

“...scholarships for research and education...”



# Newsletter August 2013

The Leverhulme Trust

## How important is learning in generating biological diversity?



Myanmar's  
timber  
elephants



Drought  
die-back  
examined



Coins of the  
Severan age

## Director's note

# Variables and constants

This newsletter reports the grants agreed at the Board Meeting of June 2013, on which occasion we also said a fond farewell to Sir Michael Perry, longstanding friend of the Trust, and Chairman since 2008.

Michael joined the Board in November 1991. Much about the Trust has changed since then. In the early 1990s, the total yearly expenditure of the Trust was around £12 million; today it is more than £60 million. Fourteen hundred applications were received in 1991; last year, the Trust received more than four thousand. In Michael's first year on the Board, the Trust made 330 awards through seven funding schemes; we now run twice that number of schemes and make around five hundred and fifty awards.

But it hasn't been a simple case of 'all change' throughout the period of Michael's tenure. From a research point of view, although there are many areas in which knowledge has advanced enormously during the past two decades, some puzzles do seem to have lingered around—unresolved—in the libraries and laboratories of successive generations of scholars. In 1991, the Trust awarded grants to researchers to investigate the following, amongst other things: how much to pay business executives; fiscal solvency and the prospects for monetary union in the EU; identity politics in the former Soviet Union; the appraisal of teachers in primary and secondary schools in Britain; and the effectiveness of psychological treatments for anorexia nervosa. That list of awards could just as easily have come from any recent meeting of the Board.

One other constant has been the Trust's approach to grant-making itself. The quality of scholarship was the primary concern when Michael joined the Board and it remains so today. The Trust has watched as successive strategic priorities for research have come and gone. It has maintained its distance from the current obsession with 'research impact'. Increasingly, the Leverhulme Trust's distinctive contribution is responsive-mode support for original research—which is often therefore fundamental, cross-disciplinary, and high-risk—with a concern only for how the results may advance knowledge of our world and of ourselves. It is as surprising as it is refreshing to find that a Board composed entirely of leading captains of industry is in the vanguard of support for an academy-driven and non-utilitarian approach to the funding of research.

As Chairman, Michael deserves great credit for holding fast to the Trust's tried and trusted approach to grant-making, when many other agencies have yielded to fashionable—though often short-lived—alternatives. More immediately, his approach to chairmanship itself could serve as a model that most chief executives would endorse, comprising as it does a perfect balance of informed questioning and unswerving support. As Michael hands over to his successor, I wish him every success in his future projects, and I look forward to working with Niall FitzGerald, his successor as Chairman, confident that Michael is leaving the Trust in the best possible shape to face the difficult research politics of the early twenty-first century.

*Gordon Marshall*



## Personal relative deprivation and status consumption

**Could the way that consumers view those around them affect their spending habits? A new research project led by Dr Mitch Callan will explore the links between a sense of resentment and the consumption of status goods.**

Status consumption involves acquiring goods, not for their inherent value, but to signal social status. Our Leverhulme Trust-funded research will extend current insights into the psychological basis of status consumption by examining whether it is motivated, in part, by personal relative deprivation.

Personal relative deprivation refers to resentment stemming from the belief that one is deprived of a deserved outcome compared to some referent (e.g. what similar others might have). For example, learning that a work colleague has similar outputs but a higher income than you can create feelings of resentment and a sense of unfairness, even though you might not be 'objectively' deprived in terms of your absolute income. Because of this resentment and perceived unfairness, people often engage in compensatory behaviours to achieve the outcomes they feel they deserve, for example through self-improvement or even gambling.

We will examine status consumption as one such compensatory behaviour. That is, we will investigate whether—and how—resentment arising from unfavourable social comparisons of financial or material outcomes motivates some people to acquire possessions that confer status.

In our three-year project, we will investigate three important, but under-researched aspects of the link between personal relative deprivation and status consumption: (a) the comparative processes and real-world situations that minimise and maximise personal relative deprivation; (b) the psychological processes that give rise to status consumption; and (c) overt spending behaviours in the laboratory and in the field.

Besides its importance to theoretical issues in both consumer behaviour and social judgement, our research may help to contribute to the development of strategies that enable consumers to make informed and sustainable financial decisions. For example, our findings may assist organisations concerned with helping people manage debt to improve the money management resources they develop for use by the public. Such resources could highlight how people's perceptions of their social standing may be influencing their spending behaviour, such as how a person might have engaged in superfluous spending after experiencing resentment towards a friend or colleague. To our knowledge, these ideas have not been formally incorporated into advice and learning resources developed to help people deal with debt. Our research should offer an evidence-based foundation for such consumer advisement and education.

*Dr Mitch Callan*  
*University of Essex*

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## Icon and centre: the implications of Keros

**Why did the communities of the early Bronze Age Cycladic period deposit thousands of deliberately broken marble vessels and figurines on the tiny island of Keros? A new Leverhulme-funded project led by Professor Lord Colin Renfrew brings together a large body of unpublished material to reveal more about the role of Keros in its surrounding communities.**

The symbolic aspect of the emergence of centrality is a crucial issue for the understanding of complexity in early societies prior to the emergence of the early state. Recent archaeological discoveries have shown the appearance of early ritual centres in the postglacial period to be a worldwide phenomenon – or at least one documented on several continents. The earliest such centre so far known is Göbekli Tepe in eastern Turkey, with its circular arrangements of upright monoliths. Caral in northern Peru is an example where pyramidal monuments are accompanied by built plazas which were clearly places of congregation, although no sign of figurative iconography is preserved. In northern Europe the major monuments of Britain and France, including the Ring of Brodgar, Stonehenge and Carnac, may likewise be regarded as ceremonial meeting places.

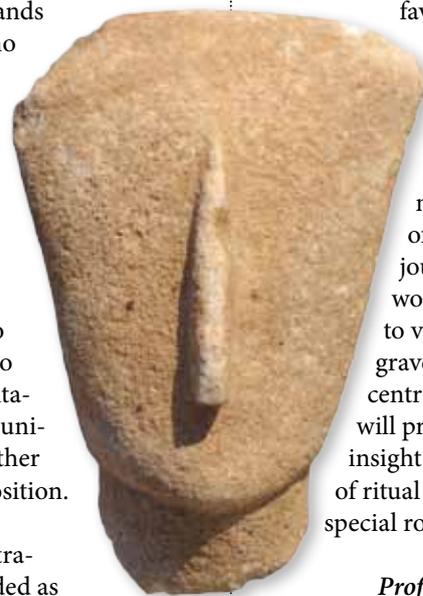
Keros in the Cycladic islands of Greece appears to be the location of the earliest maritime ritual centre in the world. Here the Cycladic logo of the ‘folded-arm figurine’ of marble seems to provide a

major symbolic focus. Recent excavations have shown that the open-air sanctuary on Keros drew in visitors from surrounding islands and further afield, who brought with them bundles of broken symbolic material for deposition in the sanctuary. This implies rituals of breakage conducted separately on other islands as a prelude to the mass pilgrimage to Keros where representatives of distant communities would come together for the rituals of deposition.

Figurines have often traditionally been regarded as divine representations. However this view has been effectively contested for the Cycladic figurines. A common feature of many of the early centres of congregation, where activity is clearly ritual in nature and related to

the realm of the supernatural, is that the rituals do not address identifiable divinities, an activity which seems related to the subsequent emergence of pre-state and early state societies. The rituals do, however, serve the purpose of drawing in and uniting different communities in periodic expressions of wider cultural unity.

This project will examine the broader role of the Keros sanctuary in the Cycladic early Bronze Age, and in particular the role of the marble folded-arm figurine in Cycladic communities. While deposition at Keros represented the end of the use-life of the figurines, insights into their origin, combined with new research into their manufacture, should give us a broader understanding of the meanings and roles of these iconic symbols. The project will bring together a large body of previously unpublished material and integrate numerous strands of research into a new synthetic study. These strands include the now completed and published (or in press) excavations at Keros; a recent island-wide surface study of Keros; two new studies of unpublished marble figurines; and new research into the manufacture and distribution of Cycladic figurines. Taking into account recent developments in the study of regional interaction, this research will investigate the symbolic, cultural and economic ties integrated in the ‘confederacy of Keros’, addressing the social and symbolic relationships which have favoured the development of centrality in pre-state societies.



Using the new information in relation to the manufacture, use, fragmentation and deposition of the sculptures, and their journey from quarry to workshop, from workshop to village, from village to grave, or from village to the central sanctuary on Keros, it will produce fresh and detailed insight into the co-emergence of ritual and centrality, and the special role of iconography in it.

*Professor Lord Colin Renfrew  
University of Cambridge*

**TOP** The sanctuary on Keros during excavation.

**ABOVE** Head of a folded-arm figurine from the sanctuary on Keros.

# European learning and the revolution in Welsh Victorian scholarship

**How did an unschooled amateur from south Wales go on to win international acclaim for his work, which was to revolutionise nineteenth-century Welsh scholarship? Dr Marion Löffler explains how her research project will trace the social and knowledge networks behind the intriguing career and correspondence of Thomas Stephens.**

Picture early Victorian Merthyr Tydfil: an industrial frontier community, lined by slums, enveloped in smoke, riven by social unrest, and bereft of the most basic civic institutions. Yet in his pharmacy at 113 Merthyr High Street, the young, unschooled amateur, Thomas Stephens, writes *Literature of the Kymry*, a critical history which would go on to lay the foundations of modern Welsh learning. Composed as a prize essay for a cultural competition sponsored by Lady Augusta Hall of nearby Llanover, *Literature of the Kymry* was published in 1849 through the patronage of Lady Charlotte Guest, wife of Merthyr Tydfil's leading iron master, John Josiah Guest. It was an intriguing and astonishing meeting of unlikely circumstances and outcomes.

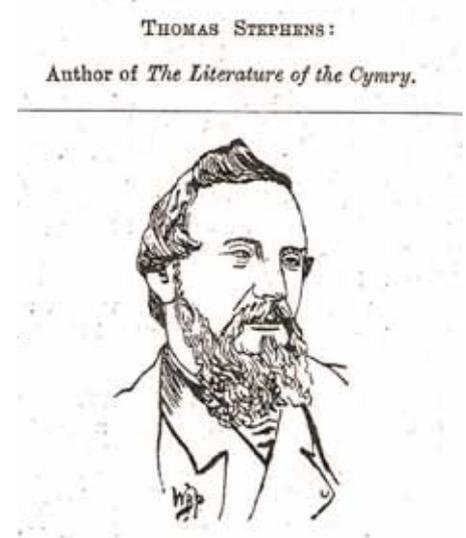


**ABOVE** A bust of Thomas Stephens made of him posthumously and included as a frontispiece to the second (1876) edition of *The Literature of the Kymry*.

And this was only the beginning. By the time Thomas Stephens died in 1875, aged only fifty-three, he had toured Europe and Ireland and was an acclaimed scholar with a network of correspondents in England, Germany, France, and Ireland. *Literature of the Kymry* had been translated into German, and Stephens's further monographs and articles had fired the controversies by which Welsh and Celtic scholarship was moving from a romantic to a modern research paradigm.

Stephens left behind an archive, now at the National Library of Wales, which includes nearly six hundred letters, sixty-three unpublished essays, and even his German exercise books. Encountering it for the first time, two things struck me. His manuscripts still have the smell of his pharmacy, where he catered for the sick by day, and pursued his research upstairs by night. Second, the notes in his essays and the letters he received show that his achievements rested on communication well beyond Wales. His correspondents included the Oxford don, Max Müller; the French folklorist, Hersart de la Villemarqué; and German philologists like Albert Schulz and Karl Meyer. Among the contacts brokered by Lady Augusta (wife of Benjamin 'Big Ben' Hall) was the historian and philologist Baron Christian von Bunsen, Prussian ambassador to the court of Queen Victoria. Stephens's footnotes referred to men like Barthold George Niebuhr, another Prussian statesman and leading historian, who was also both a friend of and co-author with Bunsen. Here was an unschooled amateur who with the help of two main patrons reached the pinnacle of his field and succeeded in revolutionising learning in his country.

The material contained in these archives raises questions as to how a poor chemist's apprentice was able to become an internationally acclaimed scholar. It highlights the importance of the financial and social patronage of local upper classes—here exerted by two influential women—for success and social mobility. The archives enlighten us as to



**ABOVE** An image of Thomas Stephens from the magazine *Cymru Fu*, 9 November 1889.

how ideas and knowledge travelled in early Victorian Europe, from Prussia's developed university system and caste of professionals, to Wales, a marginal region whose university would not be founded until 1893.

Over the next two years this research project grant from the Leverhulme Trust will enable us to pursue these questions and find answers. A research assistant will research and analyse the correspondence at the National Library of Wales. This frees me to be able to hunt for letters from Thomas Stephens at the Bodleian Library, Oxford; the German Staatsbibliothek in Berlin; and in archives in south Wales, Brandenburg, and Ireland; to study the newspapers of the time; and to scan Stephens's unpublished essays in pursuit of new connections. We will make the most important letters accessible to the public, and by means of a monograph, a workshop and an exhibition, we hope to lay open the hidden personal and European history behind the astonishing revolution of Welsh learning in the second half of the nineteenth century.

*Dr Marion Löffler*  
*University of Wales*

## ARABIC NEWSPAPERS

Arabic newspapers displayed outside a newsstand in Essaouira, Morocco.

# Phonological processing during Arabic reading

**Eye-tracking technology could provide valuable insights into how the inclusion—or omission—of diacritics affects readers of Arabic script, explains Dr Denis Drieghe.**

In alphabetic languages like English, phonological processing is typically thought of in terms of grapheme-to-phoneme correspondences (GPCs). Research demonstrates that mastering GPCs is crucial for reading development. Moreover, in languages with transparent GPCs (such as German, for example), children excel in deploying GPCs to decode new words, and reading difficulties are less prevalent compared to learners of orthographically opaque languages (such as English and French).

In non-Latin alphabetic languages such as Hebrew and Arabic, however, the transparency of GPCs varies in a unique way. In Arabic and Hebrew, words are made up from three or four consonants, and vowels are represented as diacritics, placed above and below letters to indicate pronunciation. Without diacritics, both languages have a large number of words that have a different meaning and pronunciation but look identical (homographs). Crucially for this research programme, by manipulat-

ing the presence or absence of diacritics, this language allows us to present words either with or without explicit demarcation of phonology.

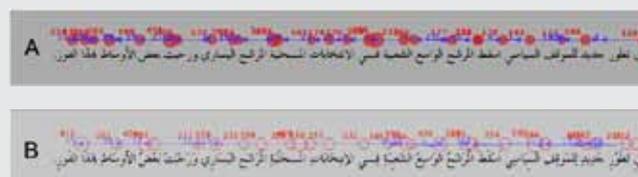
Studies show that readers of Arabic—children and adults, with and without reading difficulties—benefit from the presence of diacritics, and training in decoding diacritics is linked to better literacy performance. However, diacritics are used mainly in religious texts and texts for learners. Everyday texts (newspapers for example) typically appear without diacritics, or only with otherwise very ambiguous words diacritised. Arabic readers thus begin reading an ortho-

graphically-transparent script, and then switch to a more opaque, non-diacritised one where accurate decoding depends on sentential and grammatical cues. This places a high level of demand on readers to use meaning and grammatical cues in order to arrive at the correct pronunciation of words. Therefore studying Arabic and the cognitive processes its readers perform while reading diacritised versus undiacritised text is important because the language offers a unique insight in how readers act upon fully specified phonology (when available) during normal reading.

In our experiments, we will use an eye-tracking methodology. Eyes typically fixate for about two hundred and fifty milliseconds on a word and then move (saccade) to bring the next word into the centre of vision (fovea), where acuity is greatest. Eye movement recordings, which sample eye position every millisecond, provide a detailed insight into readers' cognitive processes. There is an extensive literature that demonstrates that this non-intrusive method is sensitive to both a reader's proficiency and to the ease with which they process text with different linguistic characteristics. Eye movement patterns are therefore ideally suited to serve as an indicator of phonological processing difficulty, which is the topic of the research project.

My co-investigator on this project is Simon Liversedge, Professor of Experimental Psychology at the University of Southampton. With Ehab Hermena, a PhD student working on reading in Arabic, we will explore whether increasing the transparency of written text by using diacritics benefits adult skilled Arabic readers.

*Dr Denis Drieghe*  
*University of Southampton*



**ABOVE** An example of a stimulus sentence from a recent experiment. The two panels show identical text, which differs only in the presence of diacritical marks: Panel A contains non-diacritised text; Panel B contains the same text with full diacritics. In both panels fixations (red circles with durations in ms written above them) and saccades (blue arrows) are displayed above the text for illustration. The direction of text reading is right-to-left. The sentence can be translated as: 'In a new development of the political situation, the popular candidate defeated the left-leaning candidate in the local elections and the victory was welcomed in some circles.'

# Coinage, policy and civic life in the Roman imperial provinces AD218–244

A research project led by Dr Andrew Burnett, Senior Research Fellow at the British Museum, will provide a new perspective on the tumultuous political and civic life of the Roman Empire during the 'third-century crisis'.

At the beginning of the third century AD, the Roman Empire extended from Spain to Syria and from Britain to North Africa. The Emperor Septimius Severus was a provincial—a native of Libya—and married to a member of the Syrian family of priests of the Sun-God. The Severan family would form the last imperial dynasty before Constantine in the fourth century; the death of Alexander Severus in AD 235 marked the start of a period of upheaval in the Empire known as the third century crisis and of the age of the so-called 'soldier emperors', directly chosen by the army.

When this period has been investigated in the past, the view from Rome has predominated. Even in recent publications, the historical picture of policy



**TOP** Bronze coin of Maximinus and his son Maximus from in Phocaea (Asia, western Turkey), AD 235–238 (BM.G1874,0715.312)

**CENTRE** Bronze coin of Severus Alexander from the city Perinthus (Thrace, northern Greece), AD 222–235 (BM.1859,0618.3)

**BOTTOM** Bronze coin of Julia Maesa (grandmother of Elagabalus and Alexander) from Bithynium (Bithynia, north-western Turkey), AD 218–226 (BM.1979,0101.1275)

and civic life of third century Rome has largely been derived from the tradition established by often late, and sometimes biased, literary sources.

This new British Museum research project, *Coinage, policy and civic life at the end of the Severan Age, AD 218–244*, will adopt a different perspective: the view seen from the provincial cities. That view will be derived from the coins that these cities produced. These represent one of the richest sources of information for our understanding of the third century, but are poorly documented and, as a result, have never been systematically studied before. Issued by some three-hundred and fifty civic mints scattered across the eastern part of the Empire they feature over five thousand different designs. With Greek inscriptions and images from both Roman and Greek traditions, these coins represent a fusion between Hellenic tradition and Roman political ideology, often using complicated iconographies.

The study will explore the impact of the 'crisis' on different provincial cities and examine how they interpreted it, thereby allowing us to adopt a contemporary and 'bottom-up' perspective. It will provide a different view of the lives and achievements of the little-studied emperors of the period—Elagabalus, Severus Alexander, Maximinus and Gordian III—and investigate important innovations in the reality of power, such as the rise of a powerful class of imperial women and the emergence of Maximinus who became the first soldier Emperor.

This is a project of wide, novel, and indeed, risky scope. We are delighted that the Leverhulme Trust has supported

what we hope will be a pioneering piece of interdisciplinary research, that will enable the realisation of some long-held scholarly ambitions.

*Dr Andrew Burnett*  
British Museum

## SEPTIMIUS SEVERUS

Marble statue of the Roman Emperor Septimius Severus (AD 193–211), from Egypt. (BM 1802,0710.2)





## Assessing ecosystem recovery after extreme drought-related dieback events worldwide

**A new international network led by Professor Alistair Jump will bring together researchers from the UK, Argentina, Australia, Spain, and the US to take a unified approach to the study of drought-related dieback, an environmental problem affecting regions around the globe.**

Temperatures are rising and will continue to rise across the globe as a consequence of human-induced changes in climate. Precipitation patterns are also being affected, though the pattern of change is less easy to predict. In many areas of the world, rising temperatures are not being matched by increases in precipitation, with the resulting droughts having an increasing impact on the plants, animals, and people living in these areas.

One of the consequences of this increase of drought is that large-scale dieback events are occurring in forest and shrubland systems across the world. In such events, trees and shrubs are often killed over large areas (sometimes across tens or hundreds of square kilometres), either by the drought itself or through outbreaks of insect pests and pathogens on the drought-weakened trees. Often dieback affects some species and not

others, so the composition of forests and shrublands can change rapidly. Effects of such dieback events are sudden and widespread, and can include soil loss (since the trees and shrubs no longer bind the soils together with their roots) and increased fire risk (as the dead trees and shrubs provide an abundant fuel source). Such types of events are predicted to happen more often as the climate continues to warm, putting plants and animals at risk of death and habitat loss, and posing considerable risk to local human populations.

Through our Leverhulme Trust-funded international network, we will be assessing which types of forests and shrublands are most at risk from such widespread dieback events, and examining the changes that occur when the drought passes and the ecosystem begins to recover.

We will investigate how plant communities have developed on the sites of past dieback events, and look for similarities between the types of trees and shrubs that are able to recolonise or recover and those that are not. By assessing the characteristics of the communities that establish after dieback—in contrast with

the ones that existed before—we also aim to identify what the consequences of such changes will be in the long term, both for the species occurring in such systems and the humans that depend on them.

This environmental problem is a global issue, yet the individual events are usually only investigated locally, within individual nation states. The international network scheme offered by the Leverhulme Trust has given us a rare opportunity to bring researchers together from many different parts of the world to look at this problem in a unified way, mixing scientific and geographical expertise to investigate a complex problem on an international scale.

*Professor Alistair Jump*  
*University of Stirling*

**ABOVE LEFT** *Aspen mortality following severe drought in Prince Albert National Park, Saskatchewan (August 2007). Courtesy of Ted Hogg.*

**ABOVE** *Eucalyptus melanophloia savanna with low mortality (top) and with high mortality (bottom) after a drought culminating in 2004.*



## PURPLE INDIGOBIRD

A parasitised brood of Jameson's Firefinches. Far right: a parasitic Purple Indigobird, perfectly mimicking their mouth markings.

# How important is learning in generating biological diversity?

**As they prepare to head for Zambia, Dr Claire Spottiswoode and her research team explain how a group of African finches could help biologists learn more about the role of learned behaviours in promoting the evolution of novel adaptations and even new species.**

A remarkable evolutionary story is unfolding in the woodlands and savannahs of Africa. Announcing its presence from the top of a prominent tree, a glossy black finch sings incessantly throughout the day. Interspersed amongst its chattering and scratchy warbles are a few clearer notes, which pioneering ornithologists noticed sounded identical to the vocalisations of a local species of firefinch. These field observations precipitated an illuminating evolutionary case study that has broadened our views on how biological diversity is generated. With the support of the Leverhulme Trust, we are hoping to add a new chapter to this fascinating story.

The singing finch is a member of the genus *Vidua*—the indigobirds and whydahs—which, like cuckoos, are cheats that lay their eggs parasitically in other birds' nests. Unlike cuckoos, *Vidua* parasitic chicks imprint on their host species' songs and calls. As adults, the *Vidua* males mimic the vocalisations

of their host, which the females are attracted to. These learned behaviours mean that females will only mate with males raised by the same host species, and will preferentially lay their own eggs in that host's nests. Consequently, a female *Vidua* accidentally laying her eggs in the nest of a new host species can initiate a new genetically isolated lineage of *Vidua*, henceforth tied to that host. In an evolutionary blink of the eye, the new *Vidua* lineage is already well on the path to forming a new species. Such speciation via host-switching has occurred many times among the *Vidua* finches in the very recent evolutionary past, giving us a unique opportunity to study speciation in action.

However, a major puzzle remains unsolved. Nestlings of each *Vidua* species perfectly mimic their host species' elaborate and unique pattern of mouth markings (see the photo above), in a genetically-determined adaptation that aids the parasitic chick's survival in the host nest. Yet when one of these parasitic lineages switches host, the mouths of the *Vidua* chicks are glaringly mismatched to those of the host. How then can new *Vidua* lineages successfully persist in novel host environments long enough for mimicry to evolve through natural selection?

Funding from the Leverhulme Trust will allow us to address this question through four seasons of field and aviary experiments in Africa, enabling a new direction for our long-term research on brood parasitic birds in Zambia. Our hypothesis is that learned behaviours facilitate *Vidua* finches' exploitation of new host environments, overriding short-term deficiencies in mimicry. Specifically, we will test whether *Vidua* nestlings can alter their begging behaviour to solicit food from novel hosts, and whether hosts themselves become less discriminating against foreign chicks under certain conditions. By providing a potential window for colonisation, such behaviour could be pivotal in allowing genetic adaptation of mouth mimicry to evolve.

We will test whether a changed environment (such as a new host species) can induce novel characteristics (such as different begging behaviours), which are immediately adaptive, and which then promote selection for genetic change. This wider hypothesis has recently been gaining ground in evolutionary theory, and runs counter to the traditional view that evolutionary change always begins with genetic mutation rather than with environmentally-induced variation. We hope that *Vidua* finches in the African bush will help us to carry out a rare empirical test of this provocative idea in wild populations.

*Dr Claire Spottiswoode,  
Professor Rebecca Kilner, and  
Gabriel Jamie, University of Cambridge.*

# Real time discovery on next generation telescopes with Graphics Processing Units

**A new research project, bringing together astrophysics and high performance computing, will allow researchers to see events in the Universe occurring in tiny fractions of a second, offering new insights into extreme astronomical phenomena. Principal investigator, Dr Aris Karastergiou, explains.**

What would the Universe look like if we could see events that last for no longer than a few milliseconds? The stunning images of the Universe coming from both professional telescopes and amateur astronomers require long exposure times. Any interesting phenomena occurring on shorter time-scales are effectively 'blurred out'. Modern radio telescopes are so sensitive that they allow us to see faint radio bursts of astronomical origin even in very short exposures, tiny fractions of a second. Fast and bright radio bursts are signatures of the most extreme physical processes. It has recently been shown that we occasionally observe such bursts whose most probable origin is in galaxies beyond the Milky Way. Not only do these bursts serve as messengers of the physics around their origin—they also carry information about the vast distances in space they have travelled through.

But how do you 'catch' a millisecond burst coming from space, in a sea of radio signals to which radio telescopes are sensitive? The answer lies in a property of space. Low densities of free electrons in space interact with radio wavelengths. This makes longer radio wavelengths travel more slowly than their shorter wavelength counterparts: in a broadband signal comprising a range of wavelengths, the shorter wavelengths arrive at the telescope earlier.

We exploit this property in our project, code-named ARTEMIS, which uses technology found in modern computers and gaming consoles to perform a very large number of calculations per second. These are designed specifically to detect fast radio bursts, and reject terrestrial signals in telescope data. Our data mostly come from LOFAR, the most sensitive radio telescope in the world, at frequen-

cies around 100 MHz, near the band of FM radio.

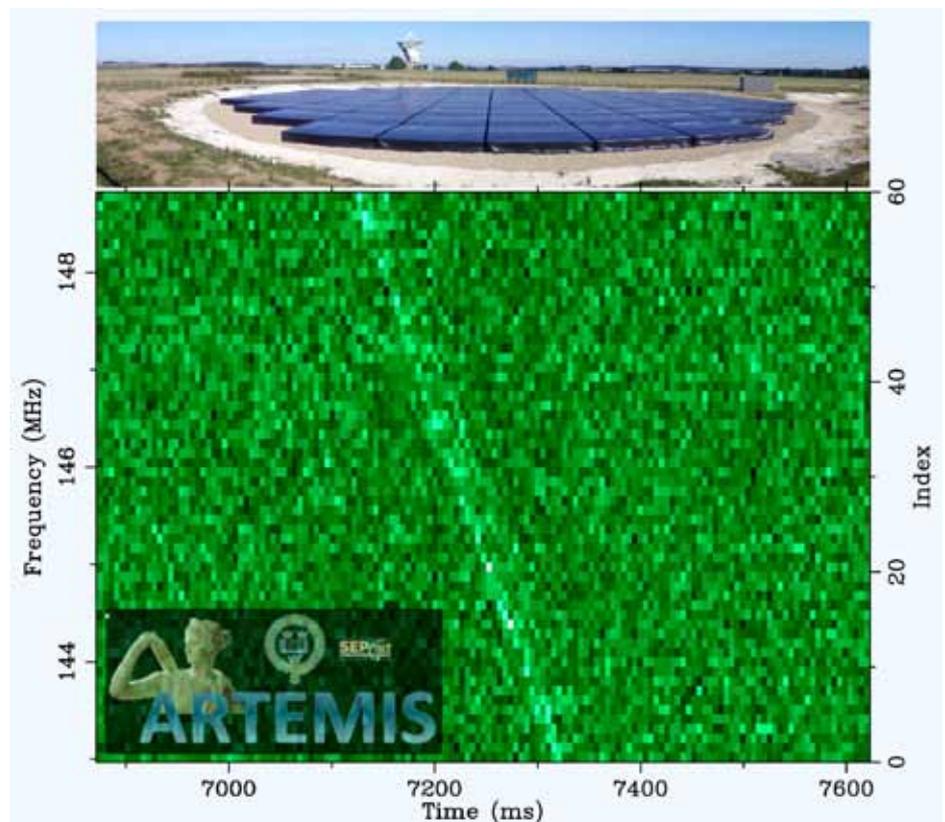
Our project will allow us to look at large parts of the sky for long periods of time, in order to understand better the population of fast radio bursts. Understanding their rates—how many occur in the sky per day—we can compare them to predicted rates of extreme phenomena such as supernova explosions, to better grasp their nature and origin.

ARTEMIS is also capable of triggering other telescopes, allowing rapid follow-up observations of interesting targets, and thereby pinpointing the location and characteristics of the event at other wavelengths. Understanding the properties of these events and how best to find them will prepare us for the next generation of even more sensitive instruments, such as the Square Kilometre

Array, which will be built at the end of this decade.

In ARTEMIS we are bringing together astrophysics and high performance computing in a cross-disciplinary project. This type of synergy is extremely beneficial to both sides. For computer science, it serves as a challenging use-case for new technology, providing incentives for new developments in hardware and software. For astrophysics, it maximises the opportunities for discovery of extreme and exciting new phenomena. Support from the Leverhulme Trust is welcome because this research project draws from more than one area of science, and would therefore not be supported by individual research councils.

*Dr Aris Karastergiou  
University of Oxford*



**ABOVE** A bright radio burst of astrophysical origin, detected by ARTEMIS with the LOFAR telescope. In the green image, the burst is observed to arrive at the telescope earlier towards the frequencies of the observing band. This particular radio burst comes from a known pulsar. ARTEMIS will detect such bursts from unknown sources and characterise the transient nature of the sky. A photo of the LOFAR instrument at Chilbolton (UK), where the data were taken, is shown above.

# Improving timber elephant health in Myanmar

**A unique population of semi-captive elephants will provide the focus for a research project exploring the connections between parasite infection, host health and reproduction. Principal Investigator, Dr Virpi Lummaa, explains why the research is of particular scientific, ecological and economic interest.**

Parasites cause significant mortality in humans, economic losses in livestock production, and threaten wildlife.

Why have animals not evolved to resist parasites, and why do some individuals suffer heavier infections than others? One reason is that hosts have limited resources to allocate to growth, repair, reproduction, and parasite resistance; this means that various strategies of resource allocation have evolved, creating variable levels of parasite resistance. These trade-offs are hard to study in the wild because of the difficulty of capturing individuals at regular intervals. In this project we will use data collected from semi-captive Asian elephants in Myanmar to investigate host-parasite interactions in a long-lived species.

Myanmar is home to the world's largest captive population of Asian elephants and it has one of the world's largest wild populations. The keeping system of the captive population is unique, with elephants working in the timber industry during the day, but at night feeding in forests unsupervised, and breeding freely with wild elephants. However, low rates of survival and reproduction in the captive population necessitate the capture of wild elephants to maintain the working population; the result has been an alarming decline in the wild population. The close link between the endangered wild population and the timber elephants means that improving the survival and reproduction rates of the captive population is a priority.

Parasite infection may reduce elephant health and reproduction, but few datasets exist on natural vertebrate populations to examine associations between multiple parasite species, health, and

the physiological basis of reproduction. The Myanmar timber industry has for a century kept detailed logbooks of the life-history and health of each elephant. Additionally, for hundreds of known individuals we have been collecting weight data; blood samples to measure hormones and chemical indicators of health; and faecal samples to measure parasite burdens. Anti-parasite treatments also allow us to mix observational data with experimental manipulation. This presents a unique opportunity to combine detailed data on life-history, health, hormones, stress and parasites from thousands of individuals. No such data could be collected on similarly long-lived vertebrates apart from humans, and given the endangered status of Asian elephants, this population may be vital in understanding interactions between population dynamics and individual characteristics in conservation.

Our results will reveal interactions between parasite infection and host health rarely studied outside the laboratory. We will assess associations between infection and reproductive and stress hormones to determine how reproductive investment is associated with physiological stress and infection. Longitudinal studies of known individuals are exceedingly rare, and are of interest to scientists from diverse backgrounds including conservation, evolution, parasitology, and epidemiology.

Understanding the impact of parasites on health and reproduction will aid management and conservational policies for captive Asian elephant populations. Our project will also disseminate knowledge of field diagnostics to local veterinarians, promoting effective management and targeting treatment to the individuals that will benefit most. The selective logging performed by the timber elephants is the backbone of the Myanmar forestry industry, and efforts to improve their health will therefore have benefits both ecological and economic.

*Dr Virpi Lummaa  
University of Sheffield*



**TOP** We use electronic scales for determining monthly variation in body weight of elephants with known life-history, documented in their logbooks. Because the timber elephants are very used to human handling and obeying their mahout commands, with a few treats and their mother's support, even most babies are happy to step on the scale.

**CENTRE** Half of timber in Myanmar is still extracted by using trained elephants, because access by vehicles is difficult, particularly in the mountainous areas, and such selective logging is more sustainable.

**BOTTOM** The Myanmar Timber Industry has kept detailed records of the health and life events of each timber elephant for over a century, which we are computerising to study the population demography.

# Grants awarded by the Board at their June 2013 meeting

## RESEARCH PROJECT GRANTS

### Sciences

**Dr Patti Adank**

*University College London*

The role of speech motor resonances in spoken language processing  
£150,989

**Dr Benedetta Bassetti**

*University of York*

Effects of orthography on phonology in second language speakers of English: Pronunciation, phonological awareness, speech perception and spelling  
£181,486

**Dr Marco Beato**

*University College London*

The tuning of motor circuits by recurrent excitation and inhibition  
£196,355

**Dr Melanie Britton**

*University of Birmingham*

Magnetic resonance imaging of aluminium and zinc electroplating in ionic liquids  
£149,951

**Professor Manfred Buck**

*University of St Andrews*

Supramolecular self-assemblies as nanotemplates for electrodeposition  
£104,436

**Professor Roger K Butlin**

*University of Sheffield*

The role of natural selection in divergence between aphid host races  
£129,902

**Dr Paola Carbone**

*University of Manchester*

Effect of responsive copolymers on the structure of phospholipid bilayers  
£150,482

**Dr Denis Drieghe**

*University of Southampton*

Phonological processing during Arabic reading  
£155,779

**Professor Vincent Fusco**

*Queen's University Belfast*

Near field subwavelength resolution imaging in lossy inhomogeneous media  
£173,435

**Dr Anjali Goswami**

*University College London*

Walking the cat back: evolutionary mechanics and modularity of felid locomotion  
£219,910

**Dr David Grainger**

*University of Birmingham*

How do cells protect their genes from pervasive transcription?  
£141,388

**Professor Claire Grierson**

*University of Bristol*

How plant roots cohere with soil  
£251,769

**Dr Ramon Grima**

*University of Edinburgh*

Pushing the frontiers of stochastic modelling in biology: Intrinsic noise in non-dilute conditions  
£124,461

**Dr Paul Harris**

*University of Brighton*

A mathematical model of the formation and growth of cavities in the spinal cord  
£101,947

**Professor Alan Johnston**

*University College London*

Temporal characteristics of gaze perception  
£244,098

**Dr Mark W Jones**

*Swansea University*

Advanced visualisation techniques for urban modelling/simulation  
£89,523

**Dr Aris Karastergiou**

*University of Oxford*

Real time discovery on next generation telescopes with Graphics Processing Units  
£230,685

**Professor James Ladyman**

*University of Bristol*

Applying homotopy type theory in logic, metaphysics, and philosophy of physics  
£177,093

**Dr Robert Leech**

*Imperial College London*

Vocal learning and the importance of noise  
£175,806

**Professor Adrian Lister**

*Natural History Museum*

Evolutionary patterns in deer on Mediterranean islands  
£180,110

**Dr Virpi Lummaa**

*University of Sheffield*

Causes and consequences of parasite infection in Myanmar timber elephants  
£290,467

**Professor Stefan Maier**

*Imperial College London*

Nano-particle assisted super-resolution microscopy for live cell imaging  
£124,143

**Dr Louise Martin**

*University College London*

Prehistoric hunting strategies in Jordan: Reconstructing prey behaviour and ecology  
£252,262

**Professor Paul McGraw**

*University of Nottingham*

The effect of abnormal visual experience early in life on cortical representation  
£238,184

**Dr Darren Obbard**

*University of Edinburgh*

The phylogenetic origins of antiviral RNAi in animals  
£110,307

**Dr Matthew Powner**

*University College London*

Phosphoro-Strecker reaction: Amino acid synthesis and phosphoryl activation  
£189,794

**Dr James Russell**

*University of Cambridge*

The development of episodic foresight in young children: spatiotemporal binding.  
£91,398

**Professor Julie Scholes**

*University of Sheffield*

Understanding virulence in *Striga*, a major parasite of African cereal crops  
£241,718

**Dr Claire Spottiswoode**

*University of Cambridge*

The role of phenotypic plasticity in driving a remarkable adaptive radiation  
£183,593

**Dr Nickolay Trendafilov**

*Open University*

Sparse factor analysis with application to large data sets  
£173,257

**Dr Lyudmila Turyanska**

*University of Nottingham*

Colloidal semiconductor nanocrystals with dual functionality  
£150,170

**Dr Richard Walker***University of Oxford*

Climatic, environmental and tectonic influences on prehistoric human development in Iran

£176,559

**Dr Jonathan Worrall***University of Essex*

Fat(al) attraction of cytochrome c: A new approach to study protein-lipid interactions

£162,175

**Social Sciences****Dr Lynda Boothroyd***Durham University*

Impact of media access and local ecology on beauty ideals in Nicaragua

£249,918

**Dr Mitchell Callan***University of Essex*

Personal relative deprivation and status consumption

£129,479

**Dr Giacinta Cestone***City University London*

Internal labour and capital markets in French business groups

£130,070

**Professor David Simon Cowan***University of Bristol*

Shared ownership: crisis moments

£71,686

**Dr Jadunandan Dash***University of Southampton*

Assessing current and future tropical cyclone vulnerability in east India

£87,626

**Professor Martin Everett***University of Manchester*

Collecting and analysing secondary covert social network data

£247,940

**Professor Barry Godfrey***University of Liverpool*

After care: Youth justice and its long term impacts 1850–1945

£85,506

**Dr Jennifer vanHeerde-Hudson***University College London*

The changing socio-economic profile of PPCs and MPs in Britain 1945–2015

£98,271

**Professor Carolyn Hoyle***University of Oxford*

Last resorts: Decisions and discretion at the Criminal Cases Review Commission

£110,338

**Dr Danny McGowan***Bangor University*

Demand shocks and productivity: Evidence from a natural experiment

£30,294

**Professor Michael Moore***University of Warwick*

The finance microstructure approach to the economics of exchange rates

£198,554

**Dr Martyn Pickersgill***University of Edinburgh*

Neuroscience and family life: The brain in policy and everyday practice

£106,031

**Professor Brian Rappert***University of Exeter*

Beyond the digital divide: Sharing research data across developing and developed countries

£123,228

**Dr Chris Stiff***University of Keele*

Campus citizen behaviours: Predicting students' pro-social behaviour

£71,291

**Dr Netta Weinstein***University of Essex*

Motivational prosody: A new approach to understanding motivational communication

£189,478

**Humanities****Dr Andrew Burnett***British Museum*

Coinage, policy and civic life in the Roman imperial provinces at the end of the Severan Age AD 218–244

£157,113

**Professor Andrew Chamberlain***University of Manchester*

An investigation of ancient animal mummies using diagnostic radiographic imaging

£246,725

**Professor Mark Edmonds***University of York*

Working stone, making communities: Technology and identity in prehistoric Orkney

£243,207

**Professor Elizabeth Graham***University College London*

The role of past human activity in structuring modern landscapes and soils

£210,554

**Professor Ronald E Hutton***University of Bristol*

The figure of the witch: The European witch-hunt in full cultural context

£220,799

**Professor Richard P Ingham***Birmingham City University*

A bilingual thesaurus

£108,329

**Professor Geoffrey Khan***University of Cambridge*

Untapped manuscripts and reading traditions for a new Biblical Hebrew grammar

£136,175

**Dr Marion Löffler***University of Wales*

Knowledge transfer and social networks: European learning and the revolution in Welsh Victorian scholarship

£85,302

**Dr Stephen Parker***University of Worcester*

Faith on the air: A religious educational broadcasting history c.1920 to present

£219,050

**Professor Anne Marie Rafferty***King's College London*

From microbes to matrons: Infection control in British hospitals 1870–1970

£223,827

**Professor Lord Colin Renfrew***University of Cambridge*

Icon and centre in the Cycladic early bronze age: The implications of Keros

£148,329

**Professor Florian Urban***Glasgow School of Art*

The New Tenement

£179,389

**Mr David Whitley***University of Cambridge*

In living memory: The place and uses of learning poetry

£135,677

**Professor Matthew Worley***University of Reading*

Punk, politics and british youth culture 1975–85

£110,569

**INTERNATIONAL NETWORK GRANTS****Sciences****Dr Alistair Jump***University of Stirling*

Assessing ecosystem recovery after extreme drought-related dieback events worldwide

£126,527

**Social Sciences****Dr Ben Anderson***Durham University*

Governing emergencies

£76,910