The University Laboratory of Physiology

Left to right: Colin Blakemore, Richard Adams and Irini Skaliora

Clive Ellory, Head of the Dept of Physiology

The Auditor Group

David Paterson

Front Cover:
Large format positive colour transparency of a glass engraving representing a rod cell from the retina of the eye.
Courtesy of The Wellcome Centre for Medical Science, London.

Carina Armstron and Frances Ashcroft
GUIDELINES FOR CONTRIBUTORS

These guidelines have been drawn up by the Editor both to assist authors in writing their contributions to the Magazine and to reduce the subsequent editing process. The Magazine Editorial Group is trying to ensure that all submissions are written in a journalistic style so that articles will have an immediate interest value for a wide readership and will be readable and comprehensible to non-experts.

Format of articles

The main message or question posed by the article should be introduced within the first two or three sentences. The background for the topic should then be established leading up to the final dénouement or conclusion of the article.

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. When disks are submitted, 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

If in doubt, see Schedule of Meetings Publications Deadlines for 1995 or contact the Editorial & Production Office. 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 below).

Magazine Editorial Group

Saffron Whitehead ........................................... News from Abroad, Letters
Phil Harrison .................................................. Science News & Views
Malcolm Segal ............................................... Teaching & Technology
Laurence Smaje .............................................. Policies & Politics
Tilli Tansey .................................................... Traces of the Past
Susan Wray ................................................... Special Features
Valerie Cox .................................................... Young Physiologists
Heather Dalitz ................................................ Committee News, Special Interest

Group Forum, Notices & Advertising

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Action Points

Affiliate Travel Grant Scheme Next deadline for receipt of grant applications: 31 July
Cork Meeting Abstracts should be submitted to the Meetings Secretary between 19 and 29 June
Eastern European & Third World Grants The next deadline for receipt of grant applications is 31 July
Email addresses Members whose current email addresses did not appear in the last edition of the Grey Book are asked to confirm their addresses by email to hkdalitz@vax.ox.ac.uk by 30 June
Grey Book Members should inform the Administration Office of amendments to their entries by 30 June
Postgraduate Support Fund Deadline for receipt of grant applications: 31 July
Salamanca Meeting Deadline for registration at reduced rates: 15 July
It is three years since the Society last met in Oxford, an unusually long interval. Coincidentally I was also temporarily in charge in 1992, but the principle of a rotating headship has now been established, and I took on the job for five years from October 1994. Colin Blakemore, liberated after 15 years as head of department, is relishing his freedom, devoting his time to new areas of research, particularly the early development of the cerebral cortex. He is looking forward to sabbatical leave at the University of California, Davis next year.

Support for New Initiatives

Literally as I write this we have heard from the Wellcome that they will support a new initiative for confocal microscopy from Richard Vaughan-Jones and Piers Nye, which will add a new dimension (literally) to pH and calcium studies in a number of areas, including cardiac myocytes and blood vessels. Generous support from the Trust is also helping a new direction in both Denis Noble, Julian Jack and Andrew Parker’s research in computation, with a supercomputer to perform both cardiac and neuronal modelling. We have just spent a large sum of money on a departmental network and fileserver (named Willis for obvious reasons) and at least some of the staff are enjoying entry to the information superhighway. In parallel we are still inching (or whatever the metric equivalent verb is) towards complete computerisation of the practicals, with the dream of reorganising our classrooms, to give us desperately needed space.

Teaching is under review because of the need for a core curriculum, and in response to the GMC’s lucubrations.

This is the last Physiological Society Meeting before Ann Taylor retires formally this October. She has been the mainstay of our renal teaching at all levels, and we will miss her badly. Happily, her post has been released for early filling, and we are anxious to recruit new expertise in the area of epithelial physiology.

The Oxford Meeting of the Society is always popular and usually well-attended, and this year will be augmented by several symposia, and, of course, the joint British Pharmacological Society Meeting. We are having an informal social gathering with our pharmacological colleagues on the first evening, and hope that as many as possible will be there. The department is looking forward to welcoming old and new friends in July, and we expect the meeting to be a memorable one.
The Oxford Meeting of The Physiological Society will be run in parallel with the Summer Meeting of the British Pharmacological Society (BPS). Details of the three BPS symposia are given below. Members of The Physiological Society wishing to attend any of these symposia or the Hertford College Lecture are asked to notify the BPS in advance using the slip at the foot of this page. Full programmes for the BPS Summer Meeting will be available for Members of The Physiological Society to collect on registration at the Meeting.

**THE HERTFORD COLLEGE LECTURE**
12.45-1.45 pm, Thursday 13 July
Law Library (Lecture Theatre 3)
Professor C F Higgins
Transporters and channels: from microbes to multi-drug resistance and cystic fibrosis

**G-PROTEIN-COUPLED RECEPTORS AS TARGETS FOR DRUG DISCOVERY**
9.30-12.30, Wednesday 12 July 1995
Law Library (Lecture Theatre 2)
Introduction and overview: L Iversen
Structure, function and transduction as criteria for receptor characterization: P P A Humphrey (Cambridge, UK)
Cloned human receptors expressed in mammalian cell lines; advantages and problems: P Hartig (Wilmington, USA)
Use of mutant receptors in studies of the molecular architecture of the NK-1 receptor: T Schwartz (Copenhagen, Denmark)
Structural biology of G-protein-coupled receptors: J Findlay (Leeds, UK)
Use of receptor modelling in drug discovery: the muscarinic receptor: N U M Birdsall (Mill Hill, UK)
The symposium will review some of the challenges facing pharmacologists in dealing with the molecular genetics approach to receptor studies, using the G-protein-coupled receptor “super family” as an example.

**CYCLIC ADP RIBOSE: METABOLISM AND CALCIUM MOBILISING FUNCTION**
2.00-6.00 pm, Thursday 13 July 1995
Law Library (Lecture Theatre 3)
Chairman: A Galione (Oxford,UK)
cADPR and Ca2+ signalling: H C Lee (Minnesota, USA)
CD38 and enzymes involved in cADPR metabolism: A de Flora (Genoa, Italy)
cADPR-binding proteins: T Walseth (Minnesota, USA)
cADPR-gated channels in plant cells: G Allen (York, UK)
Possible effects of cADPR in cardiac excitation-contraction coupling: D Terrar (Oxford, UK)
cADPR and stimulus secretion coupling in pancreatic β-cells: H Okamoto (Sendai, Japan)
cADPR and neuronal signalling: D Brown (London)

**CPS SYMPOSIUM: PITFALLS AND SOLUTIONS IN CLINICAL PHARMACOLOGY RESEARCH**
9.00-12.30, Friday 14 July 1995
Law Library Lecture Theatre 2
Host: D G Grahame-Smith (Oxford, UK)
Session 1
Chairman: G D Murray (Glasgow, UK)
Introduction: L E Ramsay (Sheffield, UK)
Presentation of data: D G Altman (London, UK)
Session 2
Chairman: G T McInnes (Glasgow, UK)
Interpretation: P C Waller (London, UK)
How can we raise standards? A regulatory viewpoint: G T Tucker (Sheffield, UK)
This symposium is intended to be interactive. Pre-registration is essential so that delegates may be sent a symposium pack containing material to be discussed.

If you wish to attend any of the above, please post or fax a photocopy of this slip to:
BPS Office, 16 Angel Gate, City Road, London EC1V 2PT, tel (0171) 417 0111, fax (0171) 417 0114
I wish to attend: {please tick}
[ ] The Hertford College Lecture on Thursday 13 July
[ ] The symposium on G-protein-coupled receptors as targets for drug discovery, 12 July
[ ] The symposium on cyclic ADP ribose: metabolism and calcium mobilising function, 13 July
[ ] The CPS symposium: pitfalls and solutions in clinical pharmacology research, 14 July
Name (in caps) ......................................................... *Membership No/Affiliate Ref ...........................................
*If you are neither a Member nor an Affiliate of The Physiological Society, please supply your full postal address.
The next edition of the Grey Book is currently being compiled. Members are asked to send any amendments to their entries to the Administration Office by 30 June. In particular, Members are asked to note:

- **Email addresses** - was your email address included in the last edition? If not, please email it to hkdalitz@vax.ox.ac.uk
- **Special Interest Groups** - a number of new Special Interest Groups have been formed since some Members notified the Administration Office of their interests (see reverse of Affiliate form in this Magazine for details of the current Special Interest Groups)
- **New IUPS classification** - the IUPS classifications of scientific interests have been updated to include Molecular Physiology; since it is possible that a new Special Interest Group on Molecular Physiology may be formed, should the ad hoc Session at the Oxford Meeting prove successful, Members sharing this interest are strongly advised to notify the Administration Office

A tear-out re-registration form is included in the last edition of the Grey Book.

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**University of Oxford**

**Dept of Pharmacology**

**POSTDOCTORAL RESEARCH ASSISTANT**

Applications are invited for the above post in a programme of research on calcium homeostasis and potassium channel regulation in smooth muscle. The applicant should have experience in patch clamp and calcium fluorescence techniques. The successful candidate will benefit from working in a highly motivated group within a progressive department, using a variety of techniques. This position, funded by the Medical Research Council, is for three years in the first instance. The starting date is negotiable.

**Salary:** Academic-Related Research Staff Grade 1A scale, £13,941-£20,953 pa.

Informal enquiries to: Dr Roland Kozlowski, tel (01865) 271879, fax (01865) 271853.

Applications, together with two copies of a full CV and the names, addresses and telephone numbers of two referees, should be sent to: The Departmental Administrator, Dept of Pharmacology, Mansfield Road, Oxford OX1 3QT. **Closing date: 30 June 1995**

The University is an equal opportunity employer.

The University exists to promote excellence in education and research.

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**OXFORD MEETING - REGISTRATION**

Registration for the Oxford Meeting will take place for the first time on two separate sites.

If you have booked accommodation, you should register at St Catherine’s College, not at the Physiological Laboratory. Your registration pack, including the security badge without which you cannot be admitted to any part of the Meeting, will be awaiting you at St Catherine’s.

If you have not booked accommodation, go direct to the University Laboratory of Physiology, as usual.

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**MEMBERSHIP SUB-COMMITTEE**

**Student Associateship**

The Committee has approved the recommendation of the Membership Sub-Committee, that a new form of association with the Society be introduced. With effect from the beginning of the coming (1995/96) academic year, Members will be able to propose students registered for a first degree in Physiology or a cognate science for approval as Student Associates. Such students will then receive copies of Meetings Programmes and the Magazine, at a cost of £5 per academic year.

Full details of Student Associateship, including the criteria for eligibility and method of proposal, will appear in the next (Autumn 1995) edition of the Magazine, together with a tear-out application form. Details, notices, application forms and information sheets for potential Student Associates will also be circulated to heads of departments of Physiology and related sciences before September.

Phil Harrison has agreed to act as Student Associate Liaison Officer. Any Member wishing to raise any issue relating to Student Associateship prior to its implementation should contact him before the end of June: tel (0171) 391 1342, fax (0171) 383 7005, Email p.harrison@ucl.ac.uk

**Foreign Membership**

The recommendations of the Working Party on Foreign Membership were published in the Winter 1995 edition of the Magazine, with an invitation to Members to write to the Committee Secretary to express their views. The Committee Secretary has received no correspondence on this subject and the Committee has therefore agreed to implement the recommendations. All candidates for election as Foreign Members at the 1995 AGM have therefore been invited to opt for nomination as Ordinary Members instead. Letters will be sent to existing Foreign Members after the AGM, inviting them to consider whether they would like to be transferred from Foreign to Ordinary Membership.
**CARDIOVASCULAR/RESPIRATORY CONTROL**

**Cork Meeting: Designated Lecture**

At the Special Interest Group meeting at Cork (20-22 September) Professor Orville Smith from the Dept of Physiology & Biophysics (Regional Primate Research Centre), University of Washington, Seattle, USA, will give a Designated Lecture entitled: “Neural Behavioural Regulation of Cardiovascular Responses in Social Groups of Baboons”.

Professor Smith has a unique approach to gaining insights into cardiovascular control using coupled video telemetry techniques. His goal is to unravel the interactions between the somatic and autonomic nervous systems to elucidate ways in which these systems are integrated for the production of complex behaviours. His talk promises to be both exciting and stimulating. It is a great honour that Professor Smith will be present at Cork and we look forward to your support. (The deadline for abstract submission is 29 June.)

Julian Paton

**HISTORY OF PHYSIOLOGY**

In addition to the History of Physiology Special Interest Group’s Designated Session, at the Oxford Meeting, the Historical Studies & Archives Sub-Committee is organising a workshop to consider the use and value of history to practising physiologists and to discuss the ways in which the history of modern physiology can be studied and promoted. Those interested in attending the workshop and receiving copies of a preliminary discussion paper are asked to get in touch with either Tim Horder or Tilli Tansey, if they have not already done so.

Tilli Tansey

**MICROVASCULAR & ENDOThelial PHYSIOLOGY AND SMOOTH MUSCLE**

**Future Meeting: Symposium at King’s College London**

The Microvascular & Endothelial and Smooth Muscle Special Interest Groups of The Physiological Society are co-ordinating a symposium entitled *Impaired Endothelial and Smooth Muscle Cell Function in Oxidative Stress* (see box) which intends to review the effects of reactive oxygen intermediates on cell signalling in endothelial and smooth muscle cells *in vitro* and *in vivo*. The symposium is scheduled for one and a half days (18-19 December).

IMPAIRED ENDOTHELIAL AND SMOOTH MUSCLE CELL FUNCTION IN OXIDATIVE STRESS

at the King’s College London Meeting

18-19 December 1995

Prof Dr H Sies (Dusseldorf, Germany)
Oxidative Stress: oxidants and antioxidants

Prof Dr P A Baeuerle (Freiburg, Germany)
Hypoxia and reoxygenation induced gene expression

Dr V Darley-Usmar (Wellcome Research Labs, Beckenham)
Nitric oxide and oxygen dependent disruption of signalling pathways in cardiovascular disease

Prof R Bucala (New York, USA)
Advanced glycosylation end products in diabetic and non-diabetic vascular disease

Prof P Weissberg (Cambridge)
Smooth muscle cell proliferation

Dr R Pelvin (Strathclyde)
Hypoxia and endothelial cell signalling pathways

Prof P Kubes (Calgary, Canada)
A delicate balance between nitric oxide and oxidants regulates leukocyte-endothelial cell interactions *in vivo*

We aim to integrate invited lectures (30-40 minutes) with free Communications and Poster Communications. We hope that Poster Communications will be scheduled for lunchtime on 18 December. If members of the above Special Interest Group or The Physiological Society require any further information, please telephone one of the Special Interest Group organisers:

Dr Giovanni Mann (0171) 333 4450

Prof Lucilla Poston (0171) 928 9292 ext 8328

Dr Jeremy Ward (0171) 928 9292 ext 8008

Giovanni E Mann

**MUSCLE CONTRACTION**

The Administration Office of The Physiological Society has informed me that a number of copies of the well known Monograph by Woledge, Curtin and Homsher, titled *Energetic Aspects of Muscle Contraction* is now available (in hardback) at the specially reduced price for Members and Affiliates of the Society of £10 plus postage & packing. Although it was published ten years ago, it gives a comprehensive coverage of the muscle physiology literature and should be a
valuable and useful guide to have in a muscle research laboratory. Those interested in purchasing copies should send their requests to the Administration & Publications Assistant, The Physiological Society, PO Box 506, Oxford OX1 3XE.

Dr Bruton (from the Dept of Physiology, the Chinese University of Hong Kong) has informed me of the sad news of the death of Professor T P Feng (Shanghai Institute of Physiology, China) last month. I met Professor Feng once, about ten years ago, during a brief visit he made to the Bristol Physiology department. I was impressed by his very warm and friendly personality and by the fact that he was willing to listen patiently to everything I had to say about my experiments. His contribution to muscle energetics, heat production etc (beginning in the 1930s) is well known and later on his work had been on the neuromuscular junction. According to our records, he had been a Member of The Physiological Society since 1933, and became an Honorary Member in 1966. He will be missed by those who knew and worked closely with him, as well as by those who knew him through his contribution to science. I would very much like to hear from those Members who knew him and/or worked with him closely.

I look forward to seeing many of you at the next Designated Session of the Group which will take place in Oxford in July.

K W Ranatunga

NEUROENDOCRINOLOGY

At the Second Joint Meeting of the Physiological Societies of Japan, UK and Eire there was a two day Symposium on the Neuroendocrine Hypothalamus organised in conjunction with the Special Interest Group. The programme was well paced with a mixture of lectures and short communications devoted to related themes. In total there were 13 lectures and ten communications with a good representation of speakers from both the UK and Japan.

The first day was largely devoted to rhythms of hormone secretion, including circadian rhythms and the LH pulse generator. The following day there were presentations on the effects of gonadal steroids on neuroendocrine function and the neurohypophysis. We also learned of the dogma and hearsay relating to growth hormone secretion. As commented on in the vote of thanks at the end of the meeting, this was a connoisseur’s symposium. Ample time was allowed during the programme for informal discussion which continued during the social events including the magnificent symposium buffet. I would like to take this opportunity, on behalf of all those attending, to thank our Japanese hosts.

The next meeting of the Special Interest Group for Endocrinology will be held in association with a meeting of the British Neuroendocrine Group in Cardiff on 10-12 September. The outline programme is as follows:

Sunday 10 September
Registration/reception

Monday 11 September
am Workshop: Cell Signalling
Lunch and Posters
pm Symposium: Pituitary Regulation
10th Anniversary Lecture of the British Neuroendocrine Group
Posters and Sherry

Tuesday 12 September
am The Mortyn Jones Memorial Lecture
Free communications
pm Symposium: Regeneration and Degeneration
Free communications

All members are encouraged to submit abstracts of posters and communications, especially on topics related to the symposia.

As already announced, next year there will be a symposium at the UCL Meeting of the Society and a Designated Session at the Edinburgh Meeting. For 1997 we are hoping to organise a joint symposium with the neuroendocrinologists from Germany. The time and venue have yet to be decided as the Society’s calendar for 1997 is not yet complete.

Mary Forsling

RENAL PHYSIOLOGY

The next meeting of the Group will be held at the Cork Meeting of the Society, 20-22 September 1995.

The Designated Lecture will be given by Professor Gerhard Giebisch from Yale. The title of his lecture will be: Renal regulation of potassium transport: from clearance to pumps and channels.

D J Potts

SENSORY FUNCTIONS

The Sensory Functions Group met at the Keele Meeting in April. This meeting began with a well attended research symposium on
"Receptors and Central Processing in Vision and Hearing", which covered transduction and frequency tuning in the cochlea, transduction and adaption in photoreceptors, mechanisms of sound localisation in owls and mammals, the dynamic properties of neurons in the visual cortex and stereo vision. The symposium set the scene for the Designated Sessions that followed over the next two days, during which 38 Oral and nine Poster Communications were presented. With Colin Blakemore’s Annual Review Prize Lecture on “The Making of the Cerebral Cortex” and several of the Demonstrations covering some aspect of vision or hearing, the Sensory Functions Group dominated what was otherwise a fairly small Meeting. Everyone I spoke to agreed that this high level of interest in one area produced a very successful and stimulating Meeting. I therefore intend to continue the format of focusing the Sensory Functions Designated Sessions on one or perhaps two Meetings each year. The next Designated Sessions will be held at University College London (April 1996) and then Leeds (September 1996).

I am keen to expand the membership of this Special Interest Group. If you think that any of your colleagues would be interested in joining (whether or not they are members of the Society), please ask them to get in touch with me (email: ajk@physiol.ox.ac.uk).

Andy King

SOMATOSENSORY PHYSIOLOGY

I trust you have all submitted abstracts for the Oxford Meeting. I have not organised a plenary speaker on this occasion but, provided there have been some entries, a Pfizer Prize will be awarded to the best Communication in the Group’s Session given by a postgraduate student.

In December, the Group will be convening at the King’s College London Meeting at which there will be a Workshop on “Techniques in Somatosensory Physiology”. The speakers will be Steve Hunt, Sally Lawson, Jose-Ramon Naranjo, Sue Fleetwood-Walker, Hans-Georg Schaible, Anne King and Duncan Banks. The programme is intended to provide a good mix of molecular and electrophysiological approaches, with some measure of combination of the two.

See you in Oxford

Rob Clarke

NORTHWEST AIRLINES TRAVELLING FELLOWSHIPS

Northwest Airlines have agreed to provide three Northwest Airlines Travelling Fellowships to The Physiological Society to encourage and enable academic biomedical interchange between the UK and USA.

The Fellowships are aimed at young research workers (up to and including lecturer level) who wish to visit a centre of excellence in the United States. Travel must be made between 1 October 1995 and 31 March 1996.

These Fellowships will be awarded to young Members or Affiliates by the Grants Sub-Committee, in conjunction with Northwest Airlines. For ease of administration, candidates will be considered in conjunction with the Rushton Fund and Affiliate Travel Grant Scheme. These Fellowships are considered particularly prestigious, being awarded to those applicants achieving the highest ranking.

Academic Fares

Northwest Airlines have arranged special fares for academics travelling to the USA.

- No Saturday night stay is required for a discounted APEX fare
- Purchase a full economy ticket for travel Tuesday to Thursday and upgrade to World Business Class

For further information on these fares, or to make a booking, call Northwest Airlines on (0293) 561000 quoting the Academic Fares programme.

University of Liverpool

PhD IN PHYSIOLOGY

An opportunity is available to study for the degree of PhD in the field of membrane transport. The research topic will be centred on control of ion fluxes across red cell membranes and, in particular, the regulation of the KCl cotransporter. This system is affected by several physiological stimuli including oxygen tension, pH and volume. In addition, it is under the control of cellular protein kinases/phosphatases.

The Studentship is available from 1 October 1995 and will be held in the Dept of Veterinary Preclinical Sciences. Stipend will be at MRC rates, currently £6,391 pa (to be reviewed in October).

For further information, contact: Dr John S Gibson, Veterinary Preclinical Sciences, University of Liverpool, PO Box 147, Liverpool L69 3BX, tel (0151) 794 4284 (direct), or the departmental secretary, tel (0151) 794 4228.
EDITOR’S LETTER

Dear Readers,

This is a bumper issue to keep you going through the summer months. It is somewhat longer than usual but does not reflect a trend for trying to increase, yet further, our information overload. It is simply because we have two special features. One on music and physiology, kindly commissioned by Sue Wray, which is published in this issue so that it coincides with the “Body of Music” series on Radio 3 (See Special Features). The second is a series of reports on the Joint Meeting of the Physiological Societies of Japan and UK and Eire. We have not forgotten about the Joint Meeting in Korea and reports will be featured in the September issue of the Magazine.

With the help of several members of the Committee we are making good progress in forming media contacts, having some success with our press releases and publicising The Physiological Society. Part of our next plan of action is to set up a small data base of physiologists who would be willing to talk to journalists, producers and media researchers on topics concerning, or at least related to, their own field of expertise. I am increasingly being approached by journalists for information of one sort or another and find it difficult to know where and to whom I should refer them to. While we never make referrals without permission of the potential contact first, chasing people up can prove to be time consuming and often unsuccessful. By the time we have made contact with the said expert, the journalist has moved on to someone else. We can obtain information about who is doing what in physiology today, but we don’t know if you are willing to talk about your areas of expertise with the Media. So if any of you read this letter and would be willing to be a media contact please let me know and provide me with a very brief summary of your research and areas of expertise.

I look forward to a loaded post bag, and as you now know, you can always Email me.

Saffron Whitehead

THE GREAT PAY DEBATE

Dear Editor,

The consideration of academic salaries by Dr Harrison in The Physiological Society Magazine is timely and appropriate. Unfortunately, however, I feel that the relatively complacent picture presented there may be somewhat misleading. The reason for this is that many of the details given are based on what I believe to be a rather unrepresentative example.

The age-related academic salaries given in Dr Harrison’s article are based on a new graduate appointed as a Research Assistant at age 21, who then moves up the salary spine each year from this starting point until age 30 (Fig 1). On the basis of this example it is asserted that academic salaries compare reasonably favourably with those of analogous professions such as teaching. What the article does not indicate is that the starting point for the RA11 scale actually falls at age point 25 on the national salary spine rather than at 21, and therefore is four years above the hypothetical graduate’s calendar age. Thus the apparently satisfactory situation presented in the article results from this anomalously high initial placing on the salary spine in the particular example chosen rather than from the underlying salary structure itself.

If, instead, a new graduate followed the more traditional route of a Research Council Studentship, then the picture would not be so rosy. After the successful completion of a PhD, the now-postdoctoral research worker would be likely to join the salary spine at a point much closer to his or her calendar age, at a correspondingly lower relative salary. The graphs of salary versus age presented in the article are therefore highly misleading. In order to represent accurately the underlying salary spine, the data for academic salaries need to be plotted at their correct age-related points as shown below (Fig 1). This affects the comparison with teachers’ salaries (Fig 1), which can be seen instead to be rather higher than those of academics within the age range considered in the article.

Fig 1
Comparison of salaries (outside London) with age for the example given in Dr Harrison’s article ( ), schoolteachers ( , data taken from Dr Harrison’s article) and academics ( , national age-related salary spine).
It seems unwise and inappropriate to exaggerate the likely financial rewards of an academic career in this way, for two reasons. First, an overly-optimistic presentation of the situation might be taken by our financial (and governmental) masters to suggest that the problems of recruitment and retention in academic science are less serious than they have in fact now become. Second, it seems to me that the new graduate should embark upon an academic career with his or her eyes wide open, prompted by the undoubted intellectual rewards of Physiology rather than by an inflated expectation of the likely financial rewards raised by the somewhat unrepresentative picture of the academic salary structure presented in Dr Harrison’s article. The complacent impression given by the article is to be regretted, and should not be allowed to go uncorrected.  

Hugh Matthews

Philip Harrison Replies

Dear Editor,

Thank you for allowing me to see Dr Matthews’ letter and for giving me the opportunity to reply. Dr Matthews is right to point out that if a 25 year old is appointed on the lowest point of the RA scale that person would progress up the pay scale in the manner described in his graph. However, this must be a worst case scenario. In my article I tried to choose the middle ground - some are paid worse than my graph depicts - some are paid better. In relation to the latter, some RAs and lecturers earn enhanced salaries, either as discretionary (or even negotiated) enhancements or more systematically as across the board increases (eg the Wellcome Trust). In Oxford and Cambridge additional emoluments are available in a variety of College appointments. Thus, there exists a sizeable group of people earning more than the standard scales and these people should not be ignored.

I also tried to choose the middle ground in relation to schoolteachers and solicitors. If I had chosen the worst case scenario for schoolteachers then their plot would have been displaced downwards and would be virtually superimposable with Dr Matthews example. This further emphasizes the assertion in my article that our salaries are broadly in line with those of teachers. If by choosing the middle ground I have exaggerated academic pay then that is to be regretted and I apologise. My personal view is that the values I chose are probably not too far from the truth. Dr Matthews view might well be otherwise. However, what is becoming clear is that there is considerable variation by individual institutions in implementing a supposedly national salary scale.

Philip Harrison

University of Wales College of Cardiff
Physiology Unit

NEUROPHYSIOLOGIST

A postdoctoral research assistant is required to study the intrinsic and synaptic activity of thalamic and cortical neurones in vitro, with relevance to thalamocortical and corticothalamic connectivity and synchronisation. Experience in intracellular and/or patch recordings essential, experience in intracellular ion concentration measurements preferable.

NEUROANATOMIST

A postdoctoral research assistant is required to study the morphology and chemistry of thalamic neurones, with relevance to Ca²⁺ binding proteins, neuropeptides and synaptic contacts between biocytin injected, simultaneously recorded neurones. Experience in pre and postembedding immunocytochemistry and in electron microscopy essential.

Both positions are available for 3 to 4 years with salary up to £22,000 and previous postdoctoral experiences is preferable. You will be joining an active research group investigating thalamic function in the sleep/wake cycle and in neurological disorders (TINS 16, 1991, 16-21; J Physiol 441, 1991, 155-174 and 175-197; J Physiol 457, 1992, 257-276; Neuroreport 3, 1992, 65-68; J Physiol 480, 1994, 281-295; Neurosci Letts 172, 1994, 155-158). The group is equipped with state of the art techniques for intracellular and patch recordings, morphological analysis of injected neurones, while electron and confocal microscopy are available as departmental facilities. Enquiries to Prof V Crunelli, at School of Molecular and Medical Biosciences, Physiology Unit, University of Wales College of Cardiff, PO Box 911, Museum Avenue, Cardiff CF1 3US, Tel +44 (01222) 874801.

Top Prize Won by Veterinary Surgeon

Professor David Morton, Head of the Dept of Biomedical Science and Biomedical Ethics at the University of Birmingham, won the annual SmithKline Beecham Laboratory Welfare Prize. He was selected winner due to his outstanding contribution to refining animal experiments over the last 15 years.

Professor Morton has encouraged many scientists nationally and internationally to improve their experimental methods in order to minimise animal suffering. He believes that it is important to study in detail animal behaviour in order to recognise when animals are in pain or discomfort and to ensure that their psychological and physiological needs are being met.

The prize money of £2,000 will go to support a current research project Professor Morton is currently working on and it will be awarded at a ceremony in London, by the RDS President, Lord Perry of Walton.
Over the past seven years, work in my laboratory has examined a number of neuropeptides for altered release in the spinal cord as inflammation develops in the periphery. This started with a six month visit of Hans-Georg Schaible from the Physiologisches Institut of the University of Wurzburg. Schaible and Schmidt had described the so-called “silent nociceptors” innervating joints. These are afferents which are inexcitable by stimuli applied to the joint in health, but which fire impulses to such stimuli when joints are inflamed. In addition they obtained evidence that spinal neurones excited by joint stimuli became hyperactive when peripheral inflammation developed and in some cases even acquired contralateral receptive fields. Subsequently many groups have found evidence for enhanced responses of spinal neurones to peripheral inputs as inflammation develops peripherally. This is of considerable interest to clinical pain control since the majority of pain states requiring intervention involve inflammation either acute or chronic.

**Inputs From Nociceptors Alter Central Processing**

Maintained hyperexcitability of central neurones with peripheral inflammation could simply result from a continued low level input from the periphery. There is no doubt that many peripheral receptors are sensitised by inflammatory mediators and these sensitised receptors could fire impulses to the temperature, tissue turgor and pH present at the site of inflammation. A favoured hypothesis however, is that intense repetitive activity in peripheral nociceptors alters the central processing of subsequent inputs such that neurones acquire enlarged receptive fields, fire more spikes to a given input, fire for prolonged periods beyond stimulation application and expand the spectrum of peripheral afferents which excite the neurones. Such alterations involve a host of neurochemical mechanisms beyond the scope of this brief review. Here we will look at the evidence for the possible involvement of neuropeptides in central processing by studying the spinal release of excitatory and inhibitory neuropeptides in the spinal cord under in vivo conditions as inflammation develops peripherally.

**Antibody Microprobes to Study Neuropeptide Release In Vivo**

We have used antibody microprobes to measure and localise release. Such microprobes are glass micropipettes bearing immobilized antibodies to the peptide under study. They remain in the spinal cord for 2 to 30 minutes and localised binding of a released neuropeptide is detected on autoradiographs produced first by incubating microprobes in a solution of the radiolabelled neuropeptide and then placing the broken-off tips on x-ray film. The initial studies dealt with the tachykinins, substance P and neurokinin A.

**Rapid Release of Neurokinin A - Release of Substance P Is Delayed**

Immunoreactive (ir)-neurokinin A (NKA) appeared in the dorsal horn immediately a joint was injected and diffused widely in the spinal cord. We have evidence that what is detected by microprobes bearing antibodies to NKA is very resistant to degradation and elimination. Thus it is improbable that this compound functions as a neurotransmitter signalling the onset, intensity and offset of a noxious stimulus. By contrast ir-substance P (SP) only appeared 3 to 8 hours after joint injection and required active joint flexion as a stimulus to release. Compared to the focal release of ir-SP by pinching normal hind limb digits (Fig 1), joint flexion caused a relatively massive release of ir-SP which was detected over the whole of the dorsal horn. These contrasting appearances on single microprobes are shown in Fig 1. For quantitative work many such probes are scanned microdensitometrically by image analysis and mean scans for defined groups are prepared. It has been found recently that acute joint inflammation rapidly produces a continuous enhanced release of ir-calcitonin gene-related peptide (CGRP) in the spinal cord of the cat.

![Microprobe autoradiographs have been superimposed on the spinal cord. Both bore immobilized antibodies to substance P. The probe on the left was present in the spinal cord while a normal hind limb digit was pinched; that on the right was in the spinal cord during flexion of an inflamed hind limb joint.](image-url)
Peripheral Inflammation, Opioid Peptides and Galanin

Twenty years ago research into pain was emphasising analgesia with hypo responsiveness of spinal neurones through brain mechanisms. The discovery of opioid peptides was an impetus to such studies. Although the switch to hyper excitability is on good experimental grounds, not surprisingly altered function of inhibitory compounds does occur with peripheral inflammation. Increased expression of the prodynorphin gene in the spinal cord with peripheral inflammation was described by several groups. Release of dynorphin has been studied with microprobes in my laboratory by Ruth Riley and Zhi-Qi Zhao. Dynorphin has been difficult to study because of very low levels, but they have obtained evidence of a diffuse spinal release in the arthritic rat following mechanical stimulation of the relevant joint. The function of dynorphin under these conditions is controversial with claims for a role in producing hyper excitability of spinal neurones. But other evidence indicates an inhibition of cell responses to peripheral stimuli. Galanin release has been studied by Philippa Hope in relation to peripheral inflammation. Basal galanin levels were unaltered by peripheral inflammation and continued peripheral stimulation reduced rather than increased extracellular galanin. Little is known of the functions of galanin but it has been shown to potentiate the action of morphine in reducing a nociceptive spinal reflex.

In all of the studies cited a prominent feature has been the lack of focal presence of the neuropeptides. Neuropeptides have been detected over a far wider area than what would be predicted from immunocytochemistry. This lends support to proposals that neuropeptides do not function as neurotransmitters with discrete actions in a somatotopic manner but rather alter the function of neurones bearing the relevant receptors over relatively large areas of the spinal cord. The significance of this broadness of effect is unknown, but an interruption of normal function may be relevant to guarding of damaged tissues and immobility of the inflamed parts. It seems that when considering neuropeptide function in the spinal cord, physiologists need to be prepared to cross into the realm of pathology.

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References

APOPTOSIS IN THE CENTRAL NERVOUS SYSTEM WITH RESPECT TO NOVEL INPUTS AND LEARNING

Apoptosis refers to a form of naturally occurring cell death in which cells are eliminated in a selective and non-disruptive manner (Wyllie, 1987). This form of cell death appears to be responsible for the massive loss of neurons seen during early development (Oppenheim, 1991; Waters et al, 1994). The question of why this loss of neurons should occur is often explained in terms of the trophic factor hypothesis which argues that there is competition amongst axons for trophic factors released from specific neuronal targets. Failure to obtain a sufficient amount of a specific trophic factor causes the neuron to undergo apoptosis. Such an account enables explanations of how neurons, which have made erroneous connections, are eliminated and how appropriate input/output ratios of neurons are formed (Raff et al, 1993).

Models of Learning

Our own theoretical studies have examined the effects of eliminating specific neurons on the computational performance of a neural system. We have shown, using networks of artificial neurons, that selective deletion can lead to improved learning ability (Brown et al, 1994). Greatest improvements in learning ability arise from deleting the least computationally useful artificial neurons, where an index of computational utility is derived from the rate of change of discharge activity of each neuron. (Neurons that show constant rate of activity would not be expected to be doing useful computational work). A similar selection procedure could take place in real biological systems if the levels of neuroprotective factors, such as neurotrophic factors and bcl-2 (a cytoprotective proto-oncogene) were produced in proportion to the rate of change of activation of each neuron.

Manipulating Neuronal Activity

If a selective procedure of this type operates in the developing nervous system in may also be present in the mature nervous system. Dramatic and prolonged changes in neuronal discharge...
patterns would then be expected to reactivate the mechanism and result in apoptosis. This hypothesis was tested by systematically treating rats with the monoamine depleting agent, reserpine, which induces a profound but reversible Parkinsonian state. This Parkinsonian condition is mediated, in large part, by striatal neurons which discharge at abnormally elevated rates following dopamine depletion. As predicted, reserpine-induced Parkinsonism was accompanied by apoptosis of striatal neurons (Mitchell et al., 1994). This apoptosis appears to be mediated via excess corticostriatal excitatory amino acid (EAA) transmission as it can be blocked by either the systemic administration of EAA antagonists or cerebral decortication.

**Novel Inputs From the Environment**

The observation of apoptosis of neurons in the mature brain following a pharmacological manipulation of neurotransmission raises the intriguing possibility that prolonged, abnormal sensory stimuli might also induce neuronal apoptosis. Thus, alterations of an animal’s external environment which induce prolonged, elevated changes in discharge patterns of neurons in the ascending sensory pathways would be predicted to induce apoptosis. We have tested this hypothesis by placing groups of adult mice, living in their home cages, on a slowly rotating turntable for 48 hours. A significant increase in the levels of apoptosis of neurons in the medial vestibular nucleus was seen in these animals compared with control mice which had not been rotated (Fig 1).

This finding demonstrates that alterations in the external world in which an animal lives is sufficient to induce apoptosis in the mature nervous system. This implies that neuronal apoptosis may represent a general response to prolonged elevations of neural transmission in the adult nervous system. Whether this neuronal loss represents an adaptive process which enables the animal to learn to adapt to its new environment or, alternatively, the inappropriate activation of a mechanism which was useful during early development, remains to be determined.

**References**


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**CAN LEARNING IN VIVO BE DETECTED IN VITRO?**

This article is about one particular form of learning in the domestic chick. The young chicken is a superb subject in which to study learning and its associated processes; in fact, it is the nearest approximation to an intelligent ‘tabula rasa’ which nature provides. This is because the newly hatched bird is comparatively mature, and becomes mobile very quickly. It must, therefore, learn. Any infant which is capable of independent action must learn very fast, if it is to survive, and each chick must succeed in two tasks during its first few days of life. It must learn to recognise its mother (the process is known as imprinting), and then it must learn to restrain its innate tendency to peck at any small conspicuous object. In other words, the bird learns that some things are inedible, and better left alone.

**Recognition Learning in the Chick Brain**

Due largely to the work of Gabriel Horn, Pat Bateson and Steven Rose there is now an impressive body of evidence that both forms of learning are dependent on a particular area of the forebrain - the intermediate, medial part of the hyperstriatum ventrale (IMHV). The IMHV of the domestic chick is therefore unique. So
strong an association between recognition learning and structure has been established in no other species. Much of this evidence has been reviewed in the book edited by R J Andrew (1991).

The task of learning to recognise the inedible has been formalised into a simple laboratory procedure in which a day-old chick is shown a small, shiny metal bead - the kind of object which it is almost guaranteed to peck. However, the bead has been dipped in fluid, which the bird tastes when it pecks. The fluid may be either water, or methylanthranilate (MeA) - a foul-tasting liquid which produces a stereotyped disgust reaction, consisting of retreat from the bead and a great deal of beak wiping. Some hours later an identical, but innocuous shiny chrome bead is again presented, and the response of each bird is noted. Those which originally tasted water will peck again, while the chicks which tasted the MeA will have learned not to peck, and will retreat from the bead with signs of disgust.

**Electrophysiology of IMHV Neurons in Vitro**

We (Philip Bradley, Ben Burns, Tanya King and Alison Webb, 1995) have trained chicks on this learning task, and immediately after testing for retention have used an in vitro slice preparation to find out whether the electrophysiological characteristics of the IMHV neurons differ between MeA-trained birds and water-trained controls. Intracellular recordings were made from 23 neurones in slices from MeA trained chicks and 19 cells from water-controls. Both spontaneous activity and evoked responses were recorded.

In completely untrained birds many, but not all, neurones in the IMHV in vitro display bursts of spontaneous excitatory post-synaptic potentials (EPSPs). These are dependent on low-threshold NMDA receptors, and the incidence of active cells varies with the age of the chick from which a given slice was taken. Both amplitude and incidence of spontaneous bursts differed when slices from MeA-trained chicks were compared with those from water-trained controls. The mean peak amplitude of the EPSPs was significantly greater in 'MeA-trained slices', and there was also a significantly higher chance of encountering a spontaneously active nerve cell. The incidence of spontaneous activity in 'water-trained slices' was not only much lower, but was statistically indistinguishable from the incidence observed in slices taken from completely untrained birds of the same age.

The responses evoked by local, extracellular electrical stimulation also differed between the two groups. Intracellular responses to this type of stimulation are always long (they can exceed 3 seconds in duration) and complex in form. However, all but about the first 20-30 milliseconds of these responses appears to depend upon the nett activity of low-threshold NMDA receptors, and post-synaptic GABA<sub>B</sub> receptors. Responses recorded from 'MeA-trained slices' were, on average, more than one second longer (a statistically significant difference) than the responses recorded from water-trained controls.

Finally, the passive membrane properties were examined. Neither the resting membrane potential nor the capacitance of the two groups of nerve cells differed significantly. However, the time-constants of cells from the MeA-trained chicks were significantly longer than those of neurones from water-trained controls. This was attributable to the fact that the membrane resistance in the MeA-trained group was significantly higher than that recorded from water-trained controls.

**Are NMDA Receptors Involved in Learning?**

Therefore, in several respects, neurones recorded from trained chicks seem to be more excitable than cells recorded from control birds. One might argue that the 'real' difference is the difference in resistance. Ohm's law dictates that cells with high resistances will produce comparatively large, long responses to 'standard' synaptic currents - hence the large amplitude and high incidence of spontaneous EPSPs, and the elongated evoked responses. There is, however, another possibility. There is a large body of evidence associating high neuronal resistance measurements with elevated levels of low-threshold NMDA activity (see Mody et al., 1988) for a detailed account of the argument), and, it is certainly true that low-threshold NMDA receptors contribute to those aspects of neuronal activity which were augmented after training. It is possible that all the changes, including the high membrane resistance, are caused by an increase in either the number or the effectiveness of low-threshold NMDA receptors. This hypothesis has the added attraction that it is consistent with the results of receptor binding studies after very similar training (Stewart et al., 1992).

Whatever the correct interpretation of these results, it does appear possible to detect the effects of experience in vivo in subsequent in vitro experiments. Perhaps this is not so
surprising after all, since training is known to be followed by considerable structural (Stewart & Rusakov, 1995) and biochemical changes (Rose, 1995) and it would, in fact, be very disturbing if these were without electrophysiological consequences. Which particular fragment of the ghost of the experience is detectable in vitro is anyone's guess.

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References
Modern Biomedical Science Collection

The Autumn 1994 issue of the Magazine contained an article on the Wellcome Centre Medical Photographic Library’s immense collection of medical images - of which there are more than 150,000. The majority of these are historical (see Tilly Tansey’s article page 15 for photographic examples) but the library has also taken over the National Medical Slide Bank, which contains about 16,000 predominantly clinical images. However, there are still very few images representing the modern biomedical sciences and the Library has recently embarked on a major new initiative to address this gap.

How We Can Help You

Much of both the clinical collection and the Iconographic collections of historical images are on videodisc and are available for use by researchers, educators and students, as well as the media and other commercial organisations. Material can be produced in different formats and, for academic use, there is only a nominal charge to cover costs. The Library has professional picture researchers who can help you in your search for the right image and they can be contacted on (0171) 611 8348.

These collections are continually expanding and, in particular, the Medical Photographic Library aims to provide a comprehensive collection of modern biomedical images in the very near future. Initially, the picture editors, Mark Osmond and Jill Bailey, are concentrating on the general fields of physiology and genetics and are especially looking for images which are appropriate for teaching purposes, such as lecture slides and graphics for computer assisted learning programs. The scope of the collection will thus be from the very basic to the highly specialised and it is expected that the entire collection will soon be available on videodisc, CD-ROM and eventually accessible on the Internet.

How You Can Help Us

You can help to make the new collection a success and work for you in two ways:

First, let the Medical Photographic Library know what sort of images you would like to see included, with regard to both research interests and education. This can include anything visual: photographs (colour or black-and-white), diagrams, cartoons, charts, tables and graphs. It is anticipated that there may be a need for the Library to custom design and produce non-photographic material, but your input - particularly information on teaching requirements and course curricula - is crucial.

Secondly, you can direct the editors to potential sources of any suitable original images. Contributors to the collection can retain their original pictures, as well as the copyright, and may continue to use them in any way they wish. They also have the option of imposing restrictions on the use of any individual image but, in any case, full credit is given. Although material is made available for academic use at cost, the contributor will receive royalties, as appropriate, whenever an image is used commercially. It may also be possible for the Library to arrange for any relevant subjects, such as laboratory equipment and techniques, or different types of specimens, to be photographed on site.

If you would like to contribute any images, receive further information, or offer any comments and suggestions, please contact either Mark Osmond (0171) 611 8347 or Jill Bailey (0171) 611 8360 at The Wellcome Centre Medical Photographic Library, 210 Euston Road, London, NW1 2BE, Fax (0171) 611 8577.

Mark Osmond
Photographic examples courtesy of The Wellcome Centre Medical Photographic Library

University of Graz, Austria
Postdoctoral Research Associate Cardiac Muscle Electrophysiology

This position is available for up to two years, preferably for a candidate with good English who has experience of using either conventional or ion selective microelectrodes. Salary £31,000 per annum.

Further information may be obtained from, and applications (with CV) sent to: Robert Gasser, MD, DPhil, Experimental Cardiology, Medizinische Universitätsklinik, University of Graz, A-8036 GRAZ, AUSTRIA Fax (00 43) 316 385 3062.
During the 1870s British physiology was revolutionised. At the start of the decade, Trinity College Cambridge appointed Michael Foster from University College London, to its newly created praelectorship in physiology, the first step towards what was ultimately to become the Cambridge Physiological Laboratory. The Physiological Society was founded in 1876 - just before, and not unconnected with, the passing of the Cruelty to Animals Act. Two years later Foster established The Journal of Physiology and in 1879 the novelist “George Eliot” established a research studentship in physiology, in memory of her partner, George Henry Lewes, a founder member of the Physiological Society. George Eliot considered physiology to be “the science least adequately studied in England”.

That Fellowship was one of the earliest awards dedicated to promoting physiology. At that time there were few ways in which a man (let alone a woman) could devote himself to professional scientific research. During the earlier parts of the 19th century there had been a few hesitant steps towards promoting and supporting science: the British Association for the Advancement of Science was established in 1831; in 1849, the Royal Society was given a Parliamentary grant “for the promotion of science”; and the Great Exhibition of 1851 focused popular attention on science and scientific achievements. Forty years later, the 1851 Exhibition scholarships, funded from surpluses arising from the Exhibition, were created, to support scientific research. In a more expressly medical context the British Medical Association had been readily persuaded to apply to the George Henry Lewes Studentship, in memory of her partner, George Henry Lewes, a founder member of the Physiological Society. George Eliot considered physiology to be “the science least adequately studied in England”.

A particularly prominent voice in the demands for the adequate support of professional science, which he remarked “Could earn a man praise but not pudding”, was Thomas Henry Huxley, who was also a founder member of the Physiological Society. The calls of Huxley and likeminded colleagues were heard in many different ways. Some livery companies in the City of London responded by supporting scientific and medical research enterprises, which as the nineteenth century drew to a close, became an increasingly acceptable way of demonstrating corporate philanthropy. The Goldsmiths Company supported Goldsmiths College, later of the University of London, and in the 1890’s also financed production of antitoxins, the wonder drugs of their age. At the turn of the century the Salters Company established a limited number of research fellowships in Universities and medical schools. As early as 1883 the Grocers Company established Sanitary Research Studentships which included “subjects, broadly speaking, which come under the category of an inquiry into the causation of prevalent disease or as a means of prevention of premature death”, terms which were interpreted sufficiently broadly to include the basic research of John Rose Bradford, (later President of the Royal College of Physicians) into kidney function, and of Ernest Starling into lymph formation. And just before the first world war, the Drapers Company donated over £20,000 towards the construction of the new Cambridge Physiological Laboratory.

Acknowledgments to these increasing sources of support can be followed in the early volumes of the Journal of Physiology. In the first few issues, the preponderance of support provided by Oxford and Cambridge Colleges is obvious, especially Trinity College Fellowships, which were held, by inter alia J N Langley and W H Gaskell, but as the majority of Oxbridge fellowships in the 1870s were for divinity or theology, competition for the few awards available to scientists was stiff. The second volume of the Journal of Physiology contains a new acknowledgement, from Charles Smart Roy to the George Henry Lewes Studentship.

The availability of this award only to physiologists was a restriction that George Eliot had been readily persuaded to apply by Foster, Huxley and the first Trustees of her fund. The studentship provided support, often at an early critical juncture in their careers, when no alternative financial assistance was available, for many subsequently eminent physiologists, virtually a “Who’s Who” of physiology. They include several Fellows of the Royal Society and three Nobel Laureates: Henry Dale, Charles Sherrington, and A V Hill. Charles Sherrington was the second George Henry Lewes (GHL) student, and immediately began his experimental work on spinal cord pathways. Henry Dale worked in London on the effects of secretin stimulation on the cells of the pancreas, under the supervision of Bayliss and Starling and A V Hill started his investigations into heat production by muscles.
However, by the time that Hill was a GHL student (1909) the financial limitations of the Trust had been apparent for some years. The original endowment, of £5,000 worth of railway stock, generated income that could comfortably support only one student for three years. It was clear to many scientists and educationalists that more substantial support for medical research was necessary, and in 1909 Sir Otto Beit established the Beit Memorial Fellowships, with an initial donation of £215,000. The first Beit Fellows were appointed the following year, and ten fellowships, each available for up to three years, were awarded annually thereafter. The very first Beit Fellow, was the physician and physiologist Thomas Lewis. Also in that first group was Edward Mellanby, later Professor of Pharmacology at Sheffield, a George Henry Lewes Trustee and Secretary of the Medical Research Council. The creation of the MRC, a consequence of the 1911 National Insurance Act, was finally to provide the levels of support, with its studentships, research positions, grants and institutes and units, that Huxley and his colleagues had called for at the end of the nineteenth century.

Crucial as they were at the time, the awards of the livery companies, the Lewes Trust and other bodies were finally supplemented by a system that encouraged and promoted professional medical research.

Tilli Tansey
Honorary Physiological Society Archivist
Wellcome Institute for the History of Medicine

At this time of year all Members of the Society receive the Annual Report and Accounts and some no doubt spend hours reading through to gain an understanding of the Society’s financial position. However, many will wonder why there is more and more information every year, and whether it is all entirely necessary. Is this the result of automation which encourages us to suffocate in a landslide of useless information, or is it more sinister - the Treasurer blinding the readership with numbers so that the actual state of affairs is known only to a cabalistic few? As usual, the truth is less exciting and such a flurry of information is yours courtesy of the Companies Act and the Charities Act which between them tightly control the reporting of charitable companies such as The Physiological Society.

Was it ever thus? Sadly no, the requirements are modern rules reflecting the Society’s modern status. But why “sadly”? Should we not be ruing the burden of providing information that means so little to so many? On the contrary, we can lament the fact that the finances of the Society in its early days must be gleaned from incomplete records and anecdotal evidence.

From the wallets of the wealthy?
The earliest reference to money in the Society’s records is in 1878, where at the Annual General Meeting the “financial state of the Society was reported to be satisfactory”. A few months later, in January 1879, the Society reported that “The Secretary read a letter from M Dunnonpallier [of the Societe de Biologie, Paris] acknowledging receipt of £80 For the Claude Bernard [Memorial] fund”. In his book History of the Physiological Society during its First Fifty Years 1876 - 1926 Sir Edward Sharpey-Schafer cites this as evidence that the Society was in a sound financial position. However, it is most unlikely that this money came from the Society’s own coffers. The Society was founded less than three years earlier and, at that stage, was limited by its rules to forty Members. The membership subscription had been set at 10 shillings per annum, so the maximum subscription income would have been £60, and naturally the Society must have incurred some expenditure in running its meetings. Whilst the Society may have received donations from wealthy Members and supporters, nothing is recorded and it may well be that individual Members made personal contributions to Bernard’s memorial. This would appear to be a valid assumption particularly given that, a year later, the minute book describes as “most satisfactory” the balance of £19 11shillings and 6 pence held at the bank on behalf of the Society.

International demands
If this interpretation is correct, such personal involvement gives an interesting insight to the early nature of the Society where individual Members would club together to achieve a particular end. It also demonstrates the precariousness of a small, young organisation which, even in its earliest days, saw for itself an important role in international liaisons. This is further exemplified in the Society’s approach to the International Medical Congress in August 1881. Forty foreign scientists were invited as guests of the Society, and those who attended were accommodated by individual Members whilst in the UK.

At the Annual General Meeting in October 1881, the Secretary reported that “the Society had not incurred any expense in boarding the foreign Physiologists during the... Congress”. However,
as the dinner hosted by the Society had cost £50, the Secretaries were empowered by the Committee to collect one guinea from each Member in order to defray this expense. Compared with this, the hundreds of thousands spent by the Society on the 1993 Congress seems lavish indeed.

Further examples exist of Members making personal contributions in the name of the Society. In 1884 the Members present at the Annual General Meeting agreed to contribute personally to a memorial to the late Professor Colnheim, a German physiologist, and in 1898 the Society and its Members demonstrated the charitable awareness that eventually gave rise to the Benevolent Fund. The Society appealed to its Members to raise money to aid the widow of Professor Duchard, which resulted in a collection of almost £75, of which £25 came from the funds of the Society. Given that the Society’s accumulated fund stood at £159 at the start of 1899, this was a most generous sum.

Defending the right to research

But sometimes this blurring of Members’ and Society funds makes it difficult to conclude just exactly what has happened. There is a very curious minute of the Annual General Meeting held on the 25 January 1908. At this meeting the Members discussed the appointment of a lecturer to address meetings on the value of vivisection, and the “formation of a special society for similar objects”. The discussion concluded with a unanimously carried resolution to empower the Committee “to utilise the invested funds of the Society if in its opinion necessity should arise during the coming year” This is a sweeping power, allowing the Committee effectively to dispose of the Society’s accumulated asset base without referring back to the Members. All is explained in March when the Treasurer was instructed by the Committee “to forward a cheque for £100 on the funds of the Society to the treasurer of the Research Defence Society.” At this point, the balance sheet total stood at £167, so this contribution represented a significant and magnanimous gesture on behalf of the Society.

But on looking at the accounts presented to the Members for 1908 it becomes clear that this money was never drawn “on the funds of the Society”. There is no record of it on the balance sheet, nor is any category of expenditure large enough in which to lose it. The Research Defence Society has maintained meticulous records but, frustratingly, its opening accounts were prepared by a firm of professional accountants and the books of prime entry are not archived. Could this money have been paid over as a donation from some, one, or any, of the Society’s Members? Did the two Societies come to some other arrangement, perhaps staggering the payment over a number of years, to save any potential financial embarrassment? Such stories are now lost in the passing of time.

So before you dismiss this year’s Annual Report as being just too much to cope with, think what illuminating reading it might make to someone in the future who is anxious to know about the issues facing learned societies in the late twentieth century. And pity the poor souls who have had to ensure it complies with the Companies Act requirements.

Victoria Penrice
Administrative Assistant to the Honorary Treasurer

Reference and acknowledgements

Sir Edward Sharpey-Schafer History of the Physiological Society during its First Fifty Years 1876 - 1926

Thanks to The Research Defence Society for access to its earliest records. The records of The Physiological Society and the Research Defence Society are housed in the Contemporary Medical Archives Centre of the Wellcome Institute.

St George’s Hospital Medical School (University of London)

LECTURER IN PHYSIOLOGY
Dept of Physiology

Applications are invited for a lectureship (neuroscience) in the Dept of Physiology effective 1 October 1995, or shortly thereafter. The position entails teaching of physiology to medical students undertaking MB BS and intercalated courses, and to carry out research in neuroscience - here considered in its broadest sense. Applicants with proven research experience and commitment to high quality teaching are especially welcome. The department offers excellent facilities for research and opportunities for research collaboration with other departments in the school. The starting salary on the grade for University Lecturers grade A or B (maximum £27,869 inclusive of London allowance) is dependent upon qualifications and experience.

Further details and an application form are available from the Personnel Officer, St George’s Hospital Medical School, Cranmer Terrace, London SW17 0RE, tel (0181) 725 5020 (24 hour answer phone). Informal enquiries may be addressed to Prof B J Whipp, Tel (0181) 725 5390, fax (0181) 725 2993, Email physiol@sghms.ac.uk. Closing date 1 July 1995. Please quote reference 54/95.
OKAZAKI SYMPOSIUM

The Okazaki Symposium consisted of six parallel two-day sessions in the areas of Comparative Neurophysiology, Ion Channels and Cardiovascular System, Epithelial Transport and its Control, Sensory Motor Processing, Neuroendocrine Hypothalamus and Molecular Mechanism of Skeletal Muscle Contraction. In fact these were six quite separate symposia without synchronized timetables, each one organized by a small Anglo-Japanese Committee. All symposia contained a number of invited lectures (about 25-30 min each) given by well-known authorities in the respective fields, but a number of abstracts submitted by younger scientists had also been selected for (mostly) shorter platform presentations. Most of the symposia were chaired in the usual way by senior members of both Societies, but one of the symposia (Epithelial Transport and its Control) tried an experiment and all its sessions were chaired by younger members (in the case of UK Chairpersons also Affiliates). This worked very well and was undoubtedly a useful experience for everyone involved.

Inevitably, nobody could attend more than one symposium and I can therefore only give my personal impressions of the Symposium on 'Epithelial Transport and its Control' here. It is of course impossible in this brief report to give a comprehensive account of this symposium so I shall restrict myself to some general points and just mention a few presentations that I found particularly interesting.

In the epithelial transport field major efforts have been made in the past decades to obtain information about the localization and the biophysical/biochemical characterization of individual transport proteins. This exercise has been very successful. We have today a fairly detailed picture, in at least some of the most important epithelia, of the distribution of specific transport proteins between, for example, brush-border and baso-lateral membranes and a large number of these transport proteins have been cloned and their basic transport properties clarified. This line of research continues since new transporters are still being discovered. An example of this was given in the lecture by Nick Simmons (Newcastle) in which data on new H*/peptide and H*/amino acid transporters were presented. Another example came from Yoshikatsu Kanai (Kyorin University, Tokyo) who talked about the recent cloning and characterization of a new Na⁺-dependent neutral amino acid transporter which is expressed in testis, kidney, lung and large intestine.

Participants on the bus to Takechiyo

Control of transport and in particular the intracellular mechanisms by which membrane transport events are regulated is now one of the hottest and most rapidly expanding areas of epithelial transport research. At this meeting many talks focused on intracellular Ca²⁺ signalling. It has become clear in recent years that one important feature of Ca²⁺ signalling is the very subtle control that exists with regard to both the temporal and spatial distribution of cytosolic Ca²⁺ signals. One interesting case of subcellular compartmentalization of Ca²⁺ signals was described by Yoshio Maruyama (Jichi Medical School, Tochigi) who reported the existence of a cytosolic Ca²⁺ domain important for control of exocytosis that was quite separate from a neighbouring plasma membrane Ca²⁺ domain regulating Ca²⁺-sensitive ion channels important for fluid secretion.

Yasunobo Okada (National Institute of Physiological Sciences, Okazaki) described a successful attempt to define very rigorously the intracellular factors triggering the Ca²⁺-insensitive Cl⁻ channels upon osmotic swelling. Using whole-cell and single-channel recording techniques the investigation focused on how
Participants at the Okazaki Symposium

Mg²⁺ and ATP reciprocally regulate the volume-sensitive Cl channels in a human intestinal cell line.

Brian Harvey’s (Cork, Ireland) talk, which opened the meeting, addressed the important issue of cross-talk between transporters in epithelial cells and he described the properties of the most likely cross-talk signals such as membrane potential, Ca²⁺, pH, ATP/ADP and several others.

Physiologists are always happy when their work is relevant for considerations of therapy of important diseases. Barry Argent (Newcastle) discussed the interesting puzzle concerning the apparently normal exocrine pancreas in transgenic CF mice. He presented evidence suggesting that in addition to the CFTR-type Cl⁻ channels murine duct cells also contain a high density of Ca²⁺-activated Cl⁻ channels. If such channels could be up-regulated in human pancreatic duct cells they might form a pathway by which defective CFTR could be bypassed.

O H Petersen

NAGOYA SYMPOSIUM

The scope of the Nagoya symposium was as wide as its title: “Integrative mechanism of physiological function: from ion channel to system”. In other words anything from molecules to man could be included, provided it was integrated. There were twelve different themes at sessions each two days long and therefore overlapping. The subjects (and organisers) were:

1. Ion channels and sensory systems (M Sokabe and J F Ashmore)
2. Receptor and intracellular signalling (N Akaike and G L Collingridge)
3. Synaptic transmission, modulation and plasticity (K Kuba and D A Brown)
4. Smooth muscle (T Tomita and T B Bolton)
5. Autonomic regulation (A Sato and J F B Morrison)
6. Physiology of pain (T Kumazawa and B Lynn)
7. Respiration (Y Fukuda and J G Widdicombe)
8. Serotonin and related monoamines in the CNS and periphery (organisers, A Takada and G Curzon)
9. Trophic factor, neural growth and transplantation in CNS (H Nishino and S B Dunnett)
10. Vestibular function (S Watanabe and G R Barnes)
11. Central nervous system (K Kubota and R N Lemon)
12. Body temperature and metabolism (T Nagasaka and A S Milton)

Each session consisted of about twenty five invited talks, with approximately equal numbers being given by Japanese and UK and Eire speakers. In addition there were posters for each session, with well over a hundred being shown. Most of these were by Japanese physiologists and the visitors greatly appreciated the chance of seeing the broad scope of Japanese physiology. There was a separate demonstration on “Computers in physiology education” with eleven demonstrations illustrating computer methods of teaching used in Japan.

I attended the session on respiration, and was privileged to help organise this in collaboration with Professor Fukuda. In general the session illustrated the closeness of research interests between physiologists in the two countries over a wide range of aspects of respiratory physiology. Three sections dealt with the central nervous system. Particularly striking were the advances in understanding the physiology of higher central control of breathing in man showing how noninvasive methods can be applied to study brain areas related to breathing. Other studies on man included an analysis of the respiratory responses during the intellectual strain of playing video games, and the effects of chest wall afferents on the sensation of breathlessness.

A number of papers concerned the long and slowly successful exploration of the neuronal mechanisms of breathing in lower mammals. Some beautiful studies on the behaviour of brainstem and spinal cord slices in neonatal...
Okazaki National Research Institute

The Banquet at Takechiyo Onsen Hall

From left to right: Yasu Okada and Ole Petersen with other organisers of the Japanese Meeting

Okazaki Castle

Entertainment at Takechiyo Onsen Hall

Entertainment at Takechiyo Onsen Hall
After a morning session.

Nagoya Castle

Collecting lunch boxes at the Meeting

Meijo Park, Nagoya
then took off for Kyoto and Nara. I stomped round as many temples, shrines, castles and gardens as I could find and spent three days without speaking a word of English - nor Japanese for that matter.

The second part of the Joint Meeting was held on Saturday and Sunday at Nagoya University. The university actually originated as the Public Medical School in the late 1880's and, after the addition of the Schools of Engineering and Science in 1939, it was renamed Nagoya University in 1949 under the new educational system. Since that time the number of different faculties has increased (including several graduate schools) and today over 2,000 undergraduates and nearly 1,000 graduate students are admitted to the University each year.

The city of Nagoya is a busy industrial metropolis. Its history began in 1612 when Ieyasu built a castle in Nagoya (then called Owari) having recognised its strategic position in the centre of Japan. After 300 years of Shogun reign, 1889 marked the municipalization of Nagoya as a modern city under the Meiji government’s reorganisation of Japan. It is a large rambling city where high rises merge into an urban network of apartment blocks, houses and more houses. Lack of space precludes gardens so the densely arranged suburban houses look more like lego-land than the little boxes and green squares of suburban England. The city centre is as western as New York, at least on the facade and ignoring the Japanese signs. However some shops and restaurants do boast English names which sometimes have a strange quirkiness - for example, a smart boutique called ‘Pinkie and Dianne’ and ‘PIZZA TAKEOUTOK’ (all one word).

In contrast to Okasaki the major street names in Nagoya were given both in Japanese and in English, as were the subway stations and bus routes. These had to be negotiated as our hotels were located in the centre of the city, the University of Nagoya on the outskirts. However when emerging from a subway station in downtown Nagoya (particularly at night) and trying to orient oneself in a north-south or east-west direction was no easy task - particularly with a Japanese map. It took one notable professor three hours to locate his hotel on Saturday night. I would recommend a compass for any visitor to Japan.

As in Okasaki the meeting in Nagoya was arranged in special symposia and participants tended to stay in their groups rather than floating between sessions. At Nagoya there were twelve parallel symposia and the number of people attending this part of the meeting was much larger than in Okasaki. In Okasaki I was told about 200 participants, in Nagoya nearly a thousand, with 128 coming from the UK and Eire, over 700 Japanese and the rest from various other global countries. More dinners were generously arranged for each symposium group on the Saturday night, but for floating participants it was beer, rice and noodles in the local cafes.

The cheap and cheerful dishes in Japan are typically of noodles or rice cooked with some sort of meat, fish or vegetables and often served with miniature bowls of pickles, bean curd and other tasters. At the other extreme there are the expensive traditional dishes of Japan. For example sukiyaki, which is very thinly sliced filet-cut beef sauteed with vegetables in soya sauce and sugar - the cooking is typically done at the table. And of course the famous raw fish dishes known as sushi. Occasionally the fish is not just raw but alive and gaping after the flesh has been ripped off its back bone - this, according to the experiences of one Member of the Society. It was time for her to feign feminine fraility and queasiness.

Now if you are wondering how one deciphers a menu in Japanese, the answer is one doesn’t. Some of the restaurants and cafes have plastic replicas of the various dishes displayed in their
windows. It's a matter of point and hope for the best. Without plastic replicas one simply points to one of the numerous paper signs pinned on the walls - these not only have the name of the dish in Japanese but also have a number (indicating the price in yen). One goes for the price, not the food in these circumstances. The alternative is MacDonalds where the menu is bi-lingual and illuminated pictures of hamburgers have replaced the plastic replicas and paper posters. Teriyaki hamburgers are available.

Another alternative is to attack one of the numerous vending machines which grace most street corners. In these one can purchase anything from a disposable camera to hot coffee... and the rest. Usually the contents of these machines provides an English translation but sometimes even this would befuddle the tourist. I mean what, for example, is in a can of Pocari Sweat? This turned out to be a rather tasteless drink which, so the small print on the side of the can explained, is a drink that not only replaces all the things one loses during exercise (sweat) but also has a “fine osmolality”. What is not available in Japanese restaurants, or indeed vending machines, are napkins or serviettes. This was a problem when trying to slurp up a bowl of noodles swimming in miso soup with a pair of chopsticks.

Back to the Nagoya symposium. The afternoon session on Sunday proved to be quiet. The trade displays were dismantled on Sunday morning, people began to drift homewards. Monday morning was an early start both for those going to Korea and those returning home. We assembled at Nagoya airport, one of us without a ticket, and during the one hour flight to Tokyo we were treated to a splendid view of snow-capped Mount Fuji circled, half way up, by a frill of white clouds outlined against a clear blue sky.

Japan is not a cheap country, everything from simple commodities through to the luxuries is expensive. It is a modernized country yet with a deep rooted culture. There is a politness and correctness in their way of life. There is no room for sloppy manoeuvring. If a bus leaves at 8am it leaves at eight. When they announce that a train will be “making a short stop” they mean short. No packing up sandwiches or folding newspapers after the train has pulled up at a station. There are even white lines on train and subway platforms to indicate both the location of the doors when the train stops (they are aligned exactly) and which direction the queue should form.

There is little crime. Bicycles are left unlocked and umbrellas (part of the national uniform) are safely left in umbrella stands outside all shops. Well, they are safe until a notable Officer of the Society gets caught in the rain. He thought these umbrellas were for general use and simply helped himself to one of his choice when required. I hear he now has quite a good collection.

The Japanese are generous hosts and for those who so excellently organised a very stimulating Joint Meeting there was no limit to their kindness and help. There was a good scientific exchange and one of the greatest values of this meeting (apart from the chance to visit Japan) was to gain a better insight into all the advances that are being made by our Japanese colleagues. To them “domo arigato”.

Saffron Whitehead

YOUNG PHYSIOLOGISTS - TURNING JAPANESE

Chosen as two of the post graduates lucky enough to be awarded a Physiological Society travel grant to the joint meeting in April, we were delighted to arrive in the evening of the 28th March 1995, at the International Airport of Osaka, where we then had to negotiate our tickets for the Shikansen (Bullet Train) to Nagoya. We were immediately aware of our novelty value as Western females, due to the wide eyed stares of curious Japanese children. We were both arriving for the ‘Physiology on Pain’ symposium organised by Professor Takao Kumazawa who had organised for all the Western participants to stay in one hotel. Arriving by taxi, we first thought that the taxi driver had delivered us to the wrong place. The ‘Iris Aichi’ Hotel is over 20 floors high and could have fitted the entire physiology department at Bristol into the reception area!

During our first exploration of Nagoya city by night, we soon discovered that the normal form of after-work relaxation for groups of friends was in the infamous ‘pachinko’ (a vertical variation of a pinball) parlours. Feeling slightly apprehensive (due to our deplorable lack of Japanese) we decided to eat. A handy tip in this situation is to find a restaurant displaying plastic versions of its’ dishes in the window. Fortunately, this is extremely common and although plastic food is not particularly appetising, it made the task of choosing a lot easier. However, our ordered meals were a constant surprise when they arrived!

We spent the second day sightseeing. Visiting Japan’s oldest castle at nearby Inuyama. The original wooden structure is over 400 years old and still intact, unlike the majority of Japan’s castles, including that at Nagoya itself, which...
are mainly concrete versions rebuilt after 1945. This was followed by an extremely interesting visit to a ‘fertility’ shrine! This long day (spent with jetlag in a constant downpour of rain) was concluded in the hotel bar catching up with fellow Bristolians who had attended the Okazaki symposium.

The next day the weather had cheered up and we took the opportunity to look around the modern city of Nagoya itself. Visits to huge food halls in the basements of the large department stores were sheer indulgence - every possible type of food and drink with plenty of free samples!

In the evening of 30 March we had our first taste of Japanese hospitality at the main reception of the Joint Physiological Society Meeting held in the Toyota symposia, part of the University of Nagoya main campus. This was the only time all the participants of the Meeting were together in one building. After the Japanese custom of numerous introductory speeches, we had the chance to meet our hosts whilst enjoying the splendid array of food including sushi and tempura - with sandwiches for the less adventurous. The Japanese/British friendship aligned with copious amounts of Sapporo beer, sake and whiskey. The networking continued in bars in downtown Nagoya until hotel curfew.

The Meeting titled the ‘Integrative Mechanism of Physiological Function: From Ion Channel to System’ was held on 1 and 2 of April. The 12 symposia had been organised so that they included the work of both the invited Western speakers and Japanese participants. We were presenting our work as part of the ‘Physiology on Pain’ symposium. This focused on different aspects of the peripheral and central mechanisms of nociception and included interesting papers given by Gebhart (USA), Lynn (UK), Cervero (Spain), Perl (UK) and Schmidt (Germany) as well as a large Japanese contingent, a truly international meeting.

Lunch was followed by our poster session and as usual this involved a lively discussion and exchange of ideas. It was here that our privileged position in being able to attend this joint meeting was emphasised. It became evident looking around the poster hall that we were the only young physiologists in the ‘Physiology of Pain’ session.

Aside from the science, there was plenty of time to socialise with our symposium participants. On the evening of 1 April, our hosts totally surpassed themselves. We were treated to an absolute superb buffet on the top floor of a hotel overlooking the bright lights of Nagoya. Here we had a wonderful opportunity to taste all aspects of Japanese cuisine from shark fin soup (reportedly an aphrodisiac), to spider crab leg tempura and Japanese style roast beef. Osh! Delicious!! One really nice aspect of this evening was time to take to some of the undergraduate students who had been helping towards the smooth running of the meeting. An opportunity for them to practice their English and for us to meet some people of our own age!

On the final evening we were invited by Professor Kumazawa to join the invited speakers at a Chinese meal (Japanese style). Again, lots of very interesting food, including marinated jellyfish!

Along with the absolutely outstanding and generous Japanese hospitality, our adventure in Japan will be remembered for by the discovery of heated toilet seats, green tea, salad with breakfast, umbrella parks and sake hangovers! Any regrets would be restricted to our extremely limited command of the Japanese language, the lack of attendance by younger physiologists and having to leave just at the start of cherry blossom season.

We are grateful to the British Physiological Society, the guarantors of ‘Brain’, MRC, the Rushton fund and the Japanese Physiological Society for funding.
I don’t remember being taught anything about physiology and music. Having prepared this feature on the topic, I’m sure that such a course would prove to be very attractive. Unlike say immunology or molecular biology, there is much of common interest and overlap between physiology and music. In fact I am very conscious of all that has not been included in this feature. For example, I left out the most obvious area, auditory physiology, on the grounds that most of us would be somewhat familiar with this. Nor is there anything on the voice and singing. Professor T Sears informed me he used to give a lecture-demonstration on the ability to alter the voice and control respiratory patterns during singing, although not doing the singing himself.

The Magazine, alas doesn’t yet come with a free CD so we weren’t able to include this or other auditory stimuli! I have also not included medicine and music, for example the use of music therapy which is now an advanced discipline.

In her article on Mozart’s clarinet concerto, Dr Sheila Young writes about the respiratory system and its control when playing an instrument. As she works in Edinburgh, it is perhaps not surprising that the bagpipes also get a mention. The utilization of small motor units for control and speed is pivotal to playing many instruments, and is of course often used by us when teaching in this area. Cognition and motor skill in musical performance is the title of Professor Eric Clarke’s article. He gives examples of the motor skills involved (motor programming) for a pianist, which when described, always sound impossible to me – you can’t have two hands doing different things so quickly, rhythmically, accurately and with the right level of loudness, not to mention feet on the pedals! And then add to this “interpretation” and the performance which all come together and transcends the mere written notes, and distinguishes the artist from others. As scientists we often bemoan the fact that most civilised, educated people know about the arts but feel no embarrassment about a total ignorance of science. It is a pleasure therefore to know that Eric Clarke is the Professor of Music in Sheffield.

The production of music is one side of an equation. Our response to the music is the other. Clearly there are cultural considerations; music from other continents or even countries can sound strange and unmusical to our ears. Similarly development of musical styles and skills can depend upon the environment. This whole area of ethnomusicology is extremely interesting but too far from physiology to be included. The responses to music can be physical; bringing tears to our eyes, making our hairs stand on end, or our feet tap. The response is also emotional; we can feel uplifted, romantic, melancholy or tranquil. Music is marketed as “mood” music; for only £9.99 we can become stress-free, or sexy or positive in attitude etc etc. Supermarkets and shops choose their background music after much research into what makes us want to buy. Fast food restaurants play music that doesn’t encourage you to linger. Airlines have different music for getting you on board, keeping you waiting and travelling. Advertisers resort to specialists agencies to get music to match their advertising campaign. This can be so successful that records are re-released and enter the charts again. How sinister and subliminal all this is depends upon your point of view. Dr Petsche, a neuro-physiologist from Vienna, has written about his work applying methods of EEG analysis to reactions to music, both listening to it and composing. Perhaps not surprisingly differences were found between musicians and non-musicians. This then leads on to the question why are we not all musicians? As Professor John Sloboda writes, the general lack of musical accomplishment is often attributed to the presence or absence of “musical talent”. Read the article to see what the data actually showed when he tested this idea. All I will say is, if you’re a parent of a “non-musical” child, it will make you feel guilty.

Finally the idea for this series followed on from discussions with Julia Eisner, a freelance radio producer, whose five programmes on the “Body of Music” will be broadcast on Radio 3 in The Music Machine, 5.00 pm each day starting 7 August 1995. This series will fill in some of the gaps and provide the musical accompaniment. Julia has written a short piece describing the trials and tribulations of persuading you, dear reader, to talk to her. We still have along way to go in overcoming our fears of the media. Yes, they will edit you, quote you out of context and expect you to be a little speculative and very succinct - but we have to be prepared to live with this and participate, if we believe that it’s healthy for us and the public to better understand physiology.

Susan Wray
Physiological Laboratory
University of Liverpool
A PHYSIOLOGICAL STUDY OF MOZART’S CLARINET CONCERTO

The respiratory system is usually portrayed as chugging away 12 to 20 times a minute to keep us alive. Yet this same system is delicately controlled to bring about the intricate movements involved in human communication. How much poorer the quality of life would be without speech, laughter and the exquisite music of wind instruments!

It is possible to persuade subjects to play the clarinet after swallowing miniature pressure transducers. Our three subjects had these small transducers in the oesophagus and stomach and at the back of the throat. They were inserted through the nose so the musicians could still use their mouths to create the varied embouchures used in clarinet playing.

For this study, which was carried out in collaboration with a clarinettist Martin Foster during his elective dental period, we selected interesting parts of the Mozart’s Clarinet Concerto. We were guided in our selections by watching TV masterclasses on this concerto given by Jack Brymer. We could easily relate the pressure patterns obtained to the music. So much so that when one of the musicians was showing me the part of the score he has played and accidentally pointed out the wrong part I immediately spotted his mistake when I compared the score and the recorded pressure patterns.

Before launching into Mozart’s Clarinet Concerto we studied scales played in various ways, arpeggios and overblowing, where the fingering remains constant but different notes are produced by altering the embouchure. The lower notes require higher thoracic pressures (about 3kPa) than the lower ones (about 1.5kPa). This is in contrast to the pressures used in playing brass instruments and bagpipes where the higher the notes the higher the pressure that is required. In the clarinet the higher notes are nearer the resonant frequency of the reed and consequently less pressure is required to bring about its vibration Benade (1976).

Mozart’s Clarinet Concerto has three movements: Allegro, Adagio and Rondo. An excerpt from the third movement is shown in Fig 1. It begins with four emphasised notes each associated with a large pressure pulse. This is followed by legato in which the pressure traces are relatively smooth whereas in the quaver staccato at the end each note is associated with a pressure pulse. In contrast at the beginning of the excerpt from the first movement in Fig 2 in semi-quaver staccato there are no pressure pulses associated with the individual notes. In this case the staccato is brought about solely by movements of the tongue. This is probably due to the faster response times of the small motor units in the tongue compared with those in the
The contrasting ways in which musicians must control their respiratory systems are well illustrated by examining the last four bars of the Adagio in relation to the first nine bars of the Rondo which were both played in 16 seconds (Fig. 3). The immense beauty of the Adagio is created by playing slow sustained notes whereas playing notes rapidly created the vivacity and brightest of the Rondo.

**Sheila Young**

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**Cognition and Motor Skill in Music Performance**

As an example of complex human behaviour, music performance at its highest level demands a remarkable combination of physical skill, and cognitive and emotional sophistication - akin to the manual dexterity and speed of movement required in a sport such as tennis - combined with the mental powers of a chess player and the motive capacities of an actor. A concert pianist may be required to play with both hands at speeds of ten or more notes per second in complex and continually changing spatial patterns on the keyboard, and with distinct temporal, dynamic and articulation patterns. At the same time s/he must be aware of the immediate and larger scale structure of the music itself. Abilities such as these do not develop overnight and, by the time the best performers have reached the age of 21, they are likely to have spent over 10,000 hours of practising their instrument (Ericsson et al, 1993), quite apart from the time spent in more informal involvement in music.

As a physical skill, musical performance has attracted the interest of cognitive psychologists studying complex spatial and temporal skills (eg Shaffer, 1981), for whom the fascination of musical performance is in part the thorough interpenetration of the mental and the physical. A dominating explanatory framework here has been the theory of motor programming, which aims to show how abstract intentions can be transformed into action. A motor program is an abstract specification of movement, and one of the ways in which this abstraction must become concrete is the matter of timing. Timing is particularly important for music performance, since the temporal characteristics of a performance are a crucial aspect of the musical structure itself, and it has been shown that expert performers can achieve remarkable precision and stability in the timing of performance at levels ranging from the individual note up to the whole sections or complete pieces. As an example, a concert pianist who played a three-minute piano piece by Erik Satie three times on the same afternoon showed less than 1% variation in the total duration of two of the performances and less than 2% variation between the longest and shortest performances - and this without any explicit instruction to play the piece in an identical manner each time.

The single most significant feature of motor skill in performance is the crucial role of a representation from which the specific features of a performance are generated. This idea has formed the core of a number of generative theories which have attempted to explain the expression in performance in terms of a rule system of some kind which transforms a whole variety of musical dimensions (tempo, loudness, attack, timbre, tuning, vibrato, etc) in performances (eg Clarke, 1988). The critical evidence is that performance expression, even in sight-read performances, which can be understood as controlled deviations from the explicit notation of the written music, can be extremely stable over repeated performances; these may sometimes span a number of years. However such expression can also be changed by a performer at a moment's notice. These observations mean that expression cannot possibly be understood as a learned pattern, remembered and applied to a piece each time it is played, but must be generated from the performer's understanding of the musical structure. The stability of performances over time reflects the stability of a performer's representation of the musical structure; the existence of expression in sight-reading stems from the performer's emerging understanding of the music as s/he reads and organises it; and differences in expression are the consequence of the many different ways in which musical structures can be interpreted.

As an illustration, the figure overleaf shows timing data from the first half of two performances of the Chopin prelude in E minor, op 28 no 4 by the same professional pianist. The graph indicates the moment-by-moment fluctuations in tempo for the quaver chords in the left hand that support the main melody.
Two features in particular are evident: first, there are very considerable tempo changes (up to 100% within a single bar) that are not explicitly notated in the music but which have a systematic relationship to the structure of the music, and represent the performer’s expressive response to it. Second, the two performances show a striking degree of commonality, but also demonstrate significant differences of interpretation. The two actually come from a set of six freely-given performances of the piece recorded within a period of about one hour, and illustrate in microcosm the point that expression in both highly controlled and flexible.

But the sources of musical expression are not all abstract: a wide range of other factors including the possibilities of the instrument, the acoustics of the performing environment, the nature of the audience and the mood and intentions of the performer contribute. Movement, and the human body, are particularly significant in this complex set of relationships for all sorts of reasons - the most obvious being that music is produced by human and instrumental movement, and is thus indelibly stamped with its bodily and instrumental origins (see Repp, 1993). Composers have to be intensely aware of the physical/technical possibilities of the instruments for which they write, and frequently explore and expand these possibilities in fascinating ways. The music for solo violin and solo cello by J S Bach provides an outstanding example, where the composer has explored the ways in which polyphonic music could be written for, and performed on, an instrument that is essentially designed to play only a single melodic line. The result is a miraculous synthesis of technical innovation and musical construction, the music gaining added force from the way in which purely musical considerations interact with the physical/technical solutions that Bach (and the performer) finds. Similarly, ethnomusicologists have shown how the development of musical styles in a variety of diverse cultures can be traced quite directly to ergonomic factors associated with the instruments on which that music evolved.

The last ten to fifteen years have seen enormous advances in our understanding of what it is that makes music come alive in performances - advances that have been strongly influenced by the same kinds of linguistic and computational models that have profoundly affected psychology as a whole. The revival of an approach that includes a stronger recognition of the close links between physiology and psychology promises to take research ahead in exciting new directions.

Eric Fillenz Clarke
Dept of Music, University of Sheffield

References

MUSIC ON THE BRAIN

Listening to music leads to personal experiences of extreme complexity, which among others depend on the emotional and intellect of the listener and on his cultural and educational background. How can a neurophysiologist, who is used to working with animals, dare approach such a tremendous problem reaching far beyond his methodologically limited horizon? When we started working in this field more than a decade ago we were puzzling about questions like these. Up until this time I had been working mainly on the structural background of the generation of the EEG with particular interest in epileptic phenomena (Petsche et al, 1984). We found that spectral analysis supplied much valuable data for understanding the processes underlying the EEG.

Turning to Music

So, triggered into the field of music research, I wanted to apply our investigative methods and knowledge of the EEG to look at possible reactions to music. My intentions were confirmed by new concepts of the fine structure of the cortex. Based on statistical studies, Braithenber and Schüz (1990) concluded that the main purpose of the neocortex must be the achievement of a maximum possible convergence and divergence of signals. Thus, the best way to search for possible changes of the EEG induced by music would be to study the electrical relations between different brain regions rather than simply a localised production of electrical signals. The coherence parameter
rest, caused by 5 min listening to Schönberg and by composing both a tonal and an atonal piece of music. Drawn-out lines symbolize increases of coherence, ie electric and, thus, functional cooperation, dashed lines indicate the reverse. The figure demonstrates that music leads mainly to increased cooperations between different regions within each and between both hemispheres, mostly while composing atonally.

**Synchronization Between Brain Regions**

Group studies yielded differences between musicians and non-musicians, gender differences and differences due to listening to pieces of different composers and styles. Single case studies yielded a great deal of invariant findings even if the examinations were several weeks apart. Neurophysiologically, this procedure can be considered as a proper method for the detection of changes of the degree of “micro-synchronization”, so to speak, between different brain regions. In subsequent studies, alterations of the topography of micro-synchronization have turned out to accompany any mentation, as was shown for listening to language, simultaneous interpreting of languages, silent reading, visual thinking, memorizing and abstract thinking. In addition, relations between EEG parameters and psychological features, such as intelligence, creativity, memory and visual imagination were found: such as between musicians and non-musicians, EEG differences were also substantiated between artists and non-artists.

Most likely, such changes of coherence represent a phenomenon which may be called “differential attention” and is very complex, both functionally and topographically. At least five transmitter-specific systems subserving attention are known to project onto the cortex where they show remarkable regional, laminar and intracortical specificity. These state-setting systems are particularly well-suited for rapidly shifting the activation state of the neocortex and are thought to ensure the “colour” of the experience versus its content (Mesulam, 1990). The EEG seems to access this low level of interactive information processing and could thus be tapping into fundamentals of thinking processes.

**Hellmut Petsche**

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Considering how widespread a phenomenon music is within our society, and the fact that listening to music is an important part of so many people’s daily lives, it is something of an enigma that so few people develop any significant level of music performance ability. In countries such as the USA and the UK, almost every child in school receives classroom music instruction from an early age. Yet the general level of musical achievement in the school-age population is surely well below that of many other skills addressed by the school curriculum.

A popular line of explanation for this general lack of musical accomplishment in the population is the invocation of the presence or absence of “musical talent”. According to this view, few people become expert musical performers because few people have the necessary talent. Whilst not wishing (or being in a position) to deny that inherited differences between individuals may play some role in determining to what extent musical skills are acquired, I and a group of colleagues (Sloboda, Davidson, Howe and Moore, 1996) have been collecting data which supports a rather different view.

We have obtained a wide variety of information, mostly biographical, on 257 young people in England. They were selected to represent a range of current performance achievement on musical instruments, from the outstandingly able through to the modal “tried an instrument, but gave it up”.

No Special Early Signs

It has often been supposed that individual differences in musical accomplishment are prefigured by individual differences in early signs of musicality, as appears to be the case for some legendary “geniuses” such as Mozart, and other child prodigies. Our results do not confirm this supposition (Howe, Davidson, Moore and Sloboda, 1995). Similarities between children of different abilities far outweighed the differences, which were non-existent on many measures. The difference most favourable to the “talent” account was a six-month average advantage for high achievers in singing a recognisable tune (18 months of age, as opposed to 24 months for the other children). However, this group showed earlier parent-initiated musical activity too, and so the result may be a consequence of differential parental behaviour. We have considerable evidence from other parts of our study that the parents of the highest achieving children showed unique behavioural characteristics.

Practise Makes Perfect

Another common supposition is that “talented” individuals can achieve without much effort, whereas less talented individuals fail to achieve even when they work hard. Our study examined this issue. All participants were asked to provide estimates of average daily practice for each year of life since beginning to learn an instrument. A strong relationship was found between practise and achievement level. Members of the highest achieving group were, even by the age of 12, practising an astonishing 800% more than the members of the lowest achieving group (two hours a day, as compared to 15 minutes a day). The intermediate groups fell between these extremes in exact order of achievement. We found no individuals in our sample who practised as much as two hours per day yet failed to achieve high levels of skill! Such cases would surely be predicted in considerable numbers were the “talent” account correct.

A chance feature of the UK instrumental education system allowed us to be even more definitive about the practise/achievement. The vast majority of children learning instruments in the UK are entered by their teachers into a national system of graded instrumental examinations, which are set and examined by a nationally constituted panel of trained assessors, whose purpose is to provide equivalent measurements across the country. There is a preliminary grade, and eight main grades, which, as a very rough guide might each represent a year's additional work on an instrument. The pedagogic practices of many teachers are totally determined by the requirements of these grade examination syllabuses.

Every child in our sample had entered for these examinations, and we were able to ascertain at what age each grade level had been reached. This allowed, for each group, the calculation of the average number of hour's formal practice required to achieve each grade. This amount proved to be not significantly different between groups. The relationship between grade level and practice for the whole sample is shown in Figure 1. This indicates, for instance, that, regardless of ultimate achievement level, it takes an average of 1200 hours of formal practice in total to achieve grade 5 standard (or 300 hours to get there from grade 4). The reason that Group 1 achieve grade exam successes earlier than other groups seems entirely due to having accumulated the requisite amount of practice more quickly. There is absolutely no evidence of
a "fast track" for high achievers. Indeed, there is a non-significant trend for high achievers to practise more than low achievers to reach a particular grade.

Parents Matter

Our study also provided some data which helped explain why the groups differed so much in the amount of daily practice they were capable of (Davidson, Sloboda and Howe, 1996). At the outset of instrumental study Groups were broadly equivalent on a crude measure or practice motivation. All reported having periods when motivation to practice was low, and when they probably would not have practised at all without parental intervention. However, parents of the highest achieving children were more likely to attend instrumental lessons with their children, obtain detailed feedback and instructions from teachers, and actively supervise daily practice on a moment-to-moment basis, often at some considerable cost to their own schedule. For instance, one family with three high achieving siblings adopted a daily routine in which the father would supervise the individual practice of each child in 30 minute intervals from 6.00 am till 7.30 am prior to the family dispersing to school and work. Parents of low achieving children were less likely to have meaningful contact with the teacher, and were likely to confine their domestic interventions to telling children to "go and do your practice", without any direct involvement in it. In sum, therefore, it seems that abnormally high levels of early practice are sustained by abnormal levels of social and cognitive support, mainly from parents.

Conclusion

Our study inclines us to believe that what separates high achieving young musicians from drop-outs is not innate talent, but supportive parents and high levels of practice. Because practice is hard and often unrewarding, parents need to do more than make encouraging noises - they need to roll up their sleeves up and get involved in the details of their children's learning. Even Mozart did not spring from nowhere. His father devoted several hours each day to one-to-one tuition. By the age of six, Mozart had probably practised as much as most young people manage by the age of sixteen. Talent may distinguish the genius from the merely excellent, but most of us could become fine musicians if only we had the motivation to put in the hours.

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References
It wasn’t a great start, but at least I had the chance to ask a series of even stupider questions about neurology, neuro-psychiatry, physiology and neuro-physiology that I wouldn’t have dared ask a stranger.

After this my little team compared notes and realised we were beginning to come up with the same names and the same answers. In my experience, whatever the subject, if you make enough phone calls you eventually get to the right people - and by ‘right’ I mean that they know their stuff and can talk about it. It was surprising to find that few of the scientists we rang were aware of others doing relevant work in this field. We also found them reluctant to speak about anything other than their own work - speculation was out of the question. Predictably we found that many of the experts were abroad, in Canada, the USA, and Austria, but we also discovered that there were people in this country doing all sorts of interesting things that nobody else seems to know about.

It was then time to look into the music side of things - terra firma for me - nevertheless I still went for the gut reaction and rang an old university friend (we did music at Sussex) who is now Professor of Music at Sheffield University. As luck would have it he turned out to be one of the music and psychology experts we were looking for, but unlike the scientists he did know exactly who was doing what in the same and related fields.

So putting a series together is a mixture of luck, who you know and hours of phoning around until you collect enough material. I discovered one potential interviewee while talking to the press department at the Institute of Psychiatry. I rang initially to talk to one of the Professors there, but after several attempts I gave up. At this point an astute member of the press department faxed an article from *The Lady* magazine to me which amazingly turned out to be extremely helpful - though why it was published in *The Lady* I shall never know. I did eventually get hold of the elusive Professor who was delightful, but of no use to me.

Once found, the ‘expert’ needs to provide the information in a succinct, yet lively way. Radio interviews reveal a great deal so the mixture of hard fact and chatty, maybe even witty, style without rambling off the point, is a skill in itself. Although the end result is always edited it’s a joy to find someone who is prepared to condense their research of possibly twenty years into five minutes and who understands that the broadcast is not going to present their life’s work in its entirety.

In general the scientists were helpful and friendly (though sometimes hard to find) and didn’t seem to mind the displays of total ignorance. I was very keen on trying to record some sort of experiment or demonstration that would illustrate the ‘expert’s’ point but this was hard to explain and impossible to arrange. The most frustrating aspect was the lack of any centralised information on the subject which meant that I was never quite sure whether the person I had got was exactly right. To this day I am still being contacted about so and so who’s researching into this and that. Having found enough interviewees, the job is now to make sure that the ‘experts’ are clear and comprehensible without being patronising and that the programmes are enjoyable to listen to. Time to start wielding the razor blade.

*Julia Eisner*

*Julia Eisner* is a freelance radio producer. “The Body of Music” - series of five programmes - will be broadcast in The Music Machine at 5 o’clock every day starting on 7 August 1995 on BBC Radio 3.

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**University of Edinburgh**  
**Dept of Preclinical Veterinary Sciences**  
**POSTDOCTORAL RESEARCH FELLOW**

Applications are invited for a postdoctoral research fellowship, supported for 3+ years by the Wellcome Trust, to study plasticity of spinal somatosensory processing, particularly in terms of regulated expression of mediators. The successful candidate will join a group employing a range of electrophysiological, molecular biological and biochemical techniques to address this and related issues. Relevant experience, especially in molecular biology as applied to neuroscience, would be an advantage.

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Further details from: Personnel Office, University of Edinburgh, 1 Roxburgh Street, Edinburgh EH8 9TB, with whom applications, including CV and the names and addresses of three referees, should be lodged.

Closing date: 23 June 1995
Welcome to a new regular column for The Physiological Society Magazine.

With every issue of the Magazine we will be bringing you the latest news on physiological and other biomedical resources of interest accessible over the Internet. If you know of any resource that you think will be of interest to others or if you or your department is engaged in any online activity then please do send in suggestions for the Net Watch column. In future columns we will not only be focusing on available resources but also on how to access them, including where to get the software.

**Physiology MCQ Database Project**

http://medweb.bham.ac.uk/http:/caia/\n
There is a project well under way in the Physiology Department at The University of Birmingham to provide a national physiology multiple choice question database. The questions, both clinical and preclinical, would be suitable for all undergraduate level biomedical students. At this stage there are a number of options for sharing this database. Presently, anyone can contribute, download or use questions directly via the Internet, specifically the World Wide Web (WWW), using the WWW address or URL at the head of this piece. You can of course contact the department directly with a view to contributing to the database but in addition you can use an automated delivery system to request questions from the database either via email or WWW. Simply send an email message with the subject 'help to:
medweb@bham.ac.uk

At Birmingham, we have set up our WWW server to deliver, mark, and collate an MCQ test completely automatically. This service is also available on trial at the address above. Further details about this project can be obtained from David Davies, Dept of Physiology, Birmingham University.

**Physiology Online**

http://physiology.cup.cam.ac.uk/

This World Wide Web (WWW) site is the electronic information service of The Physiological Society. Visit this site for all the latest news from the Society as well as Society publications, submission guidelines, meetings information etc. You can also use this server to search the Journal of Physiology and Experimental Physiology. Physiology Online is also a good starting off point as it contains links to many national and international physiology departments. The site is maintained by Andy Mell (amell@cup.cam.ac.uk) for The Physiological Society and can be accessed using any World Wide Web (WWW) client such as NCSA Mosaic or Netscape.

**Physiology Mailbase Discussion List**

physiology@mailbase.ac.uk

Lastly, a reminder about the new physiology email discussion list. To join this list, send an email message to mailbase@mailbase.ac.uk

Leave the subject line blank and set the body of the message to subscribe physiology your name

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**VITAL SPELLING?**

The spelling of the word plethysmography often confounds students. A recent one found in a SAQ was phlysmography? Is this a new method for measuring blood flow in vital organs?
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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 Autumn 1995 edition (to be distributed on 25 August) should reach the Administration Office by 17 July.

Young Physiologists Symposium
CELLS, SLICES, SYSTEMS - NEW TECHNIQUES IN NEUROSCIENCE
3 July 1995
Bristol
Sponsored by The Physiological Society and fixes. Further details from: Young Physiologists Symposium, Dept of Physiology, School of Medical Sciences, University Walk, Bristol BS8 1TD, tel (0117) 928 7809, Email bris-yps@bristol.ac.uk ★

Royal Microscopical Society
CYTO 95
3-6 July 1995
Southampton
A series of bi-annual international scientific meetings to take a fresh, critical look at areas of the life sciences currently under intense research. The new circular with provisional programme is now available. Further details from: The Royal Microscopical Society, 37/38 St Clements, Oxford OX4 1AJ, tel (01865) 248768, fax (01865) 791237, Email rms@vax.ox.ac.uk ★

Royal Microscopical Society
CONFOLICAL MICROSCOPY, 3D MEASUREMENT AND STEROEOLGY
24-28 July 1995
Liverpool
Designed for microscopists examining all types of biologically based materials, from living cells to food. Further details from: Royal Microscopical Society, 37/38 St Clements, Oxford OX4 1AJ, tel (01865) 248768, fax (01865) 791237, Email rms@vax.ox.ac.uk ★

European Society for Photobiology
6th ESP 95
2-9 September 1995
Churchill College, Cambridge
The programme will cover all aspects of photobiology but there will be a very strong photomedicine content. Further details from: Dr Paul Heels, Faculty of Science, Health & Medical Studies, The North East Wales Institute, Plas Coch, Mold Road, Wrexham, Clwyd, LL1 2AW, fax (01978) 290008, Email heelspl@newi.ac.uk ★★★

Federation of the European Physiological Societies (FEPS)
FIRST CONGRESS
9-12 September 1995
Maastricht, The Netherlands
Further details from: Conference Agency Limburg, PO Box 1402, 6201 BK Maastricht, The Netherlands, tel (00 31) 43 619192, fax (00 31) 43 619020 ★★★

School of Biological Sciences
University of Manchester International Symposium
AQUAPORINS & EPITHELIAL WATER TRANSPORT
Manchester Business School
13-15 September 1995
In addition to keynote lecturers (including Peter Agre, Dennis Brown, Maarten Chrispeels, Mark Knepper, Sei Sasaki, Alan Verkman) and poster presentations by invited participants, poster sessions will allow other participants to present and discuss their research. Registration, which covers accommodation, meals and hospitality, is £180. Scholarships may be available for young investigators (under 35 years). Further details from: Maynard Case, School of Biological Sciences, University of Manchester, Manchester M13 9PT, fax (0161) 275 5600, Email rmcase@man.ac.uk ★

Polish Neuroscience Society
2nd International Congress
13-16 September 1995
Cracow, Poland
Basic topics include: neuroactive amines, neurotransmitters, myelogenesis, brain & spinal cord plasticity, brain injury, neuroinjury, melatonin, memory & learning. Further details from: Dr K Ossowska, Institute of Pharmacology, Polish Academy of Sciences, 12 Smetna St, 31-004 Krakow, Poland, tel (00 48) 12 37 40 22, fax (00 48) 12 37 45 00 ★★★

Royal Microscopical Society
COMPUTERS IN MICROSCOPY
17-21 September 1995
Cambridge
This intensive course will provide an introduction to basic computer techniques applicable to microscopy, plus an up to date review of current practice and an exhibition of equipment currently in use in all types of microscopy. Further details from: Royal Microscopical Society, 37/38 St Clements, Oxford OX4 1AJ, tel (01865) 248768, fax (01865) 791237, Email rms@vax.ox.ac.uk ★

SECOND WORLD CONGRESS ON INFLAMMATION
17-22 September 1995
Brighton
Symposia and workshops include: lipid & peptide mediators, nitric oxide, cytokines/chemokines, receptors & transduction mechanisms, adhesion mechanisms (selectins/integrins, ICAMs), angiogenesis, pain & neurogenic inflammation, cartilage & bone metabolism, lung/gastrointestinal/CNS inflammation, immunogenetics & gene therapy, metalloproteinases & inhibitors, anti-inflammatory drugs (steroids/PDE inhibitors) etc. Further details from: Inflammation 95, Triangle House, Broomhill Road, London SW1H 4HX, tel (0181) 877 9920, fax (0181) 877 9308 ★

A Physiological Society Symposium
ION TRANSPORT IN HEALTH & DISEASE
19-20 September 1995
Cork, Eire
The symposium will cover ion transport properties and regulation in a wide variety of mammalian tissues, including lung, gastrointestinal tract, kidney, chondrocytes and erythrocytes. Further details from: Prof B J Harvey, Wellcome Trust Cellular Physiology Research Unit, Dept of Physiology, University College, Cork, Eire, tel (00 353) 21 276871 Ext 2236, fax (00 353) 21 272121, Email harvey@iruccvax.ucc.ie ★

Astronomy School
COGNITIVE NEUROSCIENCE
Oxford
26-29 September 1995
Intended for graduate students, postdoctoral scientists and third year undergraduates considering the possibility of research in neuroscience. Each day is devoted to a particular area of cognitive neuroscience: development, plasticity & adaptation in sensory systems; recovery & rehabilitation; cognitive neuropsychiatry; memory & hippocampal function. Dr W Newsome (Stanford, USA) will give a McDonnell-Pew Lecture on Seeing and deciding; a neural basis for motion vision on 27 September. The course is offered free of charge, with a limited number of bursaries to contribute to travel & accommodation costs. Further details from: Administrative Secretary, MRC Research Centre in Brain & Behaviour and McDonnell Pew Centre for Cognitive Neuroscience, Dept of Experimental Psychology, South Parks Road, Oxford OX1 3UD, tel (01865) 271364, Email cognenuro@vax.ox.ac.uk ★
Spanish Society of Physiological Sciences
27th NATIONAL CONGRESS
Salamanca, Spain
2-5 October 1995
Organised in conjunction with The Physiological Society, the Congress will include three plenary lectures (C.R Boyd, R Linas, S Grisolia) and symposia on supraspinal mechanisms in the control of movements, aging, cardiovascular physiology & the physiopathology of hypertension control, intrinsic & synaptic control of neuronal excitability, digestion & absorption in the small intestine, neuroimmunoendocrinology, the molecular basis of cell secretion, the physiology of proliferating cells and nitric oxide & the nervous system. Deadline for reduced registration fee: 15 July 1995. Further details from: TESTTEX. C/ Melchor Cano 15, 37007 Salamanca, Spain, tel (00 34) 23 255115, fax (00 34) 23 258703.

11th Symposium on Biotechnology GENES AND THE BRAIN
13-14 December 1995
University College London Medical School
Organised by the IOB and the BBSRC, this symposium aims to review an active area of neuroscience research, the genetic basis of brain disorders, with particular reference to the genes which influence animal behaviour and those which underlie human neurological and psychiatric illnesses. The £10 registration fee includes refreshments on both days. A reduced fee of £30 will be available for 20 senior graduate students, to be limited to one per institution and allocation on a first come, first served basis. Further details from: Barbara Cavilla, Institute of Biology, 20-22 Queensberry Place, London SW7 2DZ, tel (0171) 581 8333, fax (0171) 823 9409.

Gordon Research Conference MAGNESIUM IN BIOCHEMICAL PROCESSES & MEDICINE
28 January-2 February 1996
Ventura, California, USA
To include: modern aspects of basic magnesium research; measurements of ionised plasma magnesium concentrations; recent clinical trials; poster session for PhD students and postdoctoral workers. Further information from: Prof J A S McGuigan, Institute of Physiology, Buhlplatz 5, 3012 Berne, Switzerland, tel (00 41) 31 631 8704, fax (00 41) 31 631 4611, Email mcguigan@pyllunibe.ch.

Euromech 344 Colloquium FLUID-STRUCTURE INTERACTIONS IN BIOMECHANICS
10-13 April 1996
Imperial College, London
Deadline for receipt of abstracts: 20 November. Further details from: Prof C G Caro, Centre for Biological & Medical Systems, Imperial College of Science, Technology & Medicine, London SW7 2BX, fax (0171) 584 6897, Email euromech96@ic.ac.uk.

International Association for the Study of Pain
8th WORLD CONGRESS ON PAIN
17-22 August 1996
Vancouver, Canada
All aspects of acute and chronic pain, including cancer pain, basic research and clinical management. Further details from: IASP Secretariat, 909 NE 43rd St, Suite 306, Seattle, WA 98105, USA, tel (00 1) 206 547 6409, fax (00 1) 206 547 1703, Email iasp@locke.hs.washington.edu.

MSc IN NEUROENDOCRINOLOGY
This full time course (12 months), starting 18 September 1995, will provide clinical and basic scientists (with a first degree or equivalent in medicine, dentistry, biological or veterinary science) with advanced academic knowledge & laboratory training, comprising two taught modules (10-11 weeks each) and a six month lab-based research project. It will be of value to both basic and clinical scientists, providing basic training for those wishing to pursue a career in scientific research. For medically qualified students, it will provide a basis for a PGCE, for further research and for those aiming to become clinical neuroendocrinologists. Further details from Dr John Wharton, Dept of Histochemistry, tel (0181) 740 3965, fax (0181) 743 5362, or the Registry, Royal Postgraduate Medical School, Du Cane Road, London W12 ONN, tel (0181) 740 3118, fax (0181) 743 6764.

Journal Back Volumes
Dr John Kemm, a former Member of the Society, would like to dispose of his Member's copies of The Journal of Physiology (1975-1991) and his set of the Journal of Endocrinology (1973-1988). He can be contacted on (0121) 456 5600 and will be particularly pleased to hear from a Third World medical school. Merton College Library would also like to dispose of its copies of The Journal of Physiology (1949-1987); anyone interested should contact Dr Sarah Bendall on (01865) 276308.

One of the Remotest B&Bs in Britain
Members may be interested to know that Dr Peter Kohn, recently retired from the Sheffield Dept of Biochemical Science, will now be offering Bed & Breakfast in the Highlands at what his predecessors described as "the remotest B&B in Britain" at Karrachar, Kylesku-by-Lairg, Sutherland IV27 4HW, tel (01571) 833 288.

Visiting Scientists
Foreign visitors of the status of at least postgraduate student, working in laboratories of Members of the Society, may be made "Visiting Scientists" by the Society. They are then eligible to remain so, fulfils the criteria for Membership and is likely to benefit from Membership of the Society and take part in its activities. Further details from: Stephen Linsay, Dept of Physiology, School of Medical Sciences, University Walk, Bristol BS8 1TD, tel (0272) 303461.

Overseas Members
Overseas Members receive their Meetings packets only a short time before a Scientific Meeting. A consequence, making travel arrangements and reservations can be a problem. To help Overseas Members, booking forms for Meetings can be requested in advance of the usual delivery date from the Meetings Secretary's office.

Designated Sessions at Scientific Meetings
The Society has agreed that part of each Meeting can be set aside in advance for a Designated Session on a special topic. Further details from: Stephen Linsay, Dept of Physiology, School of Medical Sciences, University Walk, Bristol BS8 1TD, tel (0272) 303461.

Animal Legislation
The Committee of The Physiological Society has an advisory group that monitors the working of the Animal (Scientific Procedures) Act 1986. Members are asked to provide any relevant information relating to its local implementation to:

Tony Angel, Dept of Biomedical Science, The University, Sheffield S10 2TN, tel (0742) 701442.

Cecil Kidd, Dept of Biomedical Sciences, Marischal College, University of Aberdeen, Aberdeen AB9 1AS, tel (0224) 690618/273004.

Stephen Linsay, Dept of Physiology, School of Medical Sciences, University Walk, Bristol BS8 1TD, tel (0272) 305461.

Membership of The Physiological Society
The minimum criteria for consideration by the Committee for inclusion on the Membership List (as Ordinary or Foreign Members) are:

1 A candidate must have given at least one Communication or Demonstration in person to the Society.
2 A candidate must have published at least one full research paper on a physiological subject in a reputable journal.
3 The candidate must obtain the signatures of SIX Members of the Society who will sign a statement declaring that the candidate is well known to them, is practising in physiology or a cognate subject and is likely to remain so, fulfils the criteria for Membership and is likely to benefit from Membership of the Society and take part in its activities.

Full details and forms are available from the Administrator (Membership), The Physiological Society, PO Box 506, Oxford OX1 3XE, tel (01865) 798498, fax (01865) 798092, Email hkdalitz@vax.ox.ac.uk.
PUBLICATIONS OF THE PHYSIOLOGICAL SOCIETY

Journals

The Journal of Physiology

Two softbound issues per month in eight volumes of three issues each, plus six extra Proceedings volumes and an annual index. Price (1994 issues): £820 or $1,575 (airmail: £262 extra) [Price to Foreign Members: £95/$180]. Available from: Journals Marketing Dept, Cambridge University Press, The Edinburgh Building, Shaftesbury Road, Cambridge CB2 1RP or (USA, Canada & Mexico) Cambridge University Press, 40 West 20th Street, New York, NY 10011-4211, USA. ISSN 0022-3751

Experimental Physiology


Monographs of The Physiological Society

No 41: The Energetic Aspects of Muscle Contraction (1985) Wolledge, Curtis & Homsher
The last few copies of No 41 are available from The Physiological Society, PO Box 506, OXFORD OX1 3XE to its Members and Affiliates at the special offer price of £10 plus postage and packing (£2.15 UK; £2.75 overseas surface mail).

Nos 43-45 are available from: CWO Dept, Oxford University Press, Saxon Way West, Corby, Northants NN18 9ES, tel (01536) 746337, fax (01536) 744964.

Study Guides

Physiological Society Study Guides


The above titles are available from The Physiological Society, Administration & Publications Office, PO Box 506, Oxford OX1 3XE, tel (01865) 798498, fax (01865) 798092. [Price to Affiliates: postage only. Price to Members: £2 per set of four, excluding Neuronal Communications, plus postage. Copies are also available at the Society’s stand at Scientific Meetings.]

Studies in Physiology


Books


Careers Information


Physiology: An Inside View Video available to residents of UK/Eire on loan free of charge.
Available from: The Physiological Society, Administration & Publications Office, PO Box 506, Oxford OX1 3XE, tel (01865) 798498, fax (01865) 798092.
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<th>AWARDS</th>
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<tr>
<td>AFFILIATE TRAVEL GRANT SCHEME</td>
<td>To enable Affiliates to attend meetings and symposia overseas</td>
<td>Affiliates in the British Isles who have not already received a grant under this scheme</td>
<td>Up to £600</td>
<td>Applications are considered at the end of January, March, May, July, September and November</td>
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<td>BENEVOLENT FUND</td>
<td>To assist persons who have contributed to the advancement of Physiology and are in necessitous circumstances</td>
<td>Physiologists, their staff and dependants</td>
<td>Depend on circumstances</td>
<td>Applications are reviewed immediately on receipt</td>
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<td>BURSARIES</td>
<td>To support graduates undertaking MSc courses in physiological disciplines who cannot obtain funds from other sources</td>
<td>Science graduates of institutions in the British Isles</td>
<td>Up to £2,000</td>
<td>Applications are considered at the end of May and November</td>
</tr>
<tr>
<td>DALE FUND</td>
<td>To promote new physiological research in the British Isles</td>
<td>Physiologists working in the British Isles</td>
<td>Travel for collaborative research, learning new techniques, practical workshops and training courses: up to £800. Travel to conferences and symposia: up to £300</td>
<td>Applications are considered throughout the year</td>
</tr>
<tr>
<td>EASTERN EUROPEAN AND THIRD WORLD SUPPORT SCHEME</td>
<td>To support centres of scientific excellence where high quality physiological research is threatened by lack of resources</td>
<td>Centres of physiological research in Eastern European and Third World countries demonstrating scientific excellence and financial need</td>
<td>Up to £10,000 per annum, for up to three years</td>
<td>Applications are considered at the end of January, March, May, July, September and November</td>
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<td>EASTERN EUROPEAN AND THIRD WORLD VISITOR FUND</td>
<td>To allow physiological workers in Eastern European and Third World countries seeking to undertake collaborative research in the British Isles</td>
<td>Physiologists in Eastern European and Third World countries</td>
<td>Up to £1,500</td>
<td>Applications must be made by the host in the British Isles, and are considered at the end of January, March, May, July, September and November</td>
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<tr>
<td>NEW LECTURERS SUPPORT FUND</td>
<td>To help young physiologists to establish independent research programmes</td>
<td>Academic staff in the first year of their first appointment to an established University lectureship in the UK or Eire</td>
<td>Up to £5,000 for consumables, equipment and, in exceptional cases, technical help</td>
<td>Applications are considered at the end of March and September</td>
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<tr>
<td>POSTGRADUATE SUPPORT FUND</td>
<td>To assist the completion of research projects which have been delayed due to circumstances outside the applicant’s control</td>
<td>Graduates (normally PhD students) in departments of Physiology or a cognate science in the British Isles, whose supervisors are Members of the Society</td>
<td>Up to £1,000</td>
<td>Applications should normally be submitted before 31 July, but may be considered at other times</td>
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<td>RUSHTON FUND</td>
<td>To promote new physiological research in the British Isles</td>
<td>Young physiologists working in the British Isles who are not yet Members of the Society</td>
<td>Travel grants for collaborative research, learning new techniques, practical workshops and training courses: up to £500.</td>
<td>Applications are considered throughout the year</td>
</tr>
<tr>
<td>VACATION STUDENTSHIPS</td>
<td>To enable undergraduates to undertake research projects in the summer vacation</td>
<td>Undergraduates in the UK and Eire in their second year or above, for work in the laboratory of a Member of the Society</td>
<td>Up to £500, for maintenance (no support available for consumables or other research expenses)</td>
<td>Applications must be submitted by 31 March</td>
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APPLICATION FORM FOR AFFILIATION TO
THE PHYSIOLOGICAL SOCIETY

Surname (IN CAPITALS) .............................................................. Forenames (IN CAPITALS) ..............................................................

Special Scientific Interest: (eg thesis title or postdoctoral project) ..............................................................

interests: IUPS classes ........ / ........ / ........
(See overleaf for codes)

Groups: ........................................................................
(See overleaf for codes)

Work address ..................................................................................................................................................

Tel ........................................................................................................
Fax ........................................................................................................

Email address ........................................................................................................

Date of Birth ..........................................................................................

Present Course/Postdoctoral Position ........................................................................................................

Qualifications:

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Please delete as applicable:  
- [ ] I wish to receive Notices, Programmes & Magazines only.
- [ ] I wish to receive precirculated Abstracts as well as Notices, Programmes, & Magazines.

I enclose a cheque for £ ........ payable to The Physiological Society.

I confirm that the information given above is accurate and up to date and that I hereby authorise The Physiological Society to hold this, and such other personal information as is supplied to the Society by me or my authorised agents or representatives in future, in machine-readable form for use for the purposes registered under the Data Protection Act 1984.

Signed ................................................................................ Date ...........................................................................

Members of The Physiological Society proposing Candidates should read the Guidelines overleaf and sign the following statement.

I hereby confirm that the Candidate:
(a) is either a postdoctoral worker or registered for a higher degree in Physiology or a cognate subject, and
(b) is a person suitable for admission to Society Meetings.

Name (IN CAPITALS) ................................................................ Signature of Proposer ...........................................

Tel ........................................................................................................
Fax ........................................................................................................

Address ........................................................................................................

Date ................................................................................

On completion, please return this form to: The Physiological Society (Affiliation), PO Box 506, OXFORD OX1 3XE, (UK).
GUIDELINES TO MEMBERS OF THE PHYSIOLOGICAL SOCIETY
PROPOSING CANDIDATES FOR AFFILIATION

This form of association with the Society is intended for physiologists still in the early stages of their careers working in laboratories in the UK, Eire or abroad. It is open to postgraduate students registered for a higher degree in Physiology or a cognate subject and to postdoctoral workers who are not yet Members of the Society. It is expected that postdoctoral workers proposed as Affiliates will normally be (a) within the first five years of attaining a first professional qualification (PhD or medical degree) or (b) awaiting the outcome of their proposal for nomination for election to Membership of the Society.

The Committee has authorised the Committee Secretary to consider and accept or reject proposals for Affiliation to the Society as they are received throughout the year, so that these can be processed quickly. The Committee Secretary regards himself as free to withdraw a proposal and return the papers to the Proposer.

Affiliation is for a term of five years in the first instance. Affiliation must be renewed by payment of the appropriate fee at the start of each year (which for this purpose is the academic year, i.e. October to September). For administrative convenience, Affiliates registered after October will have to pay for the full year. The fees are determined from time to time by the Treasurer; they are currently:

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<th>UK &amp; Eire</th>
<th>Europe</th>
<th>Non-Europe</th>
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<tr>
<td>With Abstracts</td>
<td>£10</td>
<td>£30</td>
<td>£35</td>
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<tr>
<td>Without Abstracts</td>
<td>£5</td>
<td>£15</td>
<td>£20</td>
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All Affiliates receive copies of programmes, notices and the Society’s Magazine. Affiliates can attend Meetings in their own right but must be introduced by a Member of the Society when giving a Communication or Demonstration. Affiliates are not Members of the Society and do not have the right to vote at its General Meetings.

Field of Interest:
You may specify up to three fields of interest.

01 Anaesthesia
02 Anatomy & Embryology
03 Biochemistry
04 Biophysics
05 Biomedical Engineering
06 Blood
07 Cardiovascular
08 Cellular & Tissue
09 Comparative Physiology
10 Electrolyte & Water Balance
11 Endocrines
12 Energy Metabolism & Temperature Regulation
13 Environment
14 Enzymes
15 Gastrointestinal
16 General Physiology
17 Immunology
18 Liver & Bile
19 Lipids & Steroids
20 Microbiology
21 Minerals, Bone & Teeth
22 Molecular Physiology
23 Muscle & Exercise
24 Neuroscience
25 Nutrition & Food
26 Pathology
27 Radiation
28 Renal
29 Reproduction
30 Respiration

Special Interest Groups
Current Codes

AF Autonomic Function
BB Blood-Brain Barrier
CC Cardiovascular/Respiratory Control
CI Comparative & Invertebrate Neuroscience
CN Cellular Neurophysiology
CP Comparative Physiology
DP Developmental Physiology
EM Epithelia & Membrane Transport
GI Gastrointestinal Tract
HC Heart/Cardiac Muscle
HI History of Physiology
HP Human Physiology
IC Ionic Channels
ME Microvascular & Endothelial Physiology
MC Muscle Contraction
NE Neuroendocrinology
PP Placental & Perinatal Physiology
RP Renal Physiology
RE Respiratory Physiology
SC Sensorimotor Control
SF Sensory Functions
SM Smooth Muscle
SP Somatosensory Physiology
Sake mixes with science. Photograph courtesy of Joseph Clark

It was not all work in Japan. Photograph courtesy of A J Rankin

The Physiology Department

Back Cover:
Large format interneg of a magnetic resonance imaging (MRI) scan of a normal human head. Credit: The National Medical Slide Bank, London, reproduced Courtesy of The Wellcome Foundation Centre Medical Photographic Library.