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Edited by Brian G Gardiner

Editorial

This issue contains four articles: three zoological and one botanical. It also has a review of a Swedish book, read and digested by one of our Fellows, which concerns three palaeontologists, two of whom have featured in one of our festschrifts. The first zoological article concerns *Charles Darwin's "non trivial error"*. The author points out that Darwin was hostile to catastrophic mass extinctions, quoting [pp 317-318 in the *Origin*] "that the old notion of all the inhabitants of the earth, having been swept away at successive periods by catastrophies, is very generally given up even by those geologists whose general views lead them to this conclusion." Today however, palaeontologists believe that there have been four mass extinctions: at the end of the Ordovician, the end of the Devonian, the end of the Permian and the end of the Cretaceous. The greatest of these was the end of the Permian, probably as a result of volcanic action, while the final mass extinction occurred in the Cretaceous, said to have been the result of an asteroid collision with the earth [which incidentally was said to have wiped out the dinosaurs.] The author concludes that this 150 year-old non trivial error has generated countless and unquantifiable errors throughout the scientific and political worlds.

The second zoological article deals with the vexed problem of industrial melanism in moths. The author points out that in a forgotten paper by Porritt [1907] who witnessed the origin and spread of industrial melanism in species of moths in South West Yorkshire, said that these populations, which became predominantly melanic over a remarkably short period of time, were entirely free from selective predation by birds. Previously Porritt had recorded the spread of melanic individuals of several species from soot blackened areas into pristine countryside which is at variance with expectations if melanism is an adaptation to dark backgrounds. The moths studied included *Biston betularia* of which the melanic *carbonaria* became the overwhelming dominant form in the area. The author concludes that the work of van't Hor *et al* [2011] on *B. betularia,* in locating the position of the gene for melanism, and for the rapid spread of an initially unique haplotype driven by strong positive selection, demonstrates that in the United Kingdom industrial melanism in the Peppered moth was the result of a single mutation. The author concludes by drawing attention to both the *Biological Journal of the Linnean Society* [which has been the vehicle of publication for major contributions to the problem of industrial melanism] and to Porritt's forgotten paper.

The third zoological paper is Part 2 of *Eels are slipping away*. The author notes that eel populations have declined by around 90per cent. However in the 1970's several European countries, particularly Denmark began the culture of *Anguilla anguilla* L. with the development of farm systems using heated water. First they captured their elvers from around Spain, France and England, then they grew them on to a marketable size, then they graded and transported them to market [total production in 2005 was some 10,500 tonnes]. A fair proportion of these smoked eels are sent to the UK. The author concludes that his grandchildren will still be able to comprehend the expression "as slippery as an eel" as a direct consequence of European eel farming.

The only botanical article in this Linnean concerns Sternberg's missing fossil paintings. The authors give an account of how they discovered these paintings through

being initially contacted by Julian Wilson of Maggs Brothers [a Natural History book seller in London] who explained that they had acquired a set of early 19th Century paintings of late Carboniferous plant fossils and were they of any interest? In all there were 28 grey-wash paintings said to have been obtained for Prof. Buckland by Mrs. Collinson of Gateshead. Five of the paintings match the figures in the two unattributed Sternberg plates – the authors had at last found the missing paintings. The paintings were eventually purchased by the National Museum of Wales. After a long and fruitless search for the painter, William Smoult, and for Mrs. Collinson, the authors were left with several unanswered questions, particularly what happened to the Smoult paintings which Sternberg returned to Buckland after the plates had been engraved and why did Sternberg not acknowledge Smoult as the artist? The authors conclude that their story is based on circumstantial evidence and may be wrong. They then ask the reader if anyone can come up with additional information which might throw light on the mystery.

The book reviewed in this issue is in Swedish and as mentioned earlier in this editorial has been read and digested by one of our Fellows. It is the story of three Swedish palaeontologists, Eric Stensiö [1891-1984] Gunrar Säve-Söderbergh [1910-1948] and Eric Jarvik [1907-1998], whose lives were consumed by fossils and touched by tragedy. It tells how they collected fossils in Spitsbergen and Greenland, supported by the Swedish State. It describes how Jarvik and Säve-Soderbergh went to East Greenland on a 95 strong Danish expedition and collected much ichthyostegid material and how they were welcomed home by a crowd of thousands at the quayside. The author concludes that it is a story of lone, socially inadequate men working long hours in the laboratory, but that they were the envy of any palaeontologist working today, because they were supported by a team of skilled workers who helped by unpacking fossils to posting off manuscripts. Other workers were illustrators and photographers. Finally the author suggests that Hagberg and Widam's book could stimulate young Swedes to become polar explorers or palaeontologists, or like the book heroes, both.

At the back of this issue are the minutes of the 223rd Anniversary Meeting of the Society which took place on Linnaeus' birthday, 24th May 2012.

BRIAN GARDINER

Editor

Society News

It's been a busy six months with lots of new initiatives! As any of you familiar with Burlington House will know, we have a serious crisis of space. Guided by the Finance Committee, we started a search to acquire a building that would serve the dual purposes of **expansion space for the library** as well as being a sound investment proposition – and we struck gold, thanks to Priya, our Financial Controller, who spotted an office building in Wimbledon, Toynbee House, which the Society purchased in mid-August. We will be installing compactor shelving (equivalent to 1.6km) and have already started moving the lesser-used journals to this location. Have no fear, once the move is completed, your superlative library service will not be affected – Lynda and Elaine will be providing their usual rapid responses to your enquiries!

The other momentous financial decision taken this spring was that the Society goes ahead with works to **install a lift** in Burlington House. This major building project will begin in mid-December, and will mean that the Society's rooms in Burlington House will be unavailable to Fellows and the public for a number of months – BUT, we have made provision to use rooms next door in the Royal Astronomical Society, so our evening and day meetings will go ahead more or less as normal. Our librarians will endeavour to continue responding to your enquiries, but this will need to be via email or letter rather than in person for the duration of the works, while others of the team will be able to continue project work in Toynbee House.

Recruitment is underway for an Education Officer as the Society is seeking to expand its educational focus, initially on providing resources for primary school teachers who do not have a science background. We are also looking to enhance the Society's regional presence, and plan to exhibit at the Edinburgh International Festival of Science around Easter 2013.

The Society has had a full meetings agenda – Henk Beentje regaled us with the **Flora of Tropical East Africa: a very slow cutting edge**, while James Marsden gave an eloquent policy lecture on **Marine Protected Areas in English Waters.** Significant media interest surrounded our **Beatrix Potter: the Mycologist** event, including a *Womens' Hour* slot for Ali Murfitt and Elizabeth. We were sorry to have to mark the end of Vaughan Southgate's highly successful Presidency at the **Anniversary Meeting** in May but are delighted to welcome Professor Dianne Edwards CBE FRS as our incoming President, only the second woman to hold this office, Professor Irene Manton having been the first from 1973-76. Dianne gave an illuminating talk on her palaeobotanical research at the **Conversazione** in July, while the Burlington House team all showcased their respective projects involving cataloguing, conservation and digitization of various collections, educational initiatives and the **Society's new website**, which is being launched, offering much more functionality, including a members' area and on-line payment – congratulations especially to Samantha for leading this and to the whole team for their significant inputs into making the website a truly great vehicle for the Society to reach out and, we hope, a website that will be much used by the Fellowship. The meeting room was packed for Fernando Vega's charismatic talk on the **History of Coffee**, and the subsequent delicious coffee tasting. Also well attended was the joint meeting with the Lunar Society in Birmingham, where Peter Sheldon spoke on **Withering - the English Linnaeus and the flowering of pharmacology.** Three Fellows, Adrian Lister, Terry Preston and John Pearson, led the much enjoyed field trip to North Norfolk in June *(see separate article)* and meetings resumed in September with the Taxonomy & Systematics Plenary Session followed by the 1-day international conference on On-Line Taxonomy, with an evening lecture entitled **Paleoclimatic impacts on biodiversity and ecosystems - insights from ecoinformatics**. The Society's rooms were available during **London Open House,** and September meetings closed with **The Remarkable Nature of Edward Lear** presented by Bob Peck on a flying visit from the USA. October promises to be a busy month with Professor Sir Leszek Borysiewicz delivering the **Darwin Lecture** on the 8th**,** while w/c 15th October is designated **'Biology Week'** and we have 3 evening lectures on a range of topics, including a debate on *'Do we need pandas?'* – enjoy

exploring the new website for details! And don't forget the Birkbeck lecture series which the Linnean Society supports.

On the research funding front, the Society has awarded around £275,000 for various taxonomy-related projects under the auspices of the SynTax and Systematics Research Funds. The Society in turn continues to receive generous funding from the Andrew Mellon Foundation for it's own projects, but we are continually seeking other funding sources to allow us to retain our dedicated and experienced team for new projects, such as the conservation and digitization of the Charles Darwin Foundation Galapagos Archive, enhancing the accessibility of Linnaeus' manuscripts, and supporting Tom Kennett while he writes the biography of the Society's founder, James Edward Smith. Encouraging your friends and colleagues to become Fellows and/or hire our rooms are good ways that you can help augment the Society's revenues – just contact Tom Helps or Victoria. Legacy donations are also important – our most recent one being £126,000 from John Topp.

Looking forward to next year, we will be celebrating the Centenary of the death of Wallace, and have a number of collaborative meetings/events/publications planned, including one with the Society for the History of Natural History and University of Bournemouth in Dorset, to include a visit to Wallace's unusual gravestone, while the annual field trip is likely to be to North Wales.

ELIZABETH ROLLINSON
Executive Secretary

The Annual Field Trip – North Norfolk

– led by John Pearson, Terry Preston and Adrian Lister

The word is obviously out on what fun the annual field trip is, because for the first time, we found ourselves oversubscribed and are sorry for any disappointment this caused. Despite it being one of the coldest and wettest Junes on record, we managed to escape the worst of the weather. Our first excursion was to the RSPB Bird Reserve at Titchwell Marsh, where we were accompanied by two knowledgeable RSPB ornithologists. We walked from the visitor centre down to the sandy beach, through meadows dotted with orchids, then reed beds and shallow lagoons which were full of birds, including avocet, black tailed godwit and spotted redshank, and we were regaled by large flocks of knot on the beach. No booming was heard from the bittern but a marsh harrier cruised over the reeds where the bearded tits nest (it was too windy for the tits to fly), and we were delighted to spot a Chinese water deer on the way back.

Sketch by Ian Guyver showing the old lifeboat station on Blakeney Point.

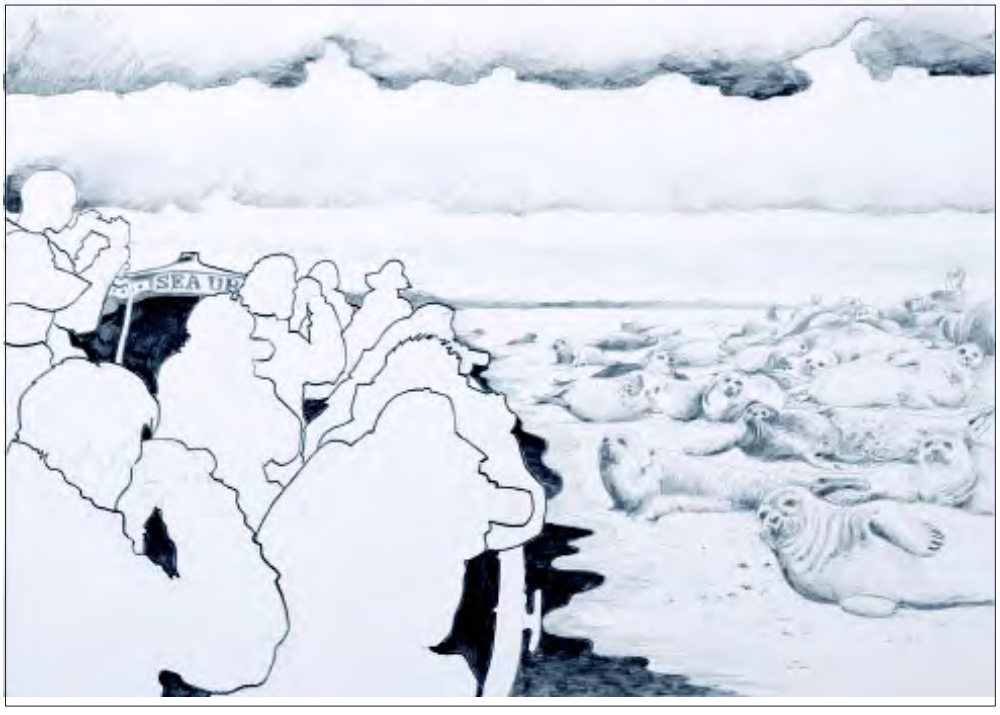
A pleasant evening was spent over dinner at *The Feathers* in Holt, where we were joined by additional members. We were up bright and early the next morning to beat the tide and catch Mr Bean's boat to take us to Blakeney Point, a 3-mile-long sand and vegetated shingle spit from which we enjoyed uninterrupted views of this dynamic coastline. The varying light of Norfolk's big skies created an ever-changing scene as the storm clouds rolled around in the distance. Led by Terry Preston and John Pearson, we visited the former lifeboat station and UCL facilities which had special exhibits to mark the 100th anniversary of the National Trust on Blakeney Point, showing the sea levels reached during various inundations (glad we missed the last high tide!). As we

Group on Blakeney Point with John Pearson talking plants. Photo Vaughan Southgate.

Photo above by David Rollinson.

It was cosy on the boat! Photo by Vaughan Southgate.

walked, we saw oyster-catcher eggs on bare shingle and recently hatched chicks, and various botanical delights, including the stunning yellow horned poppy, *Glaucium flavum*. Apart from some of the sand dune usuals that we passed, the most noteworthy was the grey-hair grass (*Corynephorus canescens*) which is a nationally scarce species, but is widespread at Blakeney Point and records show it started to spread from the late 1960s onwards. The two most noteworthy species we looked at in Great Sandy Low were two UK endemics and not just that they are confined to this 15 to 20 mile stretch of the coast of Norfolk, between Holme Dunes and Blakeney Point. These are the sea lavenders – rock sea lavender (*Limonium binervosum* ssp *anglicum*) and matted sea lavender (*Limonium bellidifolium*) – both are found in the drier parts of the upper marsh where there is a mixture of sand and shingle. At Blakeney Point they make up an assemblage of unique (in the true sense) species along with species such as sea heath (*Frankenia laevis*) and shrubby sea-blight (*Suaeda vera*) that are not found elsewhere in Europe or the world!



Sketch by Ian Guyver of the group watching seals from the boat.

Ray Heaton digging for mammoths.

Terry Preston and Adrian Lister sieving. Photo Marilyn Southgate.

The group on the beach with Susan Gove's dog Sam joining in the fun.

We then re-embarked to view the ternery, teeming with sandwich terns together with common, arctic and little terns, seen flying with sand eels in their beaks. The boat continued round the point to where the seals were basking – the Common Seals have their young between June and August, the (larger) Grey Seals between November and January – and the more inquisitive ones popped up around the boat – seals are undoubtedly hugely engaging! Our 'field artist-in-residence' Ian Guyver charmed us with his sketches as usual.

We then had a brisk drive to West Runton for lunch at the local hostelry before being taken by Adrian Lister on a beach/cliff walk in search of fossils. We didn't find another woolly mammoth but we did try hard and much fun was had by all digging into the cliff and investigating the many rock pools on the beach, where again there were plenty of seabirds to observe. We were all so engrossed that time ran out on us and the original plan to visit the Cromer museum was abandoned and we enjoyed a delightful sunny moment instead.

We are indebted to Sam and Leonie for sorting all the logistics and to John, Terry and Adrian for leading the trip and imparting their deep knowledge of the area.

ELIZABETH ROLLINSON

Library

Our Deputy Librarian, Elaine Charwat, has been working hard on two major IT developments over the past 6 months – the new Society website and the new Linnaeus Link system. Elaine has been developing the Library pages for the new website and sourcing wonderful images from the collections to illustrate and enhance the written content.

The new Linnaeus Link was conceived as a state-of-the-art one-stop-shop for online searching of Linnaean material held in institutions worldwide. It will also continue the proud tradition of being the online arm of the definitive bibliography of Linnaean works begun by Basil Soulsby. The prototype of the new system, built to our specifications, received very enthusiastic feedback from Partners and testers across the world. A demonstration for interested Fellows was given at the Conversazione in July. The new Linnaeus Link Union Catalogue went live on the 24th of September. This was an unofficial launch to ensure that the system behaved as expected when switched over to live mode. The official launch of the new system will take place in October at this year's Partners' Meeting at the National Botanic Garden of Belgium in Meise. Leaflets promoting the new system have been designed in-house, and they will be used for the first time to advertise the new Linnaeus Link to the world at this year's Göteborg Book Fair.

Work continues apace on the Smithian correspondence material. Tom Kennett is now producing in-depth catalogue entries for the letters in volume 17, while the conservation team is currently treating volume 21. The Digitisation Officer, Andrea Deneau, is setting up protocols ready to move on to scanning the letters. Hand-made fascicules will house the letters once that digitisation work has taken place and, so far 140 of those have been prepared. We were very sad to say goodbye to Lucy Gosnay, the Project Conservator, who has now joined the conservation team at the National Archives. Helen Cowdy has taken over her role here and a new Assistant Project Conservator has just been appointed to cover the remaining year of the project.

Janet Ashdown, our Conservator, has been working on preparing the annotated volumes from the Linnaean Collection for digitisation. This has involved assessing every volume and deciding on the best approach in each case. In order to facilitate scanning of the annotations in volumes that have been bound very tightly it was necessary to dis-bind some of the books completely. The volumes were then subsequently repaired, re-sewn and rebound. All old binding material was retained for reference. Some volumes were only partially dis-bound and their spines relaxed to enable scanning. The old bindings were then reinstated.

In April, the Society was delighted to accept the donation of the entire biological library of Professor John Cloudsley-Thompson, together with several artworks by his late wife, Anne, a member of the London Group. Professor Cloudsley-Thompson's activities in a wide range of zoological fields, including work on arthropods, reptiles and desert ecology, will be known to many of the Fellows. He is a Fellow *honoris causa* and has been a member of the Society for over 60 years. Work has started on sorting and cataloguing this important collection of monographs and journals.

The Executive Secretary has mentioned in her Society News the welcome acquisition

of extra storage space in Toynbee House. Recent visitors to the Society's Rooms will have seen untold numbers of book-boxes stacked ready for transfer to the new building. Since the lift work will entail the creation of a new Library entrance in the north wall of the Library Annexe, several hundred volumes from there are also being packed up and moved to the safety of the Burlington House basements for the duration.

LYNDA BROOKS
Librarian

Donations to the end of August 2012

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Correspondence

From: Peter James FLS Hunstanton, Norfolk

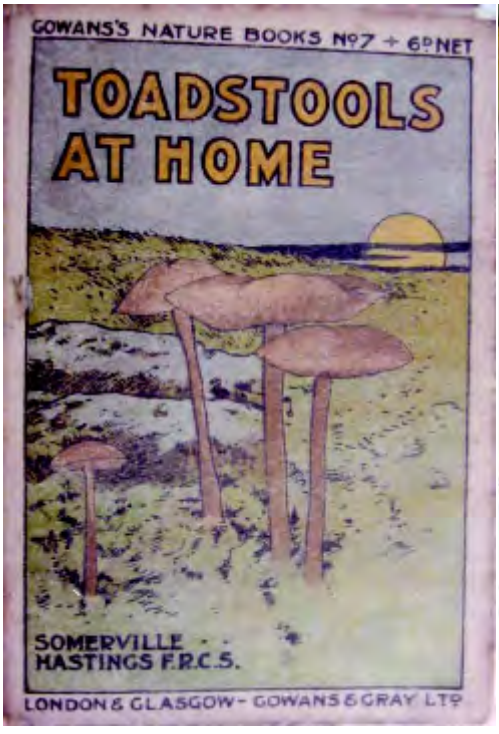
The wet, warm Summer of 2012, like that of 2010, promises, as I write, a bumper crop of woodland fungi. So, with climate change high on the agenda and after my own little foray, I decided, out of sheer curiosity, to see what Edith Holden, in her famous *'Country Diary of an Edwardian Lady',* of 1906, had had to say about fungi. Her entry for November 3rd, reads:

'Cold and foggy in the morning, bright sunshine later. I brought home a little book on British Toadstools today, with photographs of 65 different varieties...' These did not, however, include '...my beautiful scarlet, spotted toad-stool...' At the end of the book, says Miss Holden, were.... 'some interesting notes one of which describes the formation of the Toad-stools and Mushroom plants'. Whatever could this 'little book' have been?

Using the above clues, Leslie Ragab, librarian at CMI, was kind enough to trace the book for me, a copy of which I subsequently acquired via the internet. It turned out to be *'Toadstools at Home'* by Somerville Hastings. The work was no. 7 in the Gowans's Nature Books' series, retailing at 6d! Small the book certainly was (c.A6) and obviously intended as a pocket field guide. First published in June 1906, it ran to a reprint in December of that year and a second edition in May 1907. It was clearly a popular work.

Somerville Hastings was a Fellow of the Royal College of Surgeons and, through the good offices of their librarian, Geraldine O'Driscoll, I was able to obtain a short biography of him. He was a fascinating man. Born in Wiltshire in 1878, a 'son of the Manse', he was seven years younger than Edith Holden. He was educated at University College London where he won both silver and gold medals for botany. He qualified as a surgeon in 1902 and took up posts at various London Hospitals, specialising in ENT surgery at which he became an eminent practitioner. He began a political career in 1923 when be became Labour member for Reading. As if all this was not enough, he was a founder member and subsequently President, of the Socialist Medical Association which was instrumental in the setting up of the NHS. In his spare time(!) he managed to write, (in addition to *'Toadstools* at *Home'), 'Summer Flowers of the High Alps', 'Alpine Plants at Home'* and *'Wild Flowers* at *Home'*. The first two presumably reflected his holiday preferences. He died, at the age of 89, on July 7th, 1967, outliving Edith by 47 years. She, tragically, drowned in the Thames, Ophelia-like, while trying to secure a twig of chestnut, in 1920.

It is one of those twists of history that Edith Holden is now remembered *only* as the author of the *'Diary',* which became a 'cult' book in the late '70's. It was originally intended as a teaching aid for an art class, which Edith taught at a friend's girl's school, and was never meant for publication. Edith Holden was, in fact, an accomplished natural-history artist and book illustrator but, what was for her a minor work, is fixed forever in the public memory.



As to the absence of '. ...my beautiful scarlet, spotted toad-stool... ' clearly Fly Agaric, Hastings, while, as Edith laments, does not illustrate it, he does, in fact, make reference to it by drawing attention to the important difference in the colour of the pileus of the 'Blusher' *(Agaricus rubescens,* now *Amanita)* and that of the 'Fly Fungus' '...which is so deadly poisonous'.

One final intriguing detail in Miss Holden's *'Diary'* is a misquote from Hastings' book. In his explanation of the formation of the mushroom fruiting body, his original text reads:

' it is only when the plant ….. becomes vigorous enough to wish to produce seeds or spores, that Mushrooms appear'.

Miss Holden quotes this passage but omits the words 'to wish'. Was this a simple precis, a *lapsus calami* or, perhaps, just maybe, a tiny rebellion against, what she saw as, Hastings' teleological language? We shall never know.

On the Origin of Mass Extinctions: Darwin's Nontrivial Error

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Abstract

Darwin's *Origin* launched evolution into theoretical orbit and it continues to influence its course. This *magnum opus* detailed the answer to perhaps the most fundamental question that had riddled man since the dawn of civilization, and although this Promethean vision contains a few minor errors, there is one nontrivial error which misguides several crucial developments – not only in the evolving structure of evolutionary theory, but across the entire spectrum of science, including politico-economics. This problem has led theorists to mistakenly favour earth-based inputs over cosmic inputs, to over-emphasize biological evolution, and to under-emphasize stellar evolution. These perceptive, methodological, and logical errors have, in turn, emphasized the significance of the *individual* "struggle against competitors" over the *cooperative* "struggle against inclement environments", and thus fashionable theories relating to *Global Warming*, *The Problem of Sustainable Economic Development*, and *The Tragedy of the Commons* have been erected upon false and sandy foundations and suggest evolutionarily unstable solutions. And to this point, in light of the discoveries presented here, we conclude that largely redirected global threat mitigation efforts will require unprecedented levels of international cooperation if long-term human survival is to be achieved.

Introduction

On the Origin of Species by Means of Natural Selection, or the Preservation of the Favoured Nations in the Struggle for Life (1) was published 150 years ago, on November 24th of 1859, and – with *De Re Militari* (2), *On the Revolutions of Heavenly Spheres* (3), *Mathematical Principles of Natural Philosophy* (4), *A Treatise of Human Nature* (5), *An Inquiry into the Nature and Causes of the Wealth of Nations* (6), *Common Sense* (7), *An Essay on the Principle of Population* (8), *Two Lectures on the Checks to Population* (9), *Personal Narrative* (10), *Cosmos* (11), *On the Law which has Regulated The Introduction of New Species* (12), *The Gettysburg Address* (*cf* 13), *A Dynamical Theory of the Electromagnetic Field* (14), *Sailing Alone Around the World* (15)[1], ten *Annalen der Physik briefs* (16-25), *The Winning of the West* (26), *The Economic Consequences of the Peace* (27), *Theory of Games and Economic Behaviour* (28), *The Second World War* (29) *Non-Cooperative Games* (30), *The Logic of Scientific Discovery* (31), *Molecular Structure of Nucleic Acids* (32), *Island Biology* (33), *The Pretense of Knowledge* (34), *The Constitution of Liberty* (35), *The Mustique Co. Development Plan of 1968* (*cf* 36), a 1985 letter to *Nature* (37), a 1987 interview in *Woman's Own* (38), *The Process and Progress of Economics* (39), *Evolution and the Theory of Games* (40), *The Structure of Evolutionary Theory* (41), *What Makes Biology Unique* (42), *War and Peace* (43), a secret message (44), and *Failure is Not an Option*

(45)[2] – glimmers amongst our most brilliant illuminations, most valuable problem-solving tools, and most informative sources for long-term human survival strategies.

As a Fellow of the biological society (46; *cf* 36) where Darwin and Wallace devoted much of their efforts and announced their revolutionary discovery (47; *cf* 48), it may come of little surprise that I hold the *Origin* in high regard (*cf* 36). Furthermore, I concur that the *Origin*

> exceeds all other scientific 'classics' of past centuries in immediate and continued relevance to the basic theoretical formulation and debates of current practitioners. Careful exegesis of Darwin's logic and intentions, through textual analysis of the *Origin*, therefore assumes unusual importance for the contemporary practice of science (41, p58).

Which is exactly why it is so critical that I must attempt to bring the grave nature of the *Origin's* most significant error to light. This task would not be so difficult if it were not for the fact that so much that has "been so thoroughly muddled by Plato and Aristotle, whose influence has given rise to such deep-rooted prejudices that the prospect of dispelling them does not seem very bright" (49, vol II, p9), but I will try.

And it seems this effort must include rough sketches of three intellectual obstacles which effectively block the doorway to these illusive truths. Presently, we'll consider the most menacing gargoyle: *teleology*.

Several methodological issues make it rather difficult to ascertain how little or much to say about this big problem, so I will merely offer a brief definition ["any

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1. Joshua Slocum was the first man to sail around the world in a small boat with none but himself as captain, mate and crew. Other men may repeat the feat. No other man can be the first…. He wrote of his ship and his voyage, and it never occurred to him that in doing so he was forging a bond between the English whose blood was in his veins and the Americans under whose flag he was proud to circumnavigate the world….

   Captain Slocum was born in Nova Scotia in 1844.... He was eight years old when his family moved to Briar's Island and he left school and was put to work on the farm. At the age of twelve he was caught making a ship model in the cellar where he should have been grading potatoes, was given a beating, saw his model smashed and ran away from home. For the next few years he earned a living for himself, as cook, ship's boy and what not, among the fishermen on the Bay of Fundy. At the age of sixteen he and a friend sailed before the mast in a full-rigged ship from St. John's [*sic*], New Brunswick, to Dublin. We next hear of him as an ordinary seaman in a British ship, sailing from England to China. He went down with fever and was left in a hospital at Batavia. There he made a very good friend in Captain Airy of the *S.S. Soushay*. He left Batavia in the *Soushay*, and in that vessel voyaged at many far-eastern ports. He can have lost no opportunity of educating himself, for at eighteen he was promoted to second mate. He twice rounded the Horn in British ships (15, pp 21-22).

2. We had not anticipated what happened back then, on Earth.... In fact, it would be hours before we really understood what had happened.... [But] what we could not accomplish through technology, or procedures and operating manuals, we might be able to manage by drawing on a priceless fund of experience, accumulated over almost a decade of sending men into places far beyond the envelope of Earth's protective, nurturing atmosphere.... These three astronauts were beyond our physical reach. But not beyond the reach of human imagination, inventiveness, and a creed that we all lived by: 'Failure is not an option' (45, p 12)

processes that 'persist toward an end point under varying conditions' or in which 'the end state of the process is determined by its properties at the beginning'" (42, p 49)], refer the curious to a more thorough contextualization (*cf* 42, pp 39-41), and restrict focus to aspects most relevant to the problem at hand:

> Natural selection does not guarantee the power of adaptation in all circumstances, and if environments change rapidly and profoundly enough, these alterations may exceed the power of adaptation by natural selection, with extinction of most forms as the expected result, even in the most strictly Darwinian of circumstances.
>
> Darwin's hostility to catastrophic mass extinction does not arise primarily from threats posed to the mechanism of natural selection itself, but more from the challenges raised by the prospect of sudden global change to the key assumption that observable processes at work in modern populations can, given the amplitude of geological time, render the full panoply of macroevolutionary results by prolonged accretion and accumulation.
>
> The problem of mass extinction became acute for Darwin because geological paroxysm threatened something quite particular, vitally important, and therefore of much greater immediate pith and moment than his general methodological preference for locating all causality in the palpable observation of microevolution… Global catastrophe could undermine the ecological argument that Darwin had so carefully devised… to validate something more particular but no less important: *his culture's central belief in progress*.
>
> To explain the general pattern of life's history, Darwin sought to extrapolate the results of competition ordained by the immediacies of natural selection in ecological moments. In particular…, to argue that most competition, in a world chock full of species, unfolds in the biotic mode of direct battle for limited resources, *mano a mano* so to speak, and not in the abiotic mode of struggle to survive in difficult physical conditions. If struggle by battle (which favors mental and biomechanical improvement) trumps struggle against inclement environment (which often favors cooperation rather than battle…), then a broad vector of progress should pervade the history of life (41, pp 1298-1299).

But of course the fossil record has clearly demonstrated that this is not the case; and thus Darwin's need to cater to the teleological worldview of the Victorian era has, alas, generated deeply entrenched and long-lasting consequences.

This seemingly minor flaw in this magnificent foundational work has spawned grave and unintended consequences, namely, the gross underestimation of the global, national, and familial threats presented by cosmic (and a few planetary) inputs. Perhaps most significantly, it has almost completely obscured our dire need for cooperation (threats presented by cosmic and planetary inputs) at the global level.

These crucial points were recently synthesized, unified, and contextualized in a brief communiqué (*cf* 50) and then sailed the Gulf Stream in a rather long message-in-a-bottle (*cf* 36),

> but as the exposition of the entire group of considerations would be rather difficult to follow, only a few quite elementary reflexions will be given in the following

> pages, from which the reader will readily be able to inform himself as to the suppositions of the theory and its line of thought (24, p.898).

On Darwin's Nontrivial Error

The 150th anniversary of the *Origin* and the 200th celebration of Darwin's birth have generated both praise and critical reassessments of Darwin's works and methodology. To date, criticisms appear to have largely recounted trivial errors (e.g.51).

However, in order "to enhance the implausibility of truly catastrophic mass dying, Darwin holds that 'the complete extinction of the species of a group is generally a slower process than their production" (1, p 318, as cited in 41, p 1300). Darwin confessed, "Scarcely any discovery is more striking than the fact, that the forms of life change almost simultaneously throughout the world" (1, p 322). And in pages 317-318 he falsely concludes that

> this impression must be an artefact produced by the markedly incomplete preservation of more gradual and continuous change in a woefully imperfect geological record.... 'The old notion of all the inhabitants of the earth having been swept away at successive periods by catastrophes is very generally given up, even by those geologists… whose general views would naturally lead them to this conclusion. On the contrary, we have every reason to believe, from the study of the tertiary formations, that species and groups of species gradually disappear, one after the other, first from one spot, then from another, and finally from the world.' (1, p.302, as cited in 41, p.1301).

This nontrivial error leaves us increasingly vulnerable to mass extinction by continuing to misguide science and pop-culture alike:

> In particular, these… assumptions about the extended duration of apparent mass extinctions led geologists and palaeontologists to favour earth-based rather than cosmic physical inputs…, and to focus upon telluric influences (like changing climates and sea levels) that could most easily be rendered as gradualistic in style. So strongly entrenched did this prejudice remain, even spilling over into popular culture as well, that a few years after Alvarez *et al*. published their plausible, and by then increasingly well affirmed, scenario of extraterrestrial impact as a catastrophic trigger for the Cretaceous-Tertiary event, the *New York Times* even ridiculed the idea in their editorial pages, proclaiming… that 'terrestrial events, like volcanic activity or changes in climate or sea level, are the most immediate possible cause of mass extinctions. Astronomers should leave to astrologers the task of seeking the cause of earthly events in the stars' (41, p 1303).

If the problem at hand is not clear by now, please consider an extraordinary new book: *The Cosmic Connection: How Astronomical Events Impact Life on Earth* (52):

> Our ascendancy as a species is usually credited to Darwinian processes, such as passing along traits from one generation to the next, genetic mutations that improve an organism's chances of survival, successful adaptations of organisms to different regions or environments, and the flourishing of one species or another. Nevertheless, evolution is not enough to explain the ascension of the human race on this amazing planet. In its most sweeping terms, life also results from conditions not of our world but of our universe (52, p.10).

Indeed, social and biological sciences place undue emphasis upon very recent events – the social sciences find a great deal of significant data in the past few centuries, and the biological sciences find a great deal of significant data over evolutionary time, but, in reality, the Earth has experienced almost no significant cosmic events (and thus we find very little truly useful data insofar as long-term human survival is concerned) in the entire course of Hominid evolution.

For example the "asteroid the size of Mount Everest" (52, p.12) that splashed down along the coast of the Yucatán peninsula, resulting in the complete extinction of 70% of terrestrial life (including 100% of the dinosaurs) and 96% of all marine life, does, to be certain, represent one of the most significant events in natural history and therefore one of the most valuable pieces data on Earth – but neither economists, politicians, popular culture, nor even evolutionary theorists appear overly concerned with this 'outlier'. And, once again, this is problematic, to say the least because

> knowing how astronomical influences have shaped our world and enabled the human race to evolve and flourish gives us a unique perspective on the nature and direction of life on Earth and the possibility of life on other planets (52, p 13).

"Mass extinctions are more frequent, more rapid, more intense, and more different in their effects than.... Darwinian biology could permit" (41, p.1312-1313), and this has had profound effects upon all sciences and politico-economic development strategies. To paraphrase J.B.S. Haldane (53), one does not have to be a profound realist to realise that consistently underestimating the probability of mass extinction finds favour with those clinging to teleological comforts, and creates serious problems for those who endeavour to develop and deploy evolutionarily stable strategies.

And to make matters worse, those able-minded theorists who possess the courage and take the time to patiently offer these unfashionable perspectives are invariably ignored or ridiculed. One such individual, Milutin Milankovitch, quietly pointed out that the Earth's axis is not fixed, but rather oscillates over a 41,000 year cycle, an oscillation which appears to have been (and *continues* to be) the greatest long-term influence upon climate change (52). And, like many misunderstood visionaries, "Milankovitch was certainly on to something when practically everyone else thought he was not" (52, p.38).

How was it that he was able to see something so clearly which so many others could not? By simply adopting the universal worldview necessary to grasp the discovery illuminated here:

> Milankovitch did not merely see the Earth and its sediments; he saw the Earth in space and in motion around the Sun over the course of millions of years. It took uncanny vision to step off the Earth and look back from a distance of 100 million miles and watch cogs turn, then forge a. connection..... It was the same kind of vision possessed by people like Agassiz, Adhemar, Croll, and Wegener, some of whom paid a high price to see worlds, possibilities, and connections that others could, or would, not (52, p.28).

Although it is true that "nothing makes sense in biology except in the light of evolution" (54, p.449), that nothing *on Earth* (or elsewhere in the universe) makes sense except in the light of galactic, stellar, and planetary evolution is a more significant truth:

> Look anywhere beyond our little nook of Galaxy and you will see a universe that is not only dispassionate, but dangerous and random. Comets plough into planets. Stars explode without regard to what clinging forms of life may be in the vicinity. Black holes suck up space and time at will (52, p.63).

At least one influential writer (55) has suggested we will never accomplish interstellar travel; but as an optimistic[3] problem-solver focused upon human survival, your author believes that where there is a will, there is a way.

Furthermore, in essence, this pessimistic prophecy has already been falsified: *we have, essentially, been travelling in such a manner for the past ˜13 billion year*s: Our planet – along with the rest of our solar system – is speeding through interstellar space at 12 miles per second "in the direction of the constellation Hercules, southwest of the bright star Vega and just north of the billowy clouds of the summer Milky Way" (52, p.162).

Discussion

What logical implications follow from these profound and illusive truths? What are the implications for the advancement of science? National security? International Cooperation? Human survival?

In general, we may wish to start thinking more clearly about the road ahead, being mindful of obstacles we may wish to try to avoid or prepare to meet.

But this would require – amongst a myriad of inter-connected issues – the complete recognition and wide adoption of Sir Karl Popper's remarkable solution (31) to David Hume's *Problem of Induction* (5). I've written on this topic at length (e.g., 50; 36; 13) and brilliant thinkers from Hayek (34-35) to Hawking (57) have testified as well, but there's little to indicate we're willing to relinquish our "intense desire for assured knowledge" (58, p.22) and teleological fairytales; it seems our disdain for realism and affection for the *Pretense of Knowledge* (34) remains so strong that we'd rather be *Fooled by Randomness* (59) and commit ourselves to near-certain extinction than face these difficult and disquieting truths (extinction would remain a high probability even if we were thinking clearly, strategizing, and acting accordingly). Clear thinking about this problem would also require the wide recognition of a key deduction by a gifted problem-solver "regularly credited with being one of the two most important logicians of the twentieth century" (60): Economic power is derivative, not primary (61; *cf* 13, 2, 6, 26, 29, 44).

But, like the perverse effect of the welfare state (62), this is yet another unfashionable truth which most would prefer not to acknowledge. Indeed, the inter-related problems which stem from Darwin's Nontrivial Error are incredibly far-reaching, yet we must confine ourselves to brief examples. Consider, for example, that growing legions of ideological environmentalists and an entire 'school' of economics (so-called 'ecological economics') have failed to recognize the *existence*,

3. Yes, despite all this I remain an optimist toward the world. It is one's duty to be an optimist. Only from this point of view can one be active and do what one can. If you are a pessimist, you have given up. We must remain optimists, we have to look at the world from the point of view of how beautiful it is, and to try to do what we can to make it better (56, p.48).

much less the *significance*, of cosmic inputs. In fact, a very heavy game-theoretical wrecking-ball (50) topples so many widely-held and wildly popular theories (e.g., 63-64) that it will likely face fierce resistance[4], and, as Edward De Bono once conjectured, it is possible that these unfashionable ideas "can only be expressed in book form" (65, p.31); thus, Fortune willing, a very big book with a very simple, straight-forward message – *one long argument* – is on the way (*cf* 36, pp.66-68).

But for now let's consider the manner in which our theoretical wrecking-ball (*cf* 50) falsifies the central thesis of 'ecological economics' (and hip-checks ideological environmentalism to the boards) – a refutation which is quite unnecessary – for it is quite unnecessary to falsify a 'subject' which does not exist (*cf* 36, pp 80-81), yet some may insist.

So, consider the flimsy central thesis, as postulated by Herman E. Daly:

> The facts are plain and *uncontestable*: the biosphere is finite, nongrowing, *closed* (except for the constant input of solar energy), and constrained by the laws of thermodynamics. Any subsystem, such as the economy, must at some point cease growing and adapt itself to a dynamic equilibrium, something like a steady state (66, p.101).

But are the *facts plain* and *uncontestable*?
Is the biosphere *closed*?
Is solar energy a *constant* input? (*cf* 52).
Is solar energy the *sole* 'cosmic input' to consider?

I'm afraid school is officially in session for Professor Daly and his fashionable friends because the existence of a wide variety of cosmic and planetary inputs illuminates the false foundation upon which the central thesis of ecological economics is lightly tethered (50). Alas, the Earth has not, nor ever will be in a steady state, as the problem of induction renders this state indeterminable (31; 50).

But problems associated with the errors at hand are certainly not limited to this popular branch of economics. In fact, sampling the most influential scientific journals (67) at random testifies to near-universal error. For example, a review of Science's 'top articles of last month' reveals that, yet-again, Garret Hardin's 1968 *Tragedy of the Commons* (68) remains at the top, and very little literature review is required to conclude that this paper remains amongst the most influential papers in science. However, setting aside the fact that the citation itself, "Hardin 1968" (68) is incorrect (69), logical implications which follow from the truths presented here falsify this highly influential theory; although this discourse is restricted to elementary reflexions, exhaustive indirect proofs (50; 36) and *On the Travesty of the Tragedy of the Commons: Hardin's Nontrivial Error* (69) clarify this conjecture; further reflexions on this refutation yield a bountiful harvest of related revelations, including the falsification of the findings of a 2009 *Sveriges Riksbank Prize* winner. Although detailed

4. I suppose the process of acceptance will pass through the usual four stages:
   1. This is worthless nonsense,
   2. This is an interesting, but perverse, point of view,
   3. This is true, but quite unimportant,
   4. I always said so (53, p.464).

considerations remain outside the scope of this discourse, a review of collected works (70-80) reveals systemic errors, faulty perceptions, and false conclusions. And this is, in large part, due to the fact that these faulty perceptions and methodological errors are the norm, not the exception:

> When we look at the world around us we see (if we are attentive enough) what is actually there, even if what is actually there is not the same as what we expected to see there. When we turn our attention from the world around us to the world of possibilities that we can imagine with our minds, however, perception does not work nearly so well. We often fail to see the obvious until it is too late or until somebody else sees it and points it out to us. And very often something that we think is the case is not the case at all (81, p xiii).

Ostrom's potpourri of apocrypha (70-80) were derived through the inductive analysis of data relating to incomplete perceptions of various 'commons' problems around the world[5] and inherently flawed by an inability to imagine the serious possibilities presented by cosmic inputs. But, to be fair, our prizewinner is certainly not alone.

Indeed, the fashionable empirical methods in economics invariably leave us with little more than legerdemain (i.e., 63-64; 66; 68; 70-80), and these errors remain wholly uncorrected (e.g., 82):

> We have depended on analysis not only to solve problems but also for our source of new ideas. Most people in education, science, business and economics still believe that the analysis of data will give us all the new ideas that we need. Unfortunately, this is not so. The mind can see only what it is prepared to see. That is why after a breakthrough in science we look back and find that all the needed evidence was available a long time before but could be seen only through the old idea (65, p.23).

Indeed, almost all of the truths presented here were known to us *prior* to the publication of Darwin's *Origin* in November of 1859 (1), but alas, this is the process and progress of science (39).

Why is the process so slow and misguided? This is, alas, a long and sad story (34), because, once again, things have "been so thoroughly muddled by Plato and Aristotle" (49, p 9). And, as previously noted, we find very, very little useful empirical data on Earth. Refer back to the footnote below, note that Ostrom's researches are "based on

5. Ostrom... has challenged the conventional wisdom that common property is poorly managed and should be completely privatized or regulated by central authorities. Based on numerous studies of user-managed fish stocks, pastures, woods, lakes, and groundwater basins, Ostrom concluded that the outcomes are often better than predicted by standard theories. The perspective of these theories was too static to capture the sophisticated institutions for decisionmaking and rule enforcement that have emerged to handle conflicts of interest in user-managed common pools around the world. By turning to more recent theories that take dynamics into account, Ostrom found that some of the observed institutions could be well understood as equilibrium outcomes of repeated games. However, other rules and types of behavior are difficult to reconcile with this theory, at least under the common assumption that players are selfish materialists who only punish others when it is their own interest. In field studies and laboratory experiments individuals' willingness to punish defectors appears greater than predicted by such a model (82, pp.1-2).

numerous studies". Note how many times the Swedish Royal Academy has referred to her "observations". Or better yet, consider spending a few moments listening to Ostrom infer validity for her findings by rattling-off the numbers of her studies which support her untenable conjectures (83). An excerpt from some recent correspondence may help contextualize this important point:

– – – Original Message – – –

Subject: *Nontrivial indeed*
Date: *Tue, 1 Dec 2009*
From: *Jeff Kanipe*
To: *Matt Funk, FLS*

Hello Matt,

I must say I'm very impressed by your paper on Darwin's nontrivial error. Will this eventually be published? I certainly hope so, as you raise some fascinating points that I'm sure would spur further discussion.

I especially appreciate your generous direct reference to my book [52] in the text.

What was interesting for me was to see how you applied my points to yours, although they are ones that I'm embarrassed to say I didn't fully consider at the time! It leaves me feeling I accomplished something greater than what I first set out to do!

For example, Gould's statement on page [3], concerning how competition in a world teeming with species unfolds in one of two ways, either as a 'struggle by battle' or a 'struggle against an inclement environment,' made me reflect back to my chapter on asteroids and asteroid mitigation.....; [and] .....Gould's remarks, coupled with the two points you make in the following paragraph, clearly indicate that civilization is facing an imminent crossroads at which we either choose the path of global cooperation and the hope for continued existence, or stick with Darwinian processes and risk not surviving as a species. . . .

Said another way, if we are to survive as a species-as Earthlings-we must now take the high road, whereby we cooperatively struggle against the 'inclement environment' of our planet in space, rather than just localized inclement environments on Earth. Natural selection, per se, takes a back seat to global extinction events; in fact, it may not even be in the car (84).

Yes, Kanipe is quite right, Natural selection may not even be on the same roadway. Furthermore – and to this salient point – outside of pure physics, empiricism invariably takes back seat to pure theory. For example, consider one of the most brilliant illuminations, most valuable problem-solving tools, and most informative sources for long-term human survival strategies noted in §1:

In the last of his 1905 papers, entitled *On the Electrodynamics of Moving Bodies* [19], Einstein presented what became known as the special theory of relativity. The paper reads more like an essay than a scientific communication. Entirely theoretical, it contains no notes or bibliographic citations. Einstein wrote this 9,000-word treatise in just five weeks, yet historians of science consider it every bit as comprehensive and revolutionary as Isaac Newton's *Principia* [4] (85).

Alas, however, not only does the thoroughly embarrassing academic infatuation with history invariably put empiricism in the front of the car – *it puts it in the driver's seat*[6]. And the *Poverty of Historicism* (86), which happens to be inextricably intertwined with that menace known as teleology, is an impoverished and depauperated state which no species can survive for long. It may be interesting to speculate how many journals would pass on publication of *On the Electrodynamics of Moving Bodies* (19) today. Afterall, the Swedish Academy did not have confidence in this essay, thus they awarded Einstein the 1921 prize in physics for a much less significant contribution (18; *cf* 85).

Yes, our planet is a precious resource which we must endeavour to protect – but it is also a *depreciating asset* which we must *eagerly* and *voraciously* consume in order to survive, and, in light of cosmology and the problem of induction (50), we may arguably assume a depreciation schedule of ˜50,000 years. In brief, our struggle to protect this asset must be balanced with a recognition that we have rightly been consuming (and must continue to consume) this resource in our inherently resource-intensive quests for threat mitigation technologies (fission, fusion, spacecraft, weapons, telescopes, asteroid tugboats, alternative food sources, deep underground/undersea human habitats, etc.) to help extend the shelf-life of the Earth and the life-span of the human species, and, moreover, to ultimately facilitate our search for another world (ultra long-distance dispersal, *cf* 50; 87).

This new concept – *ultra-long distance dispersal* (ULDD) – happens to represent another intellectual obstacle which threatens to thwart our efforts here because, to date, it has not been recognized as the ultimate measurement of Darwinian fitness. Although Hawking champions ULDD (87), few others second this motion. This may in part be due to the fact that, given Darwin's Error, with the notable exception of a few key revolutionary insights (*cf* 33; 88-90), contemporary evolutionary theorists have also largely failed to recognized the crucial role long-distance and inter-continental dispersal have played in human evolution (i.e., getting "Out of Africa"). But a brief thought experiment reveals that, *reductio ad adsurdum*, ULDD, is the ultimate measure of fitness, because, in the long run, *resource holding power* (40) is ultimately determined by ULDD.

And this lamentable failure to recognize the unity of nature brings us to a brief reflexion on the third obstacle which threatens to obliterate our truly inconvenient truth from the light of day: the manifold and intrenched problems associated with *specialization*:

> The specialization of science is an inevitable accompaniment of progress; yet it is full of dangers, and it is cruelly wasteful, since so much that is beautiful and enlightening is cut off from most of the world. Thus it is proper to the role of the scientist that he not merely find new truths and communicate it to his fellows, but

6. There is an obsession with history. History is there and increasing in quantity, both because we are learning more about it and because we create it every day. We can get the 'teeth' of our minds into it. History is attractive because it is always possible to find a niche and there is always a reward for effort – in contrast to many subjects in which years of endeavour may produce nothing. It is attractive to minds with a preference for analysis... It may also, sometimes, be a refuge for minds that would not achieve much elsewhere (65, p.24).

> that he teach, that he try to bring the most honest and intelligible account of new knowledge to all who will try to learn (91, pp 138-139; *cf* 50).

And thus we have reached the crux of this difficult climb. Oppenheimer estimated that scientists may make up about "one one-hundredth of a percent" of the human population (91, p.94), and, to make matters worse, as Dawkins often notes, many scientists *think* they understand evolutionary theory – yet it seems very few truly do.

Furthermore, previous commitments (largely religious in nature) stir many able-minded scientists to reject evolutionary theory outright, and, just when it seems the intellectual climate could be no worse, it turns out a 150 year-old nontrivial error in the foundational base of evolutionary theory has generated countless and unquantifiable errors throughout the scientific and political worlds.

> We prefer to put our trust in evolution. This is because evolution is gradual and allows the pressure of needs, values, reactions and events to mould ideas. It allows the shaping force of criticism. Bad ideas will die. Good ideas will survive and become even better. We really like the method of evolution because it fits our traditional thinking habits. Change has its own energy and we can modify and control this by the use of our critical faculties because criticism is the basis of our thinking tradition.
>
> In spite of these excellent reasons for preferring and trusting evolution, there is a serious flaw in.evolutionary [theory] (65, p.19).

If this communique is intelligible to <.01% of the world, what are our true prospects for survival? 99.99% of all species that have ever inhabited the Earth are extinct; the average species lifespan is 2 Myr. How do we communicate the logical implications and profound truths which follow from these findings in our fossil record? How many will grasp that evolutionary stable global threat mitigation efforts require a fundamental redirection of contemporary politico-economic development strategies and unprecedented levels of international cooperation? "Studies of mass extinctions tend to emphasize the sheer scope of the carnage. But the subtle differences between the species that died and those that survived can be crucial" (92, p.122). With this thought in mind, I will sign off with the closing remark from a talk given at Princeton in 1953:

> Research is action; and the question I want to leave in a very raw and uncomfortable form with you is how to communicate this sense of action to our fellow men who are not destined to devote their lives to the professional pursuit of new knowledge (91, p.129).

Mustique, November, 2009[7]

7. The writer's object in putting forward his views in the present imperfect manner is to submit them to the test of other minds, and to be made aware of all the facts supposed to be inconsistent with them. As his hypothesis is one which claims acceptance solely as explaining and connecting facts which exist in nature, he expects facts alone to be brought to disprove it; not *à-priori* arguments against its probability (12, p.191).

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A new – and a retrospective – look at industrial melanism in moths.

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A forgotten paper by Porritt (1907), who witnessed the origin and spread of industrial melanism in many species of moths in South West Yorkshire, throws doubt on some long-accepted beliefs. Not least it demonstrates convincingly that the habits of some species, whose populations became predominantly melanic over a remarkably short period of time, are such that they are entirely free from selective predation by birds. As such selective predation has long been regarded as the agent of change among moths that displayed industrial melanism, his observations are highly significant. Even earlier (1904) he had recorded the spread of melanic individuals of several species from soot-blackened areas into pristine countryside, which is at variance with expectations if melanism is an adaptation to dark backgrounds. The species concerned included the now much studied *Biston betularia* of which the melanic *carbonaria* eventually became the overwhelmingly dominant form in the area. As Porritt also made absolutely clear, melanic individuals of this species appeared, and increased in frequency, several years earlier than they did in any of the more than 40 other species that subsequently behaved likewise, but which often became melanic more quickly than did *B. betularia*. Here a brief synopsis of his fmdings is presented; the suggestion that industrial melanism was induced by a mutagen is mooted; and attention is drawn to the still almost automatic, but surely unjustified, attribution of the spread of melanism in *B. betularia* in industrial areas to strong selection via predation. This is so for example in some very recent work that has much advanced our understanding by locating the site of the gene for melanism on chromosome 17.

Additional Keywords: habits - behaviour - predation - mutation - mutagens

Industrial melanism in moths – many species of which became black or darkly pigmented in soot-begrimed industrial areas – arose in the mid-19th century and continues to attract scientific attention because, as the atmosphere in such areas became cleaner in recent decades, it went into reverse and currently appears to be heading to its demise. The phenomenon has been controversial in recent years. Some believe that it provides an excellent demonstration of Darwinian evolution in action, and the case of the intensively studied Peppered moth, *Biston betularia*, is reputed to be the most cited example of this process (Majerus, 2009). Others argue that important elements of the work on this species are flawed. A contentious review by Coyne (1998) of a book by Majerus (1998) also engendered serious doubts about the validity of the claim and was seized upon by anti-evolutionists as a means of denigrating the concept. Majerus and Stevens (2006) and Majerus (2009) responded by seeking to defend *B. betularia* as a role model. A provocative book (Hooper, 2002) devoted to the story of work on the Peppered moth also achieved a degree of notoriety, not least among workers in that field.

Against this background attention is drawn to facts recorded by one who witnessed the origin and spread of such melanism in many species of moths, but which have escaped the attention of subsequent investigators. The lack of such facts was specifically lamented by Ford (1955) who, like others, was unaware that very relevant information had been obtained on many species as melanism arose and subsequently spread. Ironically these facts throw grave doubts on the validity of widely held assumptions, some of which have been subjected to experiments, sometimes of questionable significance, and on which a vast edifice has been erected.

In the second half of the 19th century entomologists in South West Yorkshire not only witnessed the first appearance of melanic individuals of *B. betularia* and a subsequent increase in their frequency in that growing industrial area, but one of them, George Taylor Porritt (1848-1927), recorded this and the somewhat later inception and spread of melanism in well over 40 other species (Porritt, 1907). The latter are in several respects more informative than their much studied fore-runner, than which they often became melanic much more rapidly. *Colostegia multistrigaria* for example, did so perhaps five times as fast as did *B. betularia*. In others, males and females became melanic at different rates, and the entire population of females of *Agriopus marginaria* and *Apocheima pilosaria* became melanic in only five or six years. Males took longer. All these are univoltine species, adults of which are exposed to natural selection for at most a few weeks per year. Such rates are vastly greater than those at which random mutations are even generated. Selection takes longer. Moreover, as Porritt made absolutely clear, some species hide by day and are not subjected to any predation by birds. As, with scant unequivocal evidence to support it, predation has long been held to have been the means whereby pale, and therefore conspicuous, individuals were selectively removed by birds, whereas melanic individuals harmonised with the background and escaped such a fate, Porritt's observations on the behaviour of individual species are of crucial significance. They unconditionally contradict this long held belief. None of this appears to have been known to those who have promulgated what has long been regarded as the orthodox 'explanation' of events. In fact, in many cases there is no evidence whatsoever that demonstrates the operation of any natural selection as a result of predation by birds.

A further complication reported by Porritt and his colleague Morley (1906) is that, unknown to more recent investigators, instead of becoming black, several species, of which *Lampropteryx suffumata* provides an example, became paler in colour. It is therefore more accurate to describe the frequent reaction to soot-blackened conditions, or associated environmental changes, as a disturbance of pigment synthesis or metabolism than as always becoming melanic. The survival, and increased incidence, of pale moths in soot-blackened areas where, theoretically, they should have provided conspicuous targets for predatory birds (and been eliminated as, allegedly, were pale forms of those that became melanic) is an embarrassing anomaly for the orthodox story. A simple 'black and white' version of events is clearly untenable. The inevitable conclusions to be drawn from these forgotten observations are that neither orthodox random mutation nor natural selection were involved in the dramatic changes that took place in the populations of many of the moths concerned.

The idea that melanism granted protection to adult moths in soot-blackened areas

had already suffered a serious setback when Porritt (1904) reported that the darkly pigmented *carbonaria* form of *B. betularia*, which had by then "almost eliminated" the typical form in his area, had begun to spread into clean countryside, and "bids fair to do so throughout the county at no distant date". In the clean environments so colonised, melanism offered no protection against predatory birds. On the contrary it rendered moths conspicuous. Nevertheless his prediction was fulfilled, and in the late 1960s it was estimated that probably over 95% of the Yorkshire population was melanic (Y.N.U., 1970). Not only were melanic individuals able to flourish in areas in which, theoretically, they should have been unable to do so, but they had ousted the allegedly better adapted typical form. A suggested reason for the incongruous establishment and spread of the melanic form in soot-free areas was that it had a physiological advantage over the typical form. Not only did subsequent events reveal this to be fallacious, but such an alleged advantage is of no use if one is eaten, which is the orthodox corollary of conspicuousness. Similar extensions of range took place elsewhere, as in East Anglia, where the *insularia* morph (of intermediate darkness) comprised a small proportion of the otherwise *carbonaria*-dominated melanic population. Melanic forms of other species also incongruously extended their range into unpolluted countryside, thereby exposing the fallacy that melanism served as camouflage against predators in soot-begrimed areas and was the key to success there.

Ironically a suggested explanation of the origin of melanism in industrial areas was put forward about 20 years after Porritt's account by Harrison and Garrett (1926) who claimed to have induced heritable melanism in three species of moths by feeding their larvae on food contaminated by salts of lead and manganese, though the actual mutagen was not identified and now seems more likely to have been some other component of the diet. This claim was almost universally rejected. Critics of the induction experiments, both at that time (when chemical induction of mutations was otherwise unknown) and later (after its efficacy in other cases had been demonstrated) made much of the fact that, in the two species for which most information was gathered, melanism was recessive. In most natural cases it is dominant. However, contrary to the statements of Ford (1964) and Kettlewell (1973), that the induction of only recessive melanism had been claimed, this was not the case. Dominant melanism was demonstrated in *Ectropis crepuscularia* in experiments that were pursued less far than the others because of breeding problems. The objections of Fisher (1933) that mutations do not usually occur at such high frequencies as were claimed for these induced melanics would never have been made had he been aware of Porritt's observations in nature. Although sceptical of the results of the induction experiments, Fisher also noted that the work of Hughes (1932), who failed to induce melanism in similar experiments (for which there are several possible explanations) was insufficient to refute the induction of mutations, and that even substantial levels of induction were difficult to disprove.

The possibility of induction has been ignored in recent studies on industrial melanism. However, not only is the chemical induction of mutations – which is not Lamarckian – now well known, but strong supporting evidence for induced heritable melanism is provided by the induction of resistance to pesticides in insects and of drug resistance in pathogenic organisms. In all cases the pesticides and drugs are mutagens. These operate in a simple manner. Only one change in an amino acid is necessary to render a mosquito

resistant to DDT, and the malaria parasite *Plasmodium falciparum* can counter the drug pyrimethamine by a single amino acid substitution, which increases its resistance a hundredfold. The mutagen involved in melanic moths has yet to be identified, but it is highly significant that melanism in birds and mammals is mediated by a single amino acid, differences in which give rise to melanic or non-melanic forms. Relevant also is that different foods (catkins and leaves of the same oak tree) induce dramatic morphological and behavioural differences in larvae of the moth *Nemoria arizonaria* (Greene, 1989), and that profound differences in size, anatomy, reproductive ability, life span and behaviour are induced in Honey Bees by different feeding regimes, and give rise to queens and workers from individuals with the same genetic endowment. By comparison the induction of melanism is a trivial process. If mutagens are the responsible agent, sexual differences in susceptibility provide an easy explanation of why females of some species became melanic more repidly than males.

Eventually, coal-burning, and therefore soot-production, was drastically reduced, the level of the mutagen waned, and the incidence of melanism fell, both in its industrial heartlands and in colonised clean countryside where, in *B. betularia*, the invaders had been boosted by dispersal of adults from the original source and by small larvae wind-borne on threads of silk. Such waning has a counterpart in the waning of resistance in *Plasmodium falciparum* to the initially highly successful anti-malarial drug chloroquine after its use had been withdrawn for five years. The earliest, rather small, measured decline in melanism in *B. betularia* near Liverpool shortly after a reduction in smoke emissions, was attributed directly to this reduction (Clarke and Sheppard, 1966). However, the long-claimed match was not with pollution *per se* but with the background, which remains black long after pollution is reduced. A more convincing correlation became apparent some years later when melanism declined sharply as levels of the mutagen inevitably fell.

The long held ‘orthodox’ explanation of industrial melanism in moths has had its critics, and even its proponents recognised some aspects of it as simplifications and some experiments as flawed. Nevertheless, even if acknowledged as untenable, its investigators have produced much valuable information. What they could never do, however, was to repeat contemporary observations made by Porritt and his associates – often ‘working men naturalists’ – who, by first rate natural history well over a century ago, laid the foundations of a true interpretation of events, and contributed to our understanding, not only of the phenomenon in question, but of evolution, with which concept the facts are in full accord. They provide no ammunition to anti-evolutionists.

That Porritt’s observations continue to be relevant well over a century after they were made is demonstrated by work on *B. betularia* by van’t Hof *et al*. (2011) that has very recently located the position of the gene for melanism to a linkage group on chromosome 17, that is orthologous to that on the homologous chromosome of the Silkworm moth, *Bombyx mori*. Molecular evidence also indicates that not only is this locus responsible for all *carbonaria* individuals tested, but that all British examples were derived from a single ancestral haplotype. This is in harmony with what is known of the first recorded individual of the *carbonaria* morph and the subsequent spread of such individuals, initially in the vicinity of the first find and then into adjacent industrial areas.

According to van't Hof *et al*. (2011) a key conclusion from this recent work is that "the rapid spread of an initially unique haplotype, *driven by strong positive selection* (my italics) is expected to generate the profile of linkage disequilibrium we have observed, establishing that U.K. industrial melanism in the Peppered moth was seeded by a single recent mutation which spread to most parts of mainland Britain". That all melanic individuals of *B. betularia* originated from a single mutation (perhaps not much earlier than 1848) is a reasonable expectation, though this clearly did not apply to all the many other species that became melanic. To ascertain the location of the gene concerned is a striking advance that would have been inconceivable to pioneer observers such as Porritt – the term 'gene' was not coined until 1909 – but the suggestion that its spread was "driven by strong positive selection" – predation by birds being implied – is open to question. As Porritt established long ago, many species that co-existed with *B. betularia* in industrial areas became melanic, in some cases much more rapidly than did that species, yet there is no evidence whatever of selection via predation by birds, from which the habits of some of them render them completely immune. That the unique haplotype of *B. betularia* spread as a result of "strong positive selection" of this kind is equally open to doubt. Observations on predation by birds on this species appear to be confined to un-natural situations. The suggestion is also difficult to reconcile with the spread of melanic individuals into areas not affected by soot-blackening, where they sometimes replaced the normal form just as effectively as they did in soot-blackened regions.

Porritt's observations indeed received independent, but again apparently unnoticed, confirmation. Unaware of his work, Huggins (1956) reported that, when he moved to Southend in 1932, the predominant form of *Lacanobia suasa* in that area was pale drab in colour, but that by 1956 this form made up "at most 5 per cent" of the population, of which the rest ranged from "medium brown to practically black". This moth was his "greatest puzzle". It lives in salt marshes "far from any smoke and by day it hides in the grass like the wainscots and agrotids, so natural selection appears to play no part in the change." This paper appears to have escaped attention in discussions of industrial melanism. However, referring as it does to a species not studied by Porritt, which lives in an entirely different area and habitat, it fully substantiates the observations made, and conclusions drawn, by that astute observer more than a century ago.

Details of Porritt's observations are presented in *The Naturalist* (Fryer, 2010), a venue deemed appropriate for several reasons. Between 1876 and 1884 Porritt co-edited the first nine volumes of the current series of this journal, and here he and his fellow naturalists recorded many of their observations. 2011 marked the 150th anniversary of the Yorkshire Naturalists' Union, whose journal it is. Anniversary celebrations included the publication of an updated version of Porritt's annotated list of Yorkshire Lepidoptera of 1883 and its supplements, and an appreciation of his entomological work (Frost *et al*., 2011). However, as the journals of the Linnean Society, of which Porritt was a Fellow, have been the vehicle of publication for major contributions to the problem of industrial melanism in moths, including a symposium on the subject (Berry, 1990), it seems appropriate to draw attention to his forgotten work in a more widely circulated journal of the society.

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Sternberg's missing fossil paintings

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One of the definitive publications in palaeobotany during the early 19th century was Graf Kaspar von Sternberg's *Flora der Vorwelt*, published in eight parts between 1820 and 1838.[1] It was the first really detailed description of a large number of plant fossils with extensive illustrations and is now taken as the formal starting point for palaeobotanical taxonomic nomenclature.[2] Most of the illustrations were of specimens in his personal collection, painted by local artists in Prague, but a few were based on artwork provided by other palaeontologists.[3] Most of the paintings of British fossils were loaned by William Buckland, Reader in Mineralogy at Oxford University. There is a letter (dated 11 Feb. 1822) in the archives of the Národní Muzeum (National Museum) in Prague in which Buckland lists paintings that he was sending to Sternberg, mainly of Jurassic fossil plants from the Stonesfield "Slate" of Oxfordshire, specifying that they should be returned to Oxford as soon as they had been copied.[4] We assume that they were returned as they are not among the other paintings in Sternberg's archives in Prague, but their current whereabouts is unknown. However, there are two other plates of British fossils illustrated by Sternberg (his plates 54 and 56), from the upper Carboniferous Coal Measures of the Northumberland and Durham Coalfield (Fig. 1). As well as being of a different stratigraphical age to the fossils in Buckland's paintings,

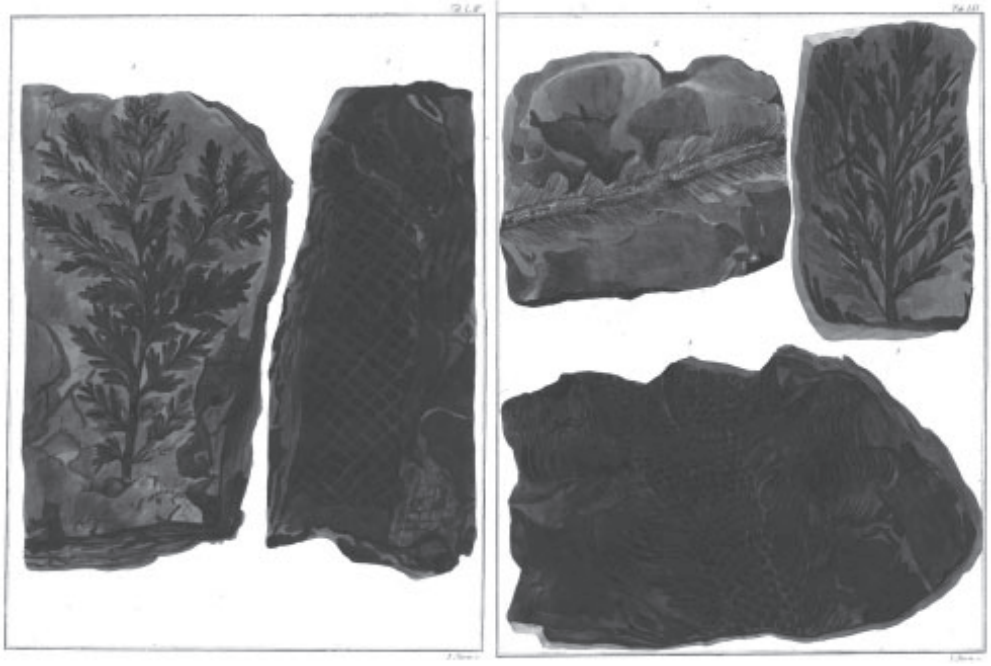

Fig. 1. Two unattributed plates of British Carboniferous plant fossils from Sternberg's (1820-1838) *Flora der Vorwelt*.(1)

they were also of a quite different style, being much darker, with black plant remains shown on a dark grey rock matrix. Unlike virtually all other illustrations in Sternberg's book, these were not attributed to an artist, the text does not say who loaned him the paintings, and the location of the original specimens is unknown.

Recently, the paintings on which these illustrations were based have come to light. This paper will briefly describe how this came about and who we believe the artist was.

Discovery of the paintings

Our first intimation of the history of these paintings came from work we were doing on the life and work of the early English palaeobotanist, Edmund Tyrell Artis.[5] Buckland knew Artis and had sponsored him to become a Fellow of the Geological Society of London. In a letter (dated 10 April 1824) to Robert Brown, to whom he had been introduced by Buckland, Artis wrote, "You have probably heard of the proposals to publish the Sunderland Coal plants with Mr Sowerbys, the drawings of them that I saw were in the possession of Professor Buckland they are principally barks…". [6]

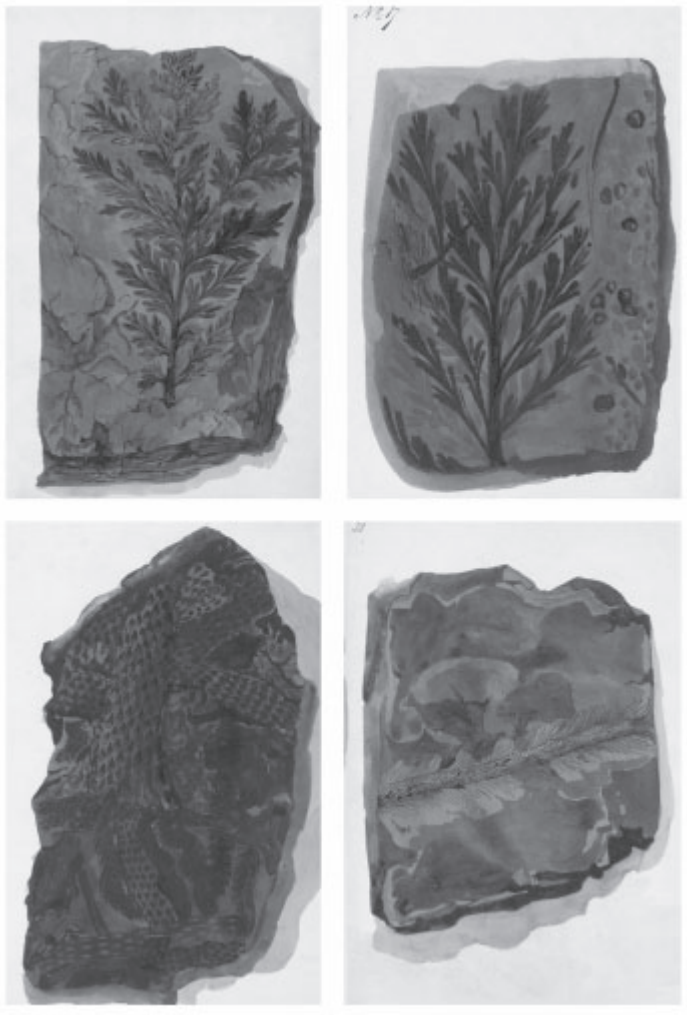

Fig. 2. Four of the twenty-eight paintings of fossil plants by William Smoult, on which the two unattributed Sternberg plates were based.

When we first saw this letter, these comments seemed to make little sense. The "Mr Sowerby" was presumably James de Carle Sowerby (1787–1871) who had painted some of the pictures of Jurassic plant fossils that Buckland had sent to Sternberg. However, we knew of no publication on the fossils from the Sunderland Coalfield nor that one had ever been planned; neither Sowerby nor Buckland had, as far as we knew, dealt with late Carboniferous plant fossils from northeast England. With hindsight, maybe we should have linked them with the two unattributed Sternberg plates as they included fossils from the Durham area but, as these plates were in quite a different style to Sowerby's other work and no mention was made of them in Buckland's 1822 covering letter to Sternberg, we did not.

In 2007 we presented a paper summarising our work on Artis to the bicentennial meeting of the Geological Society of London. Immediately afterwards, we were contacted by Mr Julian Wilson of Maggs Brothers, the leading natural history bookseller in London, who said that they had recently acquired a set of paintings of late Carboniferous plant fossils that dated from the early 19th century; would one of us go and examine them to see if they were of any interest? As one of us (CJC) was due the following week to come up to London, he arranged to visit Maggs' offices.

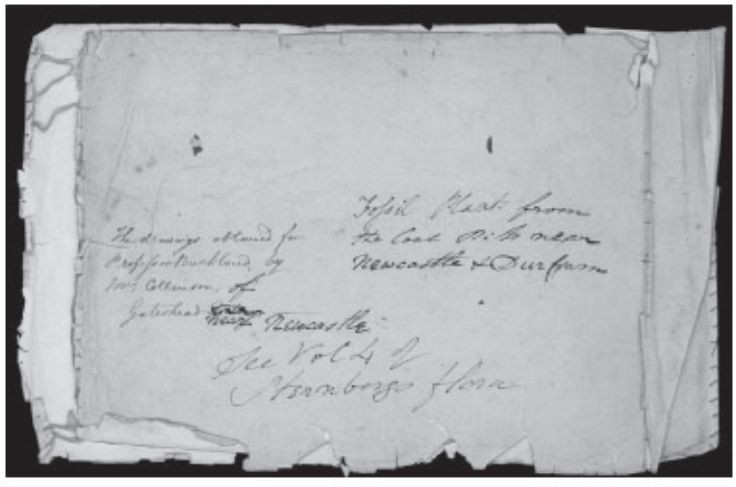

Fig. 3. Packet in which the Smoult paintings were found.

There were 28 grey-wash paintings, all of late Carboniferous plant fossils from the Durham Coalfield (Fig. 2). They were in a packet on which was written "The drawings obtained for Professor Buckland by Mrs Collinson of Gateshead near Newcastle" and "See Vol. 4 of Sternberg's flora" (Fig. 3). As it happened, CJC had with him photocopies of the two unattributed Sternberg plates; this was not because he had suspected that Maggs had the missing paintings, but because later that day he intended to go to the Natural History Museum, to continue work on a revision of the late Carboniferous plant *Eremopteris* (now published[7]) the type of which was one of the specimens shown on these plates. It was immediately clear that five of the paintings matched the figures in the two unattributed Sternberg plates – we had found the missing paintings.

The National Museum Wales has now purchased these paintings and this has given us the opportunity to investigate further the background to these long-lost paintings. Who painted them and how did they find their way to Buckland? Details of the sale where Maggs Brothers obtained them provided little help; it was merely recorded that they were obtained at a sale in Devon. However, there was evidence on the paintings themselves.

The painter – William Smoult

On the obverse side of each painting it clearly states "fecit William Smoult" (Fig. 4). The name initially meant little to us; there was no known fossil collector of that name, nor any recorded artist who had painted natural history objects. However, the name is sufficiently unusual that we thought it worth investigating further.

The family name Smoult is mainly found in the Lancashire, and Northumberland and Durham areas, and in view of the inscription on the packet containing the paintings and the provenance of the fossils, we turned our attention to the latter area. The 1820s was before fully-recorded censuses were made available and so we turned to the International Genealogical Index (IGI). We found four candidates. A William Smoult married Isabel Gibson in Wickham, Durham (8 Aug 1778) and had a son William christened 11 May 1781 in Wickham. Thomas and Alice Smoult of Newcastle-upon-Tyne had two sons called William, the first born on 17 May 1778, the second christened 4 Sep 1794 (the first son presumably died in infancy). However, despite extensive searches in the parish records for Northumberland and Durham in the library of the Society of Genealogists, we have been unable to find any further evidence of either family during the late 18th or early 19th centuries; they appear either to have emigrated or simply just died out.

The fourth candidate seemed more hopeful. William Smoult christened 22 July 1756 at St Nicholas Parish Church, Newcastle-upon-Tyne, was the son of James and Eleanor (née Dodds) and came from a more cultured family. We know little about his family's background other than both parents were of Northumberland stock, but he was educated at the Free Grammar School in Newcastle[8] and then in 1774 went to India where he served as an attorney for Sir Robert Chambers, the chief judge at the Calcutta Supreme Court.[9]

We have relatively little detailed evidence of Smoult's career in India, but in a posthumous commentary it was noted that, "…he was distinguished by his abilities and integrity, and was entrusted by his patron, Sir Robert Chambers, with the execution of several important and hazardous undertakings." Whatever these undertakings were, he was rewarded with progressive promotion through the ranks of the Supreme Court from Clerk to the post of Deputy Sherriff in 1785 and eventually Sherriff in 1793.[10]

Despite his public position, Smoult also had commercial interests. Initially this was back in England, where he was co-founder of a bank in Newcastle-upon-Tyne called Lambton & Co. (the so-called "Nabob Bank" because so many of its founders had links with the East India Co.).[11] However, in 1793, he retired from his Supreme Court post so that he could also pursue commercial interests in India. Together with a partner, Colin Shakespeare, he purchased the lease on a bazaar containing about 350 shops (at the corner of Dhurumtallah and Chowringhi thoroughfares). They attracted

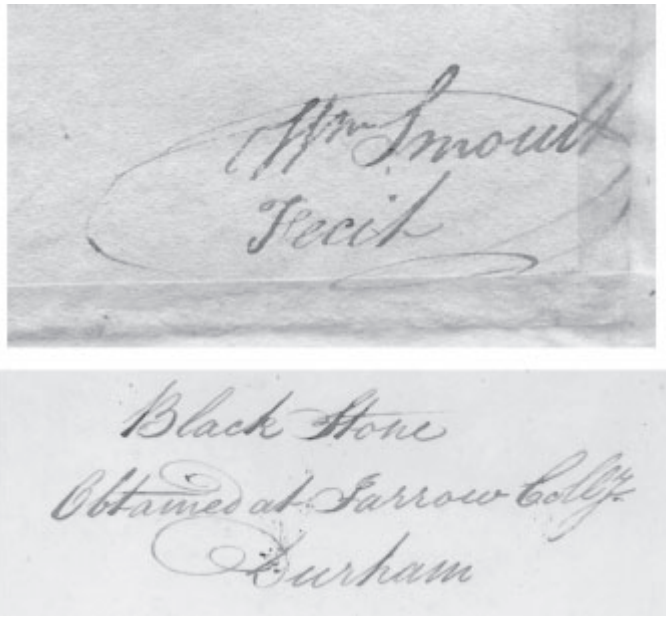

Fig 4. Handwriting on the obverse side of one of the paintings, showing the name of William Smoult and the origin of the fossil depicted.

business by allowing tenants the first six months free. Unfortunately they ran into problems when a man named Charles Weston became their competition. Charles Weston had won the Tiretta's Bazaar in the Calcutta Lottery and had placed it under the management of his servant Juggobundo Chatterji. A court case ensued when (according to the testimony) Juggobundo Chatterji and an assistant went with a Justice of the Peace (Sir John Richardson) into Smoult and Shakespeare's Bazaar. While there they caused a disturbance, apparently with the intention of intimidating the merchants into setting up their shops in Weston's rival bazaar. This reputed invasion ruined the investment of Smoult and Shakespeare who sought compensation in court.

Smoult's health was badly affected by his experiences in India. In 1794 he returned to Newcastle with "a shattered constitution" and died in his house on January 17, 1796 at the early age of 39.[12] This is at least 20 years before the paintings were sent to Buckland, so what makes us think that he may have been the artist? As we have shown, we can find no other person in the area with this relatively unusual name, but there are also a number of other lines of circumstantial evidence to support the idea. The painter seems to have been an erudite man, having used the Latin word fecit on the back of each painting. We know that the William Smoult who returned from India in 1794 had received a good education[13] and, during his time in India, had helped institute the Asiatic Society of Bengal. On his return to Newcastle he was also involved with the Literary & Philosophical Society of Newcastle-upon-Tyne, and in 1824 he had had a posthumous paper read entitled "Remarks made during a Voyage and Journey from Bengal to Alexandria, by way of the Red Sea, the Isthmus of Suez, the Monastry [sic] of Mount Sinai, Grand Cairo, &c". We have no other evidence that he was a painter, but painting was an activity typically pursued by convalescing patients and so it is quite feasible that he would have taken up the activity during his final illness. But why plant fossils?

The hint here may be his younger sister Eleanor (b. 1759) who married a local entrepreneur Simon Temple. Among other commercial interests, Temple operated coal mines at Jarrow, from where many of the fossils in Smoult's paintings came from. In the 1790s the Temples were an affluent family living in a large house (Jarrow Hall), and they were the Smoult's only immediate family still alive in the area. There is a suggestion that the Temples may have provided the ailing Smoult with support on his return to England and it is notable that his youngest son (born two months after William's death) was christened James Temple Smoult. It is not unreasonable, therefore that the Temples provided William with some objects to paint during his final illness, obtained from their mines.

Mrs Collinson

So where does Mrs Collinson fit into this story? It is not a particularly unusual family name, but a search through the earliest available census (1841) shows the most important family of that name then living in Gateshead was that of the rector, John Collinson (1781-1857) and his wife Amelia (née King, 1783-1871).

John Collinson was no "ordinary" cleric living in a poor, northern parish. He was author of a number of books, mainly on religious subjects, and nephew of Dr Septimus Collinson (1740-1827), Provost of Queen's College Oxford.[14] His wife Amelia was the daughter of Rev. Richard King and Frances Elizabeth Bernard. Richard King was a Fellow of New College Oxford, and whose ancestors included Robert King, the first Bishop of Oxford, whilst Frances ("Fanny") was daughter of Sir Francis Bernard (1712-1779), one time British governor of New Jersey and Massachusetts.[15,16,17] John and Amelia Collinson had a large family of 14 children, all but two of which survived to adulthood. Among these were the famous Arctic explorer Sir Richard Collinson (1811-1883),[18] the pioneering cartographer Major-General Thomas Bernard Collinson (1821-1902),[19] and the popular novelist of the time Julia Cecilia Stretton née Collinson (1812-1878).[20] One of the novels penned by Julia Stretton, *Valley of a hundred fires* (published 1860), gives a semi-fictionalised account of her parents and, although the story has been translocated to the Neath Valley in South Wales, it provides some interesting insights into their family life.

The Collinson family must almost certainly have known William Smoult's nephew, William Smoult Temple (1787-1859, eldest son of his sister Eleanor), who in the 1820s was also a rector in County Durham, at Aycliffe.[21] Eleanor was the only member of William Smoult's family living in the Newcastle-Durham area at the time of her brother's death, and William's widow (Charlotte née Hardcastle, 1764-1856) and children appear to have continued to be supported by the Temple family. In 1812, however, the situation changed when Simon Temple was declared bankrupt. We have been unable to determine what happened to Simon and Eleanor, but all but one of their children emigrated to India,[22] as did Charlotte Smoult and her family.[23] Only William Smoult Temple remained in Britain and so it is likely that he was left holding what remained of his family's possessions, including his uncle's paintings of fossils.

William Smoult Temple has left no evidence of an interest in natural history and may well have wondered what to do with the paintings. In the absence of any remaining family in the area, it would seem reasonable that he would consult John Collinson,

who was not only the senior rector in the county, but was also active in promoting natural history (1829, he chaired the inaugural meeting of the Natural History Society of Northumberland, Durham and Newcastle-upon-Tyne [24]). Collinson was an almost exact contemporary of William Buckland at Oxford University, obtaining his degree just two years earlier in 1803. We do not know if they knew each other personally as they were in different colleges (Collinson at Queen's, Buckland at Corpus Christi) but by the 1820s Buckland had established a national reputation in palaeontology and he would presumably have seemed the obvious person to pass the paintings on to.

Final remarks

There remain many unanswered questions. Why did Buckland decide to pass these paintings on to Sternberg, when they were of much poorer quality than the Sowerby illustrations of Jurassic plants that he had also sent him? It is even more curious why Sternberg included them in his monograph. The rather curious, dark illustrations stand out as quite different from most of the others in the book and do nothing to enhance the aesthetic appearance of the work. It may be significant, however, that Sternberg's main palaeobotanical expertise was in late Carboniferous plant fossils and he may have realised the scientific importance of some of the fossils, especially the rare *Eremopteris* leaves, which will have been quite different from anything else that he will have seen. Presumably Sternberg returned the Smoult paintings to Buckland after the plates had been engraved, but what happened to them subsequently? And why did Sternberg not acknowledge Smoult as the artist, when it clearly gives his name on the reverse of each painting?

The story that we have pieced together is, we confess, based partly on circumstantial evidence and may be wrong. However, we can come up with no alternative explanation that seems to fit the facts as we know them. We would be extremely interested if anyone can come up with any additional information that would throw light on this mystery.

Acknowledgements

Thanks go to the Society of Genealogists (London) and the Asiatic Society (London) for background information. Thanks also go to Dr Jiri Kvaèek (Národní Muzeum, Prague) for access to Sternberg's original artwork used in *Flora der Vorwelt*. Finally, thanks go to Julian Wilson (now of Christie's, London) for bringing these paintings to the attention of the authors.

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22. Ann Temple, Eleanor's only surviving daughter, deposited a bond of £200 for visiting India on 25 Jun 1817, and in 1818 married Capt. Francis John Bellew of the Bengal Infantry. Her younger brothers Anthony Becket Temple (1794-1829) and Edgar Thomas Smoult Temple (1797-1832) both became indigo planters (India Office Records, British Library, London).

23. Charlotte's youngest son James Temple Smoult (1796-1830) was a cadet at the Addiscombe Military Academy (East India Army) between 1812 and 1814, and sailed for India in 1814

along with his elder sister Charlotte; in 1816 Charlotte married William Patterson in Calcutta. The mother Charlotte Smoult and her younger daughter Anna Maria (1795-1877) deposited a bond of £400 on 14 Feb 1816 for them to visit India; in 1818, Anna married Captain (later Lieutenant Colonel) John Monckton Coombes (1784-1833). (India Office Records, British Library, London).

24. Goddard, T. R. 1929. *History of the Natural History Society of Northumberland, Durham and Newcastle-upon-Tyne 1829–1929*. A. Reid & Co., Newcastle.

Eels are slipping away: Part 2

Brian Gardiner Hon FLS

Previously the River Ouse, which runs through Ely, produced a great abundance of eels. The name Ely is derived from the Isle of eels recalling the time when Ely was surrounded by water. Eels fulfilled many of the uses of currency in the region of Ely – debts, rentals and tithes were commonly paid in eels. Eels are still caught in the Great River Ouse using traps very similar to those used in the Bronze Age (3,000 years ago) demonstrating how an ancient technology has continued virtually unchanged right up to the present day. However, there is only one commercial eel catcher left in Ely using such traps. Despite this, dishes such as eel pie and eel stew regularly appear on the menu of several restaurants locally. Today in Ely there is an eel trail run specially for tourists which commences at Oliver Cromwell's house. Cromwell's wife apparently used eels when cooking for her husband and a copy of the recipe for stewed eel pie is pinned on the wall of their house. The eel trail continues to Ely's Babylon Gallery where the glass entrance door portrays the life cycle of the eel. Further along the riverside is another piece of art in the form of an octagon made up of eight stainless steel five-pronged gleaves (spears) which were previously used to catch individual eels. The final piece of art is in Cherry Hill Park and consists of a hive made of planted willows in the shape of a tunnel nine metres long by two metres high called an osier eel trap. Eels were said to have been caught in these traps from pre-Norman times!

The remaining eel catcher, a man called Peter Carter, was preceeded up until 1999 by Sid Merry. Like Carter, Sid was born by Babylon, an island separated from the city by the Great Ouse and where the monks regularly paid their tithes of 30,000 eels yearly. The number of eels in the Great Ouse in Sid Merry's time (viz 1999) was considerably greater than the present day. Sid would, for example, put out thirty yards of baited hooks (with dead and rotting fish). The resulting catch he would sell in Ely market. On other nights he would use a length of chain with a series of lobster pot-like chambers. Sid fished all summer. Eels emerged from the fens in three distinct runs (on their way back to the Sargasso Sea) in September, October and November when Sid would catch them in a wing net stretched. across the river. Sid noted that elvers arrived in May in dark brown shoals like tadpoles, but there were nowhere near so many as there were in his youth. Sid's record for that period was some 250 eels from ten nets weighing 285 lbs. Sid put some of the eels aside for a wholesale merchant who would take them to London by train from Ely*, jelly them and sell them on. Sadly the rapid decline in eel populations has ended the above activities; jellied eels fried in butter with shallots and white wine are a thing of the past (but see later). However, elsewhere, following the setting up of The National River's Authority, the rejuvenation, following the cleaning up of many of our waterways has resulted in the return of elvers to most of our rivers including the Wear at Durham. In several instances elvers were planted

* On Ely station are several iron gargoyls in the form of eel heads.

on the other side of hazards such as locks, weirs and sluice gates and this practice has been followed over much of the United Kingdom. Thus today elvers can be found in the majority of our rivers and waterways.

Despite these obvious successes the eel population of the UK has declined by around 90 percent. Some of the factors for this decline include overfishing, parasites such as *Anguillicola crassus* and natural changes in the Gulf Stream and North Atlantic Drift.

Sequel and Conclusions

In the 1970's several European countries began the culture of *Anguilla anguilla* L with the development of farm systems using heated water. Nowadays European eel farming is mainly associated with recirculation systems (water temperature 24^{O}C) particularly in Denmark, Italy and the Netherlands. Sweden and Germany also contribute, as well as several North African countries. European aqua-culture involves 1. The capture of glass eels (elvers) from around Spain, France and England and 2. Their growing on to a marketable size. Total production of adult eels in 2003 was some 10,500 tonnes. The eels themselves are sorted, graded and transported to market with most of the Danish farmed eels having first been smoked (viz. more than 50 percent of the total).

As noted above some of the elvers are captured and subsequently farmed until they reach marketable size, when they are shipped over to the UK where they may be jellied or stewed or eaten as they are (smoked). Whichever, one thing is certain, our grandchildren will still be able to comprehend the expression "as slippery as an eel", as a direct consequence of this practice of European eel farming.

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Book Review

Fossiljägarna: En berättelse om besatta vetenskapsmän och fisken some klev upp på land by Björn Hagberg & Martin Widman. (ISBN 978-91-I-302197-3, Norstedts, Stockholm 2011, 238 pp – in Swedish).

'*Fossil hunters: A tale of obsessed scientists and the fish that climbed onto land'* is a work of popular science by an author and TV writer, and a scientific journalist and TV producer respectively. It is the story of three Swedish palaeontologists, Erik Stensiö (1891–1984), Gunnar Säve-Söderbergh (1910-48) and Erik Jarvik (1907-98), whose lives were consumed by fossils and touched by tragedy. These men made perilous journeys to Spitsbergen and Greenland to collect fossils and obtained results that astonished the world, though they eventually proved to be controversial. The authors have drawn heavily on Stensiö's unpublished 'Självbiografiska anteckningar' ('Autobiographical notes') and Säve-Söderbergh's field notebooks from Greenland, recently discovered in an old trunk by his son Bengt, to produce a well written palaeontological detective story set in the world of international politics. It is an informative and at times moving story.

The Swedish State generously supported polar exploration in the late 19th century. It was seen to be part of Swedish identity, and was of colonial, economic and military interest. Stensiö's early 20th century expeditions to Spitsbergen (he made five between 1912 and 1917, while still a young student) were altogether more hand-to-mouth affairs. Nevertheless, they led directly to all that follows in this book: his thesis on 'Triassic fishes of Spitsbergen' (1921) for which he invented the discipline of palaeoanatomy; his hunch that 'missing-links' would be found in the Arctic; his appointment to the Swedish Museum of Natural History (1923) where he was to establish the famous Stockholm School with top-class equipment and skilled technical support; his extensive foreign travel in search of fossil fishes that included a visit to Miguasha in Quebec and later resulted in the acquisition of important specimens of *Eusthenopteron*; and his work on the cranial anatomy of cephalaspids from Spitsbergen (1927), using specimens collected by Norwegians but entrusted to his scientific care, and for which he refined a number of techniques including serial grinding.

Säve-Söderbergh was a young student of fossil mammals at Uppsala University when, at the invitation of Stensiö and the Danish geologist and polar explorer Lauge Koch, he joined a multi-disciplinary Danish expedition to East Greenland in 1931. Wishing to fulfil colonial ambitions, Denmark was quarrelling with Norway over ownership of Greenland and had referred the matter to the International Court in The Hague, while investing heavily in Greenlandic research. A Navy band played, the prime minister wished them well in parliament and newspapers stressed they were undertaking work that would promote Denmark's acknowledged right to 'the land in the North', as a large crowd waved the expedition off. Koch needed results, and he got them when Säve-Söderbergh came down from Mt Celsius with a 'missing link'. Normally keen to flex his entrepreneurial muscles and grab any PR that was going, Koch was reluctant to publicise this discovery of ichthyostegids. He didn't want Norwegians gate-crashing the party. Stensiö, however, immediately saw the value of the discovery and used it to boost the standing of his department in Stockholm. His

biggest coup was to get Koch to agree that all fossil vertebrates from East Greenland would be sent to Stockholm for scientific examination. This would later cause resentment in Copenhagen and embroil Koch in a vicious political battle with his colleagues. Hell hath no fury like a Danish geologist scorn'd.

The next year Jarvik, a geology student at Uppsala, made his first visit to East Greenland when he accompanied Säve-Söderbergh on a 95-strong Danish expedition. The two Swedes returned with more ichthyostegid material and this time Koch let rip with publicity. The palaeontologists walked off the boat to be welcomed by a crowd of thousands at the quayside and stepped into a media circus, as news of sensational finds flashed around the world. The *New York Times* carried the front-page headline, 'Koch Finds Fossils of Fish with 4 Legs'. Stensiö, Säve-Söderbergh and Stensiö were more circumspect, stressing that painstaking scientific work had still to be done. But Koch was triumphant, and while planning a new expedition for the summer of 1933 he received news from The Hague: Greenland had been given to Denmark. He was convinced that the 'four-legged fish' had swung the vote in his Country's favour.

When, after the Second World War, two Americans showed a suspiciously keen interest in Greenlandic fossils, Koch hurried off to see the prime minister, who agreed they must keep the United States out of East Greenland because of its economic interest to war-torn Denmark. Thus Koch obtained further support for his expeditions. Jarvik, who had a life-long passion for Greenland, joined several of these, but the first post-war expedition in 1948 was significant because it yielded post-cranial remains of *Ichthyostega*, thus allowing the animal to be restored. Otherwise Jarvik stuck resolutely to his day-job, serially grinding a magnificent skull of *Eusthenopteron*. This was a painfully slow business that, with the resulting wax model, was to underpin his life's work. From the snout of *Eusthenopteron* he developed the theory of diphyletic evolution of tetrapods, thus adding a twist to the story of 'four-legged fishes'. Jarvik had promised to complete Säve-Söderbergh's work on ichthyostegids following the latter's untimely death from tuberculosis at the age of 38. To the frustration of palaeontologists everywhere, he published very little until long after Stensiö's death and his own retirement in 1972 as head of the department in Stockholm.

As well as providing social and political background, the authors sketch in enough science to help general readers understand the significance of the fossil finds. They finish by bringing us up to date on ichthyostegid studies since the death of Jarvik. Although they tell a great Swedish story, Hagberg & Widman are not starry eyed about their fellow countrymen and their human and scientific failings, although they would surely like Jarvik to be right about the diphyletic origin of tetrapods. They tactfully elucidate three contrasting personalities: politicially adept, entrepreneurial Stensiö, humble, workaholic Säve-Söderbergh and introvert Jarvik, fluently silent in several languages, who in my experience was more helpful and welcoming than it is now fashionable to admit. Stensiö in Spitsbergen, and Säve-Söderbergh in Greenland, worked under unbelievably primitive conditions by modern standards and endured hunger, cold and other dangers to bring home the fossils. Both were lucky to escape with their lives. They were brave men as well as great intellects.

The authors describe the rise of the Palaeozoological Department in Stockholm and trace its fall to Stensiö's conservatism, especially regarding new preparation

techniques and methods of analysis, and his and Jarvik's authoritarianism and intolerance of alternative views. As the authors say, Stensiö's attitude is all the more surprising because he invented a whole range of new approaches to the preparation, description, analysis and illustration of fossil fishes. Finishing this book, I was reminded of something the politician Enoch Powell (1912-98) said, 'All political lives, unless they are cut off in midstream at a happy juncture, end in failure, because that is the nature of politics and of human affairs.' Must that also be true of palaeontology at the Stensiö-Jarvik level?

For all their efforts to include social and political factors and bring out the importance of institutional backing, Hagberg & Widman's book is in one respect an old-fashioned history of science. It is a story of lone, socially inadequate men working long hours in the laboratory, battling against the world to reach (as they saw it) the truth. But that is far from the whole story. The Stockholm School could not have flourished without the large team of skilled workers – the envy of any palaeontologist working today – that assisted at every stage of the work, from unpacking fossils to posting off completed manuscripts. Sven Ekblom, a brilliant illustrator who also worked for King Gustaf Adolf, was foremost among these assistants, but many others were women. Over the years they included Stensiö's cousin Agda Brasch (preparator) and his wife Aina Laurell (illustrator and photographer), as well as Milda Liepina (illustrator and retoucher of photographs) and Britta Arnell (preparator), the daughter of the dentist who helped Stensiö develop his mechanical mallet. Only this last woman earns a mention in the book, and that by virtue of becoming Mrs Säve-Söderbergh. I think the point is important because the Stockholm School's 'life style', that only a large team of assistants with women in key roles made possible, proved to be very seductive to foreign scientists working and publishing under more primitive conditions. I myself was drawn to spend a year in Jarvik's department across 1963-64. To those seduced by the 'life style', the truth of the scientific conclusions was self-evident.

As a young student I read JLB Smith's account of the discovery of *Latimeria* ('Old Fourlegs: The Story of the Coelacanth', 1956) and was enthused to study the evolution of fishes. I can well imagine Hagberg & Widman's book stimulating young Swedes to become polar explorers or palaeontologists or, like the book's three heroes, both. I suspect, however, they are more likely to be sent north to study the effects of climate change than to collect fossils.

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224th Anniversary Meeting of the Linnean Society

held at Burlington House, Piccadilly, London W1J 0BF at 4.00 pm on Thursday 24th May 2012

1. **The President** took the Chair and welcomed 93 Fellows and their 11 guests to the meeting.
2. **Apologies** were received from: Professor R.J. (Sam) Berry, Mr Richard Bodenham, Professor Geoff Boxshall, Ms Jyll Bradley, Mr Ian Caldwell, Professor John Cloudsley-Thompson, Miss Gina Douglas, Dr Jenny Edmonds, Mr Roger Goodenough, Mrs Katrina Heldring-Morris, Dr Margarita Hernández, Dr Máha Kordofani, Canon Dr Stephen Palmer, Professor Hilke Ruhberg, Dr Fred Skinner, Dr Sy Sohmer, Dr Ruth Temple, Dr Mark Watson.
3. **Admission of Fellows**. The following signed the Obligation in the Roll and Charter Book and were admitted Fellows: George LOUDON and Colin SLATER.
4. The **Minutes of the Meetings held on 19th April 2012** were accepted and signed.
5. **Appointment of Scrutineers.** The following were appointed as scrutineers; Dr Mary Morris, Dr Alan Brafield and Professor David Rollinson.
6. **Ballots**. Fellows voted in the ballots for Members of Council, the Officers, and for Fellows and Associates.
7. **Citations and Presentations of Medals and Awards**

   a. The President presented the **2012 Linnean Medal for Botany** to Professor Stephen Blackmore, and the ***Scientific Secretary, Dr Sandra Knapp*** read the citation:

   "Professor Blackmore received his PhD from the University of Reading and then gained valuable experience abroad through posts in Aldabra and Malawi. Upon returning to the UK he was appointed to lead the Palynology Unit in the Department of Botany at the Natural History Museum. Under his leadership the Palynology Unit maintained and strengthened its traditional emphasis on pollen identification and systematic palynology and increased its leadership role internationally. During his time at the Natural History Museum and since Professor Blackmore has published a succession of widely cited papers on palynology. Several of these are today considered to be among those that have changed the way palynology is conducted. His contributions to understanding the developmental basis of palynological diversity have been especially influential. In addition, he was among the first to show how palynological features could be used appropriately in the context of modern approaches to plant systematics. Professor Blackmore has also supervised numerous students, several of whom have held influential positions in the UK systematics community. He also worked collaboratively with many colleagues, organised symposia and has continued to be research-active in his current position as Regius Keeper Royal Botanic Garden Edinburgh. With numerous peer-reviewed research publications to his credit, his research productivity and his contribution to knowledge of plant diversity are substantial. In addition to being a

consistently productive research botanist, Professor Blackmore has been central to the development of some important developments in linking of plant systematics and conservation, both in Europe and beyond".

Professor Blackmore thanked the Society for the award.

b. The President presented the **2012 Linnean Medal for Zoology** to Professor Peter Holland, and the ***Scientific Secretary, Dr Malcolm Scoble*** read the citation:

"Peter Holland is currently Linacre Professor of Zoology, Head of Oxford's Department of Zoology and a Fellow of Merton College. Previously he was Professor of Zoology at the University of Reading. He is interested in how the evolution of animal diversity can be explained through the genome and, in particular, the evolution of the genes that control development because the body plans of animals are generated through embryonic development. Professor Holland has made many highly original contributions to the understanding of molecular evolution, with particular reference to duplicated gene families in the Chordata. In recent years Professor Holland's research has concentrated on the evolution of homeobox genes (encoding developmentally important transcription factors) and the 'hedgehog' gene family (encoding key signalling molecules). He was instrumental in establishing the Homeobox Database. This research on gene and genome evolution has been complemented by studies on animal phylogeny, since this provides the framework onto which changes can be mapped. Most recently, Professor Holland and his group have studied these questions in humans, rodents, various fish, hagfish, lampreys, amphioxus, ascidians, hemichordates, polychaetes, insects, cnidarians and choanozoans. Previous recognitions include the Alexander Kowalevsky Medal, the Blaise Pascal Medal in Natural Scinces, the inaugural Genetics Society Medal, the De Snoo van't Hoogerhuys Medal and the Scientific Medal of the Zoological Society of London"

Professor Holland thanked the Society for the award.

c. The President presented the **2012 Darwin-Wallace Medal** to Professor Loren Rieseberg. The citation was read by the ***President, Dr Vaughan Southgate***.

"The Darwin-Wallace Medal is awarded to individuals who have made major advances in evolutionary biology. Loren Rieseberg is internationally recognised as a leader in his field. He has made fundamental contributions to the understanding of speciation mechanisms and the evolution of local adaption and was one of the earliest plant scientists to apply the tools of genomics to wild plant species. He pioneered the application of experimental genomic approaches to studies of micro evolutionary processes, and demonstrated that new diploid plant species can arise through hybridization and that this mode of speciation results from significant ecological and karyotypic divergence with the process occurring at remarkable speed. Professor Rieseberg has also shown that new hybrid gene combinations facilitate the colonization of extreme environments, indicating that hybridization provides a mechanism for major ecological and evolutionary transitions requiring simultaneous changes to multiple traits and genes. His studies have also revealed the importance of selective sweeps in the integration of conspecific populations and in the differentiation of races and species. His model organisms in the genus

Helianthus now constitute classic examples of transgressive hybridization to which all plant biologists refer. He is one of the most cited authors in plant sciences and highly respected as a mentor of postgraduate and postdoctoral students, as well as a much sought after lecturer on evolutionary processes. Previous recognitions include the Stebbins Medal and the AR Wallace – RE Franklin Medal. Without a doubt Professor Rieseberg is one of the best known evolutionary botanists of his generation."

Professor Rieseberg thanked the Society for the award.

d. The **2012 HH Bloomer Award** was awarded to Ms Libby Houston. The citation was read by the ***Editorial Secretary, Dr John Edmondson***, as follows:

Poetry, climbing and botany come together in one unique individual: Libby Houston. Libby's early career as an internationally known Beat Poet changed when she came to Bristol in 1979 and she began to help Louis Frost with research on the Avon Gorge flora in the mid-1980s. Early studies looked at Avon Gorge rarities such as *Veronica spicata, Arabis scabra* and *Trinia glauca* amongst other plants, where her climbing expertise allowed her to study populations nobody else could. She has made exceptional contributions to knowledge of the genus *Sorbus* in Britain (she is a co-author of the 2010 monograph). The initial work was in the Avon Gorge where she has spent years surveying and observing the endemic whitebeams culminating in, amongst others, her discovery of the *S. bristoliensis* × *aria* hybrid which is named after her – *S.* × *houstoniae*. Her work extended to the Wye Valley and especially Cheddar where her keen eye picked out three more new species. She has since found another two new whitebeams in the Avon Gorge, and found new populations of the rarest species. There are many aspects of her personality which have enabled her to contribute significantly to natural history as an amateur. She has an exceptional eye for picking out unusual things, which is based in turn on the huge amount of routine survey work she undertakes to satisfy her own curiosity. She has an instinct for exploration and an ability to get to inaccessible places. She is persistent and very conscientious, wishing to get all details right. She is always willing to help others with their work and share what she knows. Libby's interest in the gorge continues to this day and she continues to provide the best advice to anyone needing to make nature conservation decisions affecting the flora. She suggests appropriate habitat management and often supervises it to ensure it is done properly. She is the Guardian Angel of the Avon Gorge.

Libby is a member of Bristol Naturalists and serves on their Botany Committee. She leads educational walks and forays for scientists, conservationists and the general public".

Ms Houston thanked the Society for the award.

e. The President presented the **2012 Bicentenary Medal** to Professor Timothy Barraclough. The citation was read by the ***Collections Secretary, Mrs Susan Gove*** as follows:

"Timothy Barraclough is a natural historian in the real sense – he defies categorization as a zoologist or botanist and a glance at his impressive publication

list will reveal papers on an astounding range of organisms including tiger beetles, passerine birds, carnivores, cichlid fish, bacteria, rotifers and plants, both extant and extinct. He is fascinated with the origins of biodiversity – how, why and where species and lineages evolve. His work combines theory with field, experimental and molecular approaches, and many of his publications relate to methodologies for characterising biodiversity. Starting as a post-doctoral fellow at Imperial College, his qualities were immediately recognised, and he rose quickly through the ranks becoming a full Professor in 2009. He has been successful in obtaining grants from research councils and elsewhere and is well respected and liked by colleagues and students at all levels. He has supervised several post-doctoral fellows and numerous post-graduate students. He is organiser for MSc and MRes courses at Imperial and he serves on a range of committees, assessing grants and editing journals. In summary, Timothy Barraclough is a world leading scientist studying "*the Science of Natural History in all its branches*" (to quote from the Society's Charter). The Officers and Council of the Linnean Society cannot think of a more appropriate person to receive the Bicentenary Medal".

f. The President presented the **2012 Irene Manton Prize** to Dr Alexander Papadopulos. The citation was read by the ***Scientific Secretary, Dr Sandra Knapp,*** as follows:

"Alexander Papadopulos obtained a BSc from the University of Southampton before completing, in 2007, an MSc in Advanced Methods in Taxonomy and Biodiversity at the Natural History Museum and Imperial College London, which he passed with distinction. In 2008, he started his PhD at Imperial College London under co-supervision of Prof Vincent Savolainen and Dr William Baker of the Royal Botanic Gardens, Kew, which he defended successfully on 2 June 2011. The thesis, entitled "Plant Speciation on Lord Howe Island" was highly praised by both examiners and was accepted with no correction, a very rare event at Imperial College. Alex's thesis has turned our understanding of plant speciation on its head, particularly with regard to the frequency of occurrence of sympatric speciation. Alex collected ecological and genetic data for the entire vascular flora of Lord Howe Island. He then applied a battery of modelling and genomic techniques, as well as powerful statistics, to show that sympatric speciation was much more common within this natural laboratory than has ever been assumed. In addition, he found that sympatric speciation has been achieved by different routes in 11 new cases that he discovered. These findings strike at the core of a two century-long standing debate on the evolution of new species in the face of gene flow.

Alex published the first results of his PhD in the prestigious *Proceedings of the National Academy of Sciences of the USA*. His article received considerable attention in the scientific community at large. PNAS also commissioned a commentary of Alex's paper by world-renowned speciation expert Jerry Coyne who, ironically, praised the work after having been one of the strongest detractors of sympatric speciation. As a peer reviewer, Coyne stated that the paper was the most important contribution on the geography of speciation he had seen for a long time. As an avid fieldworker, adept molecular biologist and a rising star in the evolutionary biology

community, Dr Alex Papadopulos is a well-rounded scientist and worthy recipient of the 2012 Irene Manton Prize for a thesis in the plant sciences.".

Dr Papadopulos thanked the Society for the award.

g. The President presented the **2012 John C. Marsden Medal**, the first to be awarded, to Dr Joshua Coulcher. ***The Scientific Secretary, Dr Malcolm Scoble,*** read the citation as follows:

"Josh Coulcher's doctoral thesis is the result of four years of intense work both in the lab and in the library. The study was supported by the BBSRC and supervised by Professor Max Telford of University College London. His time spent studying for his doctorate was characterised by constant enthusiasm for the subject matter, hard work in the lab and total immersion in all aspects of his principal question regarding the evolution of the Arthropoda. Josh's aim was to conduct molecular developmental studies of a model insect species (*Tribolium castaneum*, the red flour beetle) within an evolutionary framework, making comparisons across the major clades of arthropods. He wanted to understand the evolutionary origins of the biting mandible as a third head appendage – the defining feature of the mandibulates, which is the major clade that includes insects (such as *Tribolium*), crustaceans and myriapods. The mandible must have evolved from a walking leg, but how did this transformation take place and what changes in genetic control of embryogenesis were behind the evolution of this novelty? In order to address these questions, Josh became expert in a number of laboratory techniques, including scanning electron microscopy (SEM), RNA interference for gene knockdown and, to a particularly high level, *in situ* hybridisation to reveal the expression patterns of genes during the embryogenesis of his beetle. His mastery of the *in situ* techniques has resulted in a beautifully illustrated thesis revealing the essential features of beetle mandible development with great precision, and augmented by wonderfully clear schematic diagrams. One of our assessment committee characterised the thesis as "flawless in presentation and content". Josh has also mastered the very broad expanse of literature, both ancient and modern, of importance to his central question. He became familiar with books and manuscripts covering subject matter as diverse as phylogenetics, palaeontology, comparative morphology and developmental genetics and so has been able to interpret his findings in the context of decades of previous research. Josh's lab work and thesis writing were conducted with considerable independence. His external examiner described the thesis as "...an impressive body of work and.... an outstanding success". The thesis resulted in several novel hypotheses that resonate profoundly across the field of arthropod comparative morphology. For this most impressive and beautifully presented work, we are proud to present Dr Coulcher with the first John C. Marsden medal for a thesis in the biological sciences".

Dr Coulcher thanked the Society for the award.

Mrs Hazel Marsden said how grateful and honoured she and her family were to the Society for inaugurating this medal, and that it was particularly fitting that the recipient's thesis topic echoed her husband's research interests.

There being no submissions, no award was made in respect of the **Jill Smythies Award** in 2012.

8. **The Treasurer** presented the Accounts for 2011. These are to be found in the 2011 Annual Report.

9. **Professor David Pye**, a member of the Audit Review Committee read the following statement. "In accordance with Bye-Law 12.6, the Annual Statement of Accounts for 2011, and the report of the professional auditors, were carefully examined by the Audit Review Committee of Fellows on 12th March 2012. On behalf of the Committee, of which I was a member, I am pleased to report to the Anniversary Meeting that we concluded that the Accounts give a true and fair view of the Society's finances as at 31 December 2011. I therefore move that they be accepted". This was carried unanimously on a show of hands.

10.

a. **The Treasurer** moved that the firm of Knox Cropper, of 16 New Bridge Street, EC4V 6AX, be appointed as auditors in accordance with Bye-Law 12.5, which was accepted unanimously.

b. **The Treasurer** moved that **Barclays PLC, PO Box 13555 Acorn House, 36-38 Park Royal Road, London NW10 7WJ** be reappointed as the Society's bankers and this was accepted unanimously.

c. **The Treasurer** expressed his thanks to all the staff for their commitment and hard work.

8. **The President** gave his address on "Impact of Climate Change on the Environment".

The President opened his talk by saying that, although it was not his area of expertise, he had been prompted to address the subject of climate change following a conversation with David Attenborough after his Darwin Lecture at the RSM in November 2011 – in which David Attenborough had stressed that climate change was one of the most important challenges facing biodiversity on earth. The President went on to explain the greenhouse effect and to outline the considerable body of evidence for climate change, illustrating this with data relating to many different species. He went on to review the different approaches to renewable energy sources and concluded by looking at what we as individuals can do to mitigate the causes and effects of climate change.

12. On behalf of the Fellows, Professor Gren Lucas thanked the President for his interesting and highly informative talk.

13. **Results of the Ballot**s

a. The following were elected to Council: Dr Janet Cubey (horticulturist, informatics), Dr John David (botanist/mycologist), Dr Thomas Richards (protists), Dr Sarah Whild (plant ecologist), Dr Anjali Goswami (palaeobiologist) and Dr Pat Morris (zoologist).

Details of these new Council members can be found in The Linnean Society of London Anniversary Meeting 2012 Council Agenda and Council Nominations, circulated with *The Linnean* in April 2012. These nominations were for Fellows to

replace Mr N. Keith Maybury, Dr Sylvia Phillips, Mr Terence Preston, Dr Mark Watson and Dr David Williams. As President-Elect, Professor Dianne Edwards' seat on Council was also vacated. There were thus four vacancies for botanists/mycologists and 2 vacancies for zoologists. The President thanked outgoing Council members for their services to the Society.

b. The Officers elected were: President, **Professor Dianne Edwards CBE**; Treasurer, **Professor Gren Lucas OBE**; Editorial Secretary, **Dr Mark Chase**; Scientific Secretary, **Dr Sandy Knapp**; Collections Secretary, **Mrs Susan Gove**; and Scientific Secretary, **Dr Malcolm Scoble**.

c. The Fellows were elected as on the accompanying list.

d. **The President, Dr Vaughan Southgate,** then warmly welcomed the incoming President, Professor Dianne Edwards, saying that she was the second lady to be President of the Linnean Society of London (after Professor Irene Manton 1973-76). Dianne is a distinguished palaeobotanist, a Fellow of the Royal Society and a Fellow of the Royal Society of Edinburgh, a Commander of the Order of the British Empire and a Gold Medal Winner. She is heavily involved with the National Botanic Gardens of Wales, and a former Trustee of the Natural History Museum.

e. **The incoming President, Professor Dianne Edwards**, then thanked the outgoing President, Dr Vaughan Southgate, for his kind words and congratulated him on a very successful presidency, marked by his good humour and congeniality – a difficult act to follow.

14. **Names of Vice-Presidents**

The incoming President, Professor Dianne Edwards, named her Vice Presidents for the coming year as Professor Gren Lucas, Professor Geoffrey Boxshall, Professor Mark Chase and Dr William Baker.

15. **Any other valid business**

There being no other valid business, the President declared the meeting closed, noting the dates of forthcoming meetings.

The next evening meeting would be on **Thursday 14th June** when Fernando Vega was speaking on the history of coffee.

The next Anniversary Meeting will be on **Friday 24th May 2013 at 4pm**.

The Linnean Society
Programme

2012

15 Oct	6pm	Should we save the panda? Choosing which species to save. A joint meeting between the Linnean Society and the Society of Biology Sue Nelson (Chair), Simon Watt, Mark Avery
17 Oct	6pm	Why did Darwin Change his Mind about Sex Ratio? Prof Elliott Sober
18 Oct*[a]	6pm	F.W. Frohawk (1861-1846), zoological artist and butterfly specialist: A window on the world of Victorian and Edwardian natural history. June Chatfield
23 Oct**	10am	Indian Ornithology, British Botany and Allan Octavian Hume (1829-1912): the Scientific Legacy of a Founder of the Indian National Congress. † Robert Prys-Jones, Honor Gay & Roy Vickery One day conference at the Natural History Museum, Flett Theatre
31 Oct**	10am	Linnean Society Palaeobotany Specialist Group Day meeting
1 Nov**	10am	Understanding pollen and spore diversity Linnean Society Palynology Specialist Group Day meeting † Carol Furness
15 Nov[a]	6pm	*Linnean Society Debate* Is the Common Agricultural Policy (CAP) good for biodiversity? † Andrew Sheppy
3 Dec[a]	6pm	Thomas Bewick, Engraver and Naturalist *Founders Day Lecture* Jenny Uglow

† organiser(s) ** Registration required
* Election of new Fellows [a] Admission of Elected Fellows

Unless stated otherwise, all meetings are held in the Society's Rooms. Evening meetings start at 6.00pm with tea served in the Library from 5.30pm and the lecture will be followed by a wine reception. For further details please consult the Society's website *www.linnean.org* or contact the Society Office on Tel. 0207 434 4479.

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