

HPSC 3020 Philosophy of Natural Sciences

Course Syllabus

2012-13 session | Jonathan Everett | jonathan.everett.09@ucl.ac.uk

The aim of this advanced (third-year) course is to explore the relationship between philosophy and the natural sciences, with a focus on selected issues in the history and philosophy of modern physics. The course covers the key philosophical debates throughout the history of physics: it begins with questions about the nature of space in the context of Newtonian physics and ends with contemporary questions about the nature of quantum objects. The course is organised into three parts. First we focus on the philosophy of space and time: what is the nature of space? Is our commonsense intuition that time flows from past to future grounded in physics? Second, we focus on scientific revolutions: what happens when a scientific revolution occurs? Might philosophy have a role to play in driving revolutions? Third, we look at what quantum physics tells us of physical reality: in what ways does quantum physics force us to revise our common sense intuitions about physical reality? These questions are all addressed by looking at specific episodes from the history of physics.

Course Information

Basic course information

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|------------------|--|
| Course website: | |
| Moodle Web site: | https://moodle.ucl.ac.uk/course/view.php?id=8138 |
| Assessment: | Coursework (3,000 words) (50%), Examination (3 hours) (50%) |
| Timetable: | www.ucl.ac.uk/sts/hpsc |
| Prerequisites: | Completion of HPSC1003 and HPSC2003 is preferred. However, students that have not completed either of these courses, but nonetheless have good background knowledge in philosophy and/or physics are welcome too (please contact the course tutor for any query on prerequisites, if you are uncertain). |
| Required texts: | |
| Course tutor: | Jonathan Everett |
| Contact: | jonathan.everett.09@ucl.ac.uk |
| Web: | www.ucl.ac.uk/silva/sts/staff/[insert where applicable] |
| Office location: | 22 Gordon Square, Room B14 |
| Office hours: | Monday, 2-3 Friday, 1-2 |

Schedule

| UCL Week | Topic | Date | Activity |
|----------|--|------------------------|--|
| 6 | Introduction: Newton's argument for absolute space | Tue 2/10 Fri 5/10 | |
| 7 | Absolute vs. relative space and the Leibniz-Clarke correspondence | Tue 9/10 Fri 12/10 | |
| 8 | From Newton to Mach to Einstein: the development of general relativity | Tue 16/10 Fri 19/10 | |
| 9 | Thermodynamics and the direction of time | Tue 23/10 Fri 26/10 | |
| 10 | Immanuel Kant on space and time | Tue 30/10 Fri 2/11 | |
| 11 | Reading Week | | Submit 500 word plan for essay (by 9/11) |
| 12 | The Kantian legacy for 20c. physics: the relativistic revolution | Tue 13/11 Fri 16/11 | |
| 13 | Niels Bohr and the Copenhagen Interpretation of Quantum Mechanics | Tue 20/11 Fri 23/11 | |
| 14 | The interpretation of Quantum Physics I: Bohr, Einstein-Podolsky-Rosen and the Bell Inequalities | Tue 27/11 Fri 30/11 | Submit first draft of essay (by 23/11) |
| 15 | The interpretation of Quantum Physics II: solving the measurement problem | Tue 4/12 Fri 7/12 | |
| 16 | Individuality in quantum physics: the move towards structuralism | Tue 11/12 Fri 14/12 | Deadline for assessed essay |

Assessments

Summary

| | Description | Deadline | Word limit |
|-------|-------------|--|------------|
| Essay | | 23h59 Thursday 13 th December | 3000 |
| Exam | | TBA | |

Assignments

Suggested Essay Questions:

1. What is the role of the principle of identity of indiscernibles in Leibniz's criticism of Newton's absolute space? Can the idea of absolute space be defended in light of this criticism?
2. Why can Mach be regarded as being on the same conceptual path as Leibniz? How might this conceptual path lead to the theory of relativity?

3. What does it mean to say that space is transcendently ideal and empirically real?
4. Can Kant's understanding of scientific knowledge be successfully applied to twentieth century physics?
5. Are electrons objects?

Alternative questions should be agreed by 26th October, prior to the submission of the 500 word plan.

Essays must be submitted via Moodle .

In order to be deemed 'complete' on this module students must attempt both the essay and the exam.

Criteria for assessment

The departmental marking guidelines for individual items of assessment can be found in the STS Student Handbook.

Aims & objectives

The aim of this course is to explore the relationship between physics and philosophy from Newton to the present. The course seeks to show how some of the earliest philosophical questions that were asked of physics have continued relevance today and, in so doing, to provide an overview of the field that will act as a firm foundation for future study of the subject.

By the end of this course students will have a good understanding of the central issues in philosophy of physics and have demonstrated this through assessments as well as through orally presenting an analysis of a key text and participation in discussion in seminars.

Reading list

SOURCES FOR BACKGROUND READING AND GENERAL REFERENCE

Introductory books:

Sklar, L. (1974). *Space, Time and Spacetime*. Berkeley: University of California Press

Albert, D. Z. (2000). *Time and Chance*. Harvard University Press.

Albert, D. Z. (1992) *Quantum Mechanics and Experience*. Harvard University Press

Rae, A. (2004). *Quantum Physics: Illusion or Reality?* Cambridge: Cambridge University Press.

Cushing, J. T., *Philosophical Concepts in Physics*. Cambridge: Cambridge University Press.

Sklar, L. (1992). *Philosophy of Physics*. Boulder: Westview Press.

More advanced and technical texts

Friedman, M. (1983). *Foundations of Space-Time Theories: Relativistic Physics and Philosophy of Science*.

Sklar, L. (1993). *Physics and Chance*. Cambridge: Cambridge University Press.

Dickson, M. (2007). Non-Relativistic Quantum Mechanics. In J. Butterfield and J. Earman (Eds.), *Handbook of the Philosophy of Physics*. Elsevier. (Available online: <http://philsci-archive.pitt.edu/3321/>)

Redhead, M. (1990). *Incompleteness, Non-locality and Realism*. Oxford: Clarendon Press.

NB: The readings assigned for seminar discussion on each Unit are an integral part of the Required Reading for that Unit. Any topic that is discussed in the Required Reading is examinable.

Unit 1. Newton's argument for absolute space

Required readings

Newton, I. (1729). *Philosophiæ Naturalis Principia Mathematica* (trans. A. Motte), General Scholium to Def. VII. Available online: <http://plato.stanford.edu/entries/newton-stm/scholium.html>

Newton, I. 'On the gravity and equilibrium of fluids'. In N. Huggett, *Space from Zeno to Einstein*, pp.107-115.

For seminar discussion

Janiak, A. (2008). *Newton as Philosopher* (CUP), ch.5, pp.130-162.

Further readings

Barbour, J. (1989). *Absolute or relative motion? : a study from a Machian point of view of the discovery and the structure of dynamical theories. Vol.1, The discovery of dynamics* (Cambridge University Press), ch.11, pp.628-639.

B. Dainton (2001) *Time and Space* (Acumen), ch.10.

DiSalle, R. (2002). 'Newton's philosophical analysis of space and time'. In I. B. Cohen and G. E. Smith (Eds.), *The Cambridge Companion to Newton* (CUP), pp. 35-56.

Huggett, N. (1999). *Space from Zeno to Einstein: Classic Readings with a Contemporary Commentary* (MIT Press). Commentary to ch.7.

Koyré, A. (1968) *From the closed world to the infinite universe*, ch. X.

Rynasiewicz, R. (1995). 'By Their Properties, Causes and Effects: Newton's Scholium on Time, Space, Place and Motion—II. The Context', *Studies In History and Philosophy of Science* 26: 295–306.

Unit 2. The Leibniz-Clarke controversy on the nature of space and time

Required readings

Sklar, L. (1974) *Space, Time and Spacetime* (University of California Press), pp. 157–181.

Koyré, A. (1968) *From the closed world to the infinite universe*, ch. XI.

For seminar discussion

Alexander, H. (1956) *The Leibniz–Clarke correspondence* (Manchester University Press), pp. 36-54 (Leibniz's fourth paper and Clarke's fourth reply).

Further readings

- Black, M. (1952). 'The Identity of Indiscernibles', *Mind* 61: 153–64
- J. Earman, (1989) *World Enough and Space-Time* (MIT), ch.1
- Garber, D. (1994). 'Leibniz: Physics and Philosophy', *Cambridge Companion to Leibniz*, pp. 301–309 only (see the rest of the article for a useful introduction to Leibniz).
- Huggett, N. (1999). *Space from Zeno to Einstein: Classic Readings with a Contemporary Commentary* (MIT Press). Commentary to ch.8.
- McDonough (2007). 'Leibniz's philosophy of physics'. *Stanford Encyclopedia of Philosophy*, <http://plato.stanford.edu/entries/leibniz-physics/>,

Unit 3. From Newton to Mach to Einstein: the development of general relativity

Required readings

- B. Dainton (2001) *Time and Space* (Acumen), ch.11.
- Norton, J. (1995) 'Mach's principle before Einstein' in J. Barbour (ed.) *Mach's Principle: from Newton's bucket to quantum gravity. Einstein Studies: vol. 6* (Boston), pp. 9-57 available online: <http://www.pitt.edu/~jdnorton/papers/MachPrinciple.pdf>

For seminar discussion

- Mach, E. 'Newton's views of time, space, and motion', from *The Science of Mechanics*, extract reprinted in N. Huggett *Space from Zeno to Einstein* (MIT Press), pp. 174–180.

Further readings

- Kosso, P. (1998) "The General Theory of Relativity" in *Appearance and Reality* (Oxford University Press), ch.4.
- Laymon, R. (1978) 'Newton's bucket experiment', *Journal of the History of Philosophy* **16**, pp. 399–413
- L. Sklar (1974) *Space, Time and Spacetime* (University of California Press), pp. 182–191; 198–202; 210–221 only.
- Stein, H. (1977) 'Some philosophical prehistory of general relativity' in Earman and Glymour (Eds.), *Minnesota Studies in Philosophy of Science: vol. 8. Foundations of Space-Time Theories*, pp. 3–27
- Hofer, C. (1996) 'The metaphysics of spacetime substantivalism', *Journal of Philosophy* **93**: 5–27

Unit 4. Thermodynamics and the direction of time

Required readings

- D.Z. Albert (2000) *Time and Chance* (Harvard University Press), ch. 1-2.
- H. Price "On the origins of the arrow of time: why there is still a puzzle about the low-entropy past" in C. Hitchcock (Ed.) *Contemporary debates in philosophy of science* (Blackwell), pp. 219-39.

For seminar discussion

- R. Le Poidevin *Travels in Four Dimensions* (Oxford University Press), ch. 12 only pp. 202–220 and pp. 229–233.

Further readings

- Harman, P. M. (1982). *Energy, Force, and Matter: the Conceptual Development of Nineteenth-Century Physics* (CUP), ch. 3, for the history of the 2nd law of thermodynamics.
- Sklar, L. (1993). 'Up and down, left and right, past and future'. In R. Le Poidevin and M. MacBeath (eds.) *The Philosophy of Time* (Oxford University Press), pp. 99–116.
- L. Sklar (1974) *Space, Time and Spacetime* (University of California Press), pp.351-378.
- Grünbaum, A. *Philosophical Problems of Space and Time*, pp. 209–236 only; and ch. 10.
- Black, M. (1959) 'The Direction of Time', *Analysis* **19**, p. 54.

Unit 5. Immanuel Kant on space and time

Required readings

- DiSalle, R. (2006). *Understanding Space-Time* (CUP), pp.55-72.
- Shabel, L. (2010). 'The Transcendental Aesthetic'. In P. Guyer (Ed.), *The Cambridge Companion to Kant's Critique of Pure Reason* (CUP), pp.93-117.

For seminar discussion

- Kant, I. (1973). 'Transcendental ideality of space and time', extracts from the *Critique of Pure Reason*, reprinted in J. Smart *Problems of Space and Time*, pp. 104– 123.

Further readings

- Gardner, S. (1999). *Routledge Philosophy GuideBook to Kant and the Critique of Pure Reason* (Routledge), ch.4.
- Guyer, P. (1992). 'Introduction: the starry heavens and the moral law', in P. Guyer (Ed.) *The Cambridge Companion to Kant* (CUP), pp. 1–24.
- Hatfield, G. (2006). 'Kant on the perception of space (and time)' in P. Guyer (Ed.) *The Cambridge Companion to Kant and Modern Philosophy* (CUP), pp. 61–93.
- Wilkerson, T. E. (1976) *Kant's Critique of Pure Reason. A commentary for students* (Oxford: Clarendon Press), ch. 1-2.

Unit 6. The Kantian legacy for 20c. physics: the relativistic revolution

Required readings

- Ryckman, T. (2010). 'The "Relativized A Priori": An Appreciation and a Critique'. In Domski and Dickson (Eds.) (2010). *Discourse on a New Method: Reinvigorating the Marriage of History and Philosophy of Science* (Open Court), pp.455-470.
- Friedman, M. (1999). *Reconsidering Logical Positivism* (CUP), ch. 3.

For seminar discussion

Friedman, M. (2001). *Dynamics of Reason* (CSLI), pp.71-103.

Further readings

DiSalle, R. (2006). *Understanding Space-Time* (CUP), ch. 4, especially pp.98-120 but all is helpful.

Friedman, M. (2000). 'Transcendental Philosophy and A Priori Knowledge: a Neo-Kantian Perspective', in P. Boghossian and C. Peacocke (eds.) *New Essays on the A Priori* (Oxford: Clarendon Press).

Friedman, M. (2010). 'Synthetic History Reconsidered'. In M. Domski & M. Dickson (Eds.) *Discourse on a New Method: Reinvigorating the Marriage of History and Philosophy of Science* (Open Court), pp.696-729.

Howard, D. (2005). "'No Crude Surfeit": A Critical Appreciation of *The Reign of Relativity*', <http://www.nd.edu/~dhoward1/Reign.pdf>

Ryckman, T. (2001). "Early Philosophical Interpretations of General Relativity" in the online *Stanford Encyclopaedia of Philosophy*: <http://plato.stanford.edu/entries/genrel-early/>

Ryckman, T. (2005). *The Reign of Relativity: Philosophy in Physics 1915-1925* (OUP), ch.3.

Unit 7. Niels Bohr and the Copenhagen Interpretation of Quantum Mechanics

Required readings

Sklar, L. (1992) *Philosophy of Physics* (OUP), ch. 4 pp.157–179 only.

Kosso, P. (1998) *Appearance and reality* (OUP), ch. 6, pp. 110–133.

For seminar discussion

Bohr, N. (1937) 'Causality and complementarity' *Philosophy of Science* 4, pp.289-98.

Further readings

Cushing, J. (1998) *Philosophical concepts in physics* (CUP), ch. 20 [more technical chapter].

Folse, H. (1985) 'The birth of complementarity' in Folse *The philosophy of Niels Bohr: the framework of complementarity* (North Holland), ch. 4.

Holton, G. (1973) 'The roots of complementarity' in Holton *Thematic Origins of Scientific Thought* (Harvard University Press), ch. 4.

Hooker, C. (1994) 'Bohr and the crisis of empirical intelligibility. An essay on the depth of Bohr's thought and our philosophical ignorance' in J. Faye (Ed.) *Niels Bohr and contemporary philosophy* (Kluwer), pp. 155–187: Part I and III only.

Murdoch, D. (1987) *Niels Bohr's philosophy of physics* (Cambridge University Press), ch. 3-4.

Rae, A. (2004, 2nd ed.) *Quantum Physics: illusion or reality?* (CUP), ch. 1.

Unit 8. The interpretation of Quantum Physics I: Bohr, Einstein-Podolsky-Rosen and the Bell Inequalities

Required readings

Albert, D. (1992). *Quantum Mechanics and Experience* (Harvard University Press), Ch. 3
Einstein, Podolsky, Rosen 'Can Quantum-Mechanical description of Physical Reality Be Considered Complete?' *Physical Review* **47**, 777-780. Available online:
http://prola.aps.org/abstract/PR/v47/p777_1

For seminar discussion

Bohr, N. (19'Can Quantum-Mechanical description of Physical Reality Be Considered Complete?' *Physical Review* **48**, 696-702 Available online:
http://prola.aps.org/abstract/PR/v48/p696_1

Further readings

- Bohr N. (1958). 'Discussion with Einstein on Epistemological Problems in Atomic Physics' in N. Bohr, *Atomic Physics and Human Knowledge*, pp. 32-66.
Cushing, J. (1994). *Quantum Mechanics: Historical Contingency and the Copenhagen Hegemony*, (University of Chicago Press) chapter 3, pp. 24-41
Folse, H. (1989) 'Bohr on Bell' in J. T. Cushing and E. McMullin (Eds.), *Philosophical Consequences of Quantum Theory. Reflections on Bell's theorem* (University of Notre Dame), pp. 254–271.
Howard, D. (1989) 'Holism, separability and the metaphysical implications of the Bell experiments' in J. T. Cushing and E. McMullin (Eds.) *Philosophical Consequences of Quantum Theory. Reflections on Bell's theorem* (University of Notre Dame), pp. 224–253.
Howard, D. (1985) 'Einstein on Locality and Separability', *Studies in History and Philosophy of Science* **16**: 171-201.
Maudlin, T. (1994). *Quantum non-locality and relativity*. (Blackwell), especially ch. 1 (pp.6-28), ch. 5 (pp.125-161) and ch. 7 (pp.189-222).
Mermin, N. D. (1981) "Quantum Mysteries for Anyone" *Journal of Philosophy* **78**: 397-408
Rae, A. (2004, 2nd ed.) *Quantum Physics: illusion or reality?* (CUP), ch. 3-4.
Redhead, M. (1987). *Incompleteness, nonlocality and realism: a prolegomenon to the philosophy of quantum mechanics*. (Clarendon, 1987). Chapter 3 and 4. pp71-118

Unit 9. The interpretation of Quantum Physics II: solving the measurement problem

Required readings

- Albert, D. (1992). *Quantum Mechanics and Experience* (Harvard University Press), Ch. 4 and ch. 5, pp. 80-92, ch. 6
Rae, A. (2004). *Quantum Physics: Illusion or Reality?* (CUP), ch.4.

For seminar discussion

Brown, H. and Wallace, D. (2005). 'Solving the measurement problem: de Broglie-Bohm loses out to Everett'. *Foundations of Physics* 35:517-540.

Further readings

Albert, D. (1992). *Quantum Mechanics and Experience* (Harvard University Press), ch.7 (for an introduction to de-Broglie-Bohm).

Redhead, M. (1989). *Incompleteness, Nonlocality and Realism*, (Clarendon Press) ch. 2, pp. 44-70.
Saunders, S. "What is the problem of measurement?" available at <http://www.hcs.harvard.edu/~hrp/issues/1994/Saunders.pdf>
Saunders, Barrett, Kent and Wallace (Eds.) (2010). *Many Worlds? Everett, Quantum Theory and Reality*. (OUP) See, especially, ch.4, 7, 11, 12 and 16. (Chapter 16 is a response to the argument in the seminar reading).

Unit 10. Individuality in quantum physics: the move towards structuralism

Required readings

Massimi, M. (2011). 'Structural Realism: A Neo-Kantian Perspective'. In P. Bokulich & A. Bokulich (Eds.), *Scientific Structuralism* (pp. 1-23). Berlin: Springer.
Saunders, S. (2006). 'Are quantum particles objects?' *Analysis* 66: 52-63

For seminar discussion

French, S. and Ladyman, J. (2003). 'Remodelling structural realism: quantum physics and the metaphysics of structure' *Synthese* 136: 31-56

Further readings

Bueno, O. (1999). 'What is structural empiricism? Scientific change in an empiricist setting' *Erkenntnis* 50 (1): 55-81.
French, S. (2001). 'Symmetry, Structure and the Constitution of Objects', <http://philsci-archive.pitt.edu/327/>
French, S. and Redhead, M. (1988). 'Quantum Physics and the Identity of Indiscernibles'. *British Journal for the Philosophy of Science* 39: 233-246
Ladyman, J. and Ross, D. (2007). *Every Thing Must Go* (OUP), ch. 3.
Mittelstaedt, P. (2009). 'The Constitution of Objects in Classical Physics and in Quantum Physics'. In M. Bitbol, P. Kerszberg and J. Petitot (Eds.), *Constituting Objectivity: Transcendental Perspectives on Modern Physics* (pp. 169-181), Berlin: Springer.

Course expectations

Students are expected to attend the lecture and the seminar each week. The lectures will be used to explain the main ideas of each topic and the seminars will be used for discussion of each topic. It is expected that students attend the seminars having completed the week's required reading and seminar reading and that they engage in discussion of the seminar reading. The questions addressed in both the required readings and seminar readings are examinable.

Each student will be expected to provide an oral précis of one seminar reading (of about 15-20 minutes). This is intended to kick off debate in class on the assigned topic: you will be expected to critically explore and evaluate the alternative philosophical views on a given

subject and identify the most pertinent questions for discussion. This will help enhance your critical and argumentative skills, as well as your communication skills (which is an essential part of your training as third-year students preparing for the final year dissertation and for future job interviews and/or post-graduate studies).

Assessment for this module is 50% by examination and 50% by an assessed essay. The essay is expected to critically engage with one of the topics covered in class. There are 5 suggested essay titles, but you are free to agree another topic with the module tutor. There are two (voluntary, but encouraged) deadlines before the final draft of the essay is due at the end of term. You should be thinking about what subject you would like to write your essay on in the first term, and should submit a 500 word plan by the end of reading week. I will accept first drafts of the essay until 30th November and will return comments within the next week.

Important policy information

Below are listed some important points of policy. Further details of all these policies can be found in the STS Student Handbook www.ucl.ac.uk/sts/handbook

Late submission of coursework

Penalties for late coursework submission are as follows:

- loss of 5 marks for work submitted less than 24 hours late
 - loss of 15 marks for work submitted between 1 and 7 days late
 - loss of all marks (i.e. work is graded 0) if submitted more than 7 days late
- These rules are statutory and non-negotiable.

Coursework word limits

Penalties for over-length coursework are as follows:

- Assessed work should not be more than 10% longer than the prescribed word count. Assessed work with a stated word count above this maximum cannot be accepted for submission, but will be immediately returned to the student with instructions to reduce the word length. The work may then be resubmitted, except insofar as penalties for late submission may apply.
- If submitted work is subsequently found to have an inaccurately stated word count, and to exceed the upper word limit by at least 10% and by less than 20%, the mark will be reduced by ten percentage marks, subject to a minimum mark of a minimum pass assuming that the work merited a pass.
- For work which exceeds the upper word limit by 20% or more, a mark of zero will be recorded.
- Footnotes and endnotes **do** count as part of the word limit
- Bibliography, tables, pictures and graphs **do not** count as part of the word limit.

Extensions

If unforeseeable circumstances prevent the completion of a piece of coursework, students may

request an extension to the set deadline. Please consult the STS Student Handbook for further guidance on acceptable grounds for requesting an extension. Extensions must be negotiated in advance with the course tutor. Students to whom STS is parent department may also request an extension from their Personal Tutor. No extension is considered official without written approval.

The request for extension form can be found at: www.ucl.ac.uk/sts/study

Plagiarism

The *UCL Student Handbook* defines plagiarism as “the presentation of another person’s thoughts or words or artefacts or software as though they were [your] own”. Students are expected to know the College and Department policies in detail and to avoid even the appearance of inappropriate behaviour. In the first demonstrated instance of plagiarism or other irregularities in this course, students normally will receive a 0 F for the course and will be referred to the department and College officials for further action. All course work is subject to scrutiny against past papers and other materials for irregularities. Electronic and other checks will be conducted; see the *STS student handbook* for additional information.

Attendance

Regular attendance is mandatory.

Requirements to complete modules

Students are required to be ‘complete’ in all modules. Normally all assignments must be attempted in order for students to be considered complete. This is different from ‘passing’ a module which requires a minimum overall module mark of 40%.

Assessment and additional examiners

Assessed materials are marked by the course tutors. These provisional marks will be distributed to students at the first opportunity. To ensure fairness, materials subsequently are scrutinised by a second examiner within the Department, and a consensus is reached on these separate assessments. All assessed materials and the consensus marks are made available for scrutiny by an examiner external to UCL. Marks are considered final only after the Board of Examiners for Science and Technology Studies has approved them in their annual meeting near the close of Term three.

Disputed marks

Students must endeavour to discuss any grievances over marks informally with the course tutor in the first instance. If informal discussion fails to resolve the matter satisfactorily and there appears to be genuine and substantive grounds for appeal, the student should submit a written explanation of their grievance to the chair of the board of examiners. A final formal written appeal can be made to the College Registrar.

Mechanisms for student feedback

Students have a variety of means for commenting on the module and module tutor. These

include written module evaluations at the end of term, regular lecture assessments offered by the module tutor, and in-session opportunities. Students are welcome to bring comments and criticisms to the module tutor in the first instance, by anonymous note if necessary, then to their personal tutor or the STS undergraduate tutor. The department schedules regular meetings of the Undergraduate Student Staff Consultative Committee to which all students are invited.
