded with a view to diminishing the now

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[72] REES, 3 (1910-11), pp. 11-12.

> alarmingly rapid reproduction of that unfortunate class.[73]

The society responded to this "obvious and crying need" by drawing up a Feeble-Minded Control Bill in conjunction with the National Association for the Care of the Feeble-Minded. The bill was presented to a non-party gathering of M.P.'s arranged by Walter Rea M.P., a member of the Eugenics Education Society.[74] Later, all Members of Parliament were sent a letter outlining the bill and members of the society canvassed their own M.P.'s to gain their support. The result of this activity was the adoption of the bill by Mr. Gresham Stewart as a Private Members' Bill. It was read for a first time on May 16, 1911 and unanimously for the second time on the following day.

In 1912, Stewart's Private Members' Bill was replaced by a Mental Deficiency Bill sponsored by the government. Various delays[75] meant that the new Mental Deficiency Act did not come into force until April 1, 1914. The Act was not in complete accord with the original Eugenics Society suggestions. Nevertheless the annual report of the society for 1913-14 saw the Act as a victory for the eugenics movement.

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[73] Ibid., p. 13.

[74] REES, 4 (1911-12), p. 21, for this and the following points.

[75] Delays included some opposition to the bill in the House of Commons, REES, 5 (1912-13), p. 22. Accounts of the bill's progress were given in successive annual reports of the EES.

> The Mental Deficiency Act, which came into force on April 1st, is due partly to the activities of the Society, which may therefore claim some credit for it. It is, perhaps, the only piece of English social law extant, in which the influence of heredity has been treated as a practical factor in determining its provisions.[76]

While the Mental Deficiency Act was probably the most notable success of the society its other efforts to influence legislation along eugenics lines were not without success.[77] The immediate pre-war years, 1912-14, were however the high-water mark for the political effectiveness of the society and the wider eugenics movement. During this period Leonard Darwin's utopian vision of the effects of eugenic reform seemed possible of achievement. Many eugenists agreed that,

> . . . eugenic reform, if successful, would . . . lower taxation, raise real wages, facilitate commercial competition, and increase the security of the country in time of war . . . a diminution in the number of the insane, the criminal, the feeble-minded, the diseased, and the wastrel . . . would mean the removal of a terrible burden of unmerited misery; whilst an increase in the output of men and women of character and ability would not only add to the reputation of our country, but would also add to the happiness of its inhabitants in many ways.[78]

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[76] REES, 6 (1913-14), pp. 5-6.

[77] In 1912 some changes in the Inebriate Acts were adopted along lines recommended by the EES, REES, 4 (1911-12), p. 22 and also REES, 6 (1913-14), p. 6. The suggestions of the EES about the structure of income tax also seem to have had some effect. See REES, 10 (1917-18), pp. 10-13.

[78] REES, 5 (1912-13), p. 11.

The war years, however, brought a decline in the membership of the Eugenics Education Society, which was not recovered after the war. Hopes that eugenics would form the scientific basis of British social legislation were never again to be as high as they had been in 1913-14.

The society also sponsored a program of discussions and public lectures, and beginning in 1912 organised courses for the study of eugenics.[79] These meetings covered much the same range of topics covered in the Eugenics Review and the activities of the political sub-committees. The society tried to introduce eugenic teachings into the curricula of elementary and secondary schools. For this purpose a special committee was set up[80] and it organised meetings of teachers to point out why it was vital for eugenic principles to be inculcated in the nation's schoolchildren. In March 1913 this committee organised a very well attended conference for head teachers on the teaching of eugenic principles in schools.[81] The war brought to a halt what seems to have been

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[79]Courses were given both at summer schools and on evenings during the year. The course given in 1913 at the Imperial College of Science consisted of twelve lectures by Clifford Dobell on elementary anatomy and physiology of plants and animals, twelve lectures on genetics, evolution, and heredity by Professor R. C. Punnett and twelve lectures by G. Udny Yule on statistical methods as applied to eugenics. See REES, 5 (1912-13), pp. 21, 28-9. Similar courses are described in other copies of the REES.

[80]EESMB, Council Meeting, January 14, 1908.

[81]See ER, 5 (1913-14), pp. 1ff.

a well-organised and well received attempt to gain support for eugenics among British school teachers.

The Eugenics Education Society, like most normal organisations had to curtail some of its program during the war years. Membership of the society declined and it does not seem to have recovered in the post-war years. Interest in eugenics, however, did remain at a high level as can be seen from the number of books and articles published on eugenics in the 1920's.[82]

E. The Eugenics Education Society and the Eugenics Movement

The "eugenics movement" in England consisted of more than the Eugenics Education Society and the Galton Eugenics Laboratory. The broader nature of the movement was evident in the great amount of literature--books, pamphlets and magazine articles--about eugenics which was published in Britain between 1900 and 1920. But the "eugenics movement" is adequately represented by the activities of the Eugenics Education Society and its members. That movement was not a monolithic structure. Some parts of the movement were inter-

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[82] For bibliographies of eugenics literature in the 1920's see Samuel J. Holmes, "A Bibliography of Eugenics," <u>University of California Publications in Zoology</u>, <u>25</u> (1924); <u>Bibliographica Eugenica, Supplement to Eugenical News</u> (1927-34), <u>Journal of the American Eugenics Society</u>; and the Book Review section of <u>ER</u>.

ested in the theoretical analysis of evolution in relation to man.[83] Others were more interested in eugenics because of its possible applications to particular social problems--alcoholism or crime or poverty. Eugenists did not always agree on the extent to which their favourite reform programs could be put into practice. In this way the movement was like most other human enterprises. But the whole eugenics movement was wedded to the conviction that heredity far outweighed environment in determining human character and human skills. Convinced that this belief had a sound scientific basis eugenists actively sought to reconstruct Britain's social legislation on that basis.

A number of features which played important roles in the eugenics movement were common in early twentieth century British society. The most important of these was an attempt to discover the meaning of the theory of evolution for all phases of life and thought. A second important feature in British life was a general dissatisfaction with the basic social philosophy that underlay the nineteenth century treatment of social problems. A third important feature was the rise of "social-imperialism," an attempt to strengthen British nationalism by emphasising the unity of the whole nation and by removing class and other barriers within the nation. Finally this was a period when "science" was held in high

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[83]Much of the work of the Galton Eugenics Laboratory was of this nature.
[83]Much

regard. It was in part because eugenics could fit in with all of these important elements of early twentieth century British life that it was accepted by such a large number of well-educated middle-class people.[84]

But the eugenics movement was typical of twentieth century British life in more than that it reflected common elements of the thought of the period. It was also an example of "middle class radicalism," which has become a typical feature of modern British political life. "Radicalism" is here used in the sense of a platform which calls for fundamental change in government or society.[85] Though there is a tendency in contemporary writing to identify "radicalism" with the left-wing in politics[86] such a judgment is not implied in its use here. "Middle class radicalism" is thus to be understood as a movement with mostly middle-class participation and with goals to change society fundamentally.

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[84]The points in this paragraph and those that follow are treated more fully in chapter VIII below.

[85]This usage of "radicalism" is given in both The Concise Oxford Dictionary (1967) and Eugene J. McCarthy's Dictionary of American Politics (Baltimore, Penguin, 1968).

[86]See entry under "radical" in The Penguin Dictionary of English (Baltimore, Penguin, 1965).

VII

EUGENICS AND ALCOHOLISM: A SCIENTIFIC SOLUTION FOR A SOCIAL PROBLEM?

Supporters of the eugenics movement were engaged in a number of controversies in the first quarter of the twentieth century. These controversies occurred in at least three different contexts. First, controversy raged among academics, particularly those in the biological, medical and social sciences, when academic supporters of eugenics undertook research or made claims in areas impinging on those sciences. A second context for controversy over eugenic suggestions was that of social legislation. Legislators and reformers alike were faced with the eugenist claim of having the best remedies for the social ills of the nation. Controversy was also carried on in more general terms in newspapers, magazines and books. The claims and implications of eugenics for everyday life were debated by a great number of people. In this chapter the story of one of these controversies is told.

Readers of *The Times* may have been somewhat surprised on May 21, 1910 to find that one of its editorials was devoted to a very favourable review of a scientific memoir. Under the heading, "The Children of the Alcoholic,"[1] *The Times* reported that the children of alcoholic parents did

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[1] "The Children of the Alcoholic," *The Times*, May 21, 1910, p. 13.

not suffer from inherited faults in addition to those faults brought on by the bad treatment they received at the hands of such parents. The memoir which thus seriously questioned a view then strongly held was a publication from the Galton Eugenics Laboratory entitled "A First Study of the Influence of Parental Alcoholism on the Physique and Ability of the Offspring."[2] An accurate and extensive summary of this article was published in the same issue of The Times.[3] It was introduced as a study in which "probably for . . . the first time [the indictment that drunkenness leads to diseased offspring] . . . has been subjected to strict inquiry." The paper written by Ethel Elderton with the assistance of Karl Pearson did not meet with the same favourable reaction from other sections of the British press. For two years following the publication of the original paper an often bitter debate was carried on in the pages of The Times, the British Medical Journal, the Journal of the Royal Statistical Society and elsewhere.[4]

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[2]Ethel M. Elderton (with the assistance of Karl Pearson), "A First Study of the Influence of Parental Alcoholism on the Physique and Ability of the Offspring," ELM, 10 (1910).

[3]"Alcoholism and Offspring," The Times, May 21, 1910, p. 14.

[4]References will be given as the different contributions to the controversy are discussed.

Alcoholism was a subject which had drawn the attention of many social reformers in the latter part of the nineteenth century.[5] It was one of a number of social problems in nineteenth century Britain which gave rise to a reform movement determined to eliminate the problem.[6] The temperance movement, convinced that alcohol was the source of multifarious evils, was able to find and present evidence for the theories that alcoholism was inherited and that the alcoholism of parents could severely damage their offspring by the toxic effects of alcohol on their germ cells or on the human foetus during pregnancy. These were the theories which Elderton's study was designed to test.

A. The Eugenics Laboratory Memoir

Elderton's investigation of the effects of parental alcoholism was one of a number of investigations carried out

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[5]See Roy M. MacLeod, "The Edge of Hope: Social Policy and Chronic Alcoholism in the Nineteenth Century," Journal of the History of Medicine and Allied Sciences, 22 (1967), pp. 215-245.

[6]A vigorous discussion of the ways in which these reform movements changed British social policy began in the late 1950's and continues today. See, for example, Oliver MacDonagh, "The Nineteenth Century Revolution in Government: A Reappraisal," Historical Journal, 1 (1958), pp. 52-67; Henry Parris, "The Nineteenth Century Revolutions in Government: A Reappraisal Reappraised," Historical Journal, 3 (1960), pp. 17-37; Jenifer Hart, "Nineteenth-century Social Reform: A Tory Interpretation of Hi~~story," Past~~ and Present, 31 (1965), pp. 39-61; Valerie Cromwell, "Interpretations of Nineteenth-Century Administration: An Analysis," Victorian Studies, 9 (1966), pp. 245-255; Roy M. MacLeod, "Social Administration of the 'Floating Population,' The Canal Boats Acts, 1877-1899," Past and Present, 35 (1966), pp. 101-32.

by the Eugenics Laboratory to discover the comparative strengths of heredity and environment in forming the adult human character. Despite a disclaimer to the contrary,[7] there is strong evidence that Pearson and Elderton approached the study convinced that heredity was of far greater significance than environment in the formation of human character.[8] Heredity and environment or nature and nurture were measured by methods developed within the biometric school. By this method Pearson hoped to raise eugenics to the status of an "exact science"[9] which would provide definite guidance for social legislation and social reform.

The basic elements of eugenic research were set out by Pearson in lectures delivered in early 1909 where the "bricks for the foundations of [eugenics]" were described.

> (1) We depart from the old sociology, in that we desert verbal discussion for statistical facts.
> (2) We apply the new methods of statistics which form practically a new calculus.

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[7]Elderton, "A First Study . . .," pp. 30-1.

[8]Such views can be found in Karl Pearson's "The Groundwork of Eugenics," and "Nature and Nurture, The Problem of the Future," and in Elderton's "The Relative Strength of Nature and Nurture," ELLS, 2, 6 and 3 respectively, all published before the memoir under discussion.

[9]The significance of this phrase can be found from Pearson's connections with his old teacher, W. K. Clifford, who published The Common Sense of the Exact Sciences (London, Kegan Paul, 1885), and in Pearson's own work The Grammar of Science (London, Walter Scott, 1892).

> (3) We start from three fundamental biological ideas:--
>
> a) That the relative weight of nature and nurture must not *a priori* be assumed but must be scientifically measured; and thus far our experience is that nature dominates nurture, and that inheritance is more vital than environment.
>
> b) That there exists no demonstrable inheritance of acquired characters. Environment modifies the bodily characters of the existing generation, but does not modify the germ plasms from which the next generation springs . . .
>
> c) That all human qualities are inherited in a marked and probably equal degree.[10]

The first step in solving social problems was to measure the comparative effects of heredity and environment.[11] This could be done by using the "calculus of correlation" which,

> for the first time enables us adequately to approach such problems as those of nurture and nature, and to determine what weight must be given to these respective factors in our scheme of social reform.[12]

Elderton described the same "calculus of correlation" as

> the sole rational and effective method available for attacking urgent social problems. If the calculus throws no light, when properly applied, on social dynamics, then the only solution is to develop a finer statistical calculus.[13]

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[10] Karl Pearson, "The Groundwork of Eugenics," ELLS, 2 (1909), pp. 19-20.

[11] Karl Pearson, "Nature and Nurture, The Problem of the Future," ELLS, 6 (1910), p. 11.

[12] *Ibid.*, p. 23.

[13] E. M. Elderton, "The Relative Strength of Nature and Nurture," ELLS, 3 (1909), p. 6.

These large claims for the calculus of correlation were reminiscent of Weldon's early claims for his biometric methods and like them they drew much critical comment.

The calculus of correlation used by Pearson and Elderton to "measure" heredity and environment was based on a theoretical mathematical analysis largely developed by Pearson.[14] The relative strength of heredity was measured by a correlation coefficient calculated from two sets of measurements of the same characteristic in father and son, mother and daughter or whatever relationship it was desired to measure. The coefficient could vary between -1 and +1. Complete similarity between the relatives in the two groups measured would be shown by a measurement of +1. A measurement of 0 indicated no more similarity between the two groups of relatives than any 2 groups in a population. Where a characteristic in one group was always associated with the opposite characteristic in the relatives in the other group a measure of -1 would be obtained. The effect of environment could be measured by calculating the correlation coefficient for the relationship between different environments and selected characteristics of the people living in those environments. This was the method used by Pearson and Elderton in an attempt to see if the alcoholism of parents adversely affected the physique and intellect of their children.

[14] See G. Udny Yule and L.N.G. Filon, "Karl Pearson," Obituary Notices of Fellows of the Royal Society (1936) 2 (Number 5), pp. 73-110 and Lancelot Hogben, Statistical Theory (London, George Allen and Unwin, 1957).

Correlation coefficients were calculated for two different samples for which observations about the drinking habits of the parents happened to be available. The coefficients calculated all involved the degree of alcoholism of the parents as one term. This was correlated with such variables as the height and weight of the children, their general health, intelligence and the condition of their eyesight. Coefficients of correlation between the alcoholism of the parents and the death-rate of the children were also calculated. Where numerical measures were available, as in the case of heights and weights these were used for calculation purposes. Where they were not available different qualitative categories were used and correlation coefficients were calculated using a method developed by Pearson for such cases.

If the alcoholism of parents caused defectiveness in their children then, argued Elderton and Pearson, there should be a high correlation between alcoholism in parents and defectiveness in their children. Such defectiveness might be caused by either the toxic effects of alcohol on germ plasm or on the foetus or by the moral and economic changes brought about in the home environment as a result of alcoholism. Both of these influences were seen by Pearson and Elderton as environmental influences. But in this paper they were not testing whether the ill effects of alcoholism were due to heredity or environment. They were investigating whether parental alcoholism had any ill effects at all on children.[15]

There is a brief discussion at the beginning of the memoir of two problems which were later to be used as major items in the criticism of the memoir. The first of these discussions was concerned with the classification of the degree of alcoholism exhibited by the different parents. Elderton and Pearson admitted that their classification was not based on the diagnosis of a medical practitioner but rather on five categories adjudged by visiting social workers. These categories were 1) Teetotaller, 2) Sober, 3) Suspected to Drink, 4) Drinks, 5) Has Bouts of Drinking.[16] For statistical purposes 1) and 2) were often added together as were 3), 4) and 5). In this way two groups of "sober" and "alcoholic" were obtained. The imprecision of these classifications was admitted but their use was justified on the ground that they were the best available and that they were sufficiently good to enable advances in knowledge to be made by the application of statistical analysis to them. There was also a brief discussion of the nature of the samples used. The main point of this discussion seems to have been to establish that the alcoholic and non-alcoholic parents were drawn from similar populations although this was not stated very

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[15] See E. M. Elderton, "A First Study . . .," p. 2.

[16] Ibid., p. 5.

plainly. The point was made by showing that weekly wages for the alcoholic parents were in general from sixpence to one shilling a week less than those for non-alcoholic parents. It was then argued that such a small difference could hardly be due to great physical or mental differences and was probably due simply to what employers were "willing to pay for the convenience of sobriety."[17]

The bulk of the paper was devoted to outlining the various correlation coefficients which had been calculated and to discussing their significance. Correlation coefficients were calculated in order to measure the effect of parental alcoholism on the height of children, the weight of children, the general health of offspring, the intelligence of children, filial eyesight, filial eye disease, and the child death-rate. The largest measurement obtained was a correlation coefficient of .14 between maternal alcoholism and decreased weight of children. But in general,

> no <u>marked</u> relation [was] found between the intelligence, physique or disease of the offspring and parental alcoholism . . . the balance turns as often in favour of the alcoholic as of the non-alcoholic parentage.[18]

Correlation coefficients were not, however, interpreted consistently throughout the paper. In one place, a correlation coefficient of .14 was accompanied by the comment that

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[17] *Ibid.*, p. 4.

[18] *Ibid.*, p. 32. Emphasis in the original.

"it has only about 2/7 of the intensity of parental heredity."[19] A later report of a correlation coefficient of .11 between maternal alcoholism and child mortality was described as "definitely significant."[20] The concluding discussion contradicted this latter position when it stated that

> Such slight values [below .2], especially on the relatively small samples at present available, must lead to doubt and obscurity; the variations due to random sampling are of the same order as the quantitative relations we wish to disentangle.[21]

The lack of a standardized interpretation of different values of the correlation coefficient led the authors to make contradictory statements in interpreting coefficients of approximately the same value.

In their conclusion, Elderton and Pearson admitted the possibility of finding certain characteristics which would give larger correlations with alcoholism. But the general conclusion was that the study provided further confirmation of the eugenic view that environmental influences on human characteristics were slight in comparison with hereditary influences.

Although the study provided no evidence that alcoholism was inherited, the probability of such inheritance was

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[19] *Ibid.*, p. 10.

[20] *Ibid.*, p. 27.

[21] *Ibid.*, p. 29.

emphasized in the final paragraph. "If," the authors wrote,

> as we think, the danger of alcoholic parentage lies chiefly in the . . . hereditary factors of which it is the outward or somatic mark, the problem of those who are fighting alcoholism is one with the fundamental problem of eugenics.[22]

The unusual practice of ending a scientific memoir by referring to a hypothesis that was in no way supported by the contents of the memoir highlights the commitment of Pearsonian eugenics to hereditarian explanations.

Pearson and his fellow workers believed the heredity to be much stronger than the environment (four to ten times as strong according to their measurements[23]) and despite attempts to eliminate bias from their work, their belief affected their analysis. It helps to explain their ability to see that part of a correlation coefficient measuring the influence of an environmental factor was probably really due to heredity and their failure to see that the converse was also true. A typical example of this argument was in the memoir on parental alcoholism.

> We may measure the effect of some environmental condition and find it correlated with definite characteristics in the children. We may then assume the latter to flow from the former, whereas the environmental condition may be a result of a physical or mental condition in the parents, which

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[22] *Ibid.*, p. 32.

[23] *Ibid.*, p. 30.

> in itself is hereditary. Thus the correlation may be solely a secondary hereditary effect.[24]

The opposite argument that part of a correlation coefficient measuring heredity is in fact a secondary effect of the environment was never suggested in the works of the Eugenics Laboratory, though it is an equally good argument. Such an argument would run: We may measure the amount of similarity between fathers and sons by use of a correlation coefficient. We may then assume this similarity to be due to heredity, whereas at least some of the similarity may be due to common environmental conditions for fathers and sons. Thus the correlation may be solely a secondary environmental effect.

Eugenics as a Research Tradition

Elderton's study of the effects of parental alcoholism on children was conducted in complete accord with the theories and methods for eugenics which had been laid down by Pearson. In relation to theory this involved a commitment to the Darwinian concept of natural selection as applied to man. It also involved a commitment to the germ-plasm theory of Weismann and to the non-inheritance of acquired characters. Finally, it involved a belief that all human qualities were inherited in a marked degree.[25] When taken together these

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[24] Ibid., p. 3.

[25] For an outline of these points see the quotation on p.254 above from Pearson's "The Groundwork of Eugenics," ELLS, 2 (1909), pp. 19-20.

various theoretical commitments amounted to a denial of any significant environmental influence on human qualities of intellect, character and physique. Environment was of even less importance when seen in a long-range evolutionary context. Thus the theoretical commitments of the Eugenics Laboratory demanded the replacement of social reform based on the control of the environment by reform based on the control of heredity. This explained the Galton Laboratory's continuous attempts to show that nature far outweighed nurture in forming human character.

Pearsonian eugenics also involved specific methodological commitments. At the most abstract level Pearson's methodology was based on a philosophical analysis of causation,[26] and a historical analysis of the successive stages of the development of science.[27] Causation was, for Pearson, merely complete correlation. Smaller correlations were indications of partial causation and thus could be used to elucidate cause and effect. In situations where many factors (or potential causes) were operating in competition on a large variety of objects (as was the case with the action of natural selection on biological organisms) the

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[26]See his work, The Grammar of Science, the various editions of which show his changing position about "causation." See also chapter IV, section 3 above, for fuller comments on Pearson's philosophical position.

[27]See Karl Pearson, "The Scope and Importance to the State of the Science of National Eugenics," ELLS, 1 (1909), pp. 15-16.

use of partial correlations provided a tool of analysis for what actually happened.

To his philosophical justification for the use of statistical methods, Pearson added a justification from his view of the history of science. He held that all sciences passed through three stages of development, the ideological, the observational, and the metrical.[28] The ideological or pre-Baconian stage involved argument and dispute with only crude reference to observation and none to experiment. The observational stage involved careful observation but little in the way of testing hypotheses. The metrical stage was the stage which had been reached by the most advanced sciences. It involved the testing of precise mathematical predictions by careful experiment and by statistical analysis. In this way hypotheses could be confirmed or modified. In Pearson's view both philosophical analysis and historical experience showed that the most advanced stage of science demanded the use of sophisticated mathematical and statistical techniques. Statistical analysis was particularly important in the case of man where experiment was virtually impossible. For man the methods of biometry, "actuarial methods applied to biological data," had to be used.[29]

Pearson claimed that contemporary social problems could be understood and solved by the new science of eugenics.

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[28] Ibid., pp. 15-16.

[29] Ibid., p. 20.

The problem of alcoholism was no exception to this general rule. These claims impinged directly on the work of both medical and social scientists many of whom did not accept Pearson's arguments. In the case of alcoholism (and other important social problems) the claims also affected the arguments of social reformers and members of the public interested in solving the problem. The controversies set off by the publication of Elderton's memoir vividly illustrate some of the reactions to Pearson's claims.

B. The Response of Social Scientists

The Eugenics Laboratory's memoir drew the strong criticism of Professor Alfred Marshall[30] and John Maynard Keynes,[31] both economists from the University of Cambridge. Marshall's criticism was contained in letters published in The Times. Marshall's first letter[32] was concerned mainly

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[30]Alfred Marshall (1842-1924) had been educated in the mathematical tripos at the University of Cambridge graduating in 1865. He changed fields to political economy while a Fellow at St. John's College, Cambridge (1865-77). He was then, in turn, professor of political economy at University College, Bristol; lecturer in political economy, Balliol College, Oxford; and finally professor of political economy at Cambridge from 1884 until 1908. For biographical details see the DNB.

[31]John Maynard Keynes (1883-1946) later to become renowned for his economic theories had graduated from Cambridge in 1905 and held a position as lecturer in economics there from 1908 until 1915. For further biographical details see DNB.

[32]Alfred Marshall, "Alcoholism and Efficiency," The Times, July 7, 1910, p. 12.

with the effect of alcoholism on a workman's efficiency, a matter of only peripheral importance in the original memoir. In the original memoir statistics had been given to show that the average weekly wages of alcoholic and sober workmen in the same trade differed by only sixpence to a shilling. Marshall's criticism was that these statistics were being used to support the argument that alcoholism did not affect a workman's efficiency. To support his criticism he said that a drunkard living in the same area as a sober workman would need a higher weekly wage as he would be out of work for several weeks in a year but would need an even greater yearly income than the sober man to support a family and to be able to supply himself with drink. This criticism implied, he said, that the drunken members of Pearson's sample were men of superior intellectual and physical ability to the sober members of the sample. He suggested that the drunkards were members of a higher class who had descended to a slum area because of their lack of ability.

Pearson replied to Marshall's criticism in another letter to The Times[33] pointing out that the memoir did, in fact, note that alcoholism would decrease the efficiency of a workman, but that this was not the point of the use of wage statistics in the original memoir. The wage statistics had been used to show that the sample was "random" in relation

[33] Karl Pearson, "Alcoholism and Efficiency," The Times, July 12, 1910, p. 11.

to alcoholism. In other words the average weekly wages had been used as a test to see if there were substantial differences between the alcoholic and non-alcoholic workmen. The small difference discovered was attributed to the inconvenience employers would have in employing alcoholics and was certainly not large enough to indicate the substantial differences in innate ability claimed by Marshall. Pearson concluded by asking Marshall to produce statistics to confirm his criticisms.

The reply did not satisfy Marshall who wrote another letter to The Times and yet another to answer a further reply by Pearson.[34] The point of the debate remained essentially the same with Pearson demanding statistics and "facts" rather than mere "opinions" from Marshall and claiming that the statistics in the original memoir proved the random nature of the sample with regard to alcoholism. Marshall's criticism turned more and more into an attack on the "conjectural" nature of statistics. Data selection, he claimed, determined the results. Pearson's statistics had been "culled in a hurry." They were not adequate for the problem that they were supposed to solve. The alcoholics of Pearson's sample should have been compared with non-alcoholics of a better district if the effects of alcoholism were to

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[34] Alfred Marshall, "Alcoholism and Efficiency," The Times, Aug. 2, 1910, p. 4; "Alcoholism and Efficiency," The Times, Aug. 19, 1910, p. 4; Karl Pearson, "Alcoholism and Efficiency," The Times, Aug. 10, 1910, p. 10.

be really uncovered. Finally he suggested that a "mathematical outsider" had little qualification to upbraid economists for "setting opinions against facts."

This controversy in The Times was closed with an editorial which supported Pearson and praised the Eugenics Laboratory which "could hardly have rendered a greater service to the public"[35] than by publishing the memoir. Professor Marshall, The Times wrote, had not been convincing. It regretted the introduction of personal argument into such an important matter. The inference was that Marshall had been the guiltier party in this practice. The Times debate was typical of the whole controversy for even though Marshall had some valid criticisms to make, their force was lost by his obvious commitment to the cause of temperance. This led him to place too much weight on peripheral points and to substitute ad hominem arguments for sound criticism. The original memoir was undoubtedly open to criticism. Its demonstration that the sample was random, though probably sound as far as it went, was hardly sufficient. Moreover the actual value of the statistical techniques used was debatable. There was room for much criticism at these points without falling into partisan and personal debate.

Keynes took up a number of the same points as Marshall in his review of the original memoir which was published

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[35]"Alcohol and Efficiency," The Times, Aug. 20, 1910, p. 9.

in the *Journal of the Royal Statistical Society.*[36] Keynes' review was more soundly constructed than Marshall's letters. It did not suffer from the same overtones of personal abuse. But the review contained enough in the way of statistically unsound practice for Pearson and Elderton to be able to ignore the validity of a number of his critical points. This criticism also started an exchange of articles and letters.[37]

The strongest points of Keynes' criticism had to do with the use of statistical methods and the interpretation of the results obtained by these methods. Keynes claimed that the sample size used was too small to obtain significant results. He repeated the criticism that it had not been adequately demonstrated that alcoholics and non-alcoholics were drawn from the same population. Further he claimed that an undue emphasis was laid on the precision of the correlation coefficients which was not in line with the rather imprecise nature of the original material. Thus, Keynes claimed, the results of the investigation were "valueless." "As a study in statistical method," he wrote,

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[36] John Maynard Keynes, "Review of 'A First Study of the Influence of Parental Alcoholism . . .,'" *JRSS*, *73* (July 1910), pp. 769-73.

[37] See Karl Pearson, "Supplement to the Memoir entitled 'The Influence of Parental Alcoholism on the Physique and Ability of the Offspring'. A Reply to the Cambridge Economists," *QDF*, *1* (1910); "Influence of Parental Alcoholism," *JRSS*, *74* (1910-11), pp. 221-9; J. M. Keynes, "Influence of Parental Alcoholism," *JRSS*, *74* (1910-11), pp. 114-21.

> it is a salient example of the application of a needlessly complex mathematical apparatus to initial data, of which the true character is insufficiently explained, and which are in fact unsuited to the problem in hand.[38]

Pearson's replies to Keynes' criticisms avoided the question of sample size and a number of other significant statistical points by impugning Keynes' statistical skills. This could be done in fairly convincing fashion because of some of the statements made by Keynes in his criticism.[39] As a result the more difficult questions relating to the randomness and size of samples and to the significance of given values of the correlation coefficient were not adequately debated. Careful attention to these points was necessary for there were very few statisticians with enough skill and interest to test many of Pearson's methods. The course of the debate provides further evidence that controversial debate with overtones of personal attack leads to further personal attack rather than to resolution of the substantive question at issue.[40]

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[38] J. M. Keynes, "Review of 'A First Study. . .,'" p. 773.

[39] Keynes had for example compared averages of groups consisting of only two or three members with averages of much larger groups to make one of his critical points. He had also made a statement ot the effect that Pearson's figures for the proportion of "alcoholics" in his samples were atypical of the U.K. Pearson convincingly showed that Keynes was wrong on this point. For these points see K. Pearson, "Supplement. . . ."

[40] See above, chapter V, section C.

The Elderton-Pearson memoir did not meet with hostility from all social scientists. A. M. Carr-Saunders,[41] who had originally been trained in biology, viewed the results as "what would have been nearly everywhere expected" among biologists.[42] For Carr-Saunders one crucial aspect which had been largely overlooked by Pearson's critics was the by then generally accepted theory that acquired characteristics are not inherited.[43] One should not then expect, as many temperance advocates did, that ailments acquired by parents because of their alcoholism, would appear in their offspring. Carr-Saunders did not agree with those who distrusted statistics. He held, as did Pearson, that statistical methods were the best way of approaching many questions in contemporary social theory and practice.[44] He viewed the attacks of Marshall and Keynes on the methods of Pearson and Elderton to have failed.[45]

Carr-Saunders and Keynes were both members of the Eugenics Education Society. Both were, to some extent,

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[41]Later Sir Alexander Morris Carr-Saunders (1886-1967) was professor of social science at Liverpool (1923-37) and director of the London School of Economics (1937-1956). For biographical details see Who's Who 1960.

[42]A. M. Carr-Saunders, "The Problem of Alcoholism," Economic Review, 22 (1912), p. 38.

[43]A. M. Carr-Saunders, "Some Recent Eugenics Work," Economic Review, 21 (1911), p. 22. Carr-Saunders probably overestimated the support for Weismann's theory.

[44]Ibid., p. 19.

[45]Carr-Saunders, "The Problem of Alcoholism," p. 39.

committed to the importance of heredity in forming human character. Their taking of opposite sides in this controversy was typical of the fact that not all eugenists were in agreement with the theory and methods used by Pearson in his attempt to found a science of eugenics. Keynes' acceptance of the idea that alcoholism in parents was damaging to the offspring showed that he either believed in the inheritance of acquired characteristics or that environmental factors could have as much influence on the physique and intellect of a child as hereditary ones. In either case the urgency of legislative reform based on hereditary rather than environmental control was lessened. On the other hand, Carr-Saunders' belief that acquired characteristics could not be inherited removed for him one possible mechanism for the effective working of environmental change. Legislation based on hereditarian analysis thus became more important.

C. The Response of the Medical Profession

From the medical profession came the most vocal opponents to Elderton and Pearson's paper. The most persistent of these were Sir Victor Horsley, Dr. Mary Sturge, and Dr. C. W. Saleeby. Their criticism of the original Eugenics Laboratory paper was closely associated with the attitude of various temperance societies. The criticism appeared mainly in the <u>British Medical Journal</u>, the <u>British Journal of</u>

Inebriety and the National Temperance Quarterly.[46] It gave rise to two further papers issued by the Eugenics Laboratory and a number of letters to various journals.[47] From the very beginning the debate was marked by the use of intemperate language and logomachic polemic. The substantive points were lost in the torrent of words.

A detailed review of all the articles and letters for and against the Elderton-Pearson memoir would serve little purpose as the same criticisms were used time and

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[46] A long correspondence under the headings "Alcoholism and Degeneracy" and "Alcoholism and Degeneration" occurred in the British Medical Journal (BMJ) during the latter half of 1910 and the early part of 1911. The criticisms of the Elderton-Pearson paper are expounded in Mary D. Sturge and Victor Horsley, "On Some of the Biological and Statistical Errors in the Work on Parental Alcoholism by Miss Elderton and Professor Karl Pearson F.R.S.," BMJ (Jan. 14, 1911), pp. 72-82. The British Journal of Inebriety (BJI) devoted one whole number (April 1911) to a discussion of "The Influence of Parental Alcoholism on the Physique and Ability of Offspring," BJI, 8 (1910-11), pp. 175-215. Only two or three of the nineteen contributors had any favorable comments for Pearson and Elderton. C. W. Saleeby's "Professor Karl Pearson on Alcoholism and Offspring," BJI, 8 (1910-11), pp. 53-66 was a further attack on Pearson and Elderton's findings. The National Temperance Quarterly for September 1910 carried other attacks on the memoir.

[47] Karl Pearson and Ethel M. Elderton, "A Second Study of the Influence of Parental Alcoholism on the Physique and Ability of the Offspring. Being a Reply to Certain Medical Critics . . .," ELM, 13 (1910); Karl Pearson, "An Attempt to Correct Some of the Misstatements Made by Sir Victor Horsley F.R.S., F.R.C.S., and Mary D. Sturge, M.D., in Their Criticisms of the Galton Laboratory Memoir 'A First Study . . .,'" QDF, 3 (1911). Karl Pearson, "Alcohol and Degeneracy," The Times (Jan. 16, 1911), p. 7; (Jan. 23, 1911), p. 4; (Jan. 31, 1911), p. 8; "Alcoholism and Degeneracy," BMJ (Jan. 7, 1911), pp. 50-1, (Feb. 4, 1911), pp. 278-81.

again by the medical opponents of the memoir. Instead, one of the typical attacks on the memoir will be recounted. For this purpose the best article is that by Mary Sturge and Sir Victor Horsley entitled "On Some of the Biological and Statistical Errors in the Work on Parental Alcoholism by Miss Elderton and Professor Karl Pearson F.R.S."[48]

The polemical nature of the paper which followed an already extensive exchange of letters between the authors and Pearson is clearly illustrated in its introduction.

> The first appearance of these writings [of Elderton and Pearson], and the extraordinary conclusions which the authors arrived at last May--namely, that alcoholism does not appreciably affect either the efficiency or wage-earning power of parents, or the physique and ability of their offspring--caused a great deal of pleasurable excitement in some sections of the community.[49]

Not only were the conclusions of Pearson and Elderton overstated--they had not claimed to investigate the effect of alcoholism on the efficiency or wage-earning power of parents --but it was also implied that the memoir could not be a serious scientific study if it arrived at such conclusions. Sturge and Horsley went on to list what they regarded as the main errors of Elderton and Pearson. Some of these errors were variants of the criticisms already made by Marshall and

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[48] BMJ (Jan. 14, 1911), pp. 72-82.

[49] Ibid., p. 72.

Keynes to which Pearson had replied. Thus the third error[50] was that the samples had come from a non-representative population, and the sixth error[51] that the wage-earning capacity of an alcoholic parent was the same as that of the sober parent. In relation to this last point Pearson was accused of falsifying data and of changing the figures from the original report in a supplementary memoir without acknowledging the changes. Horsley and Sturge claimed that the only adequate comparison which could have been carried out was that between the children of teetotallers and the children of those who were not. They complained that Pearson and Elderton's terms "sober" and "non-alcoholic" were not accurate.[52] They should have used the term "less alcoholic" to describe these classes. A further error[53] in the original paper was the finding that although there was a higher death-rate among the children of the alcoholic, yet Pearson and Elderton claimed that these children were healthier than those of the non-alcoholic. Finally a "vital" error[54] was that Pearson and Elderton had not determined whether the parents were alcoholics before the birth of their children.

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[50] Ibid., p. 73.

[51] Ibid., p. 77.

[52] Ibid., p. 73.

[53] Ibid., p. 76.

[54] Ibid., p. 75.

Elderton and Pearson "have not only erroneously represented the facts," wrote Sturge and Horsley,

> but they have concealed the truth by a mass of mathematically formulated conclusions which, being calculated on misstated data, are necessarily also erroneous.[55]

In a final polemical blast Pearson and Elderton were told that they should withdraw their work and that they "constituted a national danger."

A number of Sturge and Horsley's points were easily refuted. Pearson and Elderton had never made the statement about wage-earning attributed to them by Horsley and Sturge and the charges of falsifying data were shown to be not true.[56] The original memoir had included a classification for children of teetotallers and when correlation coefficients were calculated for this group by itself (they had been grouped with the children of the "sober" parents in the original) it was found that they compared even less favourably with the children of alcoholics than had the grouping which included the children of "sober" parents.

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[55]Ibid., p. 81.

[56]Genuine confusion had arisen because of the original memoir's use of the Registrar-General's classifications of occupations without a note to indicate that this was being done. Thus a heading of "Porters" in the original memoir might include men who were not porters but who were included under that classification for census purposes. Horsley and Sturge had accused Pearson and Elderton of falsifying the original figures when they had merely not indicated fully what kind of occupational classification they were using.

The dispute about the meaning of the words "sober," "alcoholic," etc., could not change the general tendency of Pearson and Elderton's results. It was also pointed out that a higher death-rate did not necessarily mean poorer health as Sturge and Horsley had implied. Accidental deaths which were unrelated to the state of health could increase the death-rate of a healthier group beyond that of a less healthy group.[57]

Only two of the objections by Sturge and Horsley appeared to carry any weight. Their contention that the original samples were non-representative of the general British public was probably true. But it was probably still beside the point in that it does not seem that the alcoholic members of the samples differed significantly in their background from the non-alcoholic. Comparison of the children of the two groups was therefore a legitimate method of trying to assess the effects of parental alcoholism on children. The second objection which was probably justified was that Pearson and Elderton had not determined whether the alcoholic parents had become alcoholic before or after the birth of their children. This was of particular importance to many of the medical critics of the original memoir because they held that alcohol affected children by poisoning the germ-plasm or the foetus before birth. For Pearson who did not believe in the inheritance of acquired characteristics such

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[57]The answers to Sturge and Horsley are taken from Pearson's "An Attempt to Correct . . .," QDF, 3.

views must have been difficult to take seriously. But the possibility had been mentioned in the introduction to the memoir on the effects of parental alcoholism and he always claimed that statistical analysis showed that alcoholism had set in before the birth of the children.

A few medical men responded more favourably to the findings of Elderton and Pearson's paper.[58] Dr. Archdall Reid who had previously been critical of biometric methods saw the investigation as one ideally suited to the use of statistics.[59] He argued that since it was well known that temperate people often had defective offspring and intemperate people often had vigorous offspring, a statistical examination could really test the claim that alcoholic parentage usually led to defective offspring. Though he did not endorse Pearson's style of debate, he absolutely condemned Horsley. The Times also condemned the intemperate and polemical language of Sturge and Horsley which it felt would serve not to discover the truth but merely to raise tempers.[60]

The medical response to the Elderton-Pearson paper illustrates the great difficulty which the Eugenics Laboratory

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[58] See R. J. Ryle, "The Galton Laboratory Memoir on the Influence of Parental Alcoholism," BMJ (Sept. 3, 1910), p. 658; Editorial, BMJ (Nov. 12, 1910); H. B. Donkin, "Alcoholism and Offspring," The Times (May 31, 1910), p. 10.

[59] G. Archdall Reid, "Recent Researches in Alcoholism," Bedrock, 1 (1912), p. 45.

[60] "Parental Alcoholism," The Times (Jan. 13, 1911), p. 9.

had in trying to carry out its aim to do scientific research upon the important social problems of the day. If those problems were of interest to medical personnel, as they often were, it was not easy to convince them that the statistical methods of the Eugenics Laboratory should be taken as seriously as the accumulated clinical lore of medical practice. But Pearson and his staff were often in closer touch with contemporary biological theory than many medical practitioners. Moreover, they showed that much of the evidence used by temperance advocates depended on statistics which were not able to stand up to a rigorous examination.[61] Thus the importance of their work was increasingly recognised by members of the medical profession.

D. Other Responses to Elderton and Pearson's Study

Mention has already been made of The Times' favourable editorial attitude towards the work of Elderton and Pearson. Such views were shared by E. H. J. Schuster, writing in Nature.[62] In a review of Pearson's final reply to his medical critics he defended the methods and conclusions of the Eugenics Laboratory paper and castigated its critics. Archdall

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[61] See particularly Pearson and Elderton's "A Second Study . . .," ELM, 13.

[62] E. H. J. S[chuster], "Alcohol and Eugenics," Nature, 85 (1911), pp. 479-80.

Reid had also supported the conclusions reached by Pearson and Elderton. Both Schuster and Reid were members of the Eugenics Education Society. But that Society was by no means completely favourable to the results obtained by Pearson and Elderton.

Montague Crackanthorpe, then president of the Eugenics Education Society, had attacked the results of the memoir in a letter to <u>The Times</u> of June 2, 1910. He had used the letter as an occasion for a more general attack on biometry. Results "so contrary to general experience," he wrote,

> confirm the belief that . . . biometry has its limitations and that a complex problem such as that of the relation of parental alcoholism to offspring is quite beyond its ken.[63]

He implied that the biometrical method was too abstract to be of practical use.

> The biometrical method is based on the 'law of averages', which again is based on the 'theory of probabilities', which again is based on mathematical calculations of a highly abstract order.[64]

mathematical calculations of a highly abstract order.[64]

He ended his letter with the information that the Eugenics Education Society would advocate that chronic inebriety be regarded as a grounds for divorce because of its belief in the ill effects of the alcoholism of parents on their offspring.

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[63]Montague Crackanthorpe, "Alcoholism and Offspring," <u>The Times</u> (June 2, 1910), p. 6.

[64]<u>Ibid</u>.

Crackanthorpe's letter drew an immediate response from Francis Galton[65] who explained that biometry was simply an extension of counting and other elementary mathematical procedures. Galton's intervention in favour of Pearson seems to have gone unnoticed by a number of Pearson's critics who assumed that opposition to Pearson by leading members of the Eugenics Society also meant opposition to Pearson by Galton.[66] This clash between two leading eugenists, Galton and Crackanthorpe, once again illustrates that the eugenics movement was not made up of people with the same views on all questions.

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The Galton Eugenics Laboratory later published two studies of "extreme alcoholism in adults."[67] Both papers were presented as attempts to throw light on the social problem of alcoholism and the treatment of alcoholics. The conclusions of these papers were that alcoholism was often

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[65] Francis Galton, "Alcoholism and Offspring," The Times (June 3, 1910), p. 6.

[66] See, for example, Sturge and Horsley, "On Some of the biological . . .," p. 73; Karl Pearson, "The University of London Galton Laboratory for National Eugenics," BMJ (Aug. 13, 1910), p. 407.

[67] Amy Barrington and Karl Pearson, "A Preliminary Study of Extreme Alcoholism in Adults," ELM, 14 (1910); David Heron, "A Second Study of Extreme Alcoholism in Adults; With Special Reference to the Home Office ~~Inebriate~~ Data," ELM, 17 (1912).

associated with mental defect and was probably caused by it, that alcoholics had larger families than non-alcoholics and that inebriate reformatories had little success in reforming alcoholics. The papers therefore recommended that inebriates be classified with the feeble-minded when they were mentally defective and segregated from the normal community. In this way they would have no chance to have large families and the proportion of alcoholics in the population should decrease.[68] These results did not generate another controversy.

The history of the controversy over the effects of parental alcoholism on children can be seen as a case study in the history of the eugenics movement. The differing reactions of eugenists themselves was indicative of their different commitments and of the different ways in which eugenics was interpreted. The extreme difficulty of being at the same time a science and a social philosophy was indicated by the reactions to the memoir. As science the authors of the memoir expected sophisticated analysis of their methods and knowledgeable discussion of the underlying theories. Instead their work was read as a tract for the times and drew polemical and partisan attacks. This double face of eugenics was often present in the writings of Karl Pearson, the leading academic proponent for the establishment of a

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[68]Barrington and Pearson, "A Preliminary Study . . .," p. 45.

science of eugenics. Pearson's inability to convince all eugenists of the correctness of his social analysis foreshadowed the failure of the utopian aim to provide a scientific solution for England's social problems. National efficiency would have to be sought by other means.

VIII

SCIENCE, SOCIETY AND POLITICS: THE BRITISH EUGENICS MOVEMENT, MIDDLE CLASS RADICALISM AND SOCIAL IMPERIALISM

The British eugenics movement was at its zenith in the first twenty years of this century. At the same time society gave science a status and prestige unprecedented in previous ages. The history of the eugenics movement was greatly influenced by that prestige and status. The Galton Eugenics Laboratory was partly sustained by government financial support which was itself the result of the prestige of science. Karl Pearson and his colleagues pioneered new methods in biometry and eugenics partly because of arguments based on the "scientific" philosophy of positivism. The Eugenics Education Society was careful to point out that its social and political reform program was based on scientific findings. The extent to which science had become a sacred element within British society is revealed time and again as the eugenics movement is examined from different frames of reference within the historical discipline. Institutions gained financial support because they were scientific institutions. Metaphysical positions gained favour because they claimed to be scientific philosophy. Political ideas gained currency because they were justified by scientific analogies.

In the following pages I will briefly discuss some of the evidence gathered in this study about the place of science in British society. Then the political role of the eugenics movement is taken up in two ways. Firstly, the thesis that the movement was an example of middle class radicalism. Finally, the role of eugenics in the social-imperialism of the early twentieth century is examined.

A. Science and Society

The Galton Eugenics Laboratory and the Financial Support of Science

Eugenics was most closely identified with science and the scientific community by the existence of the Galton Eugenics Laboratory. It was at the laboratory that research and (to a lesser extent) teaching facilities were available. The very fact that such an institution was established at an English university shows that the idea of a scientific research institution as a worthwhile academic institution was becoming accepted even if there were still very few of them. Galton's decision to endow a whole research institute and not just one professorship indicates that at least some Englishmen thought scientific research needed to be carried out full-time and with teams of workers rather than as the part-time pursuit of teachers or amateurs.

The pattern of financial support received by the Galton Eugenics Laboratory reflected changes taking place in British attitudes towards the support of scientific research.[1] By the early 1920's over half of the income of the Galton Laboratory came from governmental agencies. This represented a drastic change of attitude not only among British politicians but also among British scientists. Until about the time of the First World War it had been held that British science could find enough support from private funds and university income to carry out all necessary research. The British war experience added enough weight to the argument that science was too important to be left to the vagaries of private benefaction for the British government to take action. It initiated an extensive program of financial support for scientific research, setting up two agencies, the Department of Scientific and Industrial Research and the Medical Research Council to administer these funds.[2] Even local governments such as the London County Council thought science important enough to give financial support to scientific research from their limited resources. State support of science marked the beginning of a relationship which has since profoundly affected both the state and the scientific community.

Pearsonian Science and Positivist Metaphysics

The eugenic research carried out by the Galton Eugenics Laboratory was dominated by the thought and personality of

[1]See chapter IV, section C, for detailed analysis of the financial support.

[2]On these points, see Arthur Marwick, *The Deluge* (Harmondsworth, Penguin, 1967), chapter 7.

Karl Pearson.[3] His whole approach to science was dominated by his metaphysical beliefs about science. For him there was no knowledge outside of science, and the scientific method was the only way in which to gain new knowledge. Science was defined by its method. "The Unity of all science consists alone in its method, not in its material," wrote Pearson in *The Grammar of Science.*[4] "The goal of science" was "nothing short of the complete interpretation of the universe."[5] Furthermore, he argued, to say that there were areas outside science was to say "that the rules of methodical observation and the laws of logical thought do not apply" to those areas.[6] Such areas could not lie inside any "intelligible" definition of the word "knowledge." Thus there could be "no short cut to the truth, no way to gain knowledge of the universe except through the gateway of scientific method."[7] In other words, all knowledge was defined in terms of the scientific method.

Pearson railed at "philosophers" and "metaphysicians" who tried to set certain areas outside the realm of scientific investigation. But his whole position was based on a commitment to the metaphysical belief that there was "no way

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[3]See chapter IV above.

[4]*The Grammar of Science* (London, W. Scott, 1892), p. 15.

[5]*Ibid.*, p. 17.

[6]*Ibid.*, p. 18.

[7]*Ibid.*, p. 20.

of knowing anything apart from the scientific way."[8] He had replaced the gods of his enemies by the god of "scientific method." Despite his belief that the scientific method would lead "to practical unanimity of judgments"[9] he was unusually dogmatic about laying down the law of science.

Pearson's apotheosis of science was a sign of the times. His Grammar of Science sold well and was very influential.[10] In the preface to the third edition published in 1911, he noted that it "was surprising . . . how the heterodoxy of the 'eighties has become the commonplace and accepted doctrine of today."[11] Science had a great influence on philosophical, religious and metaphysical thought.[12] It was not surprising that Pearson should seek to bring new areas under the domain of the scientific method nor that other people and even government agencies should respond favourably to such projects. For science had successfully challenged the established religion and was running hard to replace it. For Pearson and his followers the scientific analysis of human and social problems was merely one more step in the

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[8] John Macquarrie, Twentieth Century Religious Thought (London, SCM, 1963), p. 112.

[9] The Grammar of Science, p. 23.

[10] KP, pp. 21-3; J.B.S. Haldane, "Karl Pearson," New Biology, 25 (1958), p. 14.

[11] The Grammar of Science (1911 edition).

[12] See, for example, John Macquarrie, op. cit., pp. 95-115, for a brief account of the impact of science on these areas.

inevitable victory of rational inquiry over superstition.

The Vulgarization of Science: Use and Abuse

Among other things The Grammar of Science was a plea that politicians and statesmen and, indeed, all citizens, should be trained in the scientific method.[13] Thus might all come to a common mind about the weighty matters of state.[14] But science was not a simple thing. For Pearson it might represent a way of thinking about things in order to gain new knowledge. But for the great majority of the people it appears to have meant getting things done. Science was the steam engine, or new egg-shaped sewer pipes, or the electric telegraph, or the trans-Atlantic cable.[15] Science was identified with the latest technological marvel. And because the latest technological marvel added, at least potentially, to everybody's comfort, and certainly to British prestige, science was everywhere viewed as the working man's friend. Or almost everywhere. Eccentrics (and conservatives) like John Ruskin, A. N. Pugin and William Morris might impugn the new mechanical civilization and blame science for the loss of

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[13] The Grammar of Science, chapter 1.

[14] This Pearsonian anticipation of "consensus" politics may have been more than coincidental if we can believe the interesting but pessimistic account of the role of science in contemporary Western civilization in Theodore Roszak's The Making of a Counter Culture (New York, Doubleday, 1969).

[15] This view is based on an unpublished study, L. Farrall, "Popular Science in Chambers's Journal, 1832-74."

all that was good and beautiful.[16] But these attacks on science show that it was not only among the working classes that science was identified with the results of technology.

At the end of the nineteenth century the word "science" conveyed quite different meanings to different groups of people. But whatever the meaning, the overwhelming opinion was that science carried much of the responsibility for the sweeping changes that had occurred in the previous century. The prestige of science as the engine of progress and agent of social change was high. In such an atmosphere science became a watchword to be conjured with for science was the new password to success. British society was fast developing a new cultural mythology. Herbert Spencer had invented the science of society. Havelock Ellis invented the science of sex. Politicians were not slow to make use of the new password. Often, however, they appropriated the ideas of science and not its methods, forcing the ideas into contexts for which they were never intended. So confused was the general notion of "science" that such inappropriate borrowings still managed to wear the airs of "science" and reap the benefits of its prestige.

The eugenics movement was one political movement which benefitted from the high prestige of science. In particular,

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[16] See Raymond Williams, <u>Culture and Society 1780-1950</u> (New York, Harper and Row, 1966), chapter 7, "Art and Society," pp. 130-58, especially pp. 149-50.

it gained support because its apparently rational scientific basis appealed to the educated middle classes. Imperialism was another political program in which science played an important role. In this case it was through the borrowing of ideas which were applied to the international situation. Imperialism borrowed many arguments specifically from evolutionary theory and used them in a highly doubtful manner.

B. Middle Class Radicalism

The thesis that there is a form of political movement which can be distinguished as middle class radicalism has been put forward by Frank Parkin.[17] He has suggested a number of characteristics which are typical of middle class radicalism. Obviously the members of the movement should be drawn from the middle classes.[18] The changes advocated by the movement have usually been concerned with social and moral issues rather than economic issues. In connection with this characteristic participants in such a movement seek psychological or emotional satisfaction rather than material ones. Members of a middle class radical movement are,

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[17]Parkin, Middle Class Radicalism (Manchester, Manchester U.P., 1968).

[18]"Middle classes" is here used in its usual sense of that part of the population neither aristocratic nor working class. The rough nature of such a distinction is recognised and it may well be that a more sophisticated sociological classification would help in the understanding of "middle class radicalism."

according to Parkin, generally members of the welfare and creative professions rather than of commercial professions. They have also usually received a higher education of some form, and they often have a high level of participation in voluntary organizations and societies. All of these characteristics were associated with the eugenics movement as it was represented by the Eugenics Education Society.

The members of the Eugenics Education Society about whom biographical details are available came almost entirely from the middle class.[19] Although it is undoubtedly true that information about society members who came from the working classes would not be as readily obtained as those from the middle classes, there is no evidence that any of the members of either the council or of the small random sample investigated were members of the working class. In the case of the council some evidence as to the social status of members was obtained for eighty-seven out of one hundred and eleven members. All eighty-seven had occupations, university degrees or titles[20] which would indicate middle or upper class membership. In the random sample of forty members all twenty-four, about whom information was found, were also drawn from the middle classes.

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[19]The exceptions were those who would have been associated with the "upper classes."

[20]The titles included "Sir," "Lady," "Dame" and "Dr."

The eugenists' aims were certainly directed mainly "to social reforms which [were] basically moral in content,"[21] although they more than once claimed that such reforms would also bring economic benefits for the whole community.[22] Elimination of crime, disease, poverty and alcoholism together with the improvement of the nation's general intellectual and moral qualities which formed the basis of the eugenic program were not altogether removed from the world of economic and material improvement.[23] But they certainly fit better with Parkin's characterization of middle class radicalism's concern for social reforms of a moral kind.

There are many indications that the eugenists themselves sought emotional and psychological satisfaction from their participation in the eugenics movement rather than material ones. In the case of the significant minority of married women who volunteered their services it is difficult to envisage that they had the slightest hope of material rewards. In the case of the many physicians who participated in the movement it would seem that they certainly would have obtained greater financial rewards by spending more time at

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[21] Parkin, op. cit., p. 2.

[22] See, for example, the quotation from Major Leonard Darwin in chapter VI, section D, where he argued that successful eugenic reform would lower taxes and raise real wages.

[23] These are characteristic of "working class radicalism" according to Parkin, op. cit., p. 2.

their practice and less with eugenics.[24] With the many academics who took part in the movement the story could be different. For many of them, particularly the biological and social scientists, eugenics could be regarded as a legitimate area of academic study. Participation in a semi-political movement was unlikely, however, to win promotion or gain financial rewards. The tendency for the academic members of the Eugenics Society to change it into a learned society could be seen as an attempt to gain further financial support for their work. On the other hand it may also reflect a commitment of the academic members of a radical movement to research and rational argument as basic means of gaining radical goals. The position of politicians and authors in the eugenics movement may also be seen as connected with some expectation of financial or material reward. In the first case voting support might be gained; in the second, material for books and articles, but in neither case could eugenics be expected to improve the lot of politicians or authors generally. In general then it was true that the members of the eugenics movement found emotional satisfaction in expressing their personal beliefs in action rather than seeking specific material improvement in their status within society.

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[24]One of the prominent eugenists, C. W. Saleeby, made this point himself, in his writings. See his "Professor Karl Pearson on Alcoholism and Offspring," British Journal of Inebriety, 8 (1910-11), p. 53.

It is clear from figures given above[25] that the members of the eugenics movement were mainly from the welfare and creative rather than the commercial professions. It is also true that most of the members of the movement had received some form of higher education. A high degree of involvement in other voluntary organisations has also been found where evidence is available.

The radicalism of the eugenics movement differed in at least one important way from that described by Parkin. It did not use the technique of mass-demonstration in attempts to achieve its goals. This may well have been due to the domination of its leadership by academics and physicians, two groups in very secure positions in society or it may have been due to the fact that the government did respond in a number of positive ways to the eugenics program.

Parkin described his study of middle class radicalism as an exercise in the sociology of politics" in which the movement he studied was not of "primary interest so much as the theoretical issues it helps to illuminate."[26] This study of the eugenics movement is primarily an exercise in the social history of science. But it may also help to illuminate Parkin's "theoretical issues." The similarity between two forms of middle class radicalism which were separated by half

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[25] See Table 5 in chapter VI above.

[26] Parkin, op. cit., pp. 1-2.

a century suggests that this is a typical form of socio-political movement in modern Britain, which has not been greatly changed during the last seventy years. Further comparative studies of still earlier movements using this sociological model might throw interesting light on the way political action in Britain changed during "The Long Revolution" that saw contemporary urban, industrial democracy come into being.[27]

C. Eugenics, Nationalism and Imperialism

Organic analogies have long been used in discussions about national states and other human institutions.[28] During the half century before World War I, such analogies were very much in vogue because of the tremendous impact of Darwin's theory of evolution. The phenomenon was so impressive that the term "social Darwinism" was coined to describe it. As with "science," however, the content of "social Darwinism" changed according to the views of the thinker or group who espoused it.

Social Darwinism

That part of Darwiniam theory which became best known to political theorist and common man alike is summed up in

[27] Raymond Williams, The Long Revolution (Harmondsworth, Pelican, 1965).

[28] For an interesting discussion of a much earlier use of organic analogy in relation to the state see Christopher Hill, "William Harvey and the Idea of Monarchy," Past and Present, 27 (1964), pp. 54-72.

Herbert Spencer's phrases, "the survival of the fittest" and "the struggle for existence." Two forms of "social Darwinism" can be distinguished according to the locus of the "struggle." "Internal social Darwinism" emphasised the competition between individuals within the one group. In Britain and the U.S.A. it was used as a justification for laissez-faire economic policies and as an argument against collectivist activities and forms of government. "External social Darwinism" emphasised the importance of competition between groups in the evolutionary process. It was used to justify racist, nationalist and imperialist concepts. It could also be used to justify collectivist and socialist forms of government.[29]

The straight forward use of evolutionary analogy was to liken the progress of individuals, groups or nations to the evolution of species. Both depended on the "survival of the fittest." Eugenists, however, used the analogy with a difference. They very often advocated the view that modern civilization was stopping "the struggle for existence" and preventing the "survival of the fittest." This, they argued, led to the disastrous consequence that many of the least fit were not only surviving but also in their turn bringing still

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[29]For another account of the distinction between "internal" and "external" social Darwinism see Bernard Semmel, Imperialism and Social Reform (New York, Doubleday, 1966), pp. 18-20 where both forms are traced back before the date of publication of Darwin's Origin of Species.

less fit survivors into the world.[30] This eugenic argument could be used in either "internal" or "external" social Darwinist forms as it was by different eugenists according to their own views of the social and economic forces at work in the contemporary world.

The ultimate shape taken by a particular form of social Darwinism depended also on a number of disputed points about the actual processes of biological evolution. If, for example, Lamarckian processes such as the inheritance of the effects of the use or disuse on organs were accepted, social Darwinism might take on quite a different form from that adhered to by someone who accepted that Weismann had shown that acquired characteristics could not be inherited. Indeed, that very point led to a long dispute between Herbert Spencer and August Weismann.[31] Similarly, different views about the role of "mutations" and "continuous variations" or the extent of "mutual aid" within groups might lead to different forms of social Darwinism. But the form that social Darwinism took in the thinking of many eugenists and particularly its form in the thought of Karl Pearson was very influential on British concepts of "race," "nation" and "empire."

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[30]For examples of these arguments see chapter II, section A.

[31]For this controversy see the various articles by Spencer and Weismann in the Contemporary Review for 1893, 1894 and 1895.

Eugenics and Race

Mankind can obviously be divided into different groups using different methods of classification. Many social scientists, natural historians and biologists of the nineteenth century were fascinated by a classification based on heredity, the classification of "race." In biology, "race" has been defined as a "subdivision of a species which inherits physical characteristics distinguishing it from other populations of the species."[32] However, just as "species" could be defined but still be the centre of a long scientific controversy because biologists could not agree on the significance of the definition and its implications, so "race" was defined without such definition meaning that all biologists agreed about the significance and the implications of the term. That there was some confusion about the term is illustrated by the full title of Darwin's famous work, On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life. Although "species" and "races" were not used as equivalents in the title it gave the distinct impression that they were very similar. "Race," however, was an inappropriate concept to use in relation to different groups of men.[33] It was used with the assumption that a "race" could be distinguished

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[32] Ashley Montagu, Man's Most Dangerous Myth: The Fallacy of Race (Cleveland, Meridian, 1965, 4th edition), p. 25.

[33] Ibid., chapter 2.

from the rest of mankind by its common descent from a group isolated from the rest of man. In fact, as G. M. Morant has pointed out, there has never been any definite knowledge of a "group of people separated from all others on account of the distinctive ancestry of its members."[34]

Nevertheless, the concept was used. It was used to classify people of different skin colour, of different nationality, of different religion and of different physical characteristics. Karl Pearson, among eugenists, used the concept of race within the context of his external social Darwinism. Pearson's understanding of evolution was closely tied to the population rather than the typological concept of species.[35] It was largely for this reason that he was so enthusiastic about biometrical methods. He applied to the measurement of skulls the techniques and interpretations that Weldon had applied to crabs.[36] In both cases they were prepared to distinguish separate "races" on the basis of statistical analysis of physical measurement. Not only in the case of skulls, but also in the case of finding differences in the average physical measurements of different samples of school children Pearson argued that the differences

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[34]G. M. Morant, "The Future of Physical Anthropology," _Man_, _44_ (1944), p. 17. Quoted in Ashley Montagu, _op. cit._, p. 72.

[35]See chapter IV, section B above.

[36]KP, p. 67.

could be explained by different racial backgrounds.[37] In some of the eugenic studies carried out under Pearson's directions differences in religion and temperament are also traced back to difference in "race."[38]

In all cases where "race" was used as an explanation by Pearson and his co-workers it was assumed that races had been isolated inter-marrying groups for so long that all individuals in the group had come to possess certain characteristic physical, mental and moral traits by which the "race" could be distinguished from other racial groups. "Race" was, however, a label they gave to a large number of contemporary and historical (or supposed historical) groups with little regard for the consistency with which the word was used. "The Australian native,"[39] "the negro,"[40] "Kaffir,"[41] "Aryan,"[42] "Irish,"[43] "Swedish,"[44] "Finnish,"[45]

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[37] Amy Barrington and Karl Pearson, "A First Study of the Inheritance of Vision . . .," ELM, 5 (1909).

[38] Amy Barrington and Karl Pearson, "A Preliminary Study of Extreme Alcoholism in Adults," ELM, 14 (1910), p. 12.

[39] Karl Pearson, "Social Problems: Their Treatment, Past, Present and Future," QDF, 5 (1912), p. 6.

[40] *Ibid.*, p. 8.

[41] Karl Pearson, *National Life From the Standpoint of Science* (London, Adam & Charles Black, 1901), p. 19.

[42] *Ibid.*

[43] Barrington and Pearson, "A Preliminary Study of Extreme Alcoholism . . .," p. 12.

[44] Karl Pearson and Ethel M. Elderton, "A Second Study of the Influence of Parental Alcoholism . . .," ELM, 13 (1910), p. 16.

[45] *Ibid.*, p. 16.

"Russian,"[46] "Celts,"[47] "white" and "black"[48] are all designations given to "races" in Pearson's writings. Pearson's use of the term in relation to groups is unclear because he was prepared to use one characteristic alone by which to classify a "race." Such "races" bore little resemblance to a group which was distinct from the rest of man because of its common ancestry. In fact, Pearson's use of "race," "racial" and other derivatives was often such as to make them synonymous with "hereditary." He defined "a racial character" as

> one which is the product of many centuries of selection, one which passes from generation to generation, and one which is not fundamentally modified if a child be born to the race in India, Canada, or Australia.[49]

Although this statement is almost equivalent to saying "a race is a race while it remains a race" it does indicate that Pearson thought of a race as an interbreeding group which retained the same characteristics from generation to generation. But the ever-present confusion in his concept of "race" can be highlighted by contrasting his statement

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[46] Ibid., p. 16.

[47] Ethel M. Elderton and Karl Pearson, "A First Study of the Influence of Parental Alcoholism . . .," ELM, 10 (1910), p. 31.

[48] Karl Pearson, National Life . . ., p. 20.

[49] Karl Pearson, "The Academic Aspect of the Science of National Eugenics," ELLS, 7 (1911), p. 5.

that "three, or at most four, generations of selection will suffice to establish a race in man which will breed true to itself"[50] with a slightly later statement that "in the case of man, I feel sure that purity of race is a merely relative term."[51]

Though in retrospect it may seem that Pearson was unsure what constituted a race he was confident that there were "higher" and "lower" races. The "white, Aryan" races were superior to the "black, inferior" races of Africa. Contact between the "higher" and "lower" races always resulted in the domination of the latter by the former.

> If you bring the white man into contact with the black . . . you get superior and inferior races living on the same soil, and that co-existence is demoralizing for both. They naturally sink into the position of master and servant, if not admittedly or covertly into that of slave-owner and slave.[52]

This form of racism when associated with Pearson's tremendous emphasis on the importance of heredity in determining all human characteristics and with his view that all human groups were engaged in "the struggle for existence" not only supported the racist view that the "superior" races

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[50]Karl Pearson, "The Function of Science in the Modern State," ELLS, 12 (1919), p. 4.

[51]Karl Pearson, "The Science of Man: Its Needs and Prospects," Annual Report of the Smithsonian Institution (1921), p. 425.

[52]Karl Pearson, National Life . . ., p. 20.

should not allow themselves to intermarry with the "inferior" but also justified genocide as a natural outcome of contact between "superior" and "inferior" races.[53] Pearson's views on the natural superiority of certain "races" were carried over into his analysis of relations between other groups. There were, according to him, "superior" and "inferior" classes within a nation whose respective positions depended on inherited qualities. And similarly certain nations were naturally superior to other nations.

Efficiency and Nationalism

In 1900 Great Britain was stunned by the news that the imperial army had suffered defeats at the hands of the "tiny" bands of Boers in South Africa. Karl Pearson joined the many who lectured on the significance of the defeats. The result was a dramatic appeal for the nation to learn from science how it could increase its "efficiency" in the continuous struggle against other nations. "The first function of science in national life," said Pearson,

> is to show . . . how the nation is a vast organism subject as much to the great forces of evolution as any other gregarious type of life. There is a struggle of race against race and nation against nation. In the early days of that struggle it was a blind, unconscious struggle of barbaric tribes. At the present day, in the case of the civilized white man, it has become more and more the conscious, carefully directed

[53]Galton held similar views on the superiority of the white man and his natural right to take over other lands. See LLG, II, pp. 32-3, 106-9.

> attempt of the nation to fit itself to a continuously changing environment. The nation has to foresee how and where the struggle will be carried on;[54]

The nation, as with the race, was interpreted according to Pearson's external social Darwinism. The nation, just like an organism, was subject to natural selection. If it was found less fit than a competing nation it would not survive. It would, Pearson warned, become "a stepping-stone" in the "path of progress"[55] of other nations.

Faced with the possible dire consequences of his own analysis, Pearson called for an increase in national efficiency so that Britain would always be ready to take part in the struggle between nations with the greatest possible chance of survival. The call for national efficiency was echoed by many other sections of the British community from Fabians to Unionists.[56] But whereas for most "national efficiency" depended on better administration and increased government activity in all aspects of the nation's life, for Pearson it also meant making sure that the nation maintained and improved its average level of health and intelligence. Only if this were so would it be able to train leaders and workers who could improve the "national efficiency." This could be done only if the nation followed the

[54]Karl Pearson, National Life . . ., p. 34.

[55]Ibid., p. 62.

[56]On this point see Bernard Semmel, op. cit., chapter 3, "A Party of National Efficiency," pp. 43-73.

advice of eugenists and encouraged its better "stock" to have larger families while preventing its degenerate "stock" from multiplying.[57] For the eugenist who accepted external social Darwinism and rejected the inheritance of acquired characters, the all important factor in national survival was to ensure that its genetic riches were retained from generation to generation.

Eugenics and Social-Imperialism

Karl Pearson's views on "race" and "nation" and their role as "fundamental units in the evolution of man"[58] fitted well with the new found enthusiasm for empire at the end of the nineteenth century. The way in which his evolutionary and eugenic views formed a basis for imperialism has been well described by Bernard Semmel. The particular kind of imperialism which Pearson espoused has been termed "social-imperialism."[59] Pearson's social imperialism, his nationalism, and his racism were all the logical outcome of his views about science and its role in society.

He took the position that no area of human activity or interest was outside the realm of scientific investigation. Moreover, only scientific investigation could lead to reliable

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[57]Pearson, National Life . . ., pp. 43-4.

[58]Ibid., p. 53.

[59]For this whole theme, see Bernard Semmel, op. cit., chapter 2, "Social Darwinism: Benjamin Kidd and Karl Pearson."

knowledge. Since Darwinian evolution was an acceptable biological law it necessarily applied to man who was part of the biological realm. Evolution was controlled by the interaction between heredity and environment. But investigation at the Galton Eugenics Laboratory had shown that in the case of man, heredity was five to ten times as important as environment in shaping an individual's physical, mental and moral makeup. Given the importance of heredity and of competition between populations in shaping human evolution it was extremely important that a human group control its heredity as far as possible. The struggle for existence between races and nations had already shown that the white Europeans were superior to other races round the world. Since it was inevitable that the struggle between peoples and nations would continue it was necessary to maintain one's own nation at peak efficiency. This could be done by controlling heredity and by taking over control of other lands to form an empire so that reserves of strength could be called on in defence of the motherland. Internally the necessity for efficiency meant that all potential sources of conflict should be removed. All of these things could be carried out best under a government that was prepared to take a strong hold on every aspect of national life. In Pearson's view this form of government would be a socialist government with a strong commitment to nationalism and imperialism. Social-imperialism was a form of imperialism which freely admitted that its overseas conquests were carried out in order to finance the kinds of domestic legislation which would prevent internal class struggle.[60] Its similarity to national(ist) socialism is striking. Semmel places great emphasis on the similarities between Pearson's views and those of various forms of fascism which later emerged in various European countries.[61] A careful study of Pearson's national socialism or social imperialism does help, I think, in understanding how various elements of Nazism came to be associated together, and particularly how both nationalism and socialism could be associated together. But Semmel is perhaps too ready to use hindsight in suggesting a connection between Pearson's views and Nazism, for he has made no reference at all to Pearson's post-1920 writings and no reference to the immense amount of statistical and scientific work which has little to do with social-imperialism.

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This chapter has focussed largely on Karl Pearson not because he was a typical member of the eugenics movement--he was untypical in a number of other ways besides his eminence as a scientist--but because his many writings and

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[60] The Marxist origins of this aspect of Pearson's thought are explicit in his early writings. See Semmel, _op. cit._, pp. 24-8.

[61] Semmel, _op. cit._, especially pp. 41-2.

varied activities form a very good basis for an examination of the way in which science, society and politics were related in early twentieth century Britain. And that constellation of relations was typical of the eugenics movement. The prominence attained by a positivist such as Pearson and the strength of the support gained by the eugenics movement both indicate that science was a powerful force in pre-war Britain and that it was becoming more powerful as time passed. It seemed to have assumed some of the roles normally associated with religion or national mythology. Just as the anti-slavery movement of a century before had justified its program because it was Christian, now the eugenics movement justified its program because it was scientific. The contrast of the two programs might give us pause for thought as we continue, by and large, to endorse the mythology of science.

IX

CONCLUDING REMARKS

Science has great influence and prestige in contemporary society. This study was undertaken with the aim of deepening my understanding of the role of science in that society. For this reason the study is not meant to be simply a history of the British eugenics movement. Rather it is an exploratory study of the cultural role of science as exemplified by various aspects of the history of the British eugenics movement.

In this study I have investigated the nature of science and its role in British society in two main ways. The first involved the attempt to establish eugenics as a science. This included not only the development of the theories and methodology of eugenics but also the formation of institutions appropriate to a science. The study of such an attempt to establish a science enables us to come to a better understanding of the nature of science and of the role of the scientific community as well as telling us much about eugenics and eugenists. The second part of the dissertation is a study of the way in which the eugenics movement built up a socio-political ideology based on current scientific ideas. The appearance of a science-based political movement in pre-war Britain reflected the way in which science was replacing other institutions as a means of justifying thought and action in that society. It was reaching the stage of becoming an unquestionable authority and part of the nation's cultural mythology.

The British eugenics movement embodied a sustained attempt to put into practice an ideology based on the theory of Darwinian evolution. It has been the most extensive attempt to British history to base social welfare on principles established by natural scientists. Observations and proposals later common in the eugenics movement were shown to have been frequently discussed in the 1860's and 1870's. Undoubtedly some of these elements can be traced back still further. But the discussions of the period immediately after the publication of Darwin's theories show that the origins of eugenics are not to be sought solely in the writings of Francis Galton as has been too frequently implied.

The attempt to set up a science of eugenics was closely related to the emergence of a neo-Darwinian school of evolutionists and even more closely associated with the formation of the English biometric school. This raises a number of questions which have not been thoroughly dealt with in this study. In particular the whole question of why British (and not only British) biologists became dissatisfied with the orthodox morphological tradition of their discipline deserves further attention. The acceptance of Weismann's germ-plasm theory and of his view that acquired characteristics were not inherited seem to have played an important role in the emergence of neo-Darwinism. The influence of Weismann's writings on British biologists also deserves further attention. His long debate with Herbert Spencer about the implications of his theory of heredity for social theory and policy particularly needs further study.

One question which was very much in the forefront of my thinking as I studied biometry and eugenics was the question, "How can science as a set of theories and ideas be linked with science as a social institution?" This question has been raised in different ways in a number of recent works[1] usually with the implication that the "social dimension of science" plays a very large role in determining the shape and content of scientific theory and practice. One of the most interesting aspects of Thomas Kuhn's "paradigm" concept is its emphasis on the shared nature of the key elements which determine the particular direction of a research tradition. But Kuhn does not develop the social nature of "paradigm" to any great depth nor does he relate that social nature particularly well to actual social structures within the scientific community. I have suggested that some of the valuable insights

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[1]See, for example, Warren O. Hagstrom, The Scientific Community (New York, Basic Books, 1965); Thomas S. Kuhn, The Structure of Scientific Revolutions (Chicago, U. of C.P., 1962); Michael Polanyi, Personal Knowledge (London, Routledge and Kegan Paul, 1958); Stephen E. Toulmin, "The Evolutionary Development of Natural Science," ~~American~~ Scientist, 55 (1967), pp. 456-71; John M. Ziman, Public Knowledge: An Essay Concerning the Social Dimension of Science (Cambridge, C.U.P., 1968).

from Kuhn's account of the history of science can be fruitfully combined with elements from Warren Hagstrom's analysis of the structures of the scientific community.

In this study I have specifically taken up the question of the relationship between social and intellectual elements in science in dealing with the emergence of the two new "sciences," biometry and eugenics. Eugenics and biometry were both the result of using new methods and theoretical insights in the study of evolution. It was the method of statistical analysis and the theory that evolution came about through the action of natural selection on continuous variations in organic populations which distinguished these new sciences from other ways of studying biology. But in order to survive methods and theories have to be put into practice by some members of the scientific community. In the case of both biometry and eugenics a group of self-conscious practitioners found themselves creating journals, research and teaching facilities, and arguments in justification of their new ways of research in order to preserve their identity against very strong attack from other sections of the biological community. While it is by no means impossible to separate the intellectual, institutional and social elements in the story of the attempts to set up these new sciences, such a separation leads to severe distortion in the understanding of what was happening. Holding all of these elements in mind serves as a very good antidote to the positivist "hangover" which is still all too present in our attitude towards science. Eugenics and biometry cannot be dismissed as unfortunate lapses into irrationality, as some historians have wanted to do, because they do not appear to be acceptable to the mainstream of contemporary science. They must be examined and explained for what they were, perfectly understandable attempts to bring to the evolutionary study of man and animals new insights and methods, which, though their significance may have been exaggerated by their proponents, were nonetheless explicable in the context of the science of their day.

It is particularly important to understand the biometrical methods used by Weldon, Pearson and their colleagues, for biometry was one of three competing approaches to the study of biology at the turn of the century which vied for the support of contemporary biologists. To dismiss it merely as an unsuccessful approach to the study of heredity which was doomed by the Mendelian revolution is to miss the substantive point of the early twentieth century debate about how best to study biological phenomena. The long-established natural history tradition based on careful observation and classification was competing with the experimental method, which though of long standing in physiology had received fresh impetus in the fields of embryology and heredity. The new experimental approach was not, however, easily applicable to population studies and to ignore such studies would have been to ignore one of the principle insights of Darwin's work. Alongside these two research traditions biometry became a third way of looking at nature. It offered the promise of making the study of natural populations into an exact science. All three of these traditions made important contributions to the synthetic theory of evolution which, since the 1930's, has restored the Darwinian theory of natural selection as the cornerstone of all evolutionary theory.

The second major thrust of my study of the eugenics movement was to understand the role of science in the modern world. As D.S.L. Cardwell and Arthur Marwick have pointed out it is an oversimplification to talk of the "impact" of science on society. "Science is not an alien external force like famine, pestilence or conquest, it is characteristic of our society."[2] The role of science in British society is a very difficult problem to study. For though one can point to scientific institutions and discuss scientific thought it is much more difficult to isolate scientific elements from the whole social and cultural spectrum of the nation. In this respect the eugenics movement serves as an interesting subject for study because while claiming a scientific basis it was involved in a wide range of activities to do with

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[2] Arthur Marwick, The Deluge (Harmondsworth, Penguin, 1967), p. 255; D.S.L. Cardwell, The Organization of Science in England (London, Heinemann, 1957), p. 2.

many aspects of the national life not normally associated with science.

The eugenics movement has been shown to have had a number of characteristics in common with the middle class radicalism of a British political movement of the 1960's. Thus it appears that the eugenics movement may belong to one form of political movement common in Britain. Indeed it may prove to be the case that a great number of "moral" reforms in British history from the abolition of slavery onward were initiated by middle class radical movements. The association of middle class radicalism with a "scientific" ideology in the eugenics movement was a sign of the extent to which the positivist claim that science was the only true source of knowledge had gained hold on the educated middle classes.

Much further study is needed to fully understand the significance of the claim to be a "scientific" ideology and to provide "scientific" solutions for social and political problems. Many questions remain to be answered about the way in which different parts of British society perceived science. The success with which the Eugenics Education Society was able to influence some pre-war social legislation, the government financial support granted to the Eugenics Laboratory and the common acceptance of eugenic viewpoints about racism, nationalism and imperialism all suggest that science had become an unquestioned good. Marwick aptly catches the spirit of the changed attitude towards science in his comparison of the British governments after the Napoleonic and First World Wars.

> One hundred years before, Lord Liverpool's ministry had sought release from the physical and spiritual ills which afflicted the country at the end of the Napoleonic wars by providing one million pounds for the building of new churches. Now in the latter part of another world war Parliament again passed a 'Million Act', the money this time to be devoted to scientific research. A new deity was being enthroned.[3]

Throughout my study of the eugenics movement I have endeavoured to use the study of specific events in history to come to some clearer understanding of the complex institutions we call science and the state. I have, perhaps, been more eclectic than is usual in the way in which I have treated the history of science and the sources of the main theses I was testing. I have done this because I believe that both science and history are too important to be confined within narrow bounds defined by our forefathers. We live in a world that rejoices in the many good things that science has helped bring into existence. But the same world lives under the shadow of the constant fear that nuclear warfare or the population explosion, both made possible by science, will bring destruction or misery of unparalleled proportions. In such a world any sustained attempt to throw light on the nature of science is worthwhile.

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[3] Marwick, *op. cit.*, p. 248.

APPENDIX

APPENDIX 1

Duties of First Galton Research Fellow

(a) To acquaint himself with statistical methods of inquiry, and with the principal researches that have been made in Eugenics, and to plan and carry out further investigations thereon.

(b) To institute and carry on such investigations into the history of classes and families as may be calculated to promote the knowledge of Eugenics.

(c) To prepare and present to the Committee, though not necessarily for publication, an annual Report on his work. To give, from time to time, if required or approved by the Committee, short Courses of Lectures on Eugenics, and in particular on his own investigations thereon.

(d) To prepare for publication at such times and in such manner as may be approved by the committee (and at least at the end of his tenure of the Fellowship), a Memoir or Memoirs on the investigations which he had carried out.

(From LLG, IIIa, pp. 222-3.)

APPENDIX 2

Duties of First Galton Professor

(1) Collect materials bearing on Eugenics.

(2) Discuss such materials and draw conclusions.

(3) Form a central Office to provide information under appropriate restrictions to private individuals and to public authorities concerning the laws of inheritance in man and to urge the conclusions as to social conduct which follow from such laws.

(4) Extend the knowledge of Eugenics by all or any of the following means, namely:

(a) Professorial instructions.

(b) Occasional publications.

(c) Occasional public lectures.

(d) Experimental or observational work which may throw light on Eugenics problems. . . .

(From LLG, IIIa, pp. 437-8.)

APPENDIX 3

Personnel of Galton and Biometric Laboratories[a] 1905-1923

Feb. 1905 - Jan. 1907

Edgar H. J. Schuster	Galton Research Fellow
Ethel M. Elderton	Research Assistant and Secretary (Appointed June 1905)

Feb. 1907 - July 1911

David Heron	Galton Research Fellow
Ethel M. Elderton	Galton Scholar
Amy Barrington	Computer
K. Ryley (Miss)	Draftsman (Appointed June 1909)

July 1911 - Feb. 1913

Karl Pearson	Director
David Heron	Galton Research Fellow
Ethel M. Elderton	Galton Scholar
Amy Barrington	Computer
K. Ryley	Draftsman (until Oct. 1912)
H. E. Soper	Assistant (from Oct. 1912)
Julia Bell	Assistant
Gertrude H. Jones	Honorary Secretary

Feb. 1913 - Feb. 1916

Karl Pearson	Director
David Heron	Assistant Director
Ethel M. Elderton	Galton Research Fellow
Amy Barrington	Computer (later Librarian)
H. E. Soper	Assistant (until March 1915)
Julia Bell	Assistant (not on payroll 1914-16)
Beatrice M. Cave	Assistant (from Dec. 1913)
Adelaide Davin	Assistant (from July 1914)
Israel Horwitz	Assistant (from Oct. 1915)
Andrew W. Young	Assistant (from Oct. 1915)
Gertrude H. Jones	Honorary Secretary

[a]Biometric Laboratory included from 1911

Feb. 1916 - April 1918

Karl Pearson	Director
Ethel M. Elderton	Galton Research Fellow
Julia Bell	Assistant
Beatrice M. Cave	Assistant (until Oct. 1916)
Adelaide Davin	Assistant
A. T. Doodson	Assistant (from Oct. 1916)
Winifred Husbands	Assistant (from Oct. 1917)
Leslie Ince	Assistant (from Oct. 1916)
J. O. Irwin	Assistant (from Oct. 1917)
D. W. Smith	Assistant (from Oct. 1917)
Andrew W. Young	Chief Assistant

Sept. 1918 - Aug. 1921

Karl Pearson	Director
Ethel M. Elderton	Galton Research Fellow
Julia Bell	Assistant (from Sept. 1919)
Margaret V. Child	Secretary (from Sept. 1919)
Adelaide Davin	Assistant
E. Augusta Jones	Assistant (until Aug. 1920)
Mary N. Karn	Assistant
Margaret Moul	Assistant
Eleanor G. Pairman	Assistant (until Aug. 1920)
C. E. Rhodes	Assistant (from early 1920)
Mary Seegar	Assistant

Sept. 1921 - Aug. 1923

Karl Pearson	Director
Ethel M. Elderton	Galton Research Fellow
Julia Bell	Research Fellow
Margaret V. Child	Secretary
J. O. Irwin	Assistant Lecturer
J. Henderson	Research Assistant (from Sept. 1922)
Mary N. Karn	Assistant
Ida McLearn	Draftsman
Margaret Moul	Assistant
E. S. Pearson	Assistant Lecturer
C. E. Rhodes	Assistant
Percy Stocks	Medical Officer (from Sept. 1922)

Note: After 1915 the beginning and completion of appointments have been put down as the beginning or ending of the academic year (September-October and August respectively) if no more accurate information has been available.

APPENDIX 4

Approximate Annual Expenditure of the Galton and Biometric Laboratories 1903-1925

Year[a]	Expenditure (£)	Year	Expenditure (£)	Year	Expenditure (£)
1903-4	500	1911	856	1918-19	2310
1904-5	500	1911-12	2556	1919-20	2916
1905-6	704	1912-13	2700	1920-21	4113
1906-7	767	1913-14	2735[b]	1921-22	4717
1907-8	1029	1914-15	2226	1922-23	4388
1908-9	836	1915-16	2270[b]	1923-24	4600
1909-10	1120	1916-17	2346	1924-25	4925
1910-11	1341	1917-18	2320	1925-26	4715

Sources: The figures for 1903-4 to 1911-12 are taken from the Galton Laboratory audited accounts with the Drapers Company Grant added. The figures for 1912-13 to 1925-26 are taken from "Report on the Galton and Biometric Laboratories especially with regard to their Income and Expenditure," pp. 9-11.

[a]The financial year ran from Feb. 1st to Jan. 31st until 1911 when the year was changed to September 1st until August 31st. The year 1911 therefore represents only February 1st until August 31st.

[b]These figures are my estimates derived by adding the salaries for the year (which can be found for example, in the Senate Minutes, and some of Pearson's reports, etc.) to the expected other expenditure judging by the previous year's trends.

APPENDIX 5

Galton and Biometric Laboratory Publications

Goring, Charles, The English Convict: A Statistical Study (London, H.M.S.O., 1913).

Memoir Series

I. Schuster, Edgar and Elderton, Ethel M., The Inheritance of Ability, 1907.

II. Heron, David, A First Study of the Statistics of Insanity and the Inheritance of the Insane Diathesis, 1907.

III. Schuster, Edgar, The Promise of Youth and the Performance of Manhood, 1907.

IV. Elderton, E. M. assisted by K. Pearson, On the Measure of Resemblance of First Cousins, 1907.

V. Barrington, Amy and Karl Pearson, A First Study of the Inheritance of Vision and of the Relative Influence of Heredity and Environment to Sight, 1909.

VI. Treasury of Human Inheritance, Parts I and II, 1909.

VII. Rhodes, E.C., On the Relationship of Condition of Teeth in Children to Factors of Health and Home Environment, 1921.

VIII. Heron, David, The Influence of Unfavourable Home Environment and Defective Physique on the Intelligence of School Children, 1910.

IX. Treasury of Human Inheritance, Part III, 1910.

X. Elderton, E. M. [and Karl Pearson], A First Study of the Influence of Parental Alcoholism on the Physique and Ability of the Offspring, 1910.

XI. Treasury of Human Inheritance, Part IV, 1910.

XII. Treasury of Human Inheritance, Parts V and VI, 1910.

XIII. Pearson, K. and Elderton, E. M., A Second Study of the Influence of Parental Alcoholism on the Physique and Intelligence of the Offspring. Being a Reply to Certain Medical Critics and an Examination of the Rebutting Evidence Cited by Them, 1910.

XIV. [Heron, David,] Amy Barrington and Karl Pearson, A Preliminary Study of Extreme Alcoholism in Adults, 1910.

XV. Treasury of Human Inheritance, Parts VII and VIII, 1911.

XVI. Treasury of Human Inheritance, Part IX, 1912.

XVII. Heron, David, A Second Study of Extreme Alcoholism in Adults, 1912.

XVIII. Elderton, E. M., Barrington, A., Jones, H. Gertrude, Lamotte, Edith M.M., Laski, H. J., and Pearson, K., On the Correlation of Fertility with Social Value, 1913.

XIX-XX. Elderton, E. M., Report on the English Brith Rate, 1914.

Lecture Series

I. Pearson, Karl, The Scope and Importance to the State of National Eugenics, 1909.
II. Pearson, K., The Groundwork of Eugenics, 1909.
III. Elderton, E. M., The Relative Strength of Nurture and Nature, 1909.
IV. Elderton, E. M., On the Marriage of First Cousins, 1911.
V. Pearson, K., The Problem of Practical Eugenics, 1910.
VI. Pearson, K., Nature and Nurture. The Problem of the Future, 1910.
VII. Pearson, K., The Academic Aspect of the Science of National Eugenics, 1911.
VIII. Pearson, K., Tuberculosis, Heredity and Environment, 1912.
IX. Pearson, K., Darwinism, Medical Progress and Eugenics, 1912.
X. Pearson, K., On the Handicapping of the First Born, 1914.
XI. Pearson, K., National Life from the Standpoint of Science, 1919 (originally 1901).
XII. Pearson, K., The Function of Science in the Modern State, 1919 (originally 1902).
XIII. Pearson, K., Side Lights on the Evolution of Man, 1921.
XIV. Pearson, K., The Right of the Unborn Child, 1927.

Biometric Laboratory Publications

Questions of the Day and of the Fray

I. Pearson, K., The Influence of Parental Alcoholism on the Physique and Ability of the Offspring. A Reply to the Cambridge Economists, 1910.
II. Heron, D., Mental Defect, Mal-Nutrition, and the Teacher's Appreciation of Intelligence. A Reply to the Critics of Eugenics Laboratory Memoir VIII, 1911.
III. [Elderton, E. M.,] Pearson, K., An Attempt to Correct Some Misstatements of the Critics of a First Study on Parental Alcoholism, 1911.
IV. Pearson, K., The Fight Against Tuberculosis and the Death Rate From Phthisis, 1911.
V. Pearson, K., Social Problems: Their Treatment Past, Present and Future, 1912.
VI. Pearson, K., Eugenics and Public Health, 1912.
VII. Heron, D., Mendelism and the Problem of Mental Defect, I, 1913.
VIII. Pearson, K. and Gustav Jaederholm, Mendelism and the Problem of Mental Defect, II, 1914.
IX. Pearson, K., Mendelism and the Problem of Mental Defect, III, 1914.

X. Pearson, K., The Science of Man; Its Present Needs and Future Prospects, 1920.
XI. Pearson, K., Francis Galton, A Centenary Appreciation, 1922.

Studies in National Deterioration

I. Heron, D., On the Relation of Fertility in Man to Social Status and on the Changes in this Relation that have taken place in the last 50 Years, 1908.
II. Pearson, K., A First Study of Pulmonary Tuberculosis. Inheritance, 1908.
III. Pope, E. G., Pearson, K., and Elderton, E. M., A Second Study of the Statistics of Pulmonary Tuberculosis, Marital Infection, 1909.
IV. Pearson, K., The Health of the School-Child in Relation to its Mental Characters, 1910.
V. Goring, Charles, On the Inheritance of the Diathesis of Phthisis and Insanity, 1910.
VI. Elderton, William Palin, and Sidney Perry, A Third Study of Pulmonary Tuberculosis, 1910.
VII. Snow, E. C., The Intensity of Natural Selection in Man, 1911.
VIII. Elderton, W. P. and Sidney J. Peary, A Fourth Study of the Statistics of Pulmonary Tuberculosis, 1913.
IX. Williams, Mary H., Bell, Julia and Pearson, K., A Statistical Study of Oral Temperatures in School Children, 1914.

WORKS CONSULTED

WORKS CONSULTED

Unpublished Material

I have consulted the archives of both the Galton Eugenics Laboratory and the Eugenics Education Society and some material from the former in the University College London Library. (It should be noted that the laboratory is now known as the Galtón Laboratory in the Department of Human Genetics and Biometry and the society simply as the Eugenics Society.)

The Laboratory Archives had about one dozen parcels of manuscripts, letters, accounts and various documents to do with the early history of the laboratory. These parcels have not been indexed properly and although some have titles on the outside the full nature of their contents was only apparent after opening. The most useful documents were a number of letters to and from Karl Pearson and a fairly detailed copy of the laboratory accounts from 1905 until October, 1913.

The University College Library has many parcels of material which were transferred there from the Galton Laboratory. The bulk of this material which is again unindexed but appears to be labelled accurately on the outside of the parcels is manuscript material connected with the journal Biometrika. It appears to be mostly the copies of manuscripts on which the editors worked in their production of the journal. The parcel numbered 32C,D with which was bound 26B and labelled "Papers for the History of the Lab. 1907-1933" contains a number of useful documents including:

Report to the Galton Laboratory Committee on the Work of the Francis Galton Laboratory for National Eugenics, February 1908-February 1909.

The same for 1909-10.

Report on the Work Done Owing to the Grant made by the Worshipful Company of Drapers to the Department of Applied Mathematics, University of London, University College (1903-9).

Report to the Court of the Worshipful Company of Drapers on the Present Position and Past History of the Laboratories to Which Their Annual Grant has Been Made. [Covers the years 1914-18 mainly and includes a valuable list of some 50 people who had been associated with the laboratories giving some information about their backgrounds and their whereabouts at beginning of 1919.]

Report of the Francis Galton Laboratory Committee for Presentation to the Royal Commission on University Education in London. (January, 1911). (RC)

Journal of the Galton Laboratory 1915-7. [This is a hand-written account of various events at the Laboratory which was written up from time to time by Karl Pearson in moments of leisure.] (GLJ)

Manuscript of letter to the Editor of the Times (June 1919) about the financial needs of the Galton Laboratory.

History of the Biometric and Galton Laboratories. [This is printed as an Appendix to the University of London Senate Minutes, 18 May 1920, and was probably drawn up to be used in an appeal for funds for the laboratories which was being planned at that time.] (HBGL)

Appeal for Funds to Maintain and Extend the Institute of Applied Statistics including the Biometric and the Galton Laboratory for Eugenics, University of London. [This has the date 1925-6 followed by a question mark in pencil on p. 1.]

Report on the Galton and Biometric Laboratories Especially with Regard to Their Income and Expenditure. [?1927 in pencil on cover.] (RGBL)

For the Chairman of the University Court. Memorandum on the History, Finances and Present Scheme of Reorganization of the Galton and Biometric Laboratories University of London. [This appears to have been written in 1932 or 1933 when Pearson's impending retirement caused rethinking about the organization of the laboratories.] All the above appear to be the work of Karl Pearson.

The University College Archives also contain a great deal of material to do with Francis Galton and I was able to quickly look at some of his letters to Pearson and Weldon.

The University College records contained a Minute book covering the period, 1905-13, for the Galton Laboratory Committee, which I was able to see.

I was also permitted to look at the Minutes of the University of London Senate from 1904 to 1922 for the references to the Galton Laboratory. These Minutes are kept in the Library of the University of London. (SM)

The Eugenics Society has a very useful library for the historian of eugenics with an excellent coverage of books and a large collection of reprints to do with eugenic subjects from the beginning of the century. I was also able to see their Minute books from 1907 to 1920.

Other unpublished material referred to was:

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VITA

Lyndsay Andrew Farrall

Born 9 June, 1940, Spring Vale, Victoria, Australia.

Married to Stephanie Nicolle Oats, January 16, 1965, Hobart, Tasmania, Australia.

Education

High School: Scotch College, Melbourne, Victoria, Australia, 1952-7.

University: University of Melbourne, Melbourne, Victoria, Australia, 1958-64. B.Sc., 1961. B.A., 1964.

University of Tasmania, Hobart, Tasmania, Australia, 1965. B.A. (Honours), 1965.

Indiana University, Bloomington, Indiana, U.S.A., 1967-9.

Academic Positions

Demonstrator in Physiology, Victorian College of Pharmacy, Melbourne, Victoria, Australia, 1962-4.
Tutor in Zoology, Christ College, University of Tasmania, Hobart, Tasmania, Australia, 1965.
Lecturer in English, Papuan Medical College, Port Moresby, Papua and New Guinea, 1966.
Tutor in History, Administrative College of Papua and New Guinea, Port Moresby, Papua and New Guinea, 1966.
Visiting Assistant Professor in History and Philosophy of Science, University of Pennsylvania and Bryn Mawr College, Philadelphia, Pennsylvania, U.S.A., 1969.
Lecturer in History, University of Papua and New Guinea, Port Moresby, Papua and New Guinea, 1970-.

Academic Awards

Gowrie Secondary Scholarship, 1955.
Commonwealth of Australia University Scholarship, 1958.
Ormond College Minor Resident Scholarship, 1963.
University of Tasmania Honours Scholarship, 1965.
First-class Honours in History, University of Tasmania, 1965.
Indiana University Fellowship, 1966-7.
Australian-American Educational Foundation Travel Award, 1966-9.
Membership of Sigma Xi, 1969.

Appendix (2019)

Vita (2019)

Academic Qualifications

B.Sc. (Melb) in pre-clinical sciences, statistics and genetics, 1961

B.A. (Melb) in history & history and philosophy of science, 1964

B.A. (Hons) (Tasmania) first class in history, 1965

Ph.D. (Indiana) in history and philosophy of science, 1969.

Academic Appointments

1962-4 Part-time Demonstrator in Physiology, Victorian College of Pharmacy

1965 Part-time Tutor in Zoology, Christ College, University of Tasmania, Hobart

1966 Lecturer in English, Papuan Medical College, Port Moresby

1966 Part-time Lecturer in History, Administrative College of Papua New Guinea

1969 Visiting Assistant Professor of History and Sociology of Science, University of Pennsylvania and Bryn Mawr College, Philadelphia

1970-76 Lecturer then Senior Lecturer (1972) in History of Science and Technology, University of Papua New Guinea, Port Moresby

1976-77 Visiting Senior Fellow in History and Philosophy of Science, University of Leeds

1977-79 Senior Research Fellow in History and Philosophy of Science, University of Melbourne

1979-88 Senior Lecturer then Associate Professor (1985) in Social Studies of Science, Deakin University, Geelong, Australia

1989-2002 Co-Principal then Principal (2001) of The Friends' School, Hobart, Tasmania, Australia.

Major Administrative Responsibilities

At UPNG I was Chair of the History of Science and Technology sub-department (1970-76), Dean of Preliminary Year (Matriculation) Studies (1972), Chair of the History Department (1974), Dean of the Faculty of Arts (1976), and member of the Academic Board (1970-74,1976).

At Deakin University I was Dean of the School of Humanities (1983-88), Member of the Academic Board (1983-88), member of the Vice-Chancellor's Advisory Committee (1983-88) and served on numerous review committees and various planning committees.

Publications

Charlesworth, Max, Lyndsay Andrew Farrall, et al., eds. 1989. *Life among the scientists: An anthropological study of an Australian scientific community*. Melbourne; Oxford: Oxford University Press.

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1. Joe Cain. 2011. *No Ordinary Space: A Brief History of the Grant Museum's New Home at University College London*.

2. Simon Schaffer. 2014. *Mutability, Mobility and Meteorites: On Some Material Culture of the Sciences*.

3. Hsiang-Fu Huang. 2015. *Ouranologia: An Annotated Edition of a Lenten Lecture on Astronomy with Critical Introduction*.

4. Helen Longino. 2016. *Underdetermination: A Dirty Little Secret?*

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9. Lyndsay Andrew Farrall. 2019. *The Origins and Growth of the English Eugenics Movement, 1865-1925*.

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Lyndsay Farrall's 1969 doctoral dissertation reveals the origins and operations of the "biometric school" of eugenics, which developed in London before the Great War. Key figures included Francis Galton, Karl Pearson, and Walter Raphael Weldon. Galton developed the Eugenics Record Office, which became the Galton Laboratory for National Eugenics located at University College London. Farrall tracks the development of research within these units as well as their campaigns for political action and their efforts to enlist others from university communities in London.

Farrall's widely cited original reserarch argues these men developed a distinct subculture within English eugenics focused on statistical and demographic analysis. His study is important for ongoing interest into how universities supported, encouraged, or passively allowed dubious research to develop under their oversight. It offers lessons for the way science succeeds or fails to check its work for bias and misappropriation. It traces the influence of donations on research direction and autonomy.

Facsimile edition.
Farrall, Lyndsay Andrew. 1969.
"The origins and growth of the English eugenics movement, 1865-1925." PhD, Indiana University.

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