sophia

Issue 2 Feb 2009

Fairy tales: medicine and nationalism
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Measuring global happiness
Would Frege survive the RAE?

Sophia Issue 2

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Cover image: Electrochemistry is primarily done in the liquid phase and, to a lesser extent, the solid phase. Until recently, the gas phase has remained largely unexplored. My research focuses on investigating how flames can be used as an electrolyte to perform electrochemistry.

Matthew Li , PhD student, Chemistry (with help from Andrew Yeo)

Editorial

A scientist in his laboratory is not only a technician,' wrote Nobel prize-winner Marie Curie, 'he is also a child placed before natural phenomena which impress him like a fairy tale.' Does today's world of science research retain that sense of wonder? As research initiatives become more and more dependent on bureaucracy-driven assessments, Donald Gillies argues that we risk losing those in science who dare to dream. Still, for Serena Viti the natural phenomena seen in the birth and death of stars are proof that ethereal wonders abound even in the relatively stark conditions of deep space. Artist Laura Cinti, too, finds inspiration from the techniques of the laboratory in her photographic investigation of the lives of plants.

We're delighted to be publishing Issue 2 of *Sophia*, and grateful for another fantastic range of contributions and for the warm reception and constructive feedback we received on Issue 1. Aside from its UCL distribution, *Sophia* has been selected for a reading programme run by the Italian Ministry of Education – Project Poseidon. We are also hugely grateful for funding which came from the UCL Friends' Trust in order to print this issue.

We are increasingly convinced that the success of research and the flow of ideas relies almost as much on the informal storytelling as the rigorous arguments spelled out in journals and conference papers. Fitting perhaps, then, that in this issue we look at the power of the fairy tale; both in chronicling medical complaints (or perhaps paranoias?), and in forming the basis of a cultural identity in the early years of a fledgling nation.

Again, we hope you enjoy this issue, and welcome written or photographic contributions for the next.

"The task set in every fairy tale is to free the abducted princess, kill the witch, giant or sorcerer and return home. Perhaps the struggle in the foreign land is made all the more grim by the inescapable awareness that, in the distinct political sense, there is no home to return to"

Susanne Kord
p. 16

Team

Sophia is a volunteer-run magazine aiming to showcase talent in research, writing and art from current UCL staff and graduate students.

By publishing academic content written for a general readership, *Sophia* hopes to encourage the sharing of ideas and an appreciation of the advances being made in areas of research other than our own; and to act as a forum for the discussion of academic issues and current affairs.

In creating *Sophia* we hope to provide opportunities for graduate students to begin writing about their work and for established researchers to write more creatively and for a broader audience than in a specialist journal. We believe that providing this platform will help contributors to develop as writers as well as giving readers an insight into the diverse spectrum of research taking place at the university.

If you are interested in submitting content then please contact the editor or relevant section editor. Submission guidelines are listed on our website:

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Health, equity and globalization – Professor Kazatchkine, Lancet Lecture

'Rich countries cannot forget, in times of economic downturn, their responsibility to help minimise the global inequities.' This, the central theme to Professor Kazatchkine's gripping lecture on health, equity and globalisation. Kazatchkine, executive director of The Global Fund to fight Aids, Tuberculosis and Malaria, talked of how globalisation and unprecedented global economic growth in the past decade – especially from that of the BRIC bloc: Brazil, Russia, India and China – has contributed to poverty reduction. The dark side to this, however, is that inequity within these countries has widened, and so has the gap between rich and poor countries; illustrated by the difference in gross national income between the richest and poorest countries increasing from a factor of 60 in 1980 to over 120 in 2005. Furthermore, current projections from the World Bank predict a marked fall in economic growth this year which equates to an additional 40 million people in the poverty bracket. In the context of health, 90% of the infectious disease burden lies with the developing countries while they represent just 12% of global expenditure on health. An especially poignant comment from Justice Edwin Cameron at the international Aids conference, himself living with Aids, gave a real life perspective to this fact; 'I exist as a living embodiment of inequity … I stand before you because I am able to purchase health and vigour, I am here because I can pay for life itself.'

The combined burden of Aids, malaria and tuberculosis amount to a staggering death toll of 4 million annually, which has fuelled demand for intervention. The Global Fund portfolio boasts over 600 grants awarded in 140 countries, amounting to US$7 billion. Kazatchkine's lecture is filled with case studies showing the achievements of these grants; such as the implementation of bed nets and basic antimalarials in Rwanda, which led to a 64% decline in cases in just over a year. The additional benefits of such dramatic change include the freeing up of medical resources. As one local doctor was quoted: 'hospitals can become hospitals again.'

But with these fantastic examples of how the global fund is operating comes the stark reality that there is a huge battle ahead, increased resources are needed each year for the fight against disease and all donor countries need to honour their commitments. Concern on this point comes with the publication of figures showing that total overseas development assistance contributions, although rising steadily from 2000 to 2005, are now in a state of plateau.

These moderate contributions are completely dwarfed by the huge cash sums being discussed in terms of propping up the banking system but, as purses are tightened, the 'soft' expenditures are first to be cut. It's easy to look to the likes of the new US administration to increase global health funding but, historically, many contributions come from non-government organisations, private companies etc. In essence: the public. But I'm sure many of us, myself included, feel we have more of a right to shun the 'chuggers' on Tottenham court road at the moment – after all, we're broke, right? So what hope is there for securing donations for global health projects in the coming years? Perhaps, at least, the recent rise in sales figures posted from charity shops is encouraging…

Steve Griffiths

A Shakespearean theatre in Gdańsk

On 5 August 2008, Jerzy Limon, Professor of English and Theatre Studies at the University of Gdańsk, gave a lecture on Performativity of Theatre Reconstructions in the newly-built Conference Centre within the campus of the University of Gdańsk in Sopot. Delivered as part of the 27th International Association for Scandinavian Studies Conference on Nordic Drama, Professor Jerzy Limon's talk on Shakespearean theatres invited the audience to reflect not only on the significance of the 'theatrical' spaces where a performance takes place, but also on how these spaces have a performative agency of their own.

This lecture gave an insight into the juxtaposition of temporal dimensions that inevitably occurs when a historical theatre is reconstructed. On the one hand, the newly-constructed building with its modern surroundings differs from the 'original' not only because it is another building altogether, but also because it belongs to another socio-cultural and historical context. On the other hand, this reconstruction creates a connection with the historical building it stands for: it creates – as Professor Limon effec-

tively puts it – a 'fictional past-in-the-present.' The reconstructed theatre pretends to be something that it is not: it is a modern-built building wearing a historical mask. Thanks to this extra level of fictionality, the non-original theatre becomes itself an actor staging a performance, a symbol of the essence of theatricality.

If the first example used by Professor Limon to illustrate his points, namely the Globe Theatre in London, was clearly well-known by the audience, the second one left many surprised and intrigued. The city of Gdańsk has, in fact, its own Shakespearean theatre, the so-called Fencing School. English actors performing in Gdańsk at the beginning of the seventeenth century imported into this city the plays as well as the architectural structure of a permanent theatre, based in this case on The Fortune in London. Built during the seventeenth century, at a time when Gdańsk was the most flourishing centre on the Baltic Sea, this theatre is said to be the first one of its kind to appear on the Continent. By the time the Fencing School in Gdańsk is reconstructed – a project championed by the Theatrum Gedanense Foundation – we shall have another stage on which to experience this combination of 'theatrical' past and present.

Elettra Carbone

The Forum of European Neuroscience: a report

Last summer, I got my first taste of neuroscience outside of the lab and office. The 2008 Forum of European Neuroscience (FENS) was held at Geneva's *Palexpo*. Boasting 5000 delegates, it is second only in magnitude to the equivalent event across the pond, an event so vast that you require a golf buggy to get around.

Over five days of non-stop neuroscience, I saw talks given by world leaders in their fields that I will never forget, on topics ranging from the molecular basis of learning to the mechanisms of drug addiction.

The collective neuroscience mindpower in attendance was tangible throughout, but this muscle was most flexed during intense symposia that were on offer twice daily: a chance to see up-and-coming investigators present their results under intense scrutiny from a 500-strong audience.

Poster sessions were held throughout the day in a hall that could easily serve as a hangar for the nearby airport, and gave PhD students and post-docs a chance to impress the community, some for the first time. My own was quite an experience. When not timetabled to be beside it, I watched from afar as people stood, stared and scribbled, and then used stealth tactics to get a glance at their name badges. During the two hours I was stood by it, I was constantly engaged; spoken to, listened to, spoken at, ignored, praised, lightly poached and grilled, but came out of it feeling more excited about my work than ever before.

Most of my peers had similarly positive experiences, but every single one was approached by someone working not so much in their field, but in a nearby cabbage patch, the boundaries of which it seems are usually uneasily unclear. These are the people who really get the adrenaline going – are they potential collaborators or future rivals?

In fact, the overriding impression I got of the neuroscience community was just how fiercely competitive it is. The research is undoubtedly the better for this, but in this environment, this political model, it is inevitable that some will be left empty handed and bruised. Perhaps this is what had happened to the chap I saw tearing his poster to shreds!

I was also left with the knowledge that this event was incredibly important not only to the individual (post-docs schmoozed with potential employers, young investigators went on recruitment drives and old friends met for collaborative coffees and catch-ups) but also to the community – getting young PhD students up to seasoned professors to reflect on the state of this burgeoning field, which is still in its infancy, can only be a good thing. Getting people to think about matters outside of their own project can be hard enough, but it was certainly achieved here, and I hope that everyone took home as much inspiration for the future as I did.

James Muir

Russia: From the Power of Networks to Networks of Power

In the past year Russia has rarely been far from the headlines. In January the so-called 'gas war' with Ukraine left much of Europe without heating in sub-zero temperatures. Only a few months earlier, the somewhat more conventional war against Georgia in South Ossetia had commentators speculating about the prospect of a 'new Cold War'.

But how much do we really understand about what makes the country tick? To paraphrase the title of Ledeneva's most recent book, how does Russia really work?

Professor Ledeneva's career has been dedicated to analysing the many informal practices that have pervaded

all aspects of Russian life – from the lowly Soviet black market for sausages to the new high stakes world of oligarchs and multi-million pound businesses – and bringing them to the attention of a Western audience. This inaugural lecture gave an insightful overview of how these practices have shaped Russia's post-Soviet transition, and how the economic transition to a free market has radically transformed the practices themselves.

The vast majority of Soviet citizens were well-acquainted with the practice of *blat*: the use of personal contacts to obtain goods and services in short supply. With shortages of everyday goods and basic foodstuffs common under the Soviet planned economy, the use of *blat* was an essential everyday survival tool for ordinary Russians. Being part of a well-connected network was essential. If you worked in a butcher's shop, for example, you could get privileged treatment from everyone from doctors to bureaucrats, providing you were kind enough to set aside a nice cut of meat for them, of course. Favours rather than money were the most important means of exchange. As a phrase from the time went, 'Better 100 friends than 100 roubles.'

With the collapse of the USSR and transition to a free market, shortages of everyday commodities are no longer a problem (although if you are a pensioner, having enough money to buy them might be). Accordingly, Ledeneva notes an interesting transformation in the use of informal practices and acquaintance networks to obtain 'favours'. They are no longer the weapons of ordinary Russians, but rather of the new elite – and the stakes are much, much higher. Before, favours of access from state officials might help you with some personal business, e.g. speeding up a residence permit or getting a telephone line. In the post-Soviet era, for the privileged few, favours of access can guarantee lucrative export licences and government contracts. Who wants to be a millionaire? In Russia, you should certainly phone a friend.

Anna Bailey

European literary cities and circles: meeting and melting pots for literature and languages from 1700 till the present

Long sandy beaches, reclining chairs, beach umbrellas… These are just some of the features often associated with Rimini, one of the most famous Italian seaside resorts on the Adriatic Riviera. Yet, in the last few years, this city has also been the setting of a series of late summer conferences sponsored by the University of Bologna, organised by Professor of Norwegian Language and Literature Randi Langen-Moen and generally followed by a publication containing most of the presented papers. While the theme of these conferences was initially focused on Scandinavian literature, these events have progressively enlarged their horizon in order to embrace the wider field of European literatures and beyond. This year's conference on European Literary Cities and Literary Circles attracted a particularly wide and varied group of scholars and researchers.

Each paper transported the audience in a different 'real' or 'fictional' location. Some contributions concentrated on reconstructing the history and dynamics of literary circles, salons and societies in famous cities, such as Berlin, Copenhagen, Paris, Rome, Oslo, Vienna, but also in less known ones, as for instance Skien – the small town in Norway where the Norwegian playwright Henrik Ibsen was born – or Kongsvinger – the hometown of the Norwegian guest author, Levi Henriksen. Other papers dealt more in detail with how cities and literary or social networks are represented in literature through physical denotations as well as metaphorical meanings. Speakers sketched, for instance, the image of London, Paris and Stockholm in nineteenth-century literature. Great emphasis was also given on how a city can become part of the literary imagination of another country – as in the case of Paris in Russian culture – and on how the representation of well-known surroundings can be 'rediscovered' in the light of multicultural literature.

Speakers were given a generous twenty-five-minute slot to present their papers and – given that there were no parallel sessions – everybody had the chance to listen to all the contributions. The conference was as rich in subject matter as entertaining for its many socialising opportunities. All in all, the theme of the event really addressed the principle that is behind any conference, namely that of creating 'meeting and melting pots' and not merely that of presenting one's own individual paper. By choosing Rimini as the seat of this series of conferences, the organisers have established a sort of custom that keeps up the tradition of the literary circle.

Elettra Carbone

The Princess and the Pea

Traditional fairy-tales provide a medium through which children are warned of dangers and taught about moral values and social norms, but do they also have something to tell us about past understanding of medical conditions? Based on discussions with Dr Hans Lavander, Peter Twachtmann examines the possible link between a tale by Hans Christian Andersen and the rare pain condition fibromyalgia.

The Danish author Hans Christian Andersen (1805–18775) wrote The Princess and the Pea in 1835: one of his first four fairy tales, which was published in the collection Fairy Tales Told for Children (in Danish: *Eventyr, fortalte for Børn*).

In the tale, a prince had returned disappointed after unsuccessfully travelling the world in search of a real princess to take as his bride. One dreadfully rainy and stormy evening back home at his castle, a young woman claiming to be a princess knocked on the gate to ask for shelter. His sceptical mother, the queen, soon found a way to put the supposed princess's claim to the test. Offering her a bed for the night, she stacked the bed with twenty soft mattresses and twenty eiderdowns, but placed a single pea at the very bottom. The next morning the princess complained that she had been kept awake all night and was black and blue all over because she had been lying on something hard. Convinced that her claims of royalty were genuine, the prince married her forthwith.

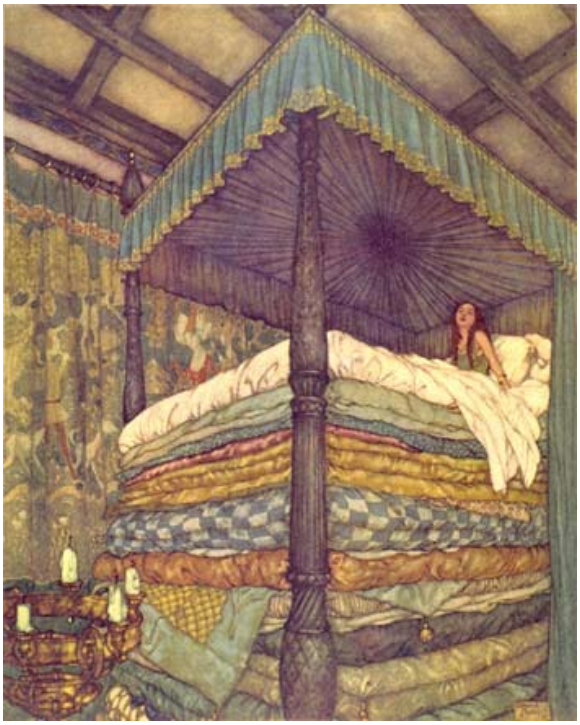
The story evidently contains elements common to many children's stories, but is it accurate to describe it as a fairy tale? A number of details lend weight to the argument that Andersen may in fact have used the tale to describe symptoms of a common medical condition.

A fairy tale is usually a magic story which is not true and is known by its audience not to be true. JRR Tolkien explained that the name is derived not because such stories include fairies, but because that they are about *faerie*: the state or realm in which fairies are present. Scholars usually refer to this type of literature by the German word *Märchen*, meaning a tale, divided into *Volksmärchen* (folk tales) and *Kunstmärchen* (tales of literary art). Tales in either category have usually originated in the European tradition and happen in an undefined place, at an unspecified time. They also often feature physical or character transformation and protagonists tend to have flat personalities without development. Magic is also a common feature.

Clearly, The Princess and the Pea does not fulfil all of these criteria, and indeed Andersen's Danish word *Eventyr*, although correctly enough translated as 'fairy tale', may also stand for 'adventure', 'experience' or even 'risqué romance'. Andersen based the story on a much older Italian folktale, *La piú delicata* (The Most Sensitive Woman), where three hopeful maidens compete to marry a prince in which the one who sustains a serious injury to her foot from a falling rose petal is declared the winner.

Whether fairy tale or adventure, the tale should at least have a message; an objective or a meaning. Bruno Bettelheim, the eminent psychologist, believed that *Märchen* address a child's unconscious dilemmas through their meaning and help resolve them through fantasy. Does Andersen's tale have a message and did he want to tell a cautionary tale?

Andersen is not known as a nineteenth-century combatant for women's rights, and thus one could conclude that the story serves only to encourage his young female



readers to aspire to the period's ideal of the sensitive and delicate woman. While this might be a convincing argument, I am reluctant to accept it: Andersen had a number of lifelong close female friendships that were strictly on an intellectual basis, e.g. the Swedish feminist writer Frederika Bremer (1801–1865) and Henriette Wulff (1804–1858), daughter to Peter Frederik Wulff, the Danish Shakespeare translator, which provides evidence that he saw females as intellectual equals and would not seek to represent their entire gender as fragile and vulnerable.

Sadomasochistic elements have sometimes been ascribed to the story, but there is no reference to such themes in any other of Andersen's works. Furthermore, although there have been a considerable number of expositions of his much-debated sexuality, none suggest that he had tendencies of that nature himself. He has variously been described as homo-, hetero-, trans- or asexual. My own research strongly suggests a platonic bisexuality, without a fulfilled love life or a satisfying sex life. He himself claimed to have remained a virgin all his life. One characteristic that is known, however, is that he was a fully-fledged hypochondriac and, to be fair, a man who was not blessed with good health; he had a closer acquaintance than many with a host of medical complaints. Andersen's obsessively meticulous diaries are full of his health anxieties and *inter alia* chronicle his recurring bouts of unbearable toothache for lengthy periods and those find an echo in the tale of 'Auntie Toothache'. He was also afraid of being buried alive and always had a note on his bedside table, particularly when travelling abroad, which read: 'I am not dead, I am only sleeping.'

Andersen was also a keen observer of human nature and its manifestations and, as an acknowledged good listener, probably came upon descriptions of his friends' and acquaintances' health conditions. Was he, time and again, being told about a condition that had existed for a long time, which caused great misery, but was not until quite recently recognised as an illness at all?

Any medical practitioner today, particularly those practising in rheumatology, will have seen hundreds of patients who complain about their rest and sleep experiences. The symptoms that are usually described include difficulties in finding comfortable positions to sleep in, to the point of being disturbed by creases in sheets; tossing and turning all night because of body aches; being kept awake by tender hips or knees and feeling bruised all over. Even a partner's hug can give more pain than pleasure. These are symptoms of a pain condition named *fibromyalgia* (FM).

It seems very possible that the observant Andersen, suitably allegorical as befits a writer, delivered an early 'case report' by describing some of the core symptoms of this widespread pain condition in his children's story. As an additional detail, patients often mention that humidity and cold wind worsen their pain. This is borne out in Andersen's story when it describes the severe storm and lashing rain as the princess arrives soaking wet at the castle gate prior to her disturbed night's sleep.

Andersen's obsessively meticulous diaries are full of his health anxieties and inter alia *chronicle his recurring bouts of unbearable toothaches. He was also afraid of being buried alive and always had a note on his bedside table, particularly when travelling abroad, which read: 'I am not dead, I am only sleeping'*

Today we know that these symptoms are the result of a patient having sensitised nociceptive pathways (neural pathways which process noxious stimuli). This sensitisation can be provoked by physical and psychological strain or trauma. There is a reported predominance of this condition in women, which fits well with our princess; even

young girls can suffer from this nociceptive sensitisation dysfunction. Clearly, credit for the earliest case report has to go to Hans Christian Andersen!

A small, unpublished pilot study into FM, carried out in Uppsala, Sweden in 1985, examined whether waterbeds could alleviate the symptoms of pain, stiffness and fatigue in sufferers. The hypotheses were first that patients would benefit because of the more evenly distributed body weight, without focal pressure on prominent tender bones and tendon insertion areas, such as the outer hip region or elbows; and second that the adjustment of waterbeds to a warmer temperature could benefit FM patients as they prefer warmth, such as hot showers; conversely their symptoms get worse in colder conditions.

The patients were offered a three-month trial on medium-balanced waterbeds, in an open, slightly biased study. The first follow-up control after two weeks showed unexpected results, as all the patients, independently, had stopped their test after seven to ten days. They cited worsened symptoms and being unable to relax on the waterbed, because of moving and swimming sensations. Despite these early discouraging results, however, the use of waterbeds has since demonstrated a reduction in patients' FM symptoms when two preconditions have been met: confidence in the bed and practising relaxation techniques.

A search for 'fibromyalgia' on the internet will today result in around eight million worldwide references and a combined search with 'waterbed' will show some 65 000 entries.

Would Andersen have agreed that *The Princess and the Pea* has a well-recognised link to fibromyalgia? His original tale ends with the words '*Se, det var en rigtig historie*'. Most translations have rendered this as 'Look, that was a good story', quite correctly – however, the word *rigtig* is open to interpretation, because it can also mean right, proper, correct, true, regular, legitimate, sound – and real.

Was it meant to be a real, an authentic story, one describing a real but not yet recognised pain condition?

Peter Twachtmann is in UCL's Scandinavian Department and Dr Hans Levander is based at Uppsala University Hospital in Sweden

Further reading

1. B Bettelheim, *The Uses of Enchantment: The Meaning and Importance of Fairy Tales*

2. V Propp, *Morphology of the Folktale*

3. P Twachtmann, *Hans Christian Andersen: Love and Sexuality*

4. H Lavander, Sensory Sensitisation, Part I: Mechanism behind Fibromyalgia, 'So my wife's pain system has become unnecessarily efficient' , *Läkartidningen*, 2003 (in Swedish with English summary)

Astrochemistry: the Making of Stars and Planets

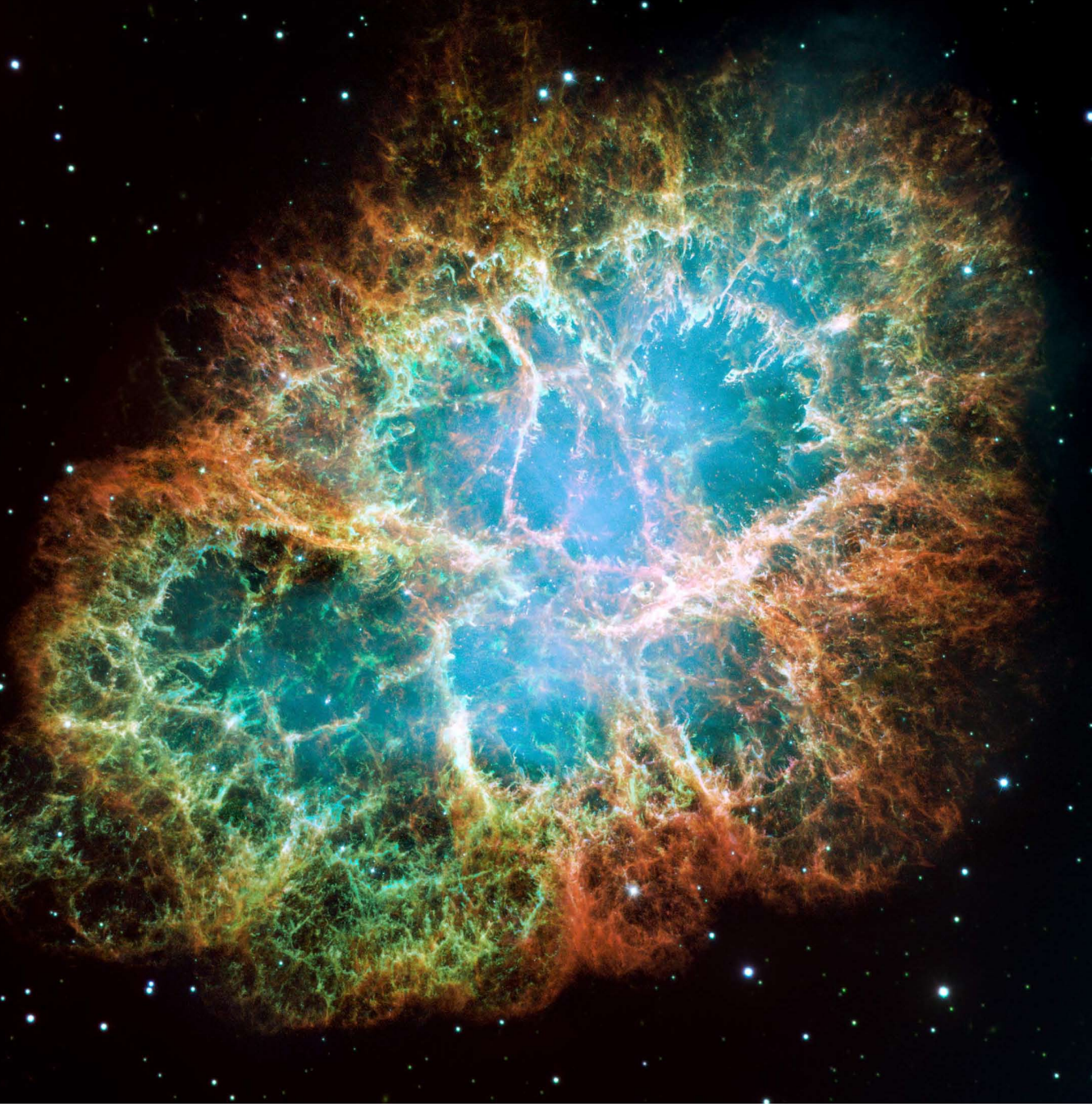
The surface of the Earth is host to a staggering array of molecular species, constantly being created by the metabolism of organisms and through other natural phenomena. In the cold depths of space, on the other hand, chemical interactions are a comparatively rare event. How, asks Serena Viti, are molecules formed in these stark conditions and how does this allow one generation of stars to seed the formation of the next?

How did the first stars form? Will the universe ever run out of star and planetary fuel? How do solar-like systems and Earth-like planets form? These are some of the most intriguing questions that humans have been asking for centuries. One certainly does not need to be an astronomer to gaze at the wonders of the universe! While the answers to such questions are very complex and, for sure, still unsatisfactory, exploring the skies has allowed us to make giant steps towards understanding how the universe works. Astronomical observations have revealed an amazing story, full of 'life' and 'chemistry'. This short article is about some of the main, and yet often neglected, characters in this story: molecules.

Molecules are formed in most places in the universe that are cooler than the sun, and they usually have a significant role to play. In particular, observations have shown that molecules are very abundant in dense regions of space called molecular clouds. These clouds are the nurseries of new stars and planets. The conditions in these clouds are extremely harsh. Temperatures barely rise above a few Kelvin and pressures are extremely low (hundreds or thousands of atoms or molecules per cubic centimetre – far fewer than the 10^{19} particles per cubic centimetre in our atmosphere). This means that almost all of the chemistry that we are familiar with does not work. So, how can molecules form in the birth sites of stars in the first place? At the low pressures found in the interstellar medium, the time between collisions is immense. While there are some types of reactions that can occur in the harsh conditions of the interstellar medium, some molecules, including the most abundant one, molecular hydrogen, are present in abundances that cannot be accounted for only by gas phase reactions. Astronomers have therefore suggested that these molecules may instead be formed by reactions which take place on the surface of dust grains, where the latter act as catalysts.

The role of molecules in tracing and probing stellar and planetary formation is well established, but it turns out that they actually have a much wider role in star formation than that; they actively control star formation. Indeed, without molecules, the universe as we know it might not exist; since stars are formed when molecular clouds collapse and their density increases. Compression of the cloud heats the gas up to high temperatures that would lead to a halt of the collapse. In order for the star formation process to continue, it is therefore necessary for the cloud to cool. So how does this cooling occur?

We know that for life to evolve, chemical building blocks such as carbon and oxygen for example, liquid water and an energy source are needed. All these ingredients, albeit in different forms, are present in molecular clouds



The Crab Nebula: remnants of a star which collapsed, forming a supernova.

As the molecular cloud collapses, hydrogen atoms present in the cloud react to form molecular hydrogen on the dust grains; other important molecules such as carbon monoxide form too. These molecules then play a very important role; they help to cool down the gas in the star-forming regions by emitting heat, mostly in the form of infrared radiation. Eventually the temperature in the clouds cools down to about 10 degrees Kelvin. When stars die, either exploding as supernovae (as in the case of very massive stars) or slowly as planetary nebulae (as in the case of stars such as our sun), they seed the universe with heavy elements and dust, thus contaminating other collapsing molecular clouds. Further generations of stars are then formed when such clouds start to collapse.

So far so good. Yet if stars need molecules in order to form and molecules form on dust particles and dust originates from dying stars, then how were stars formed in the first place? This is one of the most intriguing questions in

astronomy. One of the most plausible explanations is that the first-generation stars were massive and short-lived; the high mass ensured that enough molecular hydrogen was formed in the gas and, since very large stars die young, the universe quickly filled up with the elements needed to kick-start the next generation of stars. Thus the star cycle as we know it came to be.

Molecules play an important role in planetary formation too. The most commonly accepted theory is that planets develop during the early stages of the formation of a star from a thin disc of gas and dust. Atoms and molecules within this disc combine to form larger particles. Close to the star the stellar heat vaporises the light elements and rocky planets form from the remaining solid matter. Further from the star it is cold enough that even light elements stay frozen and giant planets form. In fact, during star and planetary formation, dust grains continue to act as a catalyst allowing for the formation not only of simple molecules such as molecular hydrogen but also of more complex molecules, such as methanol, formic acid and many hydrocarbons. These are organic species and are sometimes referred to, in a very loose sense, as 'prebiotic'. So I leave you with one last question: could they be the precursors to life? We know that for life to evolve (or at least life as we know it) chemical building blocks such as carbon and oxygen for example, liquid water and an energy source are needed. All these ingredients, albeit in different forms, are present in molecular clouds. In fact, recently the simplest sugar (glycolaldehyde) was detected in a star forming region. Glycolaldehyde molecules can be connected together to form chains or can be incorporated into larger sugar molecules such as ribose, which is part of the backbone of RNA. We may not be that far from discovering life in the universe after all.

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Further reading

1. HJ Fraser *et al.*, Astrochemistry: the molecular universe, *Astronomy & Geophysics*, 2002

2. A Shaw, *Astrochemistry: From Astronomy to Astrobiology*

3. DA Williams & S Viti, Recent progress in Astrochemistry, *Annual Reports on the Progress of Chemistry, Section C*, 2002

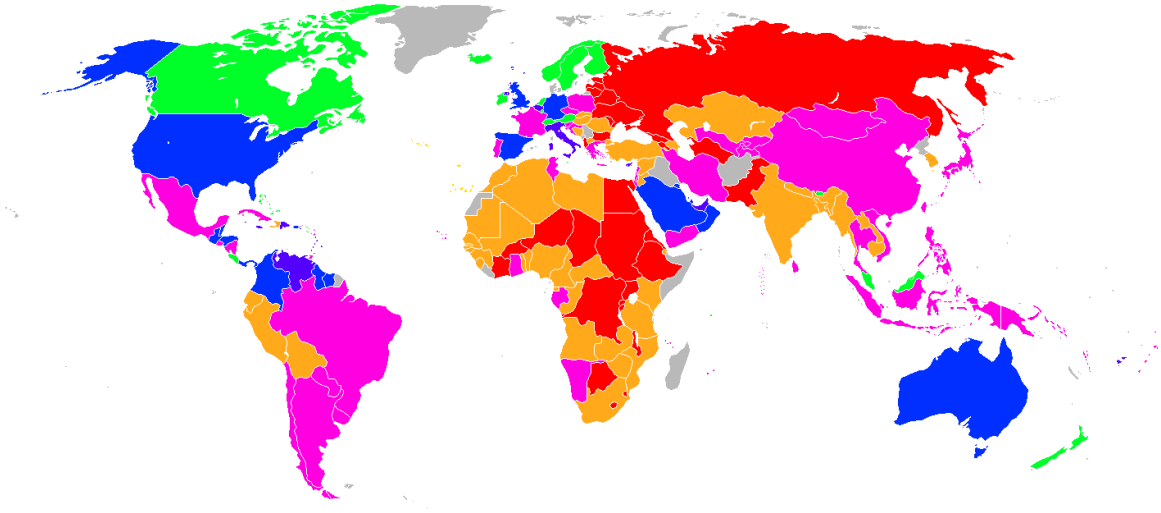
In Search of Happiness

As studies of population happiness receive ever more academic attention, Christopher Gerry and Olivia Noble ask whether current measurements of well-being are accurate and whether the global distribution of happiness reveals any clues as to what keeps us content.

The current economic crisis has accelerated the growing interest – in academia and beyond – in the age old question: does money bring us happiness? This resurgence of interest in happiness is rooted in the so-called 'Easterlin Paradox': the observation that, beyond about £10,000 per head, richer countries are no happier than poorer countries. Money appears not to buy happiness.

The ever influential Richard Layard, shifting his gaze to the new science of happiness economics, has helped to push happiness onto the current political agenda. The leader of the opposition, David Cameron, has spoken of General Well Being (GWB) as a possible new measure of national wealth. And the Liberal Democrat MP Jo Swinson, in calling for the adoption of a 'happiness index', recently launched an early day motion in Parliament calling for the government to act on the allegedly static levels of British happiness. Meanwhile, the UK Department for Environment, Food and Rural Affairs now conducts annual surveys measuring our well-being. Add this to the plethora of cross-country surveys, ranging from the World Values Survey to the World Gallup Polls, and it is clear that happiness has never before received such attention.

But what have we learned from this ever expanding concern? Are we any closer to discovering the elusive elixir that will bring us not only a long but also a happy life? We have certainly learned something: we know much



Satisfaction with Life Index Map, published in Adrian White's 2007 article 'A Global Projection of Subjective Well-being: A Challenge To Positive Psychology?' in *Psychtalk*. Colours show happiness level with green > blue > purple > orange > red.

more of how happiness is distributed around the world and over time – some of it surprising, some less so. We understand a little more about what makes us happy and what doesn't. In short, we know enough to expect development and welfare policy (and perhaps even economics) to pay heed to the growing number of non-income welfare measures.

So, who is happy? Wherever we look there is broad agreement. The University of Leicester's World Happiness Map paints as clear a picture as any: Scandinavia, Australasia, North America and parts of Central Europe contain the happiest countries; while the least happy nations are to be found across Africa and, somewhat strikingly, also across the post-Communist region.

At the very top of the list though, beaming broadly, you will find Denmark. For more than 30 years Denmark has topped the Eurobarometer's Happiness measure. No other country comes close. Suggestions abound by way of explanation: genetics, food, healthy living, family circumstances and even hair colour ('blondes have more fun'). Yet none of these have been found to adequately account for the Danes' happiness. Instead, according to a report in a 2006 article in the *British Medical Journal* (see further reading), the Danes' happiness can be traced back to the lasting impact on morale of the Danish football team's unexpected European Championship victory of 1992, combined with their tendency to adopt consistently low expectations. It would appear that the Danes are permanently relieved that their worst fears haven't been realised!

Meanwhile, at the other end of the happiness spectrum lie the countries of the Former Soviet Union. Writing in the *Journal of Happiness Studies*, Ruut Veenhoven concludes that Russians really are as unhappy as they say they are and that, moreover, they have good reason to be as they negotiate the 'troublesome transitions taking place in Russian society'.

Reviewing these studies, it becomes clear that while many of the explanations are country or region specific, there are a whole bunch of choices we can make that will enhance our happiness. Suggestions to set you on the right path include getting married, finding employment, becoming part of a good circle of friends or other social network, having a solid educational background and being in good health. In contrast, the road to despair involves long working hours, lengthy commutes to work, a lack of time with friends and family, suffering divorce or becoming unemployed.

Yet, let us pause for a moment before we migrate to Denmark, get married or cut down on our work hours. What is it that these surveys are actually investigating? Are they able to explain in meaningful ways why, for example, America and Japan have both become richer over several decades but only Japan has become happier; or why parts

of the Former Soviet Union are seemingly less happy than poverty and disease stricken parts of sub-Saharan Africa? Hardly; but the clue may lie in the 'new science' itself.

Typically, 'happiness' surveys ask a question more or less like this: 'Taking all things into account, right now would you say that you are very happy, quite happy, not very happy or not at all happy?' Is this really a subtle enough question to probe individual happiness within a country, let alone across countries or time? Is it really a paradox that a rich country doesn't move from being 'quite happy' to 'very happy' simply because its income increases? Are notions and conceptions of happiness the same in each country or even within one country over time?

Let us briefly return to our observation that former Soviet states have, for the past twenty years, occupied the bottom rungs of the happiness ladder. The explanation most likely lies in the severe economic and social consequences of the rapid transition to a free market economy, including a dramatic increase in poverty levels, alcohol and drug abuse, exposure to communicable and non-communicable disease, and a dramatic decline in life expectancy for many parts of the population. As Veenhoven observes, it really is no surprise that these people report themselves as being unhappy. What, though, should we make of the findings that large numbers of people in Africa and Asia, experiencing extreme absolute deprivation, report themselves as being happier? Should development aid be redirected to raise happiness where surveys reveal it is most lacking?

The answer to the latter is presumably no, at least not until these survey findings – and the concept of well-being that they purport to represent – are better understood. To this end, social science research is beginning to and must embrace psychology. Psychology has long shown that when human beings evaluate their place in the world, they do so in relation to a much broader range of factors than the current survey tools allow for. We evaluate ourselves against our hopes and expectations about the future, our recollections and reconstructions of the past, our understanding of other people's lives and our sense of control over our own life. Indeed, we probably all know someone with a good job, a nice house, in good health, with an active social life and enough money not to worry, who nevertheless claims not to be terribly happy. So, if it isn't material or physical welfare that explains the apparent unhappiness, then there must be some unexplored but important elements of psychological welfare influencing the reported happiness. Indeed, perhaps reported happiness is but one element of well-being.

Is it really a paradox that a rich country doesn't move from being 'quite happy' to 'very happy' simply because its income increases?

It was against this background that we set off to explore 'happiness' and well-being in our fieldwork in Ukraine. Reassuringly perhaps, our findings reinforced the universality of certain sources of happiness: family, friends, good health, a home, economic security. Our research though, also revealed a clear 'post-communist' story. Our respondents repeatedly spoke of their feelings of loss – namely, the loss of the certainty and stability that they now, somewhat fondly, associate with the previous system of government. This confirmed another fact long known by psychologists: loss is felt more than gain, even when comparing perceived losses against actual gains. The mixed methodologies we employed also taught us that the psychological elements of well-being (including happiness) cannot be captured by one or two questions asking people to position themselves on a scale of 'very good' to 'very bad'.

So, where does this leave us? Adopting an approach to well-being that is broader than traditional monetary measures is commendable and can shed light on a range of non-income welfare issues, including health, education, freedom, loneliness, control and inequality. Nevertheless, the tools currently employed in happiness and development studies lack sufficient depth and breadth to capture well-being and end up by erroneously conflating reported happiness with well-being. If social scientists are serious about well-being, then we must do better, both within and across our disciplines. We must work together more effectively and we must work with other disciplines more thoughtfully.

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Et in Germania Ego…

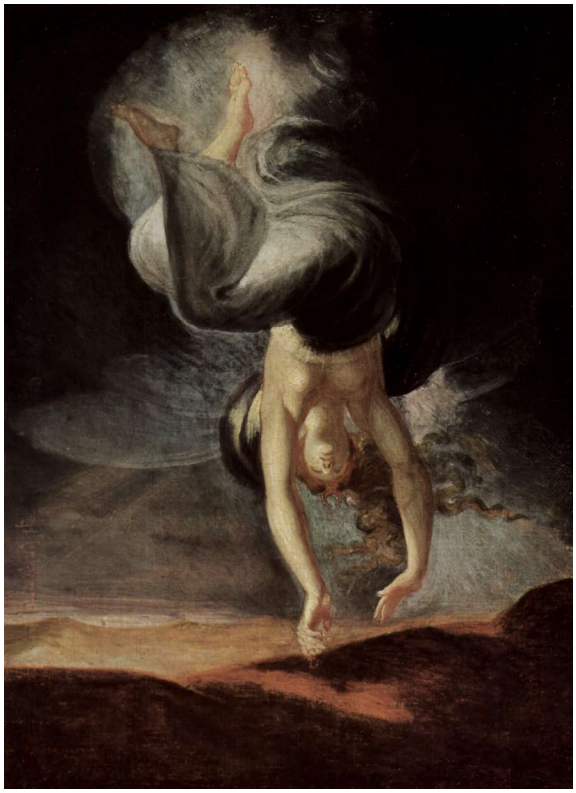
From Fairy Tale to Opera, from West to East: A German Journey

Today, fairy-tale themes in high culture are somewhat taken for granted but this has not always been the case. Susanne Kord argues that the position of fairy tales in the arts was considerably strengthened by the emergence of the German nation, eager to find its identity in a shared literary tradition.

FAIRY-TALE CHARACTERS and motifs populate some of today's most well-known German operas. Mozart's *The Magic Flute* is only one of the examples that spring to mind when looking for rich sources of fairy-tale elements such as heroes on a quest for the abducted heroine and good and evil magicians. As a form of entertainment, fairy operas, their themes and performances have gone through ups and downs of popularity over the course of the past few centuries. But, entertainment value aside, what lies behind the recurrence and renewal of certain motifs? In what way did fairy operas play a role in the German nation-building process?

In Germany and elsewhere, fairy operas have become a staple of the musical stage. We need only think of Albert Lortzing's *Undine* (1845), a love story between a prince and a water nymph; Engelbert Humperdinck's *Königskinder* (*The King's Children*, 1910), in which the love between a prince and a goose girl is horribly thwarted by a witch; Giacomo Puccini's *Turandot* (1926), in which the cruel princess vows to marry only the prince who can answer her three riddles and has all others beheaded (but is cured of her bloodthirst once she falls in love with the right prince); or the many operatic works loosely inspired by Shakespeare's grand fairy tale *A Midsummer Night's Dream* (1595/6), including Ambroise Thomas's *Le Songe d'une Nuit d'Été* (1850), and Benjamin Britten's *A Midsummer Night's Dream* (1960).

But fairy operas have not always been so popular. A mere century before Humperdinck's *Hänsel und Gretel* (1893) took Germany by storm, fairy tales, musical or otherwise, were considered *déclassé* and costly to stage, and not entirely without reason. In 1782, the musical drama *Die Fischerin* (*The Fisher Girl*, with music by Corona



Schröter and some text by Goethe, including his famous poem *Der Erlkönig*) was the most expensive production in the sixteen-year history of the Weimar theatre, which was famous for its spendthrift theatrical performances, *Singspiele* and masked balls.

More importantly, fairy tales had not yet attained the status of high art that could justify such extravagance. On the theatrical or opera stage, they were commonly considered a throwback to early eighteenth-century improvised spectacles performed by travelling companies; to the Dark Ages of hack theatre before Johann Christoph Gottsched reformed the German stage based on French classical drama, Aristotelian rules and the laws of verisimilitude. Even today, fairy tales have not entirely overcome their reputation as a literary subculture. When Wieland's *Oberon* or Mozart/Schikaneder's *The Magic Flute* are criticized for their poor literary quality, this perceived one-dimensionality tends to be associated with the fairy tale elements of these works.

The reason that fairy tales came into vogue in Germany toward the end of the eighteenth century has more to do with nationality and nation-building than literature and literary quality. Until 1871, Germany was divided into independent principalities, electorates, duchies, ecclesiastical territories and free cities of various sizes and kinds. They made their own laws, established their own political and religious hegemonies, and at times even waged wars against each other. The German nation, while factually nonexistent, was the object of extensive debate and considerable longing, particularly among writers. Famous literati, including Lessing, Schiller and Goethe, began to see literature and culture as the realm in which a unity could be forged that might either result in political unity or replace it altogether. Lessing's *Nationaltheater* in Hamburg, Schiller's and Goethe's joint speculations about a German national literature are just as much part of this project as the late eighteenth-century fairy tale collections by Herder, Musäus, Wieland, Günther, Naubert and – early in the nineteenth century – the brothers Grimm. Thus fairy tales played a significant role in the establishment of a German *Kulturnation*. Collectors and creators of such tales tended to present them as cultural artefacts of an ancient German culture that merely needed to be rediscovered, sometimes obscuring their own role in creating or modifying the tales. The ancient German fairy tales thus rediscovered (or reinvented) became the signifier of that fabled German nation: *Et in Germania ego…*

Christoph Martin Wieland (1733–1813) played an im-

posing role in this tradition. Germanists know him as a dominating figure of the German Enlightenment and one of the four great pre-Classical writers, the translator of twenty-two of Shakespeare's dramas into German prose, and the editor of one of Germany's most renowned literary journals, *Der teutsche Merkur* (*The German Mercury*), which ran from 1773 to 1810. Wieland also edited two highly successful fairy tale collections, *Der goldne Spiegel* (*The Golden Mirror*, 1772) and *Dschinnistan* (1786–89). These collections became important documents of German nation-building and significant influences on opera, both during and after Wieland's lifetime. A music aficionado himself, he authored several *Singspiele* in the 1770s and corresponded with the composer Christoph Willibald Gluck, whose opera *La Rencontre imprévue* (*The Unexpected Encounter*) partly inspired his own fairy tale epic *Oberon* (1780).

Mozart's collaborator Emanuel Schikaneder was one of many stage writers who were powerfully attracted to Wieland's material. Both of Schikaneder's projects *Der Stein der Weisen* (*The Philosopher's Stone*, 1790) and *Die Zauberflöte* (*The Magic Flute*, 1791) drew their inspiration from tales in Wieland's *Dschinnistan*. Wranitzky's *Oberon, König der Elfen* (*Oberon, King of Elves*), which was performed by Schikaneder in 1789, used Wieland's *Oberon* as its source. Other magic operas of Schikaneder's that are indebted to Wieland include *Der wohltätige Derwisch* (*The Charitable Dervish*, 1791), *Der Spiegel von Arkadien* (*The Mirror of Arcadia*, 1794), and the second part to *Die Zauberflöte*, *Das Labyrinth oder: Der Kampf mit den Elementen* (*The Labyrinth or: The Struggle with the Elements*, 1798). Schikaneder went so far as to acknowledge Wieland in his testament by stipulating a not inconsiderable bequest 'to the author of *Dschinnistan*.' And Wieland's influence on opera composers and librettists did not end there. His fairy tales inspired musical stage works throughout the following two centuries, from Sophie Seyler's *Oberon, König der Elfen* (*Oberon, King of Elves*, 1788) and Carl Maria von Weber's better-known *Oberon* (1826) to Ruth Zechlin's 1990 opera *Sommernachtsträume, nach einem Märchen von Wieland* (*Midsummer Night's Dreams, based on a Fairy Tale by Wieland*).

'*Nadir und Nadine*,' the first of the nineteen stories in Wieland's *Dschinnistan*, already employs the same plot reversal that we later find in Mozart/Schikaneder's *The Magic Flute*: a seemingly evil magician abducts a young woman, Nadine, while an apparently good magician aids Nadir, the young hero in pursuit. In the end, the evil abductor turns out to be benevolent and the seemingly good magician the villain of the story. This is essentially the plot of *The Magic Flute*, in which the evil magician, significantly, undergoes a sex change to become the Queen of the Night. Musicologist David J Buch has pointed out that this puts paid to the persistent rumour that Mozart and Schikaneder had to reassign the roles of good and evil mid-writing because a rival theatre was staging an opera with a similar plot: the sudden reversal in *The Magic Flute* was clearly and deliberately copied from Wieland's tale. It also occurs in Schikaneder's opera *The Philosopher's Stone* (a collaboration with Benedikt Schack, who later sang Tamino in *The Magic Flute*), which was lost until Buch rediscovered it in 1996 and which provides the missing link between Wieland's fairy tale and Mozart's final opera. Numerous plot strands of *The Magic Flute* and *The Philosopher's Stone* can be traced to one or the other of Wieland's *Dschinnistan* tales: the hateful Moor who falls in love with the white maiden he serves, only to be rejected (from Wieland's '*Adis und Dahy*'); the hero's vow to renounce all association with women (already in Wieland's '*Der Zweikampf*'); the introduction of magical boys who serve as guides (in Wieland's '*Timander und Melissa*' and '*Das Labyrinth*'), and – indispensably – the evil Queen or stepmother (in Wieland's '*Pertharit und Ferrandine*').

Unlike the fairy tale, which often presents us with static characters, the heroic aspects of the opera mandate that its heroes undergo a development and make independent decisions

Where Schikaneder deviated from Wieland's tales in *The Philosopher's Stone*, his changes were mostly dictated by the genre shift from fairy story to heroic-comic opera, necessitating additions of both heroic/tragedic and comic elements. Most centrally, Schikaneder introduced a Papageno/Papagena-type pair (Lubano and Lubanara) with a jealousy theme. Wittily misogynistic generalizations about women are paralleled, on the 'heroic' level, in Nadir's (and later, in *The Magic Flute*, Tamino's) induction in the mysterious and magical all-male society. Lubanara's transformation into a cat is a quintessential comic motif, as are resulting jokes such as '*Das Weib eine Katz, ein Gimpel der Mann*': the woman is a cat, the man a bird (= simpleton). New tragedic elements are the death of Nadir's mother (who survives in Wieland's tale), the tragic death and subsequent resurrection of Nadine, which are closer to mythological motifs (*Orpheus and Eurydice*) than those

of the traditional fairy tale, and Eutifronte's inducement to murder Astromond, which does not occur in Wieland's original (but reappears in *Die Zauberflöte*).

Unlike the fairy tale, which often presents us with static characters, the heroic aspects of the opera mandate that its heroes undergo a development and make independent decisions. Nadir's growth is at least as much the point of the opera as Nadine's successful rescue. What the heroic opera achieves through laborious (and at times confusing) plot changes, trials and errors, tasks, tests and ordeals, is instantly and unfussily accomplished in the fairy tale. When Eutifronte, the great antagonist of the opera, is banned and exhorted to change his evil ways, we can imagine years of penitence in exile before he is allowed to join the happy family. In Wieland's tale, on the other hand, he is instantly cured of his evil with a touch of the magic ring.

In other significant ways, however, Schikaneder left Wieland's tale intact, and it is precisely these aspects of the tale (and the opera) that can be tied to the larger project of inventing a German nation. Just as German fairy tales *à la Hänsel und Gretel* became a cultural signifier for Germany's lost political unity, oriental tales, often based on the Arabian Nights tradition, indirectly defined German-ness through its distinction and essential difference from other cultures. We can see this directly expressed in a motif that recurs, obsessively, in many fairy operas of the age, from *The Philosopher's Stone* to Mozart's *Die Entführung aus dem Serail* (*Abduction from Seraglio*, 1782) to *Oberon* (in its various incarnations) to *The Magic Flute*: namely, the abduction motif. Schikaneder, as well, must have seen this as central to his piece, since he invented a second abduction plot in the Lubano/Lubanara strand that mirrors, on a comedic level, Nadine's abduction and Nadir's quest.

By virtue of their setting alone, operas based on oriental tales, sometimes also called *Türkenopern* (Turkish operas), quite literally moved East, thus exchanging ancient Greece and Rome for Egypt and Turkey; Occident for Orient; the classical for the mysterious and mythology for the fairy tale. The recurring abduction story shows us, however, that 'East' was viewed not only as a magic wonderland, but also a dark and dangerous place that breeds evil characters such as the sadistic hangman in *Abduction from Seraglio*. In Wieland's *Oberon*, for example, Hüon, the brave knight, is charged with bringing down numerous Saracens and a giant who is a Muslim, runs around naked and maintains a harem (note that Wieland did not take these traits over from an older source, but invented them). Hüon's adventure is staged as a religious conflict, his mission initiated by Charlemagne and endorsed by God Almighty. Rezia, the maiden to be rescued, is ostensibly Muslim, but willingly, even eagerly, abandons her home, faith and family to flee with her Christian lover. Immediately after her baptism, Rezia forgets her heathen past – her family, Baghdad, and Islam – as completely as if they had never been a part of her life.

Read as a tale of the East, this portrayal sits uncomfortably with the cosmopolitanism that scholars have often attributed to Wieland. Read as a tale of Germany, we might see the East in this tale, and in many German fairy operas of the age, as a negative without a positive, as a comparison without an original. If nationalism breeds religious prejudice and cultural bias, they are in this particular case paradoxically intensified by the very fact that nationalism refers to an imaginary nation. The task set in virtually every fairy tale is to free the abducted princess, kill the witch, giant or sorcerer and return home. Perhaps the struggle in the foreign land is made all the more grim by the inescapable awareness that the final charge, the return home, cannot be achieved, that in the distinct political sense, there is no home to return to.

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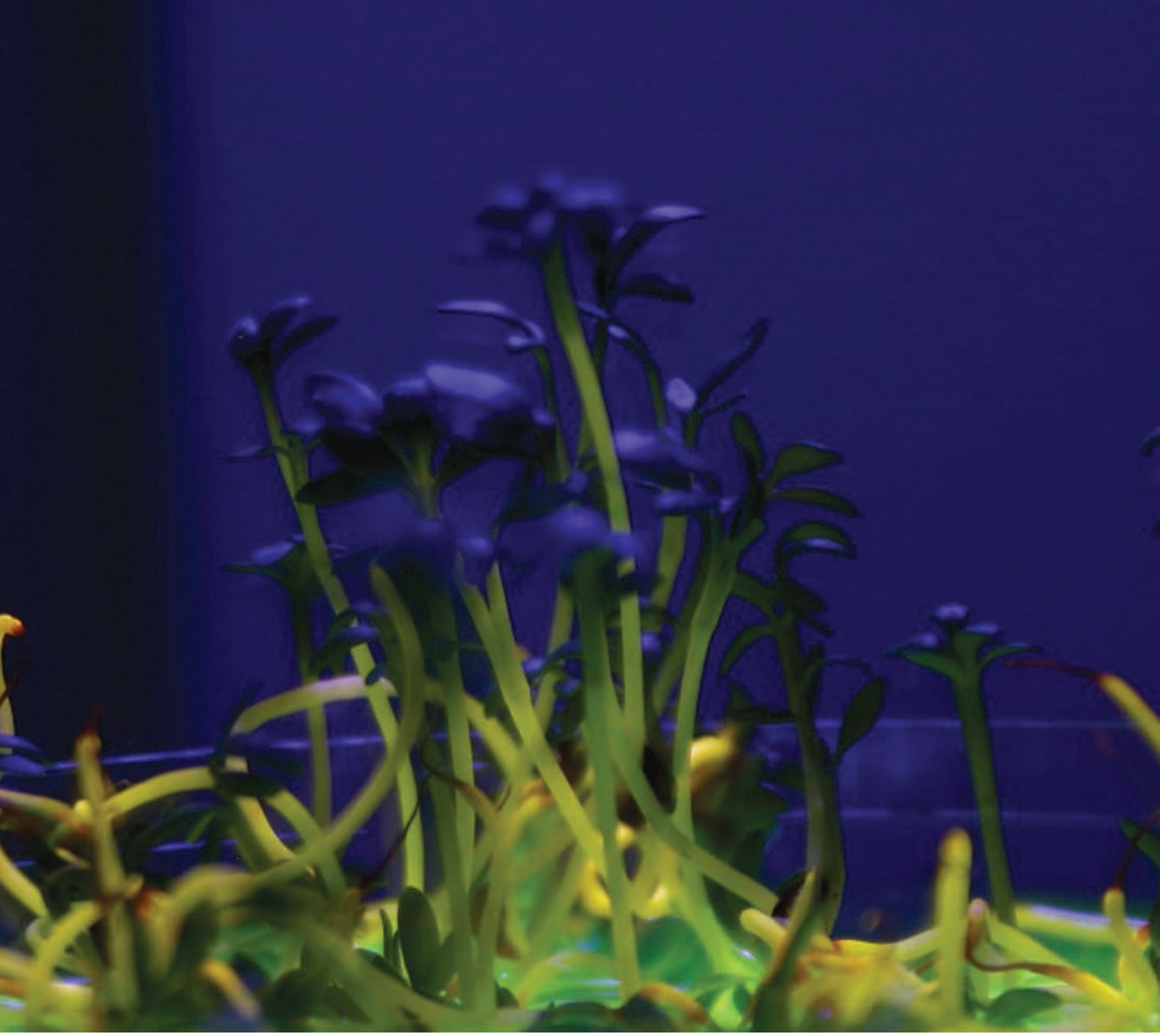

The Sensorial Invisibility of Plants: an interdisciplinary inquiry through art and science

My research focuses on the intimate interactions between ourselves and plants utilizing various strategies to counteract the obstacles of time and movement, revealing in the process plants' responses to our interaction with them. Plants' ubiquitous presence and our dependency on them are contrasted by the limited interaction we have with this type of life, in terms of immediacy. Apart from a few specialized plants, eliciting the imperceptibility of plants reactions involves the use of interfaces.

One of my strategies used an integrated interface through the internalization of nanomagnetic particles into plants. These nanomagnetic particles are used in the biosciences to develop 'smart delivery systems' within living organisms by attaching, moving and offloading. In my experiments, part of the technical bottleneck encountered was in enabling uptake of these particles in plants through their cell walls. I have been able to induce immediate movement with external magnets in plants.

It was during this process that I became aware that plants are highly selective in their uptake. The use of fluorescent dye (disodium fluorescein) in the culture medium offered me a way of visualising uptake in plants and observing this changing growth and colour through time-lapse photography.

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Gender Roles in Scandinavia

Closing the Gender Gap from the Modern Breakthrough to the Present

The Nordic countries are in the top league when it comes to equality between the sexes. Today, nearly all women work and take advantage of government-funded childcare. Nobody could publicly state that a working mother is not a 'proper' woman without causing a stir. Women and men share the housework, and fathers use part of the parental leave. This does not make men 'unmasculine' in the eyes of Scandinavian people. But has this always been the case? Kristina Sjögren asks what the rules for 'proper' gender behaviour were a century ago and whether there are still traces today of traditional nineteenth-century gender roles.

In the history of Scandinavian literature the time period 1880–1910 is called the Modern Breakthrough. The name comes from the tumultuous social changes which the Scandinavian societies underwent almost simultaneously, when both working classes and women started claiming legal and civil rights. A first wave of feminism, when women organised and demanded the right to salaried work, education and the vote, rolled over Scandinavia, leaving both men and women feeling forlorn. Gender roles were changing rapidly, and many people were no longer sure of their own role in family and society. There were fears that societal values would dissolve if the traditional, polarised gender roles (men as the bread winners, women as wives and mothers) were to become too close to each other.

The reactions against women's struggle for legal and civil rights were strong both from the institutions and from the general public. Many works by Swedish writer August Strindberg – such as *Married* (1884) – show how, if allowed to stray from the traditional gender order of the time, men become degenerate and women monstrous. Other writers supported women's quest for societal change in their works, such as the Norwegian playwright Henrik Ibsen in his play *A Doll's House* (1879) and Swedish writer Anne Charlotte Leffler in her play *True Women* (1883). These authors, and several others, caused uproar by exposing and publicly discussing women's conditions, such as their economical dependence and limited possibility to influence the course of their own lives. What was then expected of a 'properly feminine' woman (i.e. a middle class woman, who was set up as the ideal) at the time?

What should she do, or not do, to avoid being seen as unfeminine, perverse and deviant? First of all, for a woman exposing her sexuality in any way was out of the question. Contrary to men, she had to be married to have the right to a sexuality at all, and even then only for the purpose of reproduction. Many men were scared of women showing enthusiasm in the marital bed, and Strindberg's male

characters complain about women who want to make love for reasons other than getting pregnant. A wife should be 'pure', and men often sought sexual passion in the arms of a prostitute instead.

Ibsen and Leffler caused uproar by exposing and publicly discussing women's conditions, such as their economical dependence and limited possibility to influence the course of their own lives

Secondly, a woman had to be a devoted wife. She should take an interest in her husband's work (if he allowed it) and devote her own time and intelligence to supporting him at all times. A wife who had strong interests or work of her own would not have been kindly looked upon, even if she did not have any children. Women were to stay in the family home and leave salaried work and politics to men. A decent woman did not walk the streets unless accompanied by a male relative. She was not to enter public space at all, and that meant not making public speeches as a suffragist, publishing any texts, or displaying works of art either. Female artists were often seen as little better than prostitutes. A woman in public space was regarded as a 'public woman'. This might be an explanation as to why the resistance to women's education, suffrage and economic independence was often compact. A woman needed none of this, as she was 'only' to marry anyway.

Thirdly, the foremost goal in life of a 'proper' and 'feminine' woman was to have children. A woman who admitted to not wanting children would have been seen as abnormal, probably a lesbian (homosexual people were not taken lightly at the time) and extremely controversial. The Breakthrough woman was expected to be a self-sacrificing mother, spending most of her time with her children. If she had been as brave and unusual as to have worked professionally before she had her children, it would definitely come to an end once she had a family of her own. A working mother was practically unacceptable.

Today, the situation of women in Scandinavia is much different. Women were progressively allowed into universities and labour unions from the second half of the nineteenth century and gradually gained the right to vote nearly a century ago. During the last century, women have slowly trickled into the labour market and conquered most positions, even those long reserved for men, such as police officers, vicars, judges and military officers. From the seventies, government-funded high-quality childcare and parental leave have supported working mothers. At the same time, family planning advisory services as well as the possibility of free abortion have helped individuals to reach independent decisions on personal reproductive matters. After decades of struggles, the Nordic countries are consistently appearing at the top of the rankings of the Global Gender Gap Report, with Sweden (1), Norway (2), Finland (3), Iceland (4) and Denmark (8) in 2007. While no country has yet achieved gender equality, Sweden, Norway and Finland have all closed over 80% of the gender gap. This is also shown by a series of studies, information on which can be found on the official websites of the Nordic Council, Nordic Gender Institute and Swedish Secretariat for Gender Research. Today, Scandinavian women are generally more highly educated than men, and, of course, they have the right to hold their own bank account. On the other hand, their wages are still lower than those of men doing the same job, a historical backlog from the time when a man was seen as the breadwinner and a woman's wage just as extra pocket money. Scandinavian women have also still not been able to change the fact that almost all the top positions within politics and business are reserved for men, by men. During a child's first year, the parents are awarded parental leave together, ideally to be shared fifty-fifty. Although the fathers are slowly taking more and more of their share, the divide is still quite uneven. And when it comes to who does most of the housework, men are far behind.

We can certainly feel grateful towards those who a century ago opposed societal conventions at a high personal cost to obtain human rights for women, too. Had it not been for their sacrifices and strong beliefs, the Scandinavian countries would not have achieved such a prominent position in issues of gender equality. However, we are still struggling today with some century-old conceptions about the role of women and men in society. Equality has not yet been reached anywhere…

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Lessons from the History and Philosophy of Science

Why the Research Assessment Exercise may hinder rather than facilitate research

In a competitive academic environment with only limited resources, peer-review based assessment exercises are essential tools to separate the wheat from the chaff, right? Wrong, says Donald Gillies: as well as wasting time, appraisals along the lines of the RAE model risk ending the careers of truly talented researchers yet to be recognised by the academic community at large.

Since it was introduced by Thatcher in 1986, the Research Assessment Exercise or RAE has come increasingly to dominate the lives of UK academics. The RAE is very costly both in terms of money and in the amount of academics' time which it absorbs – time which could otherwise be spent on their research and teaching. The rationale for all this effort is presumably that the RAE will improve the UK's research output. But has the RAE really done this? No convincing evidence of an improvement in the UK's research output since the RAE was introduced has ever been produced, and evidence from the history and philosophy of science give us good reason for arguing that the RAE could actually have made the research output of the UK worse.

A Defect in Peer Review

The RAE usually involves a double use of peer review. A researcher has to submit publications, which will in general have been peer reviewed. Then the review by the RAE panels is itself a peer review. Although it is rational to assert that those best qualified to judge the value of research are one's academic peers, it are can happen that the work of a particular researcher at a particular time is regarded by almost all his or her peers as worthless, but ten, twenty, or even thirty years later, it comes to be realised that this work, far from being worthless, is a major advance in the field. Many examples of this phenomenon could be given, but I will here illustrate it with just one striking case.

Frege and the Introduction of Modern Mathematical Logic

The introduction of modern mathematical logic was made by Frege in a booklet which was published in 1879, and which is usually referred to by its German title of *Begriffsschrift*, which means literally: 'concept-writing'. Frege worked all his life in the mathematics department of Jena University.

In the *Begriffsschrift*, Frege presents for the first time an axiomatic-deductive development of the propositional calculus and of the predicate calculus (or quantification theory). These subjects are the core of modern mathematical logic, and are expounded in the opening chapters of most modern textbooks on the subject.

Though not foreseen by Frege, mathematical logic has turned out to be a subject of great technological importance as it forms the foundations of computer science. In a sense, Frege's *Begriffsschrift* is the ancestor of all programming languages.

Frege's remarkable achievement has been recognised by experts in the field since the 1950s. William and Martha Kneale in their 1962 history of logic write:

> 'Frege's *Begriffsschrift* is the first really comprehensive system of formal logic … Frege's work … contains all the essentials of modern logic, and it is not unfair either to his predecessors or to his successors to say that 1879 is the most important date in the history of the subject.'

The significance of Frege's work was certainly not realised by his contemporaries working in the same field, however. There were six reviews of the *Begriffsschrift*: four by Germans, one by a Frenchman, and one by an Englishman. Of these six, only one was favourable: the others were not merely hostile but completely dismissive. Schröder, the leading German logician of the time, wrote:

> ' … the present little book makes an advance which I should consider very creditable, if a large part of what it attempts had not already been accomplished by someone else, and indeed (as I shall prove) in a doubtlessly more adequate fashion.'

Tannery in France wrote:

> 'In such circumstances, we should have a right to demand complete clarity or a great simplification of formulas or important results. But much to the contrary, the explanations are insufficient, the notations are excessively complex; and as far as applications are concerned, they remain only promises.'

Venn in England entirely agreed with Schröder that Frege had made no advance in the subject, and had indeed taken a step backwards. He wrote:

> ' … it does not seem to me that Dr Frege's scheme can for a moment compare with that of Boole. I should suppose, from his making no reference whatever to the latter, that he has not seen it, nor any of the modifications of it with which we are familiar here. Certainly the merits which he claims as novel for his own method are common to every symbolic method.'

Venn concluded his review by saying:

> ' … Dr Frege's system … seems to me cumbrous and inconvenient.'

The importance of Frege's work only began to be recognised towards the end of the 19th century, twenty years after it was published; and then only by a few avant garde researchers such as Peano in Italy and Bertrand Russell in Britain.

Now suppose a system like the RAE had been in place in Germany in 1879. How would Frege have fared? Clearly he would have done badly since his research would have been judged to be of little value using the method of peer review. He would thus have had his research time cut, and might even have been at risk of being dismissed. This would have held up the development of the new approach to mathematical logic, which, as has been pointed out, was a prerequisite for the development of the computer. This is a telling example that the RAE has the potential to hold back rather than support academic research.

Kuhn's Distinction between Normal and Revolutionary Science

We have seen that the review of Frege's work by his peers was wildly mistaken, for they judged what is now seen as a major advance in the field to be worthless. But why do such errors in peer review occur? How is it possible for experts in a field to judge as valueless what is later seen to be a most important innovation? This phenomenon is addressed in Thomas Kuhn's 1962 monograph 'The Structure of Scientific Revolutions'. Kuhn's view is that science develops through periods of 'normal science' which are characterised by the dominance of a model of reality – or *paradigm* – but which are interrupted by occasional revolutions during which the old paradigm is replaced by a new one. During a period of normal science, the researchers in a given field all accept the dominant paradigm. So those who diverge from the paradigm are regarded as cranks who don't know what they are talking about. Frequently such dissidents are indeed cranks who don't know what they are talking about, but every so often they turn out to be someone like Frege, who initiated a revolutionary advance in the subject. An important consequence of Kuhn's theory is that mistaken judgements regarding figures such as Frege are not features of science's past, but are likely to recur over and over again, because they are features of the development of science in general.

Type 1 and Type 2 Errors

Let us now consider the implications of Kuhn's distinction for the RAE. We can begin by considering the effects of the RAE on normal science. In a period of normal science, those working in a branch of the subject will all accept the dominant paradigm, and no revolutionary alternative will have been suggested. It will then be a relatively easy matter for the experts in the field to judge who is best according to the criteria of the dominant paradigm. Allocating research funding to these most successful 'puzzle solvers', as Kuhn calls them, will usually enable the normal science activity of puzzle solving to continue successfully.

The review of Frege's work by his peers was wildly mistaken, for they judged what is now seen as a major advance in the field to be worthless

Even in the largely unproblematic case of normal science, however, an excessive reliance on peer review can lead to mistakes. We can clarify this point by distinguishing between two types of error: Type 1 error and Type 2 error. A research assessment procedure commits a Type 1 error if it leads to funding being withdrawn from a research programme which would have obtained excellent results had the funding been continued. A research assessment procedure commits a Type 2 error if it leads to funding being continued for a research programme which obtains no good results however long it goes on. This distinction enables us to state a major defect of the RAE: the RAE concentrates exclusively on eliminating Type 2 errors. No thought is devoted to the possibility of making a Type 1 error; the error of withdrawing funding from researchers who would have made important advances if their research had been supported. Yet the history of science shows that Type 1 errors are much more serious than Type 2 errors. The case of Frege is a striking example. If he had been denied research time on the basis of peer review, this would have held up both the development of mathematical logic and the later development of computing.

In comparison with Type 1 errors, Type 2 errors are much less serious. The worst that can happen is that some government money is spent with nothing to show for it. Moreover Type 2 errors are inevitable from the very nature of research. Suppose a research programme which would ultimately have led to a breakthrough is cancelled in order to save money (Type 1 error), then all the money spent on research in the problem will lead nowhere. On the other hand, if an additional but ultimately unsuccessful programme is also funded, the costs will be higher but a successful result will be obtained (Type 2 error). This shows why Type 1 errors are much more serious than Type 2 errors, and why funding bodies should make sure that some funding at least is given to every research school and approach rather than concentrating on the hopeless task of trying to foresee which approach will in the long run prove successful.

Analysis of the Likely Effects of the RAE

Since normal science tends to be routine in character and to produce small advances rather slowly, the damaging effects of the RAE on this type of science are likely to be fairly minor. Surely, however, we want a research regime to encourage big advances in the subject, exciting innovations, breakthroughs, etc.

It is precisely here that the RAE is likely to fail in the most serious way. Any big advance is likely to have something revolutionary about it, something which challenges accepted ideas and paradigms. However it is precisely in these cases, as we have shown above, that an RAE with its excessive reliance on peer review is likely to have a very negative effect. Our conclusion then is that an RAE is likely to shift the research community in the direction of producing the routine research of normal science, resulting in slow progress and small advances. At the same time it will have the effect of tending to stifle the really good research – the big advances, the exciting innovations, the major breakthroughs. Clearly then the overall effect of an RAE is likely to be very negative as regards research output.

It is interesting in the light of this analysis that the government have decided that the 2008 RAE will be the last one, and that from 2009 a new system at present called the REF will be introduced. But will the REF be any better than the RAE? My own view is that it will be just as bad, if not worse.

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Further reading

A more detailed discussion of both the RAE and the REF, is in Donald Gillies book: *How Should Research be Organised?*, published by College Publications (2008)

Madness in the Dakhla Oasis

This photograph was taken during a field study investigating perceptions of 'madness' in a small community in the Dakhla Oasis, Western Egypt.

I had travelled out to the Western desert with my main 'informant' and we camped there for a couple of nights. After the first night I woke around four in the morning and decided to go for a walk. It was freezing cold, hence the green wool hat featured in the photo.

I am particularly interested in the way that the community deal with behavioural and psychological deviance. They have three categories that incorporate such types of deviance: possession by spirits, madness and 'psychological troubles'. Each category carries with it very different implications with regards to treatment and, importantly, with regards to how a patient is viewed by others in the community.

Madness carries with it a heavy stigma and it is considered to be something 'in the head' that cannot be cured. In the case of possession the stigma is less because locals believe the spirit can be removed and that the patient will return to normal.

Part of what I want to find out is how exactly different patients are assigned to different categories and how this affects their experience and the eventual outcome of their problems.

The people of Dakhla Oasis haven't lost their faith in the unknown and still cling to many beliefs that we call 'superstition'. Many people claim that the desert is empty, that there is nothing to see here. For me, the desert is a chance to see yourself; in the vast emptiness and space that surrounds you, you have no choice but to confront your emotions and inner thoughts.

Mohammed Abouelleil Rashed is a PhD student in Medicine at the Centre for Behavioural and Social Sciences

Causation and Partial Success

We are informed on what seems like a weekly basis in the press that a certain factor is a 'cause' of cancer, but determining what constitutes a risk factor for a disease and what is a bona fide cause is a tricky business. Even in modern times, though, previously unknown causes of common diseases are discovered. Using cervical cancer as a case study, Brendan Clarke discusses how sufficient evidence is gathered to attribute a cause to a disease and how this informs clinical practice.

Cervical cancer is one of the most common cancers in the world. About 500 000 new cases occur per year, leading to 270 000 deaths. Eighty percent of cases occur in the developing world. Strategies for reducing the incidence of this disease therefore play a key role in global health policy. But what is the nature of this disease and what causes it?

We now believe that infection with certain types of human papillomavirus (HPV) causes cervical cancer. This statement is supported by some excellent evidence, arising from several domains. First, we can find statistical relationships between infection with high-risk HPV and cervical cancer. Second, we have convincing evidence of a biological mechanism, relating the biology of papillomavirus infection to loss of cell-cycle control and hence oncogenesis. Third, we have evidence arising from intervention: if we prevent infection with papillomavirus, then we seem to prevent (or at least greatly reduce the attack rate) of cervical cancer.

This evidence is of such strength that we can usefully engineer with it. So we can, for instance, use HPV indicators as markers of cervical disease, or we can plan to prevent the disease in future by the use of vaccines targeted against HPV. In fact, the evidence that cervical cancer is caused by HPV is about as good as any evidence for biomedical causation.

But much of this knowledge is relatively new. Before about 1985, HPV was not regarded as the cause of cervical cancer. Instead, a different virus, herpes simplex type II (HSV), was generally considered to be the cause. The evidence linking the two was of a similar form to that linking HPV and cervical cancer. HSV was statistically associated rather strongly with cervical cancer. This relationship also appeared to happen in a plausible temporal order: women demonstrated an immune response against HSV before they developed any malignancy. Further, there was convincing evidence of a disease mechanism. Many other related viruses were known to cause cancer in humans and primates (including Burkitt's lymphoma and certain types of leukaemia). HSV was recovered from many cervical tumours. Finally, HSV was known to be able to cause cells to become malignant in vitro.

Unlike many areas of science, biomedicine has clear criteria for success or failure. Even if our theory is incorrect, if we can prevent disease, if we can reduce inequalities, or if we can develop new treatments, then our work is at least partially successful

So why didn't researchers realise that HSV was not the cause? Well, there are a number of potential reasons. First, testing for HPV is difficult. This is in part due to the hundreds of types of the virus, each causing different types of disease (see box 1). Specific tests are generally needed to detect each type. A further difficulty is that the papillomaviruses could not be grown in cell culture, further complicating their detection. Thus they were not apparent in the specimens of cervical cancer examined by researchers. Instead, the relatively homogeneous herpes viruses, which were mere passengers in the cells, were detected.

Second, and related to the difficulties of testing, is the complex biology of the papillomaviruses. They cause many different types of disease. Some present a high risk of causing cervical cancer – for instance, HPV types 16 and 18 – but most do not. At the time that the herpes simplex hypothesis was prevalent, HPV was known to primarily cause certain types of benign disease in humans, rather different from cervical cancer. In particular, it was known to be involved in the pathogenesis of cutaneous warts (known to be transmissible since the beginning of the 20th century). The virus itself was demonstrated in 1949 by electron microscopy. But it was not until the 1970s that HPV was shown to be causally related to a potentially malignant condition, epidermodysplasia verruciformis. This work was followed by developments in our understanding of the unusual diversity of the papillomaviruses, with the discovery of HPV types 1, 2, 3 and 4 in the late 1970s by the efforts of research teams including Lutz Gissmann in Germany and Gérard Orth in France, who also demonstrated differing risks of malignant transformation. So the relationship between human disease and HPV was complex, with many different viral types involved in the causation of many diseases.

Third, cervical cancer is caused in a multifactorial fashion. While high-risk HPV infection is an important (and possibly necessary) cause of the disease, there are other risk factors which increase an individual's chance of succumbing. These include smoking, unprotected sex, age at first sexual intercourse and socioeconomic status. Thus, while HPV infection is an important cause of the disease, it is not the only one. This leads to problems of attributing causation. For instance, consider the role of socioeconomic status. Is this itself an independent risk factor for cervical cancer? Or is it that people of low socioeconomic status have higher rates of smoking, are more prone to becoming infected with HPV, and so on?

Finally, and leading on from the previous point, we have the problem of partial success. In general, medicine proceeds empirically. If we can usefully predict or intervene against a disease we, in general, may think that we understand how the disease comes about, or that we are at least researching along the right lines. But this is not necessarily the case. In our earlier example, we had good quality evidence apparently linking HSV infection and cervical cancer. For instance, as HPV and HSV are transmitted in roughly the same way – by sexual contact – certain measures intended to prevent infection with HSV would also prevent infection with HPV and thus prevent the development of cervical cancer. But we tend to treat our interventions as specific. But, in almost all cases, they are not, being instead highly pleiotropic. In some cases, this diversity of effect is rather advantageous. For instance, both aspirin and statins (drugs used primarily to reduce blood

Box 1

The papillomaviruses are divided by evolutionary relationship into five super-groups, three of which affect humans. Group A cause genital infection, including cervical cancer; group B cause the rare skin disease epidermodysplasia verruciformis and group E cause cutaneous warts.

Box 2

Aspirin, as well as its pain-killing properties reduces the propensity of blood to clot. It is thus used as prophylaxis against strokes and heart attacks. Statins, as well as reducing serum LDL, appear to stabilise atherosclerotic plaques, further reducing thromboembolic phenomena.

Box 3

Decades of research were dedicated to the pathogenesis, pathology and treatment of peptic ulcers (which increase the risk of developing stomach cancer) before it was discovered in the 1980s that the causative agent was the bacterium *Helicobacter pylori*.

cholesterol) display significant effects other than those for which they were originally used. In these two cases we now exploit these secondary effects in the prevention and treatment of disease (see box 2). And in this case, if we believed that HSV caused cervical cancer, and we prevented its transmission though the use of barrier contraception, and saw a resulting decrease in the disease incidence, we would feel that our intervention had worked. And indeed it had worked, but through a very different mechanism from the one we suspected. Instead, by blocking HPV transmission, it reduced the chance of developing cervical cancer. This support lead us to continue researching in the same vein, rather than looking for new causes or mechanisms of disease. And this appears to be the case when studying the history of cervical cancer.

So the history of cervical cancer is not one of clear progress to the present. There are many other examples in the history of medicine (see box 3). It seems reasonable that the future will hold similar problems. We will get it wrong, for a short period of time anyway. Does this mean we despair? No, not really. I would suggest that, when we are, in retrospect, following the wrong path, we are at least guided by success. Unlike many areas of science, biomedicine has clear criteria for success or failure. Even if our theory is incorrect, if we can prevent disease, if we can reduce inequalities, or if we can develop new treatments, then our work is at least partially successful. Partial success cuts both ways. In one respect, the guidance we get from get from our patients can inhibit our interactions with the true nature of disease. In the other, the significance of the underlying nature of a disease is dwarfed by the importance of our successfully treating it.

Brendan Clarke is a PhD student in the Department of Science and Technology Studies

Further Reading

1. S Wittet & V Tsu, Cervical Cancer Prevention and the Millennium Development Goals, *Bulletin of the World Health Organization*, 2008

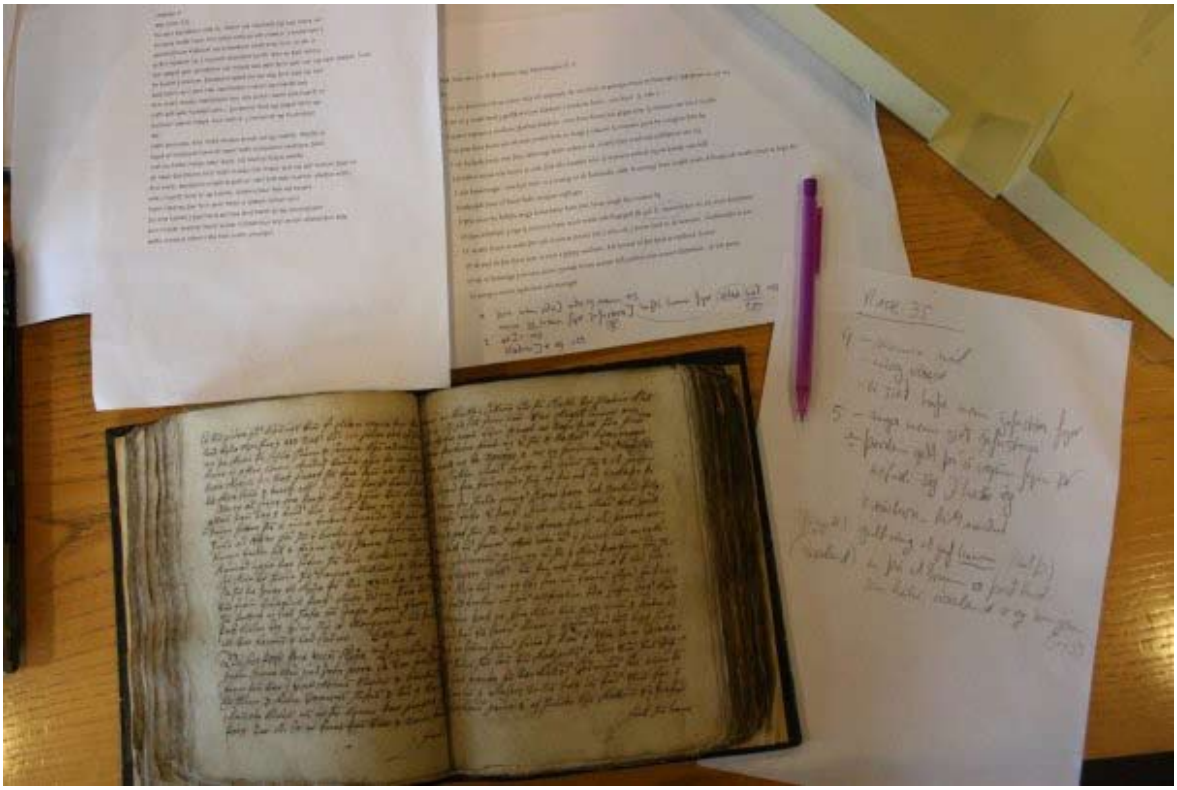
2. V Vonka & E Hamsikova, Vaccines Against Human Papillomaviruses – A Major Breakthrough in Cancer Prevention, *Central European Journal of Public Health*, 2007

3. H zur Hausen, Papillomaviruses – To Vaccination and Beyond, *Biochemistry (Moscow)*, 2008

Tying Up Loose Threads

The Arnamagnæan International Summer School in Manuscript Studies

The study and translation of early texts requires a rigorous training in palaeography and philology. PhD student Hugh Atkinson reports on the ongoing activities organised by Danish and Icelandic manuscript collections to train new researchers in the study of Old Norse literature and describes the collaborative efforts at the recently established International Summer School to determine the relationships between surviving versions of an original text.



The Arnamagnæan Institute's International Summer School in Manuscript Studies is now in its fifth year, and has been held since its inception in 2004 in alternate years at the sister institutions Den Arnamagnæanske Samling in Copenhagen and Stofnun Árna Magnússonar in Reykjavík. The two research institutes are the joint repositories of the large collection of manuscripts and charters amassed by the Icelandic scholar and antiquarian Árni Magnússon up until his death in 1730. The oldest of these manuscripts date from the 12th century, predominantly Icelandic in origin, but encompassing also Norwegian, Danish and Swedish items as well as around 100 items from continental Europe, with a significant number of Spanish provenance. Árni's own collection has since been supplemented through the purchase of individual manuscripts (at times with the financial assistance of Icelandic banks) and through the acquisition of smaller private collections. The collection now comprises more than half a million pages, both medieval vellum and post-medieval paper codices, fragments and diplomas, the younger paper items making up the bulk of the corpus.

Students attending the Summer School are divided into three groups according to previous experience. Newcomers are given a thorough grounding in all aspects of palaeography and the principles of philology, including lectures in codicology, care and conservation of manuscripts, electronic editing of texts, New Philology and workshops where students practice transcription and collation of manuscripts. The codicological material which forms the focus of study in the Beginners' group is principally West Norse (Old Icelandic and Norwegian). Those who return to attend the Summer School in a subsequent year progress to the Advanced group where they are introduced to the East Norse (Old Swedish and Danish) corpus of manuscripts, the scribal milieu in which they were produced and the particular challenges this corpus poses to the palaeographer.

Those attending the course for a third time form a Masterclass group, who are given the task of editing a medieval text which has not previously been comprehensively edited. The 2008 group was to work with an Icelandic *þáttr*, *Þorsteins þáttr bæjarmagns* (The Tale of Þorsteinn Mansion-Might). A *þáttr* (literally 'thread') is a self-contained narrative of a type which was commonly woven into the body of a larger saga text. For instance, the longer Icelandic sagas recounting the lives of the Norwegian missionary kings Óláfr Tryggvason and Óláfr Haraldsson (Óláfr the Holy, patron saint of Norway) contain many

Images

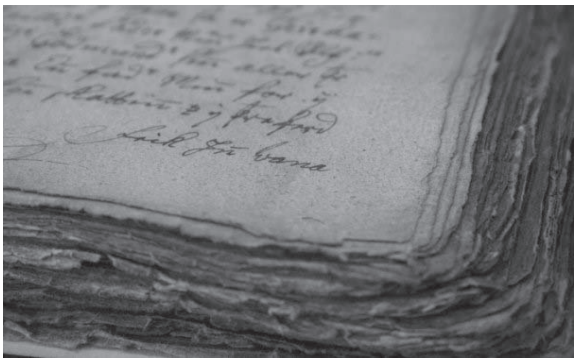
The featured photographs show the manuscript Rask 35, an eighteenth century witness to the text discussed in the article, Þorsteins þáttr bæjarmagns.

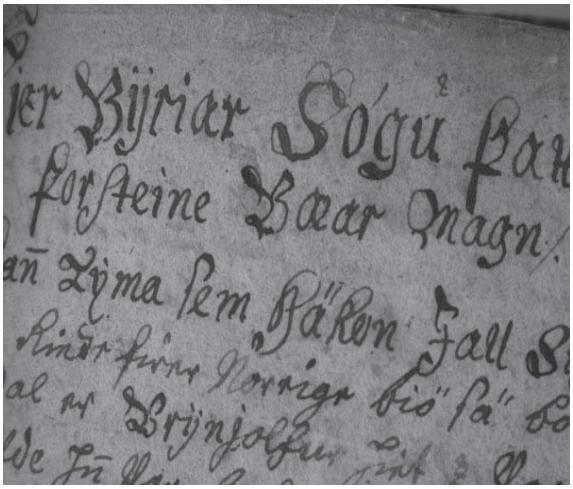
This particular manuscript was originally part of the collection of the 19th century Danish philologist Rasmus Rask (1787–1832) and is now part of Den Arnamagnæanske Samling in Copenhagen.

The photographs were taken by group member Björn Kozempel and document the transcription and editing work that led to the creation of the stemma.

such þættir. Within the context of the larger narrative of the host text the *þáttr* formed a somewhat tangential interlude, the protagonist of which often had a personal relationship to the subject of the saga. In the case of the aforementioned missionary sagas, the individual *þættir* consistently drive home the message that those who swore allegiance to the Christian king and converted to his faith would always triumph over evil men and supernatural creatures, such as trolls, who are typically portrayed as unrepentantly heathen.

The 2008 Masterclass group was made up of students from Denmark, Iceland, Switzerland, Germany, Greece, Russia, the United States, India and the UK. We spent a week devising a stemma: a diagram establishing the in-





terrelationship of the 53 manuscripts – an exceptional number in the context of the medieval Scandinavian corpus – in which the text of *Þorsteins þáttr bæjarmagns* is preserved. Having established which exemplars had authority over others (features of which indicated they were copied directly or via a lost intermediary from an older extant manuscript), we settled on a handful of texts to edit. Given the breadth of this six-century-long tradition – which suggested this was a very popular *þáttr* – it seemed appropriate, also in keeping with the principles of New Philology, to produce an edition incorporating parallel texts from different branches of the tradition. The fact that the text is relatively short makes the possibility of presenting several strands of the tradition within one published volume, together with apparatus, entirely feasible. This remains the ultimate goal of the group, one member of which runs a small publishing company in Berlin and has offered to publish the finished edition, assuming that we can secure a modest sum of funding from one or another source, perhaps The Arnamagnæan Institute itself.

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