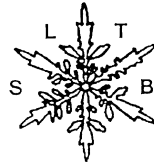


SLTB Newsletter



Dr Chris Polge FRS CBE

Sadly, Chris Polge, one of the founders of modern cryobiology and a long-term honorary member of the SLTB, passed away on August 17, 2006 aged 80.

His early work, at the National Institute for Medical Research at Mill Hill, London, resulted in the breakthrough paper (Polge *et al.* 1949) published while he was still a PhD student. This paper remains a cornerstone of any review on cryobiology and is, at in excess of 700 citations, the most cited cryobiological paper to date. This work has subsequently led to the widespread application of cryopreservation in agriculture, biodiversity conservation and medicine.

On moving to the Animal Research Station at Cambridge he continued to focus throughout his working life on the preservation of sperm and eggs in mammals and in 1950 produced the first chicks from eggs fertilised with frozen sperm. Although these chicks were the first vertebrates to be produced in this way, much greater acclaim followed two years later when he published on high pregnancy rates in cattle using sperm that had been frozen for over a year. These reports had far-reaching consequences for the future of artificial insemination and genetic improvement in livestock. Within 25 years major increases in productivity, such as the doubling of milk yields, were achieved globally. In the early 1970s pig semen was successfully frozen in his laboratory, thus fulfilling his objective of developing methods for the cryopreservation of semen from all the major species of livestock.

In the 1970s and 80s he and his team worked extensively on the freezing of embryos for use in embryo transfer programmes. The first major breakthrough was the birth, in 1973, of the first calf (Frosty) from a cryopreserved embryo. As problems in the cryopreservation of gametes were solved, he focussed on other methods of improving livestock production. He became an international authority on reproductive biology and was in the forefront of new developments in artificial insemination, control of the reproductive cycle, embryo transplantation and *in vitro* fertilisation in the pig.

In his final years as head of the Animal Research Station he was responsible for the development of projects aimed at the production of chimaeras and identical offspring in domestic animals. Success in these programmes provided the foundation for subsequent progress in cloning and in the production of transgenic animals.

After his retirement from the Animal Research Station in 1986 he co-founded Animal Biotechnology Cambridge, a commercial enterprise set up to bridge the gap between research discoveries and their conversion into profitable agricultural products and practices.

Chris Polge was highly respected within and beyond the scientific community, being elected to the Royal Society in 1983 and appointed CBE in 1992. In addition to his research and management activities, he taught at Cambridge University, becoming an honorary professor and a fellow of Wolfson College.

On a personal note, I only met Chris once when he and his wife Olive were invited to

attend the SLTB meeting I organized in Ambleside in 2000. He gave a fascinating talk, based on his research career, as well as an incisive insight into the fundamental problems in cryobiology, how they may be resolved and applied in the “real” commercial world. It was for me the highlight of that meeting and a significant contribution to the success of the meeting as a whole.

He will be sadly missed by all those who knew him, but his legacy in fundamental and applied cryobiology will act as a fitting tribute to his major contributions to science and agriculture.

Reference.

Polge, C., Smith, A. U., and Parkes, A. S. (1949) Revival of spermatozoa after vitrification and dehydration at low temperatures. *Nature* **164**, 666.

John G Day General Secretary SLTB

**CRYO2006
Hamburg 24th-27th July 2006**

The 43rd Annual Meeting of the Society for Cryobiology, in association with the SLTB, was organized by Dr Andreas Sputtek and his team in Hamburg (Germany), who did an excellent job.

Approximately 230 people attended Cryo2006. The meeting was organized in three symposia and five sessions, with presentation of numerous cryobiology research papers in a wide spectrum of fields. To accommodate the large number of presentations, parallel sessions took place.

In the symposium “Clinical applications of cryobiology” five lectures were presented. The largest session “Mammalian cells, tissues and organs” included many oral presentations (31) which were of general interest for researchers also working on other types of organisms. Examples of this were several excellent communications presented on aquaporins, cryoprotectants and ice formation, making it hard to decide which parallel session to attend. Nine oral presentations could be heard at the non-mammalian session. Talks on algae and

plants (14) ranged from the molecular aspects of cold acclimation to implementation of cryopreservation protocols for germplasm storage. The science of low-temperature biology is so interconnected that a work on rotifers was presented in the session of “Molecular determinants of low temperature and dehydration tolerance in plants”. This was a very enlightening lecture by Dr. Tunnacliffe on “...the bizarre world of LEA proteins”. This only gives one example of the multidisciplinary of cryobiology. Further works on mammalian tissues and application of cryobiology to medicine were presented at the sessions “Effects of hypothermia on mammalian cells and tissues” (7) and “Cryosurgery” (4). A small session on “Cell-free systems” (5 oral communications) was also included.

Fifteen students had the opportunity to present their work orally for the Peter L Steponkus Crystal Award Competition, which also reflected the wide range of the cryobiology science. The winning presentation was by Shannon Stott entitled: Cell perimeter modulates the kinetics of intracellular ice formation and frequency of paracellular ice formation in micropatterned endothelial cells. Shannon is a Ph.D student at Department of Mechanical Engineering, Georgia Institute of Technology, Atlanta, USA.

In addition to the large number of excellent oral presentations, 102 posters were presented, of which 7 competed for the Best Poster Award Competition sponsored by the SLTB. The Best Poster award winner was Yuuki Shichi for his poster entitled: Hyperfine structure of vitrified mouse eggs frozen under 2100 bar pressure. Yuuki is currently a Master's degree student at Frontier Science Research Center, University of Miyazaki, Miyazaki, JAPAN.

Despite the large number of communications being presented, the meeting was nicely organized so there was enough time for scientific discussion not only during the sessions but also during coffee breaks, the poster session and social events. The selection of the venue also helped the fluidity of events with halls of appropriate size for each of the parallel sessions and an open space for breaks and after-session discussions.

Social events included a guided bus tour of Hamburg, a barbecue, and the shipboard farewell banquet. At the end of the banquet, Prof. Felix Franks (Honorary member of SLTB) gave an enlightening lecture about his extended research experience both in academia and industry. This was followed by a disco (we worked hard during four days, so we deserved this more relaxing moment) with photographs taken during the meeting shown as a backdrop.

For those members who could not attend, I hope we can meet and you can present your contributions at the next SLTB meeting in Derby in September 2007.

M. Elena González-Benito, Meetings Secretary

Forthcoming Meetings

STLB: Society for Low Temperature Biology

Annual Scientific Meeting, AGM and Symposium

Verification, Safety and Ethical Issues Impacting The Low Temperature Storage of Biological Resources

12th – 14th September 2007

University of Derby

This symposium provides a cross-discipline forum to consider the role of verification, safety and ethical issues in the preservation of different types of living resources at low temperatures. The routine use of cold and ultra-cold storage technologies in culture collections, tissue and organ banks, and Biological Resource Centres requires effective technology transfer, verification and validation of a wide range of interconnected procedures (e.g. tissue procurement, *in vitro* manipulations, cold storage, cryopreservation, validation,

authentication). The approaches of different sectors and disciplines to issues of low temperature storage verification/validation, safety and ethics will be considered in this symposium. As well as the different perspectives of research cryobiologists, the custodians that safeguard the stored resources and the practitioners and end users that benefit from them. Subjects encouraged for discussion include: verification and validation procedures and safety and risk assessment strategies. For example, in relation to donors, operators and users of cold-stored living resources, cryobanking operations, risks of premature/accidental rewarming, mistaken identity, cross-infection transmission within cryotanks, safety equipment and alarm systems.

The meeting will also include “Free Communications” sessions that will include general aspects of low temperature biology.

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CRYO 2007
44th Annual Meeting of The Society for
Cryobiology
Lake Louise, Alberta (Canada)
July 29 - August 1 2007

This broadly-focused scientific meeting will bring together diverse disciplines related to cryobiology and biopreservation, from fundamentals to applications. A variety of plenary and regular sessions are planned with a goal of fostering discussion among experts and trainees.

For further information:
<http://www.cryo2006.org>

OTHER MEETINGS
3rd International Orchid Conservation
Conference
San José (Costa Rica)
March 18-23, 2007

This meeting (III IOCC) is organized by The Lankester Botanical Gardens, and promises to be a once-in-a-lifetime experience. Not only will participants enjoy a rare opportunity to hear lectures by, and rub shoulders with, some of the most important scientists in the orchid world today, but the conference is also being held in one of the world's most beautiful countries. The Congress will provide a forum for sharing knowledge, concerns, and hypotheses about the status of orchid conservation.

For further information:
<http://www.jardinbotanicolankester.org/ing/congress.html>

The Biodiversity Extinction Crisis, a Pacific
and Australasian Response
Sydney (Australia)
July 10-13, 2007

The world faces its sixth great extinction event, driven mainly by humans. The Pacific/Australasian region faces special challenges including: island ecology, rising sea levels, changing rainfall and land and water degradation. These issues are overlaid by the general problems of habitat loss and fragmentation, invasive species, pollution and

over-harvesting. This Conference identifies the major problems for biodiversity conservation in the region, existing and potential solutions and links to the global biodiversity initiatives. Real opportunities can be found in the nexus between conservation science and policy-makers, managers and the community.

For further information:
<http://www.biodiversity2007.com/>

21st Annual Meeting of the Society for
Conservation Biology
Port Elizabeth, Eastern Cape (South Africa)
July 1-5, 2007

The theme of the 2007 annual meeting is One World, One Conservation, One Partnership and emphasizes the need to move away from national, regional and disciplinary territoriality in support of a joint effort to conserve the world's biodiversity by uniting towards a common goal.

For further information:
<http://www.nmmu.ac.za/scb/>

If you have a meeting or other event that you would like published in the next SLTB Newsletter, please send the information to any member of the Committee. Thank you

New Committee member profile

Joachim Keller



The Gatersleben Genebank (<http://www.ipk-gatersleben.de/en/>), formerly called 'Crop Plant World Collection', situated in the Leibniz Institute of Plant Genetics and Crop Plant Research, IPK, Gatersleben, Germany, maintains the second largest living collection of cultivated crop plants in Europe containing 148,000 accessions of 2,500 species. Its development started in 1943 when IPK was founded. I am the head of the Working Group In Vitro Storage and Cryopreservation within this genebank, thus, not only responsible for cryopreservation but also for culture of vegetatively propagated crops like garlic, shallot, mint, yams and others under conditions of slow growth, mostly at lower temperatures.

After my doctoral dissertation in 1979 on the mechanisms of cell extension growth under the influence of auxin, I worked in a breeding institute on in vitro haploid production via anther and ovary culture and also on aspects of micropropagation. When I joined the Gatersleben genebank, I was tasked with establishing laboratory methods for maintaining the difficult vegetatively maintained crop species. In 1997, we started organizing a cryopreservation unit from scratch. It is now well-advanced, and we have a cryo-collection of more than 1000 accessions of potato, garlic and mint. At present, we are reinforcing research on various aspects of cryopreservation, such as effects of cold adaptation and various preculture conditions, ultrastructural changes in precultured, pretreated and cryopreserved tissue as well as morphogenesis during regeneration.

As a member of the genebank, I also act at an international level for coordination of the efforts of germplasm preservation. I am the Vice-chairman of the Allium Working group in the European Cooperative Programme for Crop Genetic Resources Networks, ECP/GR, a member of the Managing Board of the EU COST Action 871 'Cryopreservation of crop species in Europe' as well as a board member of the German-speaking section of the International Association of Plant Biotechnology, IAPB, the former IAPTC&B.

Keller, E. R. J. & A. Senula (2003):
Germplasm preservation in *Allium* species: an integrated approach to store morphologically characterised virus-

free plant material via cryopreservation. *Acta Hort.* 623: 201-208.

Keller, E. R. J. (2005). Improvement of cryopreservation results in garlic using low temperature preculture and high-quality *in vitro* plantlets. *CryoLetters* 26: 357-366.

Keller, E. R. J., A. Senula, S. Leunufna & M. Grübe (2006) Slow growth storage and cryopreservation - tools to facilitate germplasm maintenance of vegetatively propagated crops in living plant collections. *Int. J. Refrigeration* 29: 411-417.

A message from the President of the Institute of Biology (UK)

Dear Affiliated Society representative

I am writing to you to invite your society to continue to be affiliated to the Institute of Biology and, in doing so, to take an even more active role in the propagation of the life sciences to government, the media and the public.

The Institute has achieved a significant reputation with all these stakeholders for the quality and impartiality of our advice. Recently this included topics such as Stem Cell research, the use of animals in research, GM food and crops, Biofuels, Antibiotic resistance and sustainable agriculture.

Affiliated Societies sometimes ask: what do I get for the subscription?

Our productivity in producing briefing documents for Government has remained fairly steady at around 20 per annum, and the relevant Affiliated Societies are always consulted during the preparation of these documents. The effect of this input is always difficult to quantitate but we can be confident of some successes.

We *did* stop HEFCE lowering the funding for undergraduate biology teaching two years ago and we *have* got Tony Blair, David Sainsbury and Gordon Brown repeatedly to acknowledge that Biology is the science for the 21st century.

Legislation on the use of stem cells in research is not unnecessarily intrusive or bureaucratic.

The government *has* been supportive of the need for animals in medical research, and assertive in dealing with violence by those who believe otherwise.

We *did* get Gordon Brown to make a big allocation for school equipment in the last budget and we *have* got government to acknowledge that they need to do more to recruit science teachers.

We are increasingly taking a proactive stance and producing briefing papers in advance of the enquiry being made. These are useful for the media and schoolteachers as well as Parliament.

We have also launched a CPD scheme to support an enhanced CBiol status.

We have developed a programme of courses and workshops to support this CPD programme. Members of our Affiliated Societies may attend at IOB member rates – a significant discount.

We have supported the British Biology Olympiad, selected the UK team for the International Biology Olympiad and coached them to Gold Medal success almost every year.

In order to maintain the excellence of our science across a broad remit, we need to continue to recruit as widely as possible, and your Affiliation will help us.

In the last few years, the Huxley lecture has been given by Richard Dawkins, Stephen Jay Gould, Paul Nurse, and next year will be given by Raymond Dwek. The Charter Lecture has welcomed Frances Ashcroft as well as Steve Jones. Your members will be welcome to attend such events.

Recent Honorary Fellows of the Institute include Robert Winston, Bob May, David Bellamy and Ian Gibson.

If you would like to know more, please consult our website (www.iob.org) or contact our

Chief Executive, Alan Malcolm
(a.malcolm@iob.org)

With best wishes

Professor Sir Richard Gardner, FRS

Recent publications roundup

Small birds wintering in temperate regions generally show markedly improved cold tolerance capabilities relative to summer-acclimatized birds. This winter acclimatization primarily results from an increased ability to sustain high levels of shivering thermogenesis over prolonged periods. Swanson and Liknes (*J. Exp. Biology* **209: 466-474 Feb 2006**) note that in birds showing marked winter improvement of cold tolerance, this improvement is also associated with expanded M_{sum} (summer metabolism or thermogenic capacity), typically measured by indirect calorimetry as the maximal rate of oxygen consumption under cold stress. Furthermore, birds that show relatively minor seasonal differences in cold resistance also show no, or only minor, seasonal differences in M_{sum} . Thus, during winter acclimatization the expanded M_{sum} is closely associated with increased shivering endurance at submaximal levels of cold challenge. Collecting birds by mist netting in Clay County, South Dakota, USA the authors studied 21 species in summer and 11 species in winter, all of which heroically underwent examinations in order to reveal M_{sum} and T_{CL} (temperature at cold limit) values. Following capture, birds were transported to the laboratory where they were held at room temperature (22°C), with food and water *ad libitum*, until cold exposure tests later on the day of capture. Individual birds were exposed to a declining series of temperatures in 79% helium/21% oxygen (helox), where temperature was decreased until hypothermia was induced (verified by removing birds from the metabolic chamber and measuring body temperature by inserting a lubricated copper–constantan thermocouple into the cloaca). In this way it was demonstrated for the first time that an interspecific phenotypic correlation does exist between cold tolerance and M_{sum} for birds. Another noteworthy finding from the summer

analyses was that high M_{sum} and low T_{CL} , as well as low M_{sum} and high T_{CL} , occurred in taxa composed solely of migrants, as well as taxa with members wintering in cold climates. This suggests that physiological capacities for heat production or cold tolerance are not the sole determinant of wintering strategy within a taxon. Participants were released much relieved.

As noted by Zhu et al (*Physiologia Plantarum* **128: 80-94 Sept 2006**) freezing tolerance mechanisms depend on (amongst other things) membrane stabilization (through changes in lipid composition, sugar accumulation and production of membrane protecting polypeptides) and increase of sugar levels in the apoplastic space. Besides proteins, sterols and phospholipids are the major components of plant membranes. Plant sterols are not only able to regulate membrane fluidity and permeability but can also modulate the activity of membrane-bound enzymes. It is now also recognized that phospholipids are not only just structural components of membranes, but they can also act as cofactors for membrane enzymes, signal precursors or signaling molecules themselves. Focusing on banana meristem cryopreservation this group studied changes in soluble sugars, sterols and fatty acids of different lipid fractions and demonstrated that while a sucrose pretreatment is required for high survival after cryopreservation (effects on water contents of the cells and its possible protecting effects on proteins and membranes), it also induces stress in the meristems as denoted by a change in sterol composition (increase of stigmasterol/sitosterol) and a decrease in the double bond index of membranous fatty acids. These results suggest that the application of specific sterols or fatty acids (preferably unsaturated ones) in addition to high-sucrose

concentrations may be used in establishing new, more efficient plant cryopreservation protocols.

Leaf teeth are conspicuous and often diagnostic features of many plant species. In mesic environments with sufficient nutrient resources, the percentage of toothed species in extant floras generally correlates negatively with temperature; consequently, fossil leaf teeth are widely used to estimate continental paleotemperatures. However, the function of leaf teeth with respect to climate is poorly understood. Royer and Wilf (*Int. J. Plant Sci.* **167(1):11-18 Jan 2006**) have tested the hypothesis that teeth enhance rates of carbon uptake at the beginning of the growing season when temperatures are limiting. They measured the seasonal patterns of leaf-margin photosynthesis and transpiration for 60 woody species from two temperate regions with differing climates (Pennsylvania and North Carolina). Three significant results were, first, physiological activity at leaf margins is greatest early in the growing season (first 30 d); second, toothed margins are more active with respect to photosynthesis and transpiration than untoothed margins; finally, leaf margins are more active in species native to colder Pennsylvania. The toothed species increase transpiration and photosynthate production early in the growing season relative to untoothed species and do so more in the Pennsylvania sample, maximizing carbon gain when temperature is limiting but moisture and nutrient availability are not. This mechanism may provide a proportionally increasing selective advantage to toothed species with decreasing temperature that is reflected in empirical correlations used for paleotemperature estimation.

Andy Wetten

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