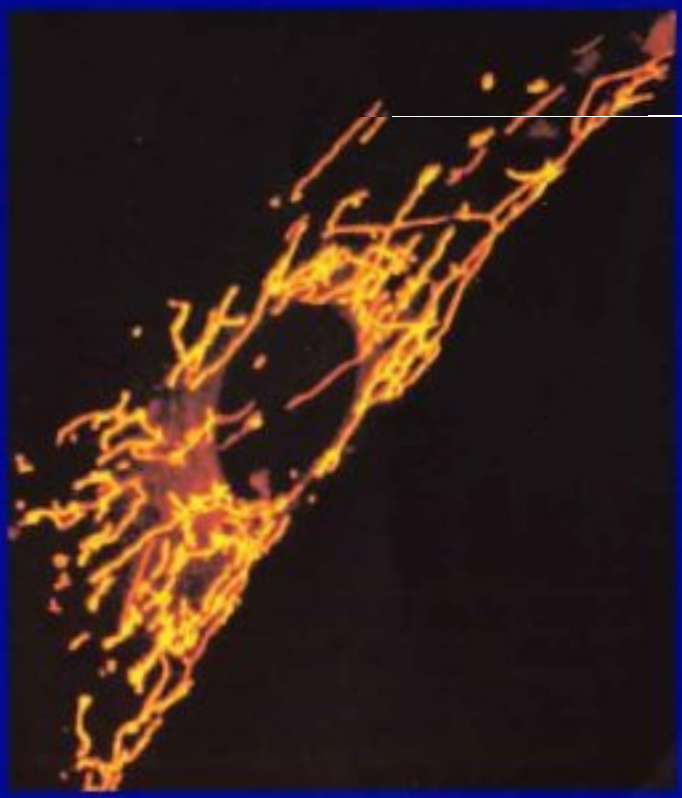
The Physiological Society Magazine



Winter 1998
No 33

(L-R) Dr Alison Barth, Miss Helen Wallace, Dr Julian Staddon, Miss Penny Hill, Professor Kevin Fox, Mr Phil Blanning, Dr Mervyn McKenna.

(L-R) (Back): Dr David Carter, Dr Tim Wells, (Front): Miss Zöe Burke, Dr Martin Smith.

(L-R) Professor Vincenzo Crunelli, Mr Stuart Hughes, Mr Tim Gould, Mr David Cope, Dr Rhein Parri, Dr Tibor Tóth, Dr Gül Erdemli.

(L-R) Mr Chris Sent, Mr Mark Uphill, Mr Phil Blanning.

Photography courtesy of Martin Rosenberg

Front cover: 3-D reconstruction of a confocal series of images of a rat cortical astrocyte in which the mitochondria have been stained with a flourescent indicator (mitofluor green).

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ACTION POINTS

Affiliate Travel Grant Scheme: The next two deadlines for receipt of applications are 30 November 1998 and 31 January 1999.

Change of Address: Please can Members inform the Administration Office of any changes of address, telephone or fax numbers.

Email Addresses: The Society is making increasing use of email addresses. Please can Members inform the Administration Office of new email addresses, or changes to existing ones. Changes can be emailed to admin@physoc.org.

Manchester Meeting: Abstracts should be submitted to the Meetings Secretary between 11 January and 21 January 1999.

Magazine: Letters and articles for inclusion in the next issue should reach the Editor by 23 November 1998. Advertisements and Notices should reach the Administration Office by 30 January 1999 whilst items for the Special Interest Group Forum should reach the Meetings Secretary's Office by 8 January 1999 and items for Committee News should reach the Committee Secretary's Office by 8 January 1999.

Membership Proposals: Candidates for election as new Members at the 1999 Semi-Annual General Meeting should ensure that their proposal papers reach the Administration Office by 15 February 1999.

Membership Subscriptions: Annual Membership subscriptions for 1999 are due on 1 January 1999. Members who have not completed direct debiting instructions should ensure that their payments reach the Administration Office by 10 December 1998.

Editor

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The society web server-
Web: http://physiology.cup.cam.ac.uk

GUIDELINES FOR CONTRIBUTORS

These guidelines are intended to assist authors in writing their contributions and to reduce the subsequent editing process. The Magazine Editorial Group is trying to ensure that all articles are written in a journalistic style so that they will have an immediate interest value for a wide readership and will be readable and comprehensible to non-experts. In particular, scientific articles should give a good overview of a field rather than focus on the authors' own research.

Format of articles

The main message or question posed should be introduced in the first paragraph. The background for the topic should then be established, leading up to the final denouement or conclusion.

Length of articles

This will be determined by the subject matter and agreed between the contributor and the commissioning editor. Articles will vary in length from 200 words to a maximum of 800 words.

Submission of articles

Authors should submit text in the form of a disk accompanied by a printout wherever possible. Use of disks reduces the risk of introduction of errors during re-typing. It is helpful to give brief details of the computer, operating system and software package(s) used (DOS formatted Wordperfect 5.1 files preferred, but not essential).

Deadlines for submission

Contact the Editors office or the Administration office for submission dates. Late submissions will not be accepted or publication will be deferred to a later issue.

Illustrations

Authors are encouraged to submit diagrams, drawings, photographs or other artwork to illustrate their articles or, if they cannot provide these themselves, to suggest what artwork might be appropriate. Photographs may be colour or black & white, prints or transparencies.

Author photographs

The Magazine normally includes photographs of the authors of articles. These may be colour or black & white; prints are preferable if cropping is required.

References

Authors are requested to keep the number of references to a minimum (preferably no more than two or three).

Suggestions for articles

These should be made (in writing, by phone, or in person at Scientific Meetings) either to the Editor, to the Editorial Assistant or to the relevant member of the Magazine Editorial Group (see left).

Artwork & DTP - Denise Young, Academic Services, St George's Hospital Medical School, London.

PHYSIOLGY IN CARDIFF

Croeso I Cymru - Welcome to Wales, after 10 years. Yes, it is exactly a decade to the day since the Society held its last meeting in the capital city of Wales. Plenty of things have changed: a few in line with national trends (or are they idiosyncratic paranoias?), others unique to our University.

Merge, or...else !

Firstly, we are not the Department of Physiology any more! (Let's face it, how many are actually left in the country as a whole?) Indeed, `they' wanted us to get rid of the name `Physiology' altogether, but all of us (Welsh, English, Americans, Argentineans and Sicilians) fought hard and won: we are now called the `Physiology Unit'. Together with the Anatomy and the Biochemistry Units, we became the School of Molecular and Medical Biosciences in August 1995, while research was re-organized into a number of groups spanning the three Units. The three subsequent years saw us undertaking major steps to improve efficiency and productivity in teaching and research as well as in streamlining the School back-up facilities. But....., the tornado of changes had not unfortunately passed over the Severn Bridge yet! As a Christmas present in December of last year, in fact, we were told once again: `Merge, or ...else!'. We thus left crying wives, screaming children, the beloved in-laws and all the other Christmas activities (i.e. writing our next J. Physiol. paper and research grant), went into `the merging mode' with the School of Pure and Applied Biology, welcomed our new entomologist/ecologist colleagues and formed the *Cardiff School of Biosciences*.

On a more serious note, the Physiology Unit has, at present, 5 Professors, 2 Readers, 1 Senior Lecturer, 5 Lecturers and a Senior Research Fellow, and we hope we will have filled three vacant positions by the time of the meeting. Through the fully devolved budget arrangement of Cardiff University, our teaching and research activities earns the Unit an average recurrent budget of over £1M per year from the HEFCW.

Teaching in the Physiology Unit

The Unit continues to run successfully the B.Sc. courses in Physiolgy (a Single and two Joint Honours degrees with Biochemistry and Psychology), and the Single Honours course in Neuroscience. The latter, which has a 3rd year placement option, was one of the first in the country and was set up in 1991, mainly through the vision and hard work of Malcolm Roberts. Within our modular teaching structure, we also contribute to other undergraduate courses, so that our first year Physiology modules are taken by over 120 students. In addition, 60 dental students and almost 200 medical students are taught by the physiology staff, and we are looking forward to the arrival of 100 more medical students per year which the HEFCW has just decided will be trained in Cardiff by the year 2001! Fortunately, the computerized student record system (developed and run by John Robertson, the ex-physiology chief technician, now school administrator) helps to minimize the administrative time associated with this large number of students.

Savings following the formation of the School in 1995, together with the strong commitment of John Bedwani and the invaluable expertise of Chris Stent (our scientific officer) and Mark Uphill (our teaching lab technician) gave us the opportunity to upgrade our undergraduate facilities. They now include a fully equipped suite for exercise physiology, 12 electrophysiological rigs for practicals on brain slices, and a larger general teaching laboratory with 25 multi-purpose computerized units where we make full use of the practicals and tutorial programmes developed via our participation in the TLTP initiative. The climate of innovations in teaching has seen Alison Davies involved with our clinical colleagues in the restructuring of the medical curriculum, while the current emphasis on student-directed learning has given Steve Barasi (and others) the opportunity to develop a Teaching and Learning Resource Centre (of which he is now the manager). This Centre provides rooms for self-directed learning, a small self-contained library with the most used textbooks, organizes workshops for our staff on new teaching methods, and recently received outstanding approval by the TQA assessors. (By the way, good luck to everybody in England for the incoming TQA round: it only takes about eight weeks of toil!).

Research and funding

On the research side, the physiology staff are part of three research groups within the new School. Eighty per cent of the staff in the *Neuroscience Group* are physiologists, a clear reflection of the neuroscience interest within the antecedent department. My work on cellular thalamic mechanisms now includes the pathophysiology of absence epilepsy and

Cardiff University Main College Building, Physiology Building in background

analysis of $[Ca^{2+}]_i$ dynamics. Kevin Fox's long standing interest in cortical plasticity focuses on NMDA receptors, a-CaMKII and CREB, and is strongly linked to Paul Chapman's cellular and behavioural studies of learning and memory in normal animals and in transgenic models of Alzheimer's disease. Malcolm Roberts's studies of the mechanisms of pain modulation has recently shown that a noxious stimulus itself initiates analgesia, while David Wallis' latest work has included the electrophysiological analysis of 5HT receptor-mediated responses in cultured human motoneurones. David Carter's work utilizes molecular and rodent transgenic techniques to investigate the transcriptional processes involved in neuronal gene expression (including the central circadian clock), and Tim Wells (Senior Research Fellows) is using genetically modified models (including the transgenic, growth retarded rat) to study the central mechanisms of growth and food-intake regulation. George Foster is developing novel and safer sources of tissue for neural transplantation as part of neurodegenerative disease treatment, and Malcom Rose continues his modelling studies of intrinsic oscillations in mammalian neurones. The strength of the neuroscience group has recently been consolidated by the award of a MRC Cooperative Group (Mechanisms of Neuronal Plasticity, Learning and Memory) to Fox, Carter and Chapman in collaboration with staff from the School of Psychology.

Within the *Molecular Biochemistry and Cellular Physiology Group*, Tim Jacob uses molecular techniques (antisense knock-down) to investigate the ion channels and channel regulators involved in cell volume homeostasis, while Sarah Hall, who joined the Unit two years ago, is interested in the role of phosphorylation in volume-activated channels and of the cytoskeleton in the control of cardiac cell volume. The Unit is currently targeting some of the available positions to strengthen the cell physiology component of this group.

Ron Eccles's expertise in human respiratory physiology was instrumental in securing the initial industrial grant to set up the *Common Cold and Nasal Research Centre* within the Physiology Department in 1988. The Centre (with Ron as its director) now has a permanent compliment of 4 staff (including a full time physician), enjoys a self-contained site within the School and is fully self-financing since it attracts funds for basic and applied research from a variety of national and international sources. In addition, the Centre continues to provide opportunities for undergraduate, postgraduate and postdoctoral studies as well as research placements for clinicians.
The production of transgenic rats is one of the latest achievements of our multi-user transgenic facilities that were setup in 1994 following the appointment of David Carter. He and Tim Wells ensure that the scientific and technical knowhow is available to those (both within and without the Unit) wishing to apply this difficult technique to resolve physiological problems.

The Physiology Unit research income from MRC, BBSRC, EU, NIH, Human Frontiers, Wellcome Trust and other charities reached an yearly total of £1.5M last year. In addition to this, industry-derived income has run at an average of almost £1.2M for the past 5 years, and we are extremely fortunate in that the financial stability of our University allows a large proportion of both european/research council and industrial overheads (50 and 80%, respectively) to be returned to the originating department/researcher. At a time of an ever increasing erosion of the technical staff support

Physiology Building, Cardiff University

because of the HEFCW efficiency gain plans, this research income helps in the continuing employment of some of our technical complement. We are thus very fortunate that Phil Blanning and Tim Gould (in the staff research laboratories), John Harris (in the mechanical workshop) and Bob Jones (in the computerized artwork and photography workshop) continue to give us their invaluable expertise and committed technical support.

'Brains' for beer

The last few years have undoubtedly been a period of radical changes, requiring careful planning and at times raising some serious concerns, but they have also provided unprecedented opportunities for Physiology in Wales. By the time of the meeting, we also hope that all the new appointees will have taken up their positions and that the new School Director (who we sincerely hope will be a physiologist) will be in place. Our strengths will be well represented throughout the meeting, including the Cellular Neurophysiology, the Somatosensory Physiology, the Development and Plasticity, and the Neuroendocrinology Designated Sessions as well as the Symposia on Cell Transplantation, Synaptic Plasticity and Transgenesis Techniques, and the Workshop on Problem-based Learning. This, together with the Wellcome Prize Lecture (by Leon Lagnado, Cambridge) and the Sensorimotor Control and Somatosensory Physiology Lectures promise to bring variety and depth. And .... remember: if during any of these scientific events your *brains* become overloaded, appropriate lubricants are provided by *`Brains'* (the local Welsh brewers, down the road from our site), while refuge and support through `smoking' sessions can always be found in my office!

Vincenzo Crunelli
Physiology Unit
University of Cardiff

SMITHKLINE & BEECHAM WELCOMED THE PHYSIOLOGICAL SOCIETY

Seeing Harlow on the list of Society Meeting venues prompted at least one enquiry as to how to find the University. The reality is that a new University of Harlow has not quietly crept up on us. However, over the last three years SmithKline Beecham has become the major employer in the town as we consolidated our UK Research activities at our Harlow Site. This has both provided us with a superb facility for drug discovery and a suitable venue to host meetings with our academic colleagues. So, it was a pleasure to be able to welcome the Society to a non-academic venue for the first time in November 1998.

SmithKline Beecham at Harlow

A Research presence was established on the current site by Beechams in the early 1970s and was gradually developed until the time of the merger with SmithKline Beckman in 1990. Prior to 1990 research focused on GI function, Arthritis and Neuroscience but since the merger, the pace of change at the site has accelerated. Parcels of adjacent land were being quietly bought up, culminating with the purchase of the old BP shipping Head Quarters. At a stroke we were able to solve the travel nightmare that the merger had created by consolidating the 10 UK research sites onto one based at Harlow. This was achieved by building two major new buildings on the enlarged site. The combined site is now fully operational with roughly 2,000 people working on the New Frontiers Science Park.

Activities on site

The site is in two halves linked by a bridge. On the South site are based many of the Drug Development and Clinical functions of SB in the UK. On the North site, where the meeting was hosted, are the UK Discovery activities. This covers a broad range of biological, chemical and analytical disciplines. In fact, all the resources you need to get from a gene target to a potential drug to commence clinical trials. Biological Science disciplines, with a therapeutic focus, are mainly represented in the two departments, Neuroscience and Vascular Biology and a range of generally applicable molecular biology skills are resident in Biopharm and in vitro screening skills in Molecular Screening Technologies. The latter two departments, together with Medicinal chemistry, are transnational and collaborate with the therapeutic area departments in particular drug discovery projects. All departments are actively linked to academic groups through

The new Science Complex One building on the New Frontiers Science Park at Harlow.

collaborations at post-doctoral, CASE studentships and an annual influx of enthusiastic undergraduates here for their Sandwich year.

Research interests

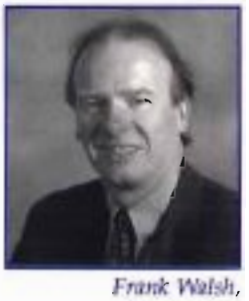
Historically, the Neuroscience Dept has had a strong interest in serotonergic mechanisms developed around the commercial success of the antidepressant SSRI paroxetine and the anti-emetic 5-HT3 antagonist granisetron. Prof Frank Walsh, our new Department Head, has orchestrated recent recruitments into the department, which now numbers 135. This has strengthened the existing drug discovery expertise and equipped Neuroscience to vigorously explore a wealth of new molecular targets.

The therapeutic focus of the department is on the areas of greatest unmet medical need - Alzheimer's disease, depression, neuropathies and pain, Parkinsons' disease, schizophrenia and stroke. A major molecular focus of the department is on G-protein coupled receptors (GPCRs) where, in addition to various potential opportunities in the serotonin field, a number of novel GPCRs that have only recently been paired with ligands are being actively investigated as CNS therapeutic targets. The other major cell surface targets are ion channels where recent advances in technology have permitted high throughput screening to be used on these targets. A strong interest in kinases is enhanced by collaboration with the University of Dundee Division of Signal Transduction Therapy directed by Professors Philip Cohen and Peter Downes. A need for new animal models of disease has resulted in another major academic collaboration with the MRC Harwell mutagenesis unit. Further information on the project is available at http://www.har.mrc.ac.uk/mutabase/

The other main therapeutic areas covered at Harlow by our Vascular Biology group are diabetes/obesity and atherosclerosis. A number of diabetes targets in the insulin signal transduction pathway are under investigation as we build on our existing work in the area of PPAR insulin sensitisers. New members of the GPCR family that are looking interesting as potential approaches to obesity such as the orexin receptor are among the areas of study.

We hope that the meeting provided a forum to continue the best traditions of the meetings of the Society, to further existing collaborations and establish new contacts between academic and industrial endeavour in the field.

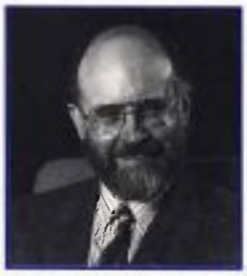
Chris Benham and Frank Walsh,
Neuroscience Department,
New Frontiers Science Park (North),
Harlow,



Frank Walsh, Neuroscience Department Head

Chris Benham

NEW EDITOR OF THE PHYSIOLOGICAL SOCIETY MAGAZINE


Dr William Winlow

My five-year term of office as editor of the *Magazine* finishes at the end of this year and Dr William Winlow from Leeds University will be taking over the position. This has lead to some changes in the day-to-day running of the *Magazine*. It will no longer be primarily based at St George's but will run from the central office in London. All contributions and queries should be directed to Miss Craigie Chapas at the Administration office.

I would like to take this opportunity to thank all people who have given me continued support during my time as Editor. Firstly to all the authors who have contributed over the last few years and have submitted interesting articles under the pressure of deadlines and a nagging editor. Secondly to all the staff employed by the Society who tirelessly do all the hard work in the production of the *Magazine* and pick up all the pieces that I leave scattered behind. Thirdly to Denise Young in the Academic Services at St George's Hospital Medical School who took up all the *Magazine's* artwork and DTP when the Physiological Society's Office in Oxford closed. My thanks also to Martin Rosenberg, who has provided a continual supply of Departmental photographs. And finally to all past and present members of the *Magazine* Editorial group who generate ideas for articles, commission articles and do their share of proof reading, editing and chasing up contributors. There are too many people to mention by name but I am extremely grateful to everyone for providing me with the support that has enabled me to have the challenges, the rewards and the friendships I gained as Editor.

Saffron Whitehead

NEW MEMBERS

Following the AGM in Southampton on 10 September, the Committee extends a warm welcome to its new Foreign Secretary, Professor David Brown, the new Chairman of the Animal Legislation and Welfare Sub-Committee, Professor Fiona Broughton and the three new Ordinary Members of the Committee, Dr Rob Clarke, Professor Giovanni Mann and Professor Sue Ward. The Committee also wishes to thank the departing Foreign Secretary, Professor Ole Petersen and Ordinary Members, Dr David Attwell, Dr Richard Ribchester for all their hard work and effort. Thanks are also extended to Nina Burdakova for her help as Assistant to the Foreign Secretary.

HONORARY MEMBERSHIP

The Committee Secretary invites nominations for Honorary Membership by end of November. Suggestions should be sent to his office in strict confidence. The Membership is reminded of Article of Association II4:

'Honorary Members: persons of distinction in Science who have contributed to the advancement of Physiology are eligible for election as Honorary members on the nomination of the Committee. Honorary Members shall have the rights of Ordinary Members of the Society, excluding that of voting, but shall not be called upon to pay annual subscriptions. Honorary Members shall have the additional right to choose to be sent *The Journal of Physiology* free of charge.'

If you have any items that you feel the Committee should discuss, please contact the Committee Secretary.

Christina Docchar

1999 PRIZE LECTURES

The Annual Review Prize Lecture *Professor Alan North FRS*	Nucleotide-gated ionchannels: Birmingham
G W Harris Prize Lecture *Professor Geoff Burnstock FRS*	Purinergic Signalling: London (UCL)
G L Brown Prize Lectures *Dr Peter Lipp*	Elementary Ca^{2+} signals: a new understanding of cellular signal transduction: Dublin, Aberdeen, Cork, Liverpool, East Anglia, London (King's College)
The Sharpey Schafer Lecture & Prize (1998) *Dr Julian Paton*	*Nucleus tractus solitarii*: an integrating structure London (UCL)

CARDIOVASCULAR/ RESPIRATORY CONTROL

This Special Interest Group had a great meeting at Southampton: ten Communications, nine Posters and two Designated Lectures. I would like to thank our speakers - Professors Lawrence Schramm (Department of Biomedical Engineering, Johns Hopkins University School of Medicine, Baltimore, USA) and Stephen Logan (Department of Biomedical Sciences, University of Aberdeen) for presenting two excellent lectures on spinal mechanisms controlling sympathetic activity. Schramm demonstrated a high degree of correlation between dorsal horn neurones and sympathetic outflow in spinalised but not intact *in vivo* preparations. He suggested that this may explain the hyper-reflexia and hypertension in spinal injured patients. Logan updated us on electrical coupling between sympathetic preganglionic neurones via gap junctions *in vitro*. He provided unequivocal data for this by using paired recordings. The gap junctions showed rectification and may be located on dendritic membranes; their structure remains to be fully described and is undergoing analysis at the E M level; we look forward to hearing more!

I would also like to acknowledge a fascinating symposium entitled Sleep & Breathing, organised by Prem Kumar and Douglas Corfield. The speakers were all good and had different perspectives to offer on what is clearly a clinically important topic.

At Southampton, the Cardiovascular/ Respiratory Control Group held a business meeting on Wednesday 9 September to establish a new Convenor. Following an e-mail to all members of the Group, I had one response from Dr Teresa Thomas from the Autonomic Neuroscience Institute, Royal Free & University College Medical School, London. I am pleased to report that Dr Thomas was voted in by members of the SIG.

We shall co-run the Group for the first six months and wish to organise a symposium for the Birmingham Meeting in December of next year. We would appreciate any suggestions for a theme or topic and nominations for Designated Lecturers. Please e-mail Teresa Thomas: teresat@rfhsm.ac.uk with ideas. Please note that Dr Michael Gilbey is planning a symposium for the UCL Meeting in April 1999 entitled 'Rhythm and Synchrony in the Nervous System'. This symposium is likely to deal with the subject in a broad sense, although there are likely to be aspects of it that are of great interest to members of the Group. The next SIG Designated Session is also at the UCL Meeting, 20-22 April 1999.

Julian Paton & Teresa Thomas

COMPARATIVE PHYSIOLOGY

The Comparative Physiology Group is relaunching itself under its new Convenor, with a major international symposium to mark the end of the millennium at the Meeting of the Society in Birmingham, 20-22 December 1999. The topic of the symposium will be Comparative Cardiorespiratory Physiology. This will emphasise the importance of comparative studies to the advancement of knowledge in this area of physiology. A list of possible contributors is with the Meetings Secretary, and our plans are well advanced. There will also be room in the programme for contributed papers from all interested comparative physiologists. Please aim to be there as it promises to be an exciting time.

Stuart Egginton

EPITHELIA & MEMBRANE TRANSPORT

Plans are now well advanced for the Manchester Meeting of The Physiological Society next March. This will be a Designated Meeting (as in March 1996), which will pool the resources of the Epithelia & Membrane Transport, G I Tract, Placental & Perinatal Physiology and Renal Special Interest Groups.

There will be two symposia on Monday 29 March: 'Molecular Physiology of Chloride Channels' and 'Materno-Fetal Exchange Across the Placenta: Current Status and Future Directions'. Talks for a third symposium on 'Acid/Base Transporters in Epithelial Cells' will be interspersed with Oral and Poster Communications during the Meeting on Tuesday 30 and Wednesday 31 March. Details of each symposium can be found on page 13 of this *Magazine* and on the Society Website (http://physiology.cup.cam.ac.uk). The closing date for the receipt of abstracts is Thursday 21 January 1999.

Peter Brown

HUMAN PHYSIOLOGY

The Group will hold a Designated Session at the Christmas Meeting to be held in Cardiff on 15-17 December. Unfortunately, it has not been possible to schedule a symposium for this Meeting, the first time for many years that we have not been able to do so. The feature of the Session will be a Designated Lecture by Dr John Cotes, University of Newcastle. The title of Dr Cotes' lecture will be 'Inappropriate indices in cardio-respiratory and exercise physiology: are we misleading ourselves?' He promises that there will be some among the audience who will feel the need to challenge his views, and to stimulate debate. There are prospects of a busy Session, with interest from a number of European colleagues.

We hope to organise a symposium and Designated Session either at the Birmingham Meeting next Christmas or the Glasgow Meeting in September, although final details have yet to be worked out. Suggestions for symposium topics are welcome and they will be discussed at the Group meeting to be held in Cardiff, December 1998. Clyde Williams, for example, has suggested that it would be appropriate at the end of the millennium to have a symposium dedicated to the history and evolution of human and exercise physiology. This suggestion has considerable attractions.

The Annual Meeting of the UK's Climatic Physiology Group will take place on Friday 18 December 1998 at Loughborough University. This meeting is devoted to human (mostly) environmental and climatic (stress) physiology (please see notice opposite for fuller details). Anyone wishing to submit an abstract or to attend should contact the Secretary (Mr Jim House) at: Environmental Medicine Unit, Institute of Naval Medicine, Alverstoke, Hants PO12 2DL. Following from the successful joint meetings which the Group has had with the Nutrition Society and with the British Association of Sport and Exercise Sciences, it would seem appropriate for us to consider closer links with this group, perhaps in the form of a joint meeting.

The 6th International Research Group on Biochemistry of Exercise will be held at Maastricht, The Netherlands, 18-21 February 1999. The Society has negotiated a reduced registration fee of 900 DFL (approx £280). For further details contact myself or the Meetings Secretary's Office (tel/fax: 0171 636 5053, e-mail: meetings@physoc.org).

Ron Maughan

THE ANNUAL MEETING OF THE UK'S CLIMATIC PHYSIOLOGY GROUP

18 December 1998, Loughborough University

At the kind invitation of Professor Ken Parsons, Head of Human Sciences, the 39th meeting of the Climatic Physiology Group will take place at Loughborough University on 18 December 1998. The group meets annually to present work in climatic, environmental and survival physiology. Presentations will last 15 minutes with five minutes for questions. The group is informal and welcomes presentations regarding completed experiments, work underway and proposals for work. Anyone wishing to present work at the meeting should forward a one page A4 abstract (Times Roman 12pt or similar), or at least the title, by 1 December 1998 to:

Mr J R House,
Secretary of the Climatic Physiology Group
The Institute of Naval Medicine,
Alverstoke GOSPORT PO12 2DL
Tel: 01705 768032 Fax: 01705 504823

Work that may have been presented or published at other meetings at which members of the group are unlikely to have seen are also invited. Presentation of the work and the abstract does not preclude publication of the work elsewhere. The cost of the meeting is £15 which includes lunch and refreshments. Anyone wishing to attend should forward a cheque for £15 payable to the Climatic Physiology Group to the above address providing details of the senders address and telephone number so that a programme may be forwarded prior to the meeting.

Jim House (INM, Alverstoke)

ION CHANNELS

Southampton Meeting, September 1998

Ion channels featured strongly in this south coast Meeting, in both the research symposium, 'Molecular Physiology of Receptors and their Ligands', and the lively but good-humoured Ion Channels Communication and Poster Sessions on Thursday. This theme continued on Friday in the Ion Channel SIG supported, symposium 'Sodium Channels: Clones and Consequences'. This symposium was instigated by two events in particular; firstly that the voltage gated sodium channel was one of the first cloned (1984); and secondly a comment made by an unnamed colleague 'what do you mean there's more than one sodium channel?' Therefore a 14 year update did not seem unreasonable. We were privileged to a morning of exceptional talks starting with Stephen Waxman (Yale, USA), who gave us the four Ds, that sodium channels

are widely Distributed, Diverse, Dynamic and Disease relevant. Wayne Crill (University of Washington, USA) followed, presenting us with some elegant evidence for a physiological role for the persistent sodium current in cortical pyramidal cells. After coffee John Wood (UCL, UK) detailed the relationship between the TTX resistant sodium current and a sodium channel clone, called SNS, and highlighted it as a possible target for novel analgesic drugs. This was followed by Mustafa Djamgoz (ICL, UK), engaging the attention of the male audience, particularly over a certain age, when he discussed the role of sodium channels in the metastasis of prostrate cancer. Finally William Catterall (University of Washington, USA) covered the structure, function, pharmacology and physiology of sodium channels with such eloquence and ease that it seemed there is little left to do in this field. However, the questions throughout the symposium suggested this was not the case and I might add another D to the four of Stephen Waxman's, continuing Development.

We wish to thank all the speakers; John Chad, for chairing the symposium; and Helen Laird and Scarlett Buckley for help with the organisation. We, your Ion Channels SIG Convenors, hope that we have shown the way and now wish that you as members of this Group will come forward with ideas for future events.

A forthcoming attraction is a Designated Lecture by Nigel Unwin on the structure of the nicotinic acetylcholine receptor, at the UCL Meeting in April 1999.

Jon Robbins & Reggie Docherty

MICROVASCULAR AND ENDOTHELIAL PHYSIOLOGY

Our Special Interest Group met on Friday 11 September 1998 at The Physiological Society Meeting in the University of Southampton. The Session began with a Designated Lecture by Professor Martin Schmelz entitled 'Neurovascular Interaction in Human Skin' and was followed by a Poster lunch (eight Posters and three illustrated Communications), Approval of Posters and eight Oral Communications in the afternoon. (The small number of microvascular abstracts for our SIG meeting at Southampton was attributed to the close proximity of the meeting to that of the European Society of Microcirculation held in Paris late this August). Many related 'endothelial' posters were presented as part of the programme of The British Pharmacological Society. Congratulations go to Victoria Gauden (Dr Paul Fraser's PhD student) for being awarded the Pfizer Prize for her Communication in our Session.

Dr John Lever kindly agreed to chair our business meeting in Southampton, as I needed to travel to Cambridge to attend a funeral. At that business meeting, future venues for our SIG were discussed. The Joint Meeting of the Chilean and UK Physiological Societies on 13-16 November 1999 will feature eight themed symposia, including one on microvascular and endothelial physiology. Financial support has been promised by The Society and those who wish to participate should contact Giovanni Mann, who will be acting as the UK liaison for the meeting. The next 'home' meeting will be held at the University of Birmingham, 20-22 December 1999. Professor Janice Marshall and Dr Stuart Eggington have been approached with a view to organising a symposium or Designated Lecture for our Group at this Meeting. In 2000, there will be two further SIG Designated Sessions, the first at Imperial College during The Physiological Society meeting, 12-14 April, and the second at King's College London in December. The former will include joint sessions with The British Microcirculation Society whose meeting begins on 11 April. It is expected that there will be a symposium that will be hosted jointly by The Physiological Society, British Microcirculation Society and The Microcirculation Section of the IUPS. International input, particularly from the (American) Microcirculatory Society is also under discussion.

University of Birmingham

The next meeting of The British Microcirculation Society will be held on 12-13 April 1999 at the University of Durham. This is being organised by David Harrison of the Medical Physics Department, Dryburn

Hospital. It will feature a symposium on 'Measurement of Imaging of Blood Flow and Oxygen Supply in the Microcirculation'. Further information will be available from John Lever (e-mail: m.j./ever@ic.ac.uk)

My time as the Convenor of our SIG has come to an end and I am delighted to hand over the task to another colleague. The Society recommends a three year term of office. There was considerable discussion at Southampton about the appointment of a successor. A decision was eventually reached that the new Convenor should be elected by an e-mail ballot. Nominations have now been received and I have e-mailed the Group membership with a request to receive their e-mail/fax vote by 6 October 1998. I have certainly enjoyed acting as the Convenor and am delighted to transfer my 'Access' database of members and their interests to the new Convenor, who will co-ordinate the future business/meetings of our SIG.

Giovanni Mann

Cardiff University

NEUROENDOCRINOLOGY

Neuroendocrinology has fairly frequent Designated Sessions and symposia, so there was some concern as to whether there would be enough material to make the Liverpool Meeting, in conjunction with the Spanish Physiological Society, a really successful one for the neuroendocrinologists. In the event we need not have worried as there were some 13 Oral Communications and 14 Posters. This meant that together with the mini-symposium on Sex steroid hormone actions on neuronal function organised by Rafael Alonso (Tenerife) and George Fink (Edinburgh) the sessions ran for much of the 27th and 28th April. The Posters and most of the Communications were presented on the Monday. Given the topic for the symposium, the Poster Session, as one might have expected, focussed on reproductive function, although there were presentations on other topics including three on melatonin. The Communications covered a similar range of topics, the Session opening with an investigation on the effect of vasopressin on vasopressin neurones and closing with discussion on nitric oxide dynamics during penile erection and the effects of androgens. Presentations were not limited to laboratories in Spain and the UK, but France, Germany and the USA were represented, so that the afternoon had a truly international flavour and one heard neuroendocrinology in a variety of accents, rather like a tune being played on different instruments of the orchestra. Immediately after the tea break, when one could view any Poster missed earlier in the day, came the approval of Posters. With the large number to discuss, they were taken in groups, each group being reviewed by a Member of the Society chosen, I have to admit, after consultation with me. However, I got my come-uppance as I had to review the Posters on Comparative Physiology.

The next Neuroendocrinology Designated Session is at the Cardiff Meeting (15-17 December 1998), when the symposium on transgenesis should prove of interest to many members of the Group, so I hope to see you there. Presentations by young physiologists may be entered for the Pfizer Prize round. Next year we have a Designated Session at the Meeting at University College London in April.

Mary Forsling

RENAL PHYSIOLOGY

The Southampton Meeting was the first Renal Physiology Designated Session at which I was in charge as Convenor. It was a great pleasure to see so many of the SIG there giving their active support and heartening to see the high level of interest. The Oral Communications covered a wide range of topics, dealing with cellular mechanisms of fluid handling, micropuncture studies looking at factors influencing loop of Henle and proximal fluid handling and whole kidney studies examining

central mechanisms in an integrated sense. It was interesting that at this Session there was only one Communication (from Leeds) which did not have a Southampton graduate as a senior author!

The Poster Communications showed a similar diversity of interest with a series of presentations concerned with changes in the composition of sodium transporters in the spontaneously hypertensive rat, the tubular actions of endothelins, the influence of chloride ions on carbonic in hydrase activity, the influence of glucagon on proximal tubular function and the importance of nitric oxide in several rat models of diabetes. The challenge for me was to assimilate and evaluate these Posters as the Society had asked me to act as scrutineer. This was a novel task in which we had minimal guidance, but any constructive feed back on my performance would be valuable!

My intention was to ensure that we had a Designated Lecture at the Meeting and that the subject should reflect some aspect of kidney research which had been carried out at Southampton. An obvious person who could do this was Professor Ole Skott from the Department of Physiology, University of Odense, who has a very solid research record into the mechanisms regulating renin release, both at a cellular and whole animal level. He gave us a very clear and instructive lecture covering his latest research into the roles of chloride channels in regulating renin secretion and related this to the integrated mechanisms regulating the production of renin in a whole animal situation. Judging by the comments I received afterwards everyone enjoyed his contribution and many (including myself) felt reassured that we had indeed been teaching the correct dogma to our students!

Looking to the future, could I remind you that we have two Designated Sessions next year; one as part of the Designated Meeting to be held in Manchester in March 1999 along with the Epithelia & Membrane Transport, G I Tract and Placental & Perinatal Physiology Groups and the second to be held at Birmingham in December 1999. Your enthusiastic and positive support at both of these Designated Sessions is very necessary to make them a success. We only have a few months left to get new and interesting data to present and talk about.

Many of you will be aware that I have been trying to update the email address list and that process has been completed for the time being. My intention is that by the time this newsletter appears I will have already been in contact with you all by email. If I have missed you off the list, please get your address to me as soon as possible (e.j.johns@bham.ac.uk). I look forward to seeing many of you at the Manchester Meeting!

Edward Johns

RESPIRATORY PHYSIOLOGY

Southampton Meeting

I've been told that the more you complain, the longer God lets you live. Given then that I already have a long life ahead I might as well add some extra years by stating that the student accommodation at Glen Eyre Halls of Residence (non-ensuite section) certainly can't have won any design awards although they must have won a fair few Crime Prevention awards. To have to use a security code and unlock a minimum of 2 doors simply to use the very-shared toilet/shower room must mean that either the general crime rate is very high in Southampton or, more intriguingly, that the local criminal fraternity are very specialised indeed. With the small sized rooms and the sound of so many doors locking and unlocking each night and morning, it was only the lack of bars on the windows that reminded me that I was there of my own free will. Talking of a lack of bars ....

Fortunately the Biomedical Sciences Building (Boldrewood) was much more user-friendly and provided an excellent setting for the Meeting which for the Respiratory Group started with a Research Symposium on 'Sleep and Breathing'. Sleep and breathing are both essential behaviours and I always find it sobering to realise that we spend some 15-20 years of our life asleep - give or take a few years depending on the courses we opted for in our undergraduate days. In the first of 3 sessions held in the superb Lecture Theatre 1, Allan Pack and George Lees brought the audience up to date on the neural and chemical bases of sleep. In the 2nd session, John Orem and Douglas Corfield discussed the relation between sleep and breathing primarily in the normal physiological situation and in the 3rd session, after lunch, Neil Douglas, Mary Morrell and Phil Nolan continued with an examination of the mechanisms predisposing to sleep apnoea. The data presented throughout was gained from a variety of models ranging from bulldogs to frogs and utilising approaches from the integrative to the

molecular. I found the symposium totally engrossing and I am sure many of the audience did so too judging by the as-wide-awakeness of everyone at the end as at the start. I now know why bulldogs snore, what cats dream of, what oleamide is (or isn't), what sleep apnoea looks like, what respiratory-related neurones sound like in REM sleep and why rabbits don't smoke. Ask me next time you see me. This was the first symposium at which we have been able to bring two speakers from the USA (plus speakers from Scotland and Ireland) and this was due to generous support from the British Pharmacological Society as well as, of course, from our own Society.

The following day - starting as usual at 9 am - we had our Designated Session comprising 6 Communications and 2 Posters. The first Communication will be remembered by everyone present for a long time. Dr R W Torrance, using only two numbers writ large on the blackboard behind him, gave a convincing argument to support a physiological role for haemoglobin in the carriage and transport of carbon monoxide. The harmful consequences upon this normal process of late-20th century industrialisation were, in his words, simply an accident waiting to happen. Later that evening, Bob Torrance informed me that this Communication marked the 50th anniversary of his first ever Communication to the Society. A not-very difficult calculation determined that were I to achieve this same distinction I would have to still be going through this ritual until at least 2033!

University College, London

Our next Session is scheduled for the UCL Meeting next year (20-22 April) and we may be having an additional Session at the Newcastle Meeting (13-15 July). More news on this will be circulated via the Group's email list or the Society's webpage.

Prem Kumar

SMOOTH MUSCLE

The new Convenor for the Smooth Muscle Group is:

Professor Noel McHale
Dept of Physiology
Queen's University
Medical Biology Centre
97 Lisburn Road
BELFAST
BT9 7BL

Tel: (01232) 335794
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Our thanks go to Jeremy Ward and Lucilla Poston, previous joint Convenors, for maintaining the Group over the last few years.

Meetings Secretary's Office

SOMATOSENSORY PHYSIOLOGY

Cardiff Meeting

The Group will be convening here for a Session on Tuesday 15 December. We will have a Designated Lecture from Dr Jonathan Cole, of the University of Southampton. Jonathan was featured in the BBC Horizon programme 'The Man Who Lost His Body' and will be talking about his work with sufferers of large fibre neuropathies. The title of his presentation will be 'Physiological and clinical studies with 'deafferented' human subjects'.

Malcolm Roberts has organised a social at the Fontana de Trevi restaurant for the Tuesday evening. Please support this event - it is a really good place and will be well worth the money for the food alone. There will be a disco until 2.00 am for those with the necessary stamina!

Next year we will be meeting at UCL (20 - 22 April) and Glasgow (15-17 September). Ray Hill has agreed to give a Designated Lecture at the UCL Meeting on clinical studies with tachykinin receptor antagonists. Glasgow will feature a joint symposium between ourselves and the Sensorimotor Control SIG. Watch this space for news on that event.

Rob Clarke

TEACHING

The Teaching Special Interest Group (http://www.physiology.demon.co.uk/SIG/Teaching/) was convened by Professor Sue Ward in 1997, largely in response to recent new initiatives proposed for the Higher Education sector. The membership is currently in excess of 30, of whom about one-quarter are not presently Members of the Society. The Teaching SIG has been active over the past year. It sponsored a teaching symposium on IT developments at the UMDS St Thomas Meeting of the Society last November (see website), which was organised by Jim McGarrick (UMDS St Thomas) and Sue Ward. The Group's first business meeting followed. A second teaching symposium entitled 'Introducing Problem-Based Learning into an Undergraduate Curriculum' is scheduled for the forthcoming December Meeting of the Society in Cardiff. It is being organised by Dr Stephen Barasi from the School of Molecular and Medical Biosciences as a one-day event on Monday 14 December. Plans are also well advanced for an exciting 1999 symposium on 'Using the Internet to Manage On-line Teaching Resources, Deliver Assessment and Support Course Administration', to be held at the Newcastle Meeting (13-15 July) and organised by Dr Megan Quentin-Baxter, Assistant Director of the Faculty of Medicine Computing Centre at Newcastle University. It is clearly not too early for expressions of interest for the 2000 teaching symposium.

The Teaching SIG contributes to other activities of the Society. For example, the Convenor sits on both the Education & Information Sub-Committee and the recently-formed Quality Assurance Group headed by Dr Lynn Bindman (Department of Physiology, UCL). In addition, the Society's Teaching Resource Home Page can be found at the Teaching SIG website.

The Group will be holding its 1998 business meeting at the Cardiff Meeting (after the teaching symposium on Monday 14 December). Items for the agenda should be forwarded to Sue Ward by Monday 7 December. One important item to be considered will be the election of a new Convenor - Sue Ward was recently elected to the Society's Committee and will therefore be relinquishing this office at the December Meeting. Anyone interested in standing for the position of Teaching SIG Convenor is encouraged to contact Sue Ward for informal discussion. Nominations should be submitted to Sue Ward prior to the SIG business meeting in Cardiff, preferably by 7 December.

Sue Ward

NEW SPECIAL INTEREST GROUP: PATHOPHYSIOLOGY

At a recent Committee Meeting of the Society the possibility of initiating a new Special Interest Group concerned with matter relating to Pathophysiology was discussed. The focus of this SIG would be towards understanding the molecular and genetic basis of defects in normal physiological events, and the manner in which they underpin the onset of disease. The identification and characterisation of channelopathies exemplifies one area of potential activity for this group.

Cell and molecular aspects of Physiology are clearly seen as an important area of research for an increasing number of laboratories, and how these relate to medical science is also matter of some considerable interest for the Society.

We are trying to gauge potential interest in this initiative. One way forward is to hold a Symposium at a forthcoming Meeting of the Society, but before we commit to this we would generate a mailing list of interested individuals and groups, and explore suitable subjects to cover.

Would anyone who is interested in the initiation of a Pathophysiology Special Interest Group please contact Mark Dunne at Sheffield University:

E-mail: m.j.dunne@sheffield.ac.uk
Fax: 0114 276 5413
Tel: 0114 222 4636.

Mark Dunne,
The Physiological Society Committee.

Quality education in a mass market

Since the distinction between universities and polytechnics was removed, there is a need for the quality control of degrees, especially as student numbers are on the increase. John Midwinter, Vice-Provost of UCL, puts forward his views that different institutions should provide a variety of degrees at varying levels which the student can choose from.

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Source: SPIN

DESIGNATED MEETING OF THE PHYSIOLOGICAL SOCIETY

Epithelia and Membrane Transport, G I Tract, Placental & Perinatal Physiology and Renal Physiology Special Interest Groups

UNIVERSITY OF MANCHESTER, 29-31 MARCH 1999

Monday 29 March - Research Symposium
Molecular Physiology of Chloride Channels

(Organisers: David Sheppard, Miguel Valverde and Tim Jacob)

Speakers include:

M Welsh	(Iowa)	Cystic Fibrosis and CFTR
K Strange	(Nashville)	Molecular identity of volume-regulated chloride channels
T Jentsch	(Hamburg)	Structure and function of ClC channels
R Thakker	(London)	Dysfunction of ClC channels in kidney disease
B Nilius	(Leuven)	Volume-regulated chloride channels
F Lang	(Tuebingen)	Chloride channel regulation and cell survival
M Paulmichl	(Innsbruck)	Function of I_{Cln}
K Kunzelmann	(Frieburg)	Calcium-activated chloride channels in intestinal epithelia
B Tilly	(Rotterdam)	Regulation of chloride channels by protein kinases and phosphatases
P Brown	(Manchester)	Chloride channels in choroid plexus epithelia
C Korbmacher	(Oxford)	Chloride channels in kidney epithelia
M Gray	(Newcastle)	Chloride channels in pancreatic duct epithelia
C Poll	(Bayer plc)	Therapeutic potential of chloride channel modulators

Monday 29 March - Research Symposium
Materno-fetal Exchange Across the Placenta: Current Status & Future Directions

(Organisers: Colin Sibley and Abigail Fowden)

Speakers include:

K Thornburg	(Portland)	Water transport across the placenta
N Illsley	(New Jersey)	Glucose transport across the placenta
T Janson	(Goteborg)	Transcellular transport across the placenta
P Haggerty	(Aberdeen)	Transport of fatty acids by the placenta
C Sibley	(Manchester)	Gestational changes in placental transport mechanisms

Tuesday 30 and Wednesday 31 March - Research Symposium
Acid/Base Transporters in Epithelial Cells

(Organisers: Peter Brown and Maynard Case)

Speakers include:

S Alper	(Harvard)	Cl^--HCO_3^- in the kidney
S Grinstein	(Toronto)	Acid-base balance in intracellular organelles
M Montrose	(Baltimore)	Na^+-H^+ exchange in the intestine
M Romero	(Cleveland)	Molecular identification of the Na^+-HCO_3^- cotransporter
M Steward	(Manchester)	HCO_3^- secretion in the pancreatic duct
F Thevenod	(Homburg/Saar)	H^+ and HCO_3^- transporters in rat salivary glands

NB Titles of all the above talks are provisional.

"LIFE ON THE OTHER SIDE"

Martin Thomas, Managing Director of Cairn Research, gives his distinctive view of what it is like to set up and run a physiologically oriented business, or at least this particular one.

Running a business is a very different sort of undertaking from performing academic research - or at least, one is tempted to say that it should be. At present we live in a climate in which free market economics is seen as not just the best, but possibly the only way to run society. The concept of a university being a place of learning and a repository of knowledge is under threat of replacement by that of a production line which must process ever-increasing numbers of students at ever-lower unit cost. (Yes, I know it's happened already, but I'm just trying to be diplomatic). I have no vested interest in this situation - apart from helping the research funds find a good home, of course - but it does mean that academia and commerce are much more similar nowadays than they used to be.

But at least with a company one can choose how to run it, since all that matters at the end of the day is that the company should be profitable, rather than it being obliged to operate in some particular way. This means that I actually can't tell you about what the business world is like in general, but I can tell you how Cairn is run, and why I think our particular way of doing things - which is admittedly not a well-publicised business model - actually works.

No outside investors

We have always been funded entirely from sales of our products, so there have never been any outside investors to influence our decisions or siphon off our proceeds. This is not a business model which is often described, for reasons which are actually rather obvious. The sad truth is that a business is controlled by whoever supplies the funding, and since banks and venture capitalists are themselves in business to do just that, they go to great lengths to make everyone aware of their services, while never mentioning that it is possible - and in my opinion vastly preferable - to get by without them. These institutions exist to make money for themselves, and the old adage about bankers and umbrellas (i.e. the weather conditions under which umbrellas can be obtained from them) is regrettably all too true. With venture capital funding, you are pretty much committed to floating the company on the stock market within a few years, and although everyone involved can become very satisfactorily rich from the proceeds if all goes well, you are now just in charge of the company rather than in control.

Taking technological risks

There is another important aspect to consider, and that is risk-taking. Doing anything involves risk, but clearly it is inadvisable to take too many risks at the same time. In my opinion a company that takes financial risks, such as aiming to make the high returns which are needed to attract venture capital, has to be technologically conservative, since there are just too many additional uncertainties involved in trying to do something genuinely new. Of course it can be worthwhile for VENTURE CAPITALISTS to invest in technologically ambitious companies if the profits from possible success collectively outweigh the risks. They may not mind if nine out of ten investments fail, but it is very painful indeed for most of the other people involved. Biotechnology companies are a perfect example of this (as anyone at British Biotech will doubtless confirm).

However, we want to design and sell innovative products rather than just to copy other people's, and that requires us to take technological risks. By being financially independent, we CAN take such risks without risking the company itself, and we can take the time to get a new product right before we sell it in any quantity, instead of being forced to launch it in a half-finished state. I'll illustrate this point in a moment, but first I should explain how we managed to put ourselves into such a happy situation.

Falling from a sinking ship into a lifeboat

I came to be running a business more or less by accident. I had expected to spend life in a university, but I was approached by a then well-known - but now closed - industrial research laboratory, who made me an offer which seemed too good to be true, as indeed it was. To begin with, everything seemed fine, but then followed wave after wave of reorganisations and cuts, implemented by a management who were increasingly out of touch with reality. To see a laboratory which, in its heyday, had performed some Nobel prize-

winning research, being progressively reduced to the point where nobody could achieve anything at all, was very sad as well as being personally very inconvenient. However, it also made me realise, as I watched the mistakes being made, the things that were actually important for running ANYTHING successfully. We're talking about concepts like leadership, inspiration, enthusiasm for the task in hand, trust, and empowering people to do things their way rather than yours. I'm not claiming to be proficient at any of these things, but I do understand from first-hand experience just how critically important they are. Of course the financial aspects are important too, but if you don't pay primary attention to these other matters, then the business plan is just so much wasted paper. There was plenty of that in the laboratory I escaped from.

So Cairn began literally as a lifeboat to get me off a sinking ship. The ship was going down for sure, but slowly enough for me to take the time to build the lifeboat the way I wanted it. By starting Cairn as a part-time operation, I was able to support myself from my existing salary, and to fund the relatively modest initial production costs from personal savings. I was then able to employ someone else full-time, and this situation lasted for a whole year before I finally jumped overboard in 1989. By then the business was very nicely in credit, and has remained so ever since. Within a few years we had done well enough to buy our own premises in Faversham, where we remain today. We're only an hour away from London, and visitors are always welcome. Currently there are seven of us full-time, but we are struggling to meet a rapidly-growing demand. It looks as if more of us will be needed very soon.

From development to production

So how do we put our financial independence to both our, and our customers', advantage? Our "Optopatch" patch clamp amplifier provides an excellent example. Several years ago I realised that the accurate measurement of picoampere currents, which this application requires, could in principle be achieved very effectively by feedback-controlled illumination of semiconductor pn junctions, to generate compensatory photocurrents. Readers of this article may or may not be interested to know that this realisation occurred as a result of my attending a Physiological Society meeting, in which a casual discussion on patch clamp technology was followed by an excessive ethanol intake. But that, as they say, is another story.

However, to develop the idea into a saleable product took several years of sometimes very intense work. As we had realised, the headstage of a patch clamp is just the tip of the iceberg, and we were making innovations in other areas of patch clamp design as well; so we had taken on a pretty enormous task. In fact, it took longer than even we had expected, and if we had relied on loan or venture capital finance to start a company to develop this product, we would probably have had the plug pulled on us long ago. Only now are we beginning to release the Optopatch in any quantity, yet the few early sales (to users who were prepared to help troubleshoot it for us) have already more than recouped the direct costs of developing it! Of course, if I were to cost my research time at what I would like to think it is worth, instead of regarding it as essentially free, the project would be running at an enormous deficit right now, but that's a notional cost rather than a real one. Now we have a developed product (at last!), a healthy financial situation, and the prospect of an additional stream of revenue to help us live (in the words of James, our Sales Manager) "in the manner to which we wish to become accustomed".

Fortunately not all projects turn out to be so demanding. In contrast to the patch clamp, our other major recent project, which is a monochromator with fast selection of optical bandwidth as well as wavelength, turned out much quicker and easier than we had expected. We spent several months investigating a variety of alternative design approaches, then made a very clear choice, and got the design up and running in just a few (admittedly VERY busy) weeks, just in time to exhibit at the Cambridge meeting last December. And since we'd thought to plan the rest of our equipment with a view to providing such an instrument one day, it's directly compatible with our well-established modular fluorescence photometry system.

Our design projects sometimes take us into areas about which we initially know absolutely nothing, but since we don't have to justify our activities to anyone else, this doesn't seem to matter. What next? Well, we have a lot of ideas, but not even we know which ones will make it into reality. We can also change our plans in a hurry in response to an interesting suggestion or opportunity, so our next major product may well be a surprise to us too.

Martin Thomas, M.D
Cairn Research
Faversham

GRAVITY AND LUNG FUNCTION

What happens to lung function in zero gravity? Kim Prisk talks about experiments they have performed in Space Shuttle flights or in parabolic flights

The lung is an expanded network of air spaces and blood vessels designed to bring gas and blood into very close proximity to each other to facilitate efficient gas exchange. As a direct consequence of this architecture, the lung is highly compliant and is markedly deformed by its own weight. Over the past several years our group at UCSD has been examining the effects of gravity on the human lung through studies in zero gravity (μG).

Access to microgravity

There are only two practical methods of achieving μG suitable for human experimentation: parabolic flight in aircraft and space flight. Parabolic flight has the advantage of being relatively accessible and, in comparison to spaceflight, inexpensive. However, while a parabolic flight is an exhilarating ride, rather like a large roller coaster in the sky, it provides only short periods of μG, which are sandwiched between periods of hypergravity. Spaceflight provides the only other practical means of performing pulmonary studies in weightlessness. Low earth orbit space flights are now common, and fairly frequent, but in most cases the flights are of limited duration (up to 17 days) with small subject populations (typically 4). For more than 10 years, the Russian space station Mir has been permanently manned, providing some access to long duration exposure, and the International Space Station may ultimately provide better access to μG. To date most of our studies have been performed in Space Shuttle flights or in parabolic flights.

Ventilation perfusion ratios – the effects of gravity and μG

On earth, the alveoli at the top of the lung are relatively over-expanded compared to the bottom of the lung because the weight of the dependent portions of the lung stretches the upper portions. As a consequence, ventilation is higher at the bottom of the lung, because the initial smaller volume there makes the lung more readily able to expand in response to a given breathing effort. There are even larger differences in pulmonary blood flow between the top and bottom of the lung due to the hydrostatic pressure gradient down the lung. While both ventilation and pulmonary perfusion increase towards the lower regions of the lung, the differences in perfusion are larger than in ventilation. As a result, ventilation-perfusion ratio ($\dot{V}_A/\dot{Q}$) is higher at the top than the bottom of the lung resulting in regional differences in alveolar gas and effluent blood composition.

The removal of gravity results in a large increase in venous return to the thoracic cavity, which raises stroke volume and cardiac output. This increase is reduced over the course of a week in μG, as blood volume is adjusted to the new state. Interestingly, this increase in stroke volume occurs in the face of a reduction in cardiac filling pressures, a paradoxical result. The resolution of this paradox in the face of an overall reduction in lung volume implies that pleural pressure near the bases of the lung must have fallen.

Canadian Payload Specialist Bob Thirsk performing the Astronaut Lung Function Experiment (ALFE) during the June 1996 Life and Microgravity Spacelab (LMS, STS-78) flight of the Space Shuttle Columbia. The black suit he is wearing contains the coils of a respiratory inductive plethysmograph providing a continuous record respiratory motion. He is breathing into a bag-in-box system which records all respired flow while a mass spectrometer samples gas at the lips.

Mission Specialist and Flight Engineer Susan Helms performing the Astronaut Lung Function Experiment (ALFE) during the June 1996 Life and Microgravity Spacelab (LMS, STS-78) flight of the Space Shuttle Columbia.

The distribution of blood flow within the lung becomes considerably more uniform in µG than it is in 1G, consistent with the removal of the hydrostatic gradient in pulmonary vascular pressures. The increases in both pulmonary capillary blood volume and membrane diffusing capacity support the more uniform distribution. However, contrary to expectations, there remains considerable inhomogeneity of pulmonary perfusion in the absence of gravity, suggesting that structural properties of different portions of the lung play a large role in the distribution of pulmonary blood flow.

Pulmonary ventilation is known to be inhomogeneous both as a result of convective (large-scale) differences in the lung and diffusive mixing inefficiency in the lung periphery. Our studies showed that much of the convective inhomogeneity in the lung persists in µG, showing that this was not only a result of gravity. Even more surprising were the results from tests performed using near-normal tidal volumes, which showed that contrary to expectations, most of the convective inhomogeneity seen in tidal breathing was non-gravitational in nature.

Using gases of widely different diffusivity (e.g. helium, He and sulfur hexafluoride, SF_6) allows us to probe the nature of diffusive mixing in the lung periphery. These measurements showed us that the persisting non-gravitational convective inhomogeneity is likely span just a few acini. These measurements provide the first direct information on the scale of the intrinsic convective inhomogeneity of the human lung. The studies also showed an unexpected change in the conformation of the acinus in µG, probably resulting from changes in pulmonary fluid distribution.

High ventilation associated with low perfusion in µG

Indirect observations of the range of ventilation-perfusion ratio ($\dot{V}_A/\dot{Q}$) in the lung show that while there is a reduction in the overall range, consistent with the removal of gravity, in the region of normal tidal volume, the range of $\dot{V}_A/\dot{Q}$ remains unaltered. This is surprising, since most of the normal inhomogeneity of $\dot{V}_A/\dot{Q}$ was thought to be gravitational in origin. Examination of the phase relationships of cardiogenic oscillations in expired gases provides a potential answer. In 1G, the bases of the lung have high ventilation and perfusion, and similarly the apices have low ventilation and perfusion. This partial matching of ventilation and perfusion serves to reduce the range of $\dot{V}_A/\dot{Q}$ seen in the lung. However in µG it appears that regions of high ventilation are now associated with regions of low perfusion, and *vice versa*. Thus, despite the reductions in the inhomogeneity of both ventilation and perfusion, the range of ventilation-perfusion ratios seen during normal tidal breathing is not reduced.

Lung volumes and inhaled particles

Lung volumes in µG are only slightly changed. The resting end-expiratory lung volume is smaller than that seen in 1G, presumably as a result of the lack of the weight of the abdominal contents. Vital capacity is largely unaltered, although does increase slightly with time in µG, resulting from the reduction in intra-thoracic blood volume as the body readjusts circulating blood volume. Residual

French Payload Specialist Jean-Jacques Favier floats in the June 1996 Life and Microgravity Spacelab (LMS, STS-78) flight of the Space Shuttle Columbia. Spacelab provides a large habitable volume in which to conduct experiments in microgravity.

Mission Specialist and Flight Engineer Kay Hire performing the Astronaut Lung Function Experiment (ALFE) during the April 1998 Neurolab Spacelab (STS-90) flight of the Space Shuttle Columbia.

volume is also reduced, resulting from the loss of the expanding influence of the weight of the lung on its upper parts. Similarly, there are only minor changes in forced expiratory flows.

The absence of gravity was expected to have marked effects on the deposition of inhaled aerosol particles, since sedimentation is not present in μG. This may allow the deeper penetration of medium sized aerosol particles into the lung, causing a potential increase in alveolar deposition. Studies in parabolic flight showed total deposition of small (0.5 and 1μm) particles in μG was much greater than anticipated suggesting that another mechanism is operating to increase the mixing of the inhaled particles with the air in the lungs. The important aspect of this observation is that the effects are not confined to μG, but also occur in 1G, perhaps providing a link between environmental aerosols and lung disease.

The author in front of the Space Shuttle Columbia, on the launch pad for the April 1998 flight of Neurolab (STS-90).

The studies we have performed on the human lung in μG have served to provide us with a greater understanding of that unique environment. More importantly, they shed light on the intrinsic behavior of the human lung on earth.

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Further Reading:

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MITOCHONDRIA IN ANIMAL PHYSIOLOGY - A WHIMSICAL PERSPECTIVE

Michael Duchen argues that mitochondria are more than simply the 'power house of the cell': they may control whole body physiology and trigger the final stages of apoptosis. Read on for a 'mitochondrial-centric' view of evolution.

Mitochondria are the power house of the cell, every medical student knows that: they consume oxygen, use carbon sources through the Krebs' cycle and make ATP. The mitochondrion sits on the sidelines of exciting physiology, quietly subservient to the energetic demands of the cell. End of story.

But it isn't. A literature search on 'mitochondria' these days will call up papers ranging through an astonishing array of topics: the control of insulin secretion; cellular calcium signalling; the regulation of local intracellular calcium flux; even mechanisms of post-tetanic potentiation; generation of free radicals and cellular degeneration; the modulation of membrane excitability through a number of classes of ion channels; actions of nitric oxide and peroxynitrite. Mitochondria have even been dubbed the executioners of the cell in the final common pathway of apoptotic cell death (Green & Kroemer, 1998) and, in a recent TINS review (Miller, 1998). Richard Miller wrote about the Kraken and cited Tennyson... Where will it end?

As an essay in a series dealing with the aspects of 'respiration' I thought it might be entertaining to consider the impact that the demands of our mitochondria have made in shaping whole body physiology - a 'mitochondrial-centric' view of evolution, perhaps? After all, the whole business of oxygen acquisition, carriage and delivery to tissues is organised for the sake of keeping our mitochondria happy. In order to understand much of what follows, you may need reminding about how mitochondria work, which is briefly, and rather simplistically outlined in Fig 1.

Mitochondria as sensors of oxygen and glucose

Mitochondria are the body's major oxygen consumers and the major beneficiaries of the supply of glucose and they must be served. It seems that mitochondria may in fact play a substantial role in orchestrating the homeostatic regulation of the supply of both of these substrates - oxygen and glucose. Even the rate limiting step in haem synthesis is housed

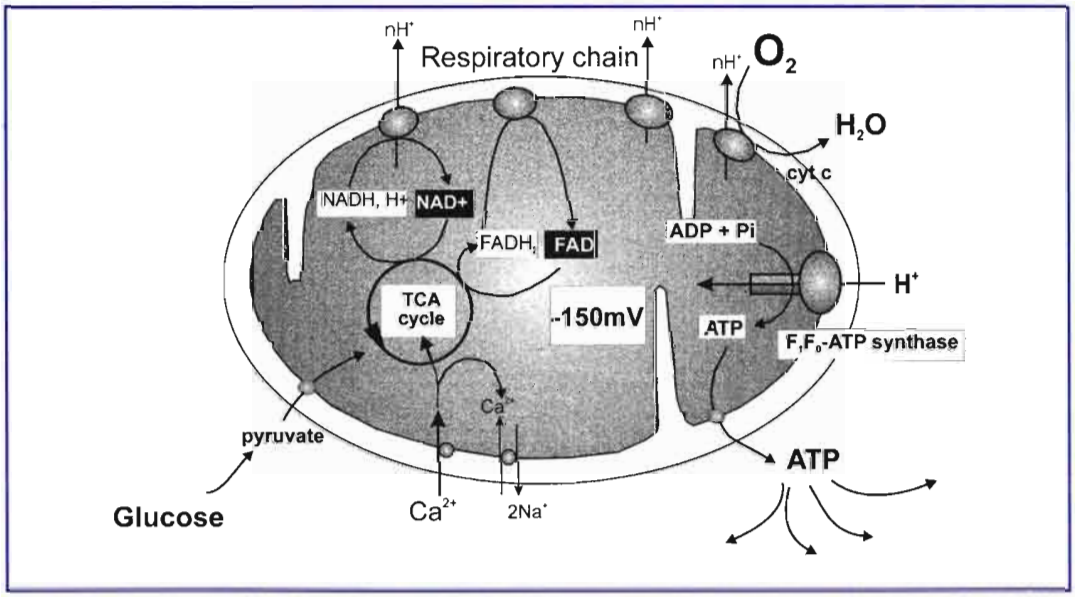

Fig 1. The chemiosmotic basis for oxidative phosphorylation. The supply of sustrate to the citric acid cycle (the tricarboxylic acid - TCA- cycle or Krebs cycle) supplies reduced NADH and $FADH_2$ to the respiratory chain. Electrons from NADH or $FADH_2$ are transferred through a series of coupled redox reactions regulated by the components of the respiratory chain eventually to oxygen which is reduced to generate water. In the process, protons are transferred across the inner mitochondrial membrane into the intermembrane space, thus generating a proton gradient which is expressed largely as a membrane potential some -150 to -200mV negative to the cytosol. That potential then provides the driving force for proton influx through the ATP synthase, an enzyme complex that includes a component which is essentially a proton channe. The proton influx is thought then to drive the ATP synthase and to phosphorylate ADP, ATP is generated and transported to the cytosol.

in mitochondria. Oxygen sensing by the carotid body may involve mitochondria as the oxygen sensor (I have to tread carefully here - this is not a widely accepted view, but there is evidence (Duchen & Biscoe, 1992ab, Mills & Jobsis, 1972) and so just humour me ?). Here, then, we have an outpost of specialised mitochondria at the cartoid artery which detect a modest fall in Po_2 and generate a reflex increase in respiration that will then help to maintain the supply of oxygen to the remaining mitochondria throughout the body and especially in the brain.

What about glucose? The expression of K^+ channels which are closed by ATP provides a mechanism that couples plasma membrane excitability to mitochondrial metabolism. The selective expression of these channels in pancreatic beta cells and in hypothalamic neurons appears to play a central role in both the regulation of insulin secretion (Duchen et al, 1993) and in appetite respectively (when [ATP] rises in response to a rise in [glucose], the channels close and the plasma membrane depolarises; in the beta cell this causes calcium influx and insulin secretion, in the hypothalamic neuron, this may suppress appetite (Spanswick et al, 1997, Duchen et al, 1993). Thus, through the regulation of ATP production in response to substrate availability, mitochondria regulate the homeostatic mechanisms that serve to maintain the supplies of substrates that they need. What a thought: these tiny prokaryotic passengers in their eukaryotic host (that's you and me) seem to have organised the host organism to maintain their own well-being by keeping themselves well supplied with the nutrients that they need.

Mitochondria fight back when starved of oxygen and glucose

What happens when the supply lines fail? During a stroke or a heart attack, local ischaemia prevents the supply of oxygen and glucose to the mitochondria. The respiratory chain will stop, the intermediates will all become reduced, and the potential will start to dissipate. The ATP synthase, however, is a reversible enzyme whose equilibrium is determined both by the mitochondrial potential and by the ATP/ADP.Pi ratio. As the membrane depolarises, it reaches the equilibrium at which the enzyme reverses, and it starts to act as a proton translocating ATPase: i.e. it now consumes ATP, pumps protons outwards, and maintains the mitochondrial potential. In other words, the mitochondria will commit cellular treason and use up what little ATP is available in order to maintain their potential.

This is not an altruistic thing to do. The last thing the organism needs if substrate supplies are limited are symbionts busily consuming what little ATP is left ! This will accelerate cell death, and the mitochondria only hasten their own end. It turns out, that some cell types in some tissues in some species (e.g. rabbit heart muscle) have generated a mechanism to counter that process, and to protect themselves from this treachery. These cells produce a protein called IF-1, which inhibits the ATPase activity in this 'reverse'mode (Rouslin & Broge, 1996). Thus, these cells will limit their mitochondrial ATP consumption, but the cost is that those mitochondria will then depolarise much faster, they will swell, and then what ?

The final common path of programmed cell death

Recent evidence suggests that mitochondria may play a critical role in triggering the final stages of programmed cell death, or apoptosis. This has been debated for some years, but now the evidence seems inescapable. Innumerable developmental, hormonal and toxic factors may initiate the apoptotic cascade, but it seems increasingly likely that the major point of convergence for these signals to a final common path of cell death lies in the mitochondria where the release of cytochrome c from the mitochondrial intermembrane space initiates a cascade that leads inexorably to apoptotic cell death. Apoptosis is central to development, and is probably central to many disease processes while the failure of appropriate apoptosis may lead to the development of cancers.

And so, mitochondria are not simply there to generate energy supplies, but seem to act centrally in several complex functions of cell physiology and pathophysiology. And is that really all there is ? Does this mean that we are really only vessels for the perpetuation of our mitochondrial pool, with a physiology largely organised for the benefit of our mitochondria?

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THE "BLUE ROOM" – EXPERIMENTS ON THE EFFECTS OF SUSTAINED HYPOXIA ON RESPIRATORY CONTROL IN HUMANS

Peter Robbins describes his experiments in the Blue Room and shows why the ventilatory acclimatization to high altitude (hypoxia) cannot be explained as a reaction to respiratory alkalosis - it is more likely to be a direct effect of hypoxia resetting the sensitivity of the chemoreceptors

Like so many other biologists, I study an aspect of biological regulation and much of my work has been on the respiratory control system - a system that has the advantage that many of its major inputs (such as arterial Pco_2, Po_2 and pH) and outputs (eg pulmonary ventilation) can be readily identified and measured. In this article I am going to focus on the effects of sustained low Po_2, or hypoxia and to show how recent studies have dispelled the early ideas that ventilatory acclimatization to hypoxia develops as a reaction to the associated respiratory alkalosis.

Ventilatory acclimatization to hypoxia

Since the previous century it has been known that hypoxia can stimulate ventilation. However, an important advance was made on an Anglo-American expedition to the summit of Pike's Peak in 1911 (Douglas et al, 1913). This particular mountain in Colorado which has an elevation of 14,110 feet had been chosen because there was a funicular railway leading to a hotel at its summit. During their expedition the investigators noted that their pulmonary ventilation progressively increased over a number of days, as evidenced by a progressive fall in their alveolar Pco_2. Hypoxia not only has acute effects on ventilation, it also has a slower effect that develops over days – this slower process has become known as ventilatory acclimatization to hypoxia.

Respiratory alkalosis and ventilatory acclimatization

So what underlies ventilatory acclimatization to hypoxia? The initial acute increase in pulmonary ventilation in response to hypoxia causes a fall in alveolar Pco_2 and an associated respiratory alkalosis. This alkalosis reduces the respiratory drive from the central chemoreceptors. Thus it is possible that the slower acclimatization process is not due to a direct effect of hypoxia *per se*, but rather to some adaptive process occuring in response to the respiratory alkalosis. The most obvious of the possible adaptive processes is that the kidney excretes bicarbonate and the progressive restoration of arterial pH towards normal sea-level values drives the progressive rise in ventilation that we recognize as acclimatization. There is little doubt that renal compensation for respiratory alkalosis is important in longer-term exposure to hypoxia, particularly at higher altitudes. However, this mechanism is too slight and too slow to explain the ventilatory acclimatization observed over the first few days of exposure to hypoxia (Kellogg, 1963).

Realizing that renal compensation for the respiratory alkalosis could not fully account for ventilatory acclimatization to hypoxia, other theories arose. However these were often still based on the notion that it was a reaction to the initial acute respiratory alkalosis. One notable theory was that the pH of the cerebro-spinal fluid (CSF) was actively regulated. Thus the initial alkalosis in the CSF (and hence the brain interstitial fluid surrounding the central chemoreceptors) was corrected over a time scale that could explain the observed ventilatory acclimatization (Severinghaus et al, 1963). What was needed to examine these theories of adaptation was to find a way of separating the hypoxic stimulus from the acute respiratory alkalosis. Thus the effects of pure hypoxia in the absence of the respiratory alkalosis could be examined.

Such studies were undertaken on the goat in the 1980's (Bisgard et al, 1986). By carefully titrating carbon dioxide into the inspired gas so as to prevent a change in arterial pH, Bisgard and co-workers showed that a progressive rise in ventilation did occur over a 4 hr period of hypoxia in the absence of respiratory alkalosis. However, in comparing goat with man, a particular concern was that ventilatory acclimatization in the goat takes just a few hours to complete (Smith et al, 1986), whereas in humans acclimatization occurs over a period of days, even at moderate altitudes. So could such a result also be true for humans?

The Oxford Chamber (or Blue Room)

In order to study the ventilatory acclimatization in man we needed a chamber which not only fixes the inspiratory Po_2 (as in a simple hypobaric chamber) but can also control alveolar Pco_2 and Po_2. Furthermore it was essential that subjects could move around and breathe freely in the environment with

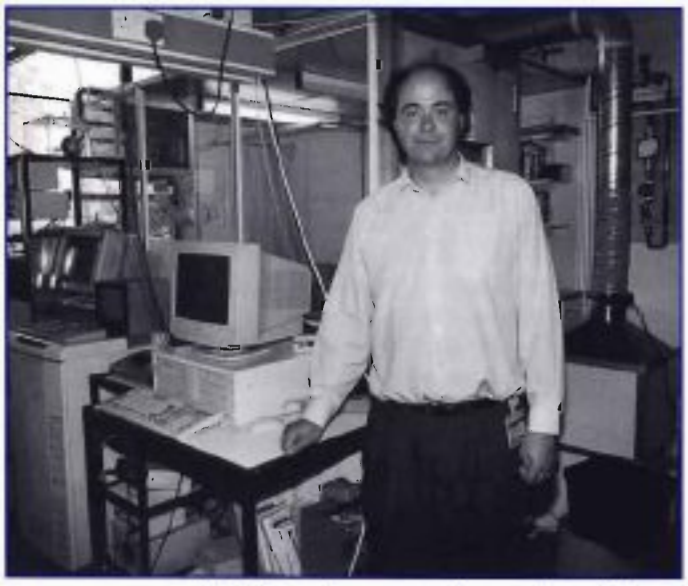

Fig 1. The author next to the experimental chamber.

minimal instrumentation. Therefore we decided to build a chamber (Fig 1) in which the ambient Po_2 could be adjusted by adding either nitrogen or oxygen and in which the ambient Pco_2 could be adjusted by adding or removing carbon dioxide to prevent respiratory alkalosis. The subjects' breath-by-breath end-tidal (alveolar) Pco_2 and Po_2 values were detected by a fine catheter placed in one nostril and connected to a mass spectrometer. Signals from the spectrometer provided a feedback signal to a prediction-correction control scheme, implemented on a PC, and this was used to vary the chamber composition in order to regulate the end-tidal gas compositions at the desired levels. Apart from the nasal catheter no other instrumentation was required and subjects were free to eat, drink, move around and sleep in their controlled environment.

Human responses to sustained hypoxia in the absence of respiratory alkalosis

Our first set of experiments involved a study of 8 hr of constant alveolar hypoxia (end-tidal Po_2 = 55 Torr) during which the normal respiratory alkalosis was prevented by maintaining alveolar Pco_2 at its pre-hypoxic level (Howard & Robbins, 1995a). The results were striking (Fig 2). After an hour (during which there is a well-recognized decline in ventilation), ventilation began to rise progressively and by 8 hr the ventilation was much greater than observed following the initial acute response to hypoxia. In fact the increase was much greater than that seen during steady hypoxia in which the alveolar Pco_2 was allowed to fall.

Rapid variations in alveolar Po_2, again with alveolar Pco_2 held constant, indicated that much of this effect was due to an increased sensitivity of the reflex involving the peripheral chemoreceptors (Howard & Robbins, 1995b). A similar increase in the sensitivity of the peripheral chemoreflex could also be seen in subjects after an 8 hr exposure to hypoxia in which the respiratory alkalosis had been allowed to develop (once alveolar Pco_2 has been elevated back to pre-exposure values). Thus changes in respiratory control occur following 8 hr of hypoxia whether or not a respiratory alkalosis is present. But the changes are more difficult to detect with respiratory alkalosis unless the alkalosis is first reversed.

Apart from the increase in sensitivity of the chemoreflex, the results also suggested that not all of the ventilatory response could be reversed rapidly once the hypoxic stimulus was removed. Some persistent hyperventilation is well recognized following return from high altitude, but this has generally been attributed to renal compensation for the respiratory alkalosis. A further set of 8 hr exposures to hypoxia were undertaken, again both with and without a concurrent respiratory alkalosis, but this time ventilations were measured before and after the exposures during a period of high oxygen (hyperoxia) at a fixed alveolar Pco_2 (Tansley et al., 1997).

With both types of hypoxic exposure, hyperoxic ventilation was higher following the exposure than before the exposure. This indicates that a respiratory alkalosis during the hypoxic exposure was not required in order for part of the rise in ventilation after relief of hypoxic exposure. Hence, at least part of the persistent hyperventilation observed on return from high altitude may be unrelated to any acid-base changes that have occurred to compensate for the respiratory alkalosis. Further experiments showed that this increase in ventilation is associated with an increase in the ventilatory sensitivity to carbon dioxide (Fatemian & Robbins, 1998).

Extending the period of hypoxia

The experiments described above all relate to 8 hr of hypoxia, which is rather short in relation to the recognized time course for ventilatory acclimatization in humans. We therefore extended the hypoxic period to 48 hr – a period over which a substantial degree of ventilatory acclimatization to hypoxia is known to occur in humans. The sensitivity of the peripheral

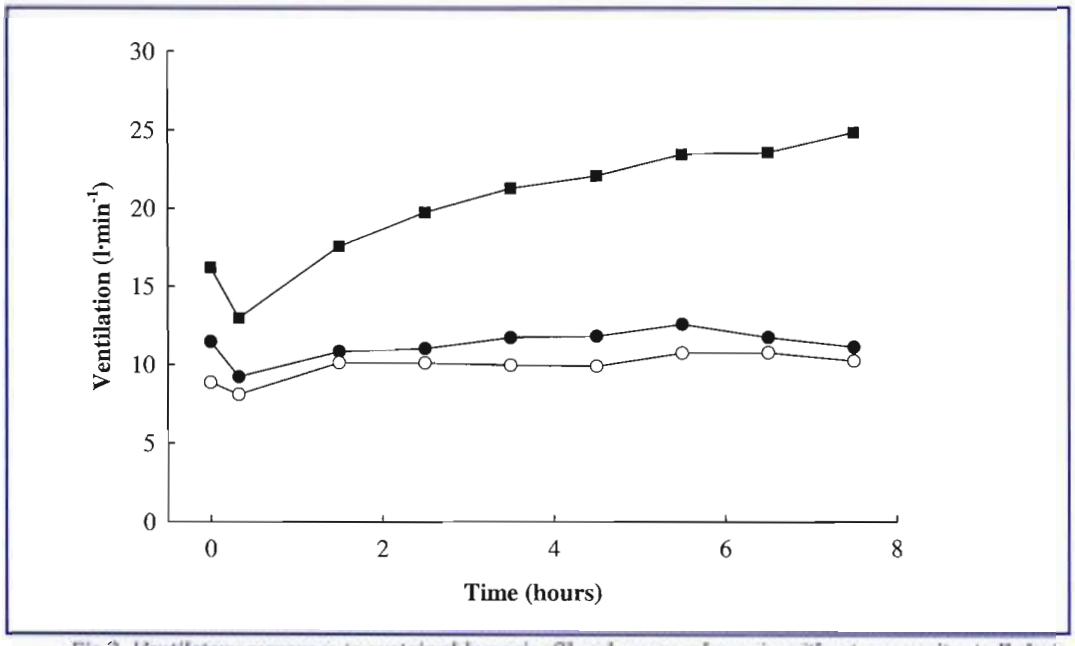

Fig 2. Ventilatory responses to sustained hypoxia. Closed squares: hypoxia without concomitant alkalosis. Closed circles: hypoxia with concomitant alkalosis. Open circles: air breathing control.

chemoreflex to hypoxia, ventilation during brief periods of high oxygen (at fixed alveolar Pco_2 and ventilatory sensitivity to carbon dioxide were all examined (Tansley et al, 1998). All of these variables increased, but, just as for the 8 hr exposures to hypoxia, no differences were detected between the exposures with and without a concurrent respiratory alkalosis.

Concluding remarks

Our experiments have shown that early ventilatory acclimatization to hypoxia in humans is unrelated to the respiratory alkalosis that normally accompanies low atmospheric Po_2. Rather it appears that hypoxia exerts more direct effects on the respiratory "controller". It is tempting to consider the changes in the respiratory controller as useful acclimatization processes to a hypoxic environment. However, it really does not seem that most humans have ever been exposed to an evolutionary pressure to develop such responses. Thus, for example, the increase in red blood cell numbers that occurs with altitude probably has not developed through such an evolutionary pressure, but rather occurs because (predominantly renal) tissue hypoxia is part of the signalling system that regulates red cell production. Indeed, animals that have evolved at high altitude do not have particularly high haemoglobin concentrations. If so, we are left with the question of why should sustained hypoxia exert such a powerful influence on the chemoreflex sensitivities? The answer to this question remains obscure, but one possibility is that some adaptive process may be necessary to keep tuning the chemoreflex sensitivities appropriately. If so, perhaps it is possible that hypoxia plays some role in this process.

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JOINT MEETING WITH THE CZECH PHYSIOLOGICAL SOCIETY
22 - 24 JUNE, 1998.

I was told two things about Prague before my first visit in June. It is one of the most beautiful cities in Europe and the beer is cheap. I found both to be true and with a free day before and after the Joint Meeting I took the opportunity to see the city and, of course, take advantage of the cheap beer.

Delegates were welcomed to the meeting by an Opening Ceremony which took place in the Main Ceremonial Hall of the Karolinum, Charles University on Sunday evening followed by a reception with wine and canapes. This historic part of the University is close to the famous Old Town Square which is a lively tourist attraction offering a wide variety of eating and drinking places. Needless to say many of the UK physiologists ended the evening sampling the Czech cuisine and beverages in the Square.

Opening Ceremony in the Karolinum

The scientific meeting was held in the Third Medical Faculty of Charles University which stands in an attractive campus on the outskirts of the city. This was not a problem because the city has an extensive network of trams, buses and a metro and one could travel by whatever means and for any distance within an hour of purchasing a 12Kc (24p) travel ticket. Honesty in this matter was encouraged by plain clothes ticket inspectors who, without warning, would check unsuspecting travellers.

The meeting began at nine o'clock on Monday morning with two parallel symposia on 'Muscarinic Receptors and Glial Cells' and 'Brain Interstitium' and a Designated Session on Epithelia and Membrane Transport. Later on there were sessions on Thermoregulation, Human Physiology and Cell Signalling. In the evening there was an opportunity for delegates to attend a Chamber Music Concert in the Church of St Simon and Jude. Indeed, many of the churches in Prague hold frequent concerts (at least two or three times a week) and music is certainly high on the cultural agenda.

The ceremony at the Karolinum at which Professor Sir Andrew Huxley was awarded an Honorary Doctorate in Medical Science by Charles University.

The two symposia held on Tuesday were 'Acoustical Signal Processing' and 'Regulation of Muscle Tone and Tension' with a variety of Designated Sessions running throughout the day. In the evening the Societies' Dinner was held in the Restaurant Vikarka within the grounds of Prague Castle. On the final day symposia on 'Nerve-Muscle Interactions' and 'Respiratory Control: From Mechanics to Models' were held in the morning along with five more Designated Sessions during this last day of the Meeting.

Reception after the Opening Ceremony

There were over 300 UK delegates who attended the Meeting and the Society awarded travel grants of between £150-200 to one hundred Affiliates and sixty seven Members. There was certainly enough Physiology to sustain everyone's appetite and more than enough in the beautiful city to entertain the tourist's appetite. We are grateful to our Czech hosts for their part in organising such an enjoyable Meeting.

Saffron Whitehead

JOHN SCOTT HALDANE AND CARBON MONOXIDE

Introduction

JS Haldane (1860-1936) was the second son of a Scottish aristocrat. His first job after graduating in Medicine from Edinburgh was in Dundee where he studied the chemical and bacterial composition of air in houses, schools and sewers. This set the tone for his long career, for from then on he concentrated on improving the health and productivity of miners, divers, factory workers, soldiers and those who repaired wells. To do this he developed supremely accurate methods for measuring the composition of inspired and alveolar gas and of blood gases. Many of his methods became standard throughout the world and some remained so for fifty years. His volumetric gas analyser measured CO_2 and O_2 tensions of gas mixtures to within 0.1mmHg. His ferricyanide technique for completely displacing the gases bound to haemoglobin was the simplest and most accurate way of measuring the oxygen or carbon monoxide content of blood volumetrically, making leak-prone vacuum pumps obsolete. He also developed colourimetric methods of measuring HbO_2 and HbCO.

CO as a poison

CO played an immensely important part in Haldane's work. He demonstrated that its poisonous effects were due entirely to the fact that it binds to haemoglobin with an affinity so great that breathing only 0.1% CO excludes oxygen, explaining why the lethal euphoria and lethargy of CO poisoning are indistinguishable from those of severe hypoxia. His analyses of venous blood from miners and horses killed in a South Wales colliery showed that almost all had died from CO poisoning and corrected the current view that death, from causes other than violence, resulted from breathing air deficient in oxygen. The blood of nearly all the men contained 80% HbCO, meaning that they must have been breathing for a long time after the explosion. This work led to his introduction of caged birds and mice into mines for the early detection of CO and dangerous levels of hypoxia. The lamps and candle flames previously used to detect hypoxia were useless for the detection of lethal pressures of CO.

His work on the HbCO dissociation curve (e.g. Douglas et al., 1912) explained the leftward shift of the remaining HbO_2 curve and the resulting viciousness of CO poisoning compared to equivalent levels of anaemia. In one experiment on himself he reached a CO saturation of 56%, at which point he stopped the experiment because of 'palpitations, giddiness and dullness of the senses... I could hardly stand, and could not walk alone without falling down' (Haldane, 1895). He was in this condition when his house-keeper, who had noticed him staggering through the garden, consoled his wife by saying 'I know's how you feel ma'am, my husband's just the same on a Friday night'.

CO as a physiological tool

The enormous affinity of CO for haemoglobin allowed him to measure total blood volume from HbCO and haematocrit after inspiration of a known quantity of CO. He also discovered that HbCO is dissociated by bright light, an

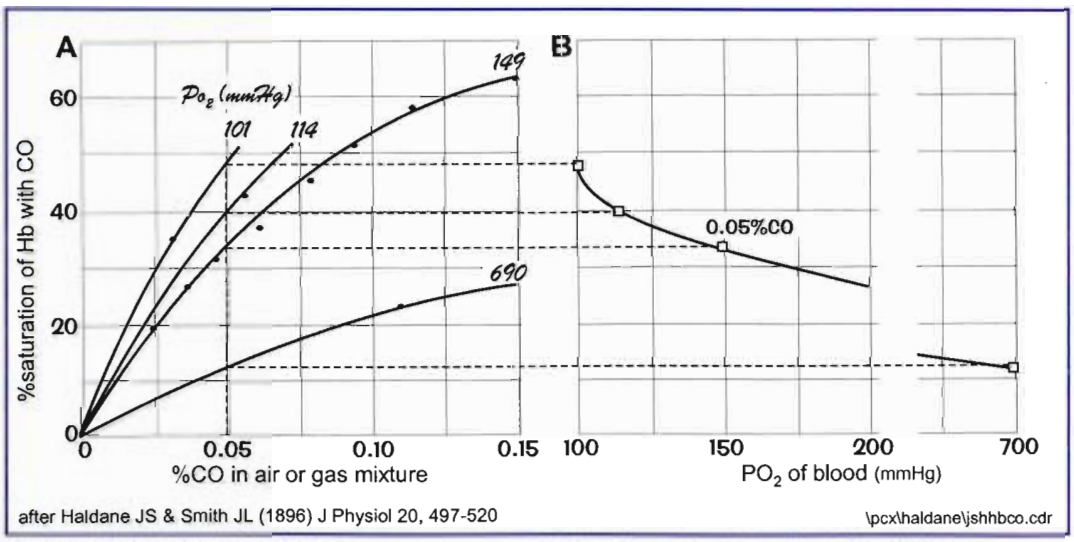

Fig 1. A. The saturation of Hb by low concentrations of CO is reduced by raising Po_2. Thus if blood is equilibrated with gas of a known, low and therefore safe %CO (ca. 0.05%), the HbCO saturation can be used, as in B, to give arterial Po_2.

observation used later by Hartridge and Roughton to measure its rate of combination with haemoglobin and by Warburg to measure its rate of combination with cytochrome oxidase. Biochemistry was thereby given a near-perfect way of measuring the rate of a chemical reaction using only transmitted and reflected light.

Using CO to measure arterial Po_2

Like Pflueger and Bohr he had for years wanted to study the transfer of oxygen from alveolar gas to pulmonary capillary. To do this he needed accurate measurements of arterial Po_2 for comparison with alveolar Po_2. At the time it was not possible to take samples of blood directly from human arteries without excessive risk of infection, so others had relied on animal experiments in which the gas tensions of a bubble equilibrated with blood in an aerotonometer were measured. Because Haldane distrusted aerotonometers which often gave arterial Po_2 values of 30mmHg when breathing air he developed an indirect method which depended upon the competition in pulmonary capillaries between oxygen and CO for haemoglobin (Figure 1). Thus, once equilibrium between blood and a known alveolar Pco had been achieved, the HbCO in blood released by a pin prick to a finger could be used as a measure of end-pulmonary capillary Po_2.

At first this method gave values which were consistently higher than those in alveolar gas and he interpreted this to mean that oxygen is transported actively from alveoli to blood, against its diffusion gradient. However the method is susceptible to artefacts which give artificially high arterial Po_2's. For example if the Pco of blood has not been fully equilibrated with that of alveolar gas then HbCO is low and the estimated Po_2 is therefore high. Over the years Haldane repeatedly refined the technique to accommodate each artefact and with each refinement arterial Po_2 fell towards the alveolar value, but the two did not come together in hypoxia.

His claim that oxygen could be secreted was strongly disputed, particularly by August and Marie Krogh, and it became something of an obsession for him. Thus when he planned an expedition to Pike's Peak (14,100ft) in Colorado for the first detailed study of acclimatisation to high altitude (Douglas et al 1913), one of his primary goals was to establish whether or not the secretion of oxygen contributes to this process. The results exceeded his expectations, showing that, although arterial Po2 was only 7mmHg above alveolar Po2 in acute hypoxia, the difference averaged 35mmHg in samples taken after the third day. This cruel stroke of fate sealed Haldane's conviction that the secretion of oxygen aids its uptake when most needed. Here his faith in the supreme accuracy of his techniques had let him down.

The technical flaw that led to Haldane's erroneous conclusion about the secretion of oxygen has never been conclusively explained, though Torrance (1996) has recently proposed that his low HbCO values might have arisen because CO may be actively excreted. He did however have qualms about the idea. He found it odd that the haematocrit should rise substantially when secretion alone appeared to raise the blood's oxygen carrying capacity to within 1% of its sea level value. A qualm he might have paid more attention to relates to the fact that he had placed oxygen-secretion in a membrane known to be highly permeable to oxygen where the rate of the back leak down a 35mmHg Po_2 gradient would be close to the resting oxygen consumption.

By confining myself to carbon monoxide I have not mentioned the majority of Haldane's massive contribution to our understanding of gas exchange and the control of breathing. I hope however that I have given some idea of the background to, and importance of, his 284 publications (Douglas, 1936 includes a complete biography) and how these arose largely from a desire to benefit the working man.

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ENERGETIC CONSTRAINTS ON THE SUSTAINABLE ROWING SPEED OF THE ANCIENT ATHENIAN TRIREME.

According to the classical author *Xenophon* a crew of 170 rowed an ancient Athenian Trireme from Byzantium to Heraclea in, what in modern timing would be, approximately 18 hours. This demands a challengingly-fast average speed of slightly more than 7 knots to cover the 129 nautical miles. This would represent a notable feat of human endurance for the 'human engine' of the warship, and has caused some commentators to dismiss the account as propaganda. There are occasional other comments from classical sources to corroborate the veracity of *Xenophon's* statement, and thus, if valid, the passage could represent an important testimony to the bioenergetic capabilities of this ancient culture.

Reconstructing the *Olympias*

Morrison and Coates (1968), were interested in the *trieres* and in the important role these warships played in exercising political and military power for about 300 years from 500 BC. These ships, being faster and more effective in battle than their contemporaries, played a crucial role in the development of western civilisation. A reconstruction, therefore, would not only inform classical scholars of the skills required to design and build *trieres* but also of those needed to row and sail them in combat or on voyage.

We were surprised to learn however that it was only in this century that the oar system of the trireme (as used in the reconstructed ship *Olympias*) has been accepted: formally proposed by Morrison and Coates (1968). Prior to this the understanding was that a 'trireme' was a ship with three oarsmen pulling on each oar on the same level. Now it is accepted that the oarsmen were stacked into three layers and to keep both the length of the oars and the arc through which they travel constant the addition of an outrigger to the *Thranite* (uppermost) rowing position was required. The Lenormant relief (in the Acropolis Museum, Athens) provides a major piece of iconographic evidence that, it is argued, shows the thranite oarsmen each pulling on one oar, the two other oars (*zygian and thalamian*) being arrayed vertically and emerging from levels below the *thranites*. In 1981 John Morrison (Professor of Classics, Cambridge) and John Coates (former Chief Naval Architect to the British Navy) began their plans to reconstruct this ancient warship and the story of this reconstruction is described in 'The Athenian Trireme' (1986). But problems were to arise when sea trials of the *Olympias* began.

An adequate modern reconstruction of such a Trireme would require not only adherence to the sparse archaeological, iconographic and epigraphic evidence currently available, and contemporary documentary accounts of their structural features but also to a construction that would actually allow rowers to sustain the bioenergetic and related physiological demands of the reported passages. The naval architect can therefore profitably look to the human physiologist for information that complements that possessed by the classical historian.

Estimating the power demands to row the trireme

Important experiments which were performed on a reconstructed trireme, *Olympias* (Fig 1), provided the essential fluid-mechanical data to allow plausible estimates of the energy and O_2 demands of the "representative" rower for this task. For example, it was determined that a power of 10,500 Watts was required to move the warship through the water at the required speed. Assuming, for the purpose of the calculation, that all 170 rowed continuously, this would represent a power demand of 62 Watts per man. This is an 'effective' power, however, as during the stroke there are components of power generation that are 'wasted' in terms of boat movement. These include 18 Watts which is "lost" through oar slippage through the water and a further 35 Watts which is required for non-propulsive oar movement at a stroke rate of 26; thus, the total power to be generated by the oarsman adds up to approximately 115 W. Current estimates of the O_2 cost ($\dot{V}o_2$) of rowing - albeit for sliding-seat as opposed to fixed-thwart rowing - is some 14 ml/min/Watt (calculated from Steinacker *et al.*, 1993). The work-related O_2 cost would therefore amount to 1.6 l/min. But, of course, to this must be added the cost of simply maintaining the body in the appropriate position, reasonably 0.4 l/min, making the total $\dot{V}o_2$ requirement approximately 2.0 l/min. Interestingly, this is the approximate equivalent O_2 requirement of exercise that Brian Lloyd has judged as being "probably about the maximum sustained output of which the human frame is capable" (1966). This comment was made of an elite performer in the six day 'go as you please' contests (i.e. walk or run) during the latter half of the last century i.e. assuming only 4 hrs/day for sleep and other functions - the performers were required to cover as much distance as possible under their own power in six days. The best of these men would cover more than 600 miles.

Did the rowers rest to replenish glycogen stores ?

The demands of appropriate muscle substrate provision would require that the work rate of the rowers remain below their lactate thresholds so that glycogen is used at a low rate - such that the glycogen stores would be eked out over the entire duration; according to Newsholme et al (1992) glycogen depletion would drastically reduce sustainable power output, by as much as half.

It is likely, however, that the rowers actually rested periodically in turn, allowing them to ingest a source of carbohydrate and, at least in part, replenish the stores. The benefits of such a strategy are not easy to predict, however. If, as proposed by Morrison and Coates (1968) (from *Thucydides* (3.49)) only two-thirds of the 170 rowers would be active at one time then the required power output of each of the remaining oarsmen would have to increase appreciably to maintain the required speed. Consequently, with the individual oar-slippage and oar-movement energy cost remaining unchanged the 10,500 Watts for ship propulsion would be shared among only 112 rowers i.e. 94 Watts/rower. This yields a total individual power requirement of 147 Watts demanding a $\dot{V}o_2$ of approximately 2.5 l/min. Unless the rowers were unusually large and/or "fit" this is likely to have been above the subjects' lactate thresholds with the consequent obligatory acceleration of glycogen utilisation. Thus, it appears to us unlikely, if *Xenophon's* statement is to be believed, that the rowers stopped on the voyage in question. However, if the crew were to rest in turns, the implication of the increased carbohydrate utilisation rate during the exercise coupled with some replenishing of the stores during the rest phase provides an interesting challenge for physiologists concerned with nutritional aspects of optimising prolonged activity strategies. Naturally, stresses to other physiological control systems such as thermoregulatory (mid-day ambient temperature of ~35°C), fluid and electrolyte balance (the rowers in the *Olympias* sweated 3-4 litres/day), would also conspire to constrain the sustainable speed of the vessel.

And so, could they have done it? Just plausibly so from a bio-energetic standpoint. Did they do it? If we can believe the historical accounts that they did then the rowers would have to have been highly fit athletes, and on arrival they would surely have been good for little except rest.

Fig 1. The reconstructed Trireme Olympias under oar, August 1987.

How fast did the ancient triremes travel?

Documentation of the speeds of which triremes were capable is, at best, sparse. The most specific statement comes from *Xenophon* (*Ababasis* VI.4.2), who states that 'the passage from Byzantium to Heraclea (mod. Eregli) is a long day's voyage for a trireme under oar'. (Some translations read 'a very long day'). The distance, of 129 nautical miles, must therefore be covered in approximately sixteen to eighteen hours (the longest days of summer in this region being approximately 17.5 hours). *Thucydides* (3.49) on the other hand tells us of a trireme which was dispatched from Pireus to the island of Mytilene with the commander under order to put to death the whole population of the island. The next day, however, the Athenian Assembly issued a reprieve and dispatched a second trireme to overtake the first which was proceeding at leisurely pace - taking approximately 48 hours to travel the 184.5 nautical miles. The second trireme, arriving at Mytilene only shortly after the first, would have taken 26-27 hours to make the passage: *Thucydides* also tells (8.101) us of another voyage of 124 miles in 18 hours. In each case the average speed was approximately 7 knots.

It proved to be of no small significance, therefore, that during the sea trials of the *Olympias* an average speed of only five and a half knots could be maintained for about an hour, and only four knots with two-thirds of the crew rowing. As it requires only approximately one quarter of the energy to move the boat at 4 knots compared with 7 (if the 'ineffective' energy requirements remain the same) this should have been well within

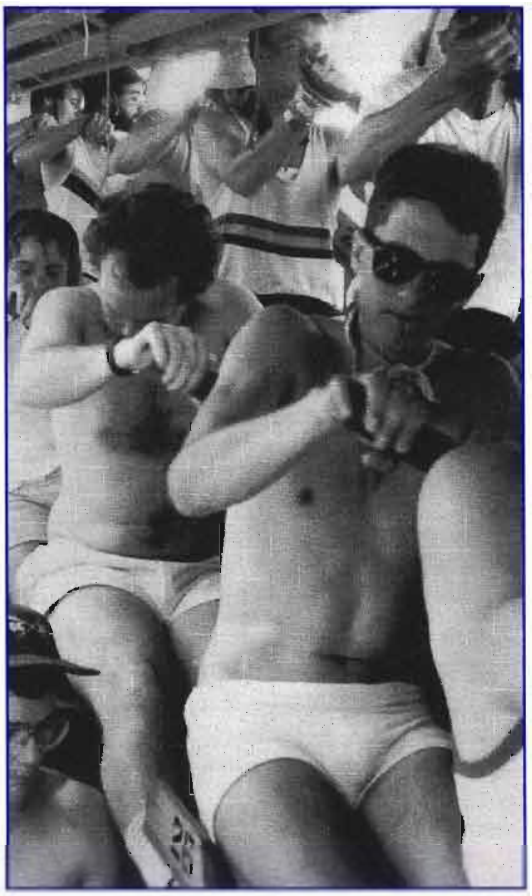

Fig 2. Thalamians, zygians and thranites (L-R)
The Trireme Trust (with permission).
Photograph courtesy of Christopher Dodd

the sustainable aerobic capabilities of even modestly fit rowers. It is likely, therefore, that there is a large energy loss due to the mechanical inefficiencies of rowing in the confined available space which would be compounded by the inexperience of the crew propelling such a vessel. And so, as it is unlikely that the fundamental bioenergetic demands of muscular power generation have changed since 500 BC this provides a serious challenge to the veracity of the structural and architectural design of the reconstructed vessel.

The issue of sail adds further complexity. While all triremes carried sails, it appears that they were not used for fast passage making. Although the ships could sail and be rowed at the same time, there is evidence to suggest that this was not the case. Sailing alone was slower than rowing alone (Morrison and Coates, 1989). When a following wind was strong enough to make the use of the sail beneficial, the oar has to be pulled through the water very quickly in order for any additional power to be applied: this requires the rowing-stroke rate to increase with a reduction in the rowing efficiency. The sea swell also increases, however. This is significant!

Detailed calculations have suggested that with a wind sufficient to drive the trireme the swell would increase to the extent were it would be detrimental to the safety of the ship (Shaw, 1998). Furthermore, *Thucydides* (3.49) stated that during the passage from Pireus to Mytilene there were 'fortunately, no contrary winds' and that the chasing ship was 'making such haste that they pulled...without customary stops'. *Xenophon*, also, specifically states 'a trireme under oar' in his description of the speed of the warship. There are also concerns about when, and even if, crew took rests. Obviously if the whole crew rested together the required speed and associated aerobic demands for the remaining passage time would increase significantly. However, *Thucydides* reports that 'they pulled and ate at the same time...and [at night] some slept and others pulled turn and turn about.' This, coupled with the immediacy of the task (reprieve of the death-sentenced Mytilene islanders) does suggest that this may not have been common practice. Common practice or not the above calculations suggest that if the oarsmen did row 'turn and turn about' then the power requirement for the oarsmen not resting would have likely increased beyond the plausible bounds of sustainable exercise - unless, of course, the original vessels had design features more conducive to mechanically efficient rowing than the reconstructed *Olympias*.

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SIXTH FORM PHYSIOLOGY WORKSHOP AT UMDS (LONDON)

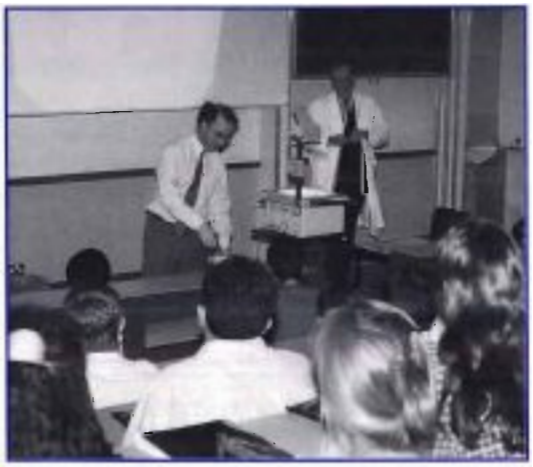
16 – 17 APRIL 1998

Eighty eight sixth formers attended a two-day workshop at the Sherrington School of Physiology at the St. Thomas' Campus of UMDS. Since we could not offer overnight accommodation we restricted invitation to schools in the London Boroughs and in the counties of Kent and Surrey. These all have access to the school via the underground and mainline stations at Waterloo. Interest was greater from Independent and Grant Aided schools with only a third of students coming from State Schools, and girls outnumbered boys by two to one. The majority of participants were in their first year of sixth form study and only four had provisional places at University.

How fit is fit? Laboratory session on exercise physiology.

Our aim was to ensure that students knew of the discipline of physiology and would consider studying the subject at University either as a pure science or as part of a vocational training. We tried to input some of our enduring fascination with the subject into our lectures, tutorials and hands-on practicals. Throughout we treated the delegates as responsible adults and tried to create the atmosphere of a scientific meeting of the Physiological Society.

We decided that lectures should be only 35-40 min since this is the normal length of a lesson at school. Apart from a presentation by Adrian Pini on 'The excitable cell', the lectures were mainly slanted towards man. Lucilla Poston discussed her move away from pure physiology into the field of obstetrics and the protection of the foetus and newborn.



Fred Imms (R) watches Chris Fry posing the question 'Why do we no longer wet our nappies?'

Malcolm Segal discussed both the physical protection of the brain by the skull and the role of the blood-brain barrier in protecting its chemical environment. David Gradwell travelled from Farnborough to give a fascinating review of 'Human problems during space travel' – what do you do with urine and faeces in a space capsule? Jane Ward who has become interested in some of the more bizarre aspects of death, stemming from a study of the death of a public figure who drowned whilst relieving himself from the side of his yacht, gave a well received talk on 'Murder and Mayhem'. Finally, the Society's Meeting Secretary Chris Fry posed the question 'Why do we no longer wet our nappies?'

We felt it important that the participants should be introduced to the moral and ethical aspects of teaching and research in physiology. Bryan Robinson outlined the current procedures for licensing of experimenters and discussed the continuing need for animal experimentation. Fred Imms outlined the roles of human ethics committees and discussed the concept of informed consent. The students own views and feelings were subsequently explored in separate tutorials (groups of 13 to 15) on animal and human experimentation.

Groups of 27 to 30 delegates attended two practical sessions on human physiology: the monitoring of heart rate and gas exchange during exercise on a bicycle ergometer and some experiments on sensory physiology. For a vision of the future the participants were introduced by Jim McGarrick and David Byrne to the use of computers in teaching and played

with some of our simulations of the heart, circulation and kidneys. Malcolm Lidierth demonstrated the recording of action potentials from a human nerve and the measurement of conduction velocity, using a 'volunteer' from the delegates.

On the first evening we held a reception to which all participants, the staff of the Division, and other teachers and officers of the School were invited. There was a substantial buffet, a judicious quantity of wine and an excess of soft drinks. This was followed by a noisy disco until 8.00pm when the pupils trooped wearily home. At the end of the Workshop there was a short reception at which certificates of attendance signed on behalf of the Society and the School were presented.

Fred Imms
Sherrington School of Physiology
GKT School of Biomedical Sciences

SIXTH FORM PHYSIOLOGY WORKSHOP AT CARDIFF

29 – 30 June 1998

CARDIFF UNIVERSITY

The Physiology Unit in the Cardiff School of Biosciences held its second Sixth Form Physiology Workshop in June and the event was attended by 149 students who came both from local areas and more distant parts of the UK ranging from North Wales, Devon, London and the Home Counties.

After coffee and registration, the workshop started at 11.00 am with a welcome and introduction from the workshop organisers Drs Stephen Barasi and John Bedwani. Professor Ron Eccles then gave a lecture explaining what physiology is, and some of the openings available to physiologists. He illustrated his talk with particular reference to cardiovascular and respiratory control, and he soon livened up proceedings by getting the audience to "hold hands" to feel each others' pulses.

The participants then split into two groups for the first laboratory sessions. These involved measurements of conduction velocity in motor fibres of the human ulnar nerve, and assessments of physical fitness. The latter comprised measurements of heart rate during and after exercise, and tests of ventilatory function using a Vitalograph. Each practical was supervised by a member of staff, with help from some of our undergraduate and postgraduate students.

There were more practical sessions after a buffet lunch, and then two short presentations from members of staff about their research. Dr Sarah Hall talked about the electrophysiology of cardiac muscle cells, and Professor Malcolm Roberts about pain and his recent work on central pathways involved in antinociception. These talks were followed by a poster display illustrating many of the current research activities within the Department, together with information on careers and the destinations of our recent graduates. Staff and students were on hand to talk to participants, who particularly welcomed the opportunity to get first-hand information from some of our students and recent graduates.

After the workshop dinner there was an optional open-top bus tour of Cardiff. Unfortunately enthusiasm for this was rather dampened by torrential rain which confined passengers to the lower deck. Following this there was a lively (and very noisy!) disco, held, conveniently, in the bar of the Student Hall of Residence where the participants stayed for the night.

Tuesday's programme began with more practical sessions, on the electrocardiogram, and a computer-based experiment using the excellent simulation 'SimNerv' to investigate properties of the compound action potential in frog sciatic nerve. These were followed by a lecture entitled The Decade of the Brain, given by Dr Kevin Fox. He created quite a stir by producing a post-mortem human brain, and also had the audience try a number of visual illusions. This lecture was extremely well received, and at the end Kevin was swamped by people asking questions and seeking further information.

After lunch, the final major event of the workshop was a consideration of the use of animals in biomedical research. This was led by Myc Riggulsford from The Walnut Bureau, who presented a very balanced, as well as lively and hugely entertaining, argument for the continuing necessity for animal experimentation. After a few concluding remarks, participants were asked to complete a questionnaire, and were then presented with certificates to record their attendance at the workshop. The workshop finished at 3.00 pm, when transport was provided to the station.

We found the two-day workshop event to have distinct advantages over the one-day event we held last year. Not only did it enable us to include a wider range of activities, but it also meant that proceedings could occur at a less demanding pace, giving more time for participants to understand and consolidate the information presented to them. The overnight stay and associated social events gave more opportunity for our visitors to get to know one another, and hopefully establish lasting contacts. The results of the questionnaire showed that the workshop was very well received, the most popular events being the 'live' practical sessions, the Decade of the Brain lecture and the discussion on the use of animals in research. The research posters were received less enthusiastically. It probably didn't help that these were at the end of a rather long day, and it is also possible that some were pitched at too high a level for many of the audience.

We are grateful once again to the Physiological Society for their administrative help with our workshop, and for providing the funding which enabled us to subsidise heavily the costs of attendance and accommodation.

Stephen Barasi,
John Bedwani,
Physiology Unit,
Cardiff School of Biosciences,
Cardiff University.

THE SENSES: FROM CELL TO CORTEX

Young Physiologists Symposium Keele University 15 - 16 July 1998

The Department of Communication and Neuroscience at Keele held its first Young Physiologists Symposium on 15-16 July 1998. The title, chosen to reflect our research interests, and with due deference to the ground-breaking text book by John Nicholls and the late Stephen Kuffler, was "The Senses: From Cell To Cortex".

Presentations were in the form of talks or posters, and covered many aspects of vision and hearing ranging from cellular and animal physiology to computer models based on physiological and psychophysical data. Talks lasted 20 minutes followed by 10 minutes for discussions. The presenters were: Walter Marcotti (University of Bristol); Juan Burrone (MRC Laboratory of Molecular Biology, Cambridge); Jan Lauritzen and Margaret Thomas (University of Cambridge); Gunter L"ffler and David Simmons (Glasgow Caledonian); Jan Schnupp and Darragh Smyth (University of Oxford); Eliza Chan, Laura Doherty, Julie Hulme, Shantini Mahendrasingham and Robert Morse (Keele University).

Some of the participants of the Young Physiologists Symposium.
Photograph courtesy of Jan Schnupp

The general consensus was that the symposium had been a great success. The standard of the presentations was very high, which must mean that the specialities of vision and hearing are about to get a big boost from all this up-and-coming talent. Those presenting got a chance to do so to an unknown but interested audience, and there was ample opportunity for discussions during the day and in the evening. The social highlight was dinner at the "Bosted Onion", a restaurant occupying premises that were once the main ironmongers, blacksmiths and dynamite-maker for a thriving local coal mine.

Thanks are due to the Physiological Society for their generous sponsorship. This really is a valuable initiative in terms of supporting and encouraging young scientists working in research areas related to Physiology.

Michael Evans
Department of and Neuroscience
Keele University

No notice is carried for more than three successive editions. Notices are starred so that readers can see at a glance whether this is the first (one star) or final (three stars) appearance of the notice. Notices for the spring 1999 edition (to be distributed on 5 March 1999) should reach the Administration Office by 5 February.

TALKING SCIENCE+

Talking Science+, the national database of speakers on science, engineering and technology is having a recruitment drive. Talking Science+ is aimed at any organisation or representative of a community group who needs a SET speaker for anything from a small informal chat to a group to an international conference. Talking Science+ is looking for willing speakers throughout the country who have experience of giving talks on any science, engineering or technology based subject.

FURTHER INFORMATION FROM ROBBIE AITKEN,

Talking Science+ Administrator, British Association, 23 Saville Row, London, W1X 2NB. Tel: 0171 287 0980, email:ba.talk.science@mcr1.poptel.org.uk
lbryan@bcm.tmc.edu
**

Gordon Research Conference
MAGNESIUM IN BIOLOGICAL PROCESSES AND MEDICINE
7 - 12 February 1999

Holiday Inn, Ventura,
California, USA
Topics to be covered at this conference include measurement of ionised Mg in plasma; recent developments in Mg-electrodes; estimations of total elemental Mg; Mg cellular transport/transduction; regulation of extracellular Mg; the role of Mg in neuroscience, cardiovascular system, hypertension, stress and sport; Mg deficiency and its clinical relevance.
There will also be poster sessions at which younger scientists can present on-gong work.

Further information from Professor John A S McGuigan, Physiologisches Institut, Bühlplatz 5, 3012 Bern, Switzerland. Tel: +41 31 631 8704, fax: +41 31 631 4611, e-mail: McGuigan@phy.unibe.ch**

World Congress on
NEUROHYPOPHYSIAL HORMONES
28 August - 2 September 1999

Edinburgh
This meeting will cover a wide range of topics including endocrinology, neuroendocrinology, nephrology, reproductive biology and behavioural studies.

Further information from Alison Douglas or Mike Ludwig, Department of Physiology, Edinburgh University Medical School, Teviot Place, Edinburgh, EH8 9AG. Tel: 0131 650 3274/3275, fax: 0131 650 6527, e-mail: wcnh.1999@ed.ac.uk, WWW address: http://www.phl.ed.ac.uk/wcnh/**

ACCOMMODATION FACILITIES AT THE NOVARTIS FOUNDATION

Any scientifically or medically qualified person on a working visit to London is welcome to use one of fifteen bedrooms for a period of up to two weeks. Charges as from 1 January 1998 are £44 for a single and £56 for a twin room which includes breakfast. Further details from the Reservations co-ordinator/ Receptionist, The Novartis Foundation, 41 Portland Place, London W1N 4BN. Tel: 0171 636 9456, fax: 0171 436 2840.

VISITING SCIENTISTS

Foreign visitors of the status of at least post-graduate student, working in laboratories of Members of the Society, may be made "Visiting Scientists" by the Society. The names of such persons, with the dates of their visits and a letter of support, should be sent to the Foreign Secretary, Professor O H Petersen, The Physiological Laboratory, University of Liverpool, PO Box 147, Crown Street, Liverpool L69 3BX.

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