produce. S. Mohan (Hari Industries, Mandi) explained the need by scientists to develop strains of EMPs for commercial cultivation. D. R. Nag (RIISM, Jogindernagar) discussed future raw-material requirements by pharmaceuticals. M. Kapoor (Mediroma International, Kullu) informed about the decline and adulteration of raw materials available to local units. J. Sodhi (Ayush Herbs, Kangra) highlighted licensing problems for trade in HP, resulting in illegal markets.

In session-IV, Judy Man (Rothamsted International, UK) covered aspects related to building partnerships. L. Singh (HRG, Shimla) expressed the concerns of NGOs in the cultivation of EMPs. R. R. Bhalaik (HFRI, Shimla) felt that it was important to enumerate and quantify EMP resources and develop a database. N. A. Farooquee (GBPIHED, Almora) spoke about barter exchange practices in *Zanthoxylum armatum* among the Himalayan tribes.

Pal led the plenary session on the second day, focusing on technical and commercial dimensions of cultivation. A two-step cultivation initiative was identified: short term (demonstrations) and long term (community-based cultivation). Four basic criteria were considered to prioritize species-endangered status (based on literature and local perception), knowledge base (on population studies, multiplication technology and cultivation trials), cultivation prospects (technical and economic feasibility) and marketability. Four agro-climatic zones were identified for cultivation (Table 1). Species identified for each zone were assessed for their elite populations, availability of propagule and quality planting stock, certification, processing, quality production, value-addition and ensured-markets. *Swertia chirata*, though ranked among the top for high-altitudes was excluded for immediate cultivation due to its long gestation period and delicate field-handling requirements. *Picrorhiza kurrooa* and *Aconitum heterophyllum* were highly recommended.

A follow-up committee (Pal, James, Abrol, Chopra, Man and Badola) was formed to carry forward the programme. James revealed that a pilot-fund is available. Other recommendations were: review knowledge on targeted species, identification of best cultivation practices, R&D to reduce long-gestation periods, cost-effective technology, organic-farming, buy-back mechanisms, policy-revision in the interest of stakeholders, protocols for post-cultivation management, quality-control and awareness training.

ACKNOWLEDGEMENTS. We are grateful for the permission of the Indian Ministry of Environment and Forests. Major financial assistance of the World Resource Foundation, through Rothamsted International-UK, is gratefully acknowledged. We thank Drs S. James for support and I. P. Abrol, J. Mann and A. Chopra for co-operation, and Mr S. Aitken for going through the revised draft of the manuscript.

Hemant K. Badola*, G.B. Pant Institute of Himalayan Environment and Development, Himachal Unit, Mohal-Kullu, 175 126, India and **Mohinder Pal**, G.B. Pant Institute of Himalayan Environment and Development, Kosi-Almora 263 643, India. *For correspondence. (e-mail: badolahk@hotmail.com).

MEETING REPORT

International Ornithological Congress*

The International Ornithological Congress (IOC) is one of the oldest and most widely attended of international scientific meetings. This event is held once in four years, and unlike other biological conferences, attracts a large number of amateur nature-lovers (especially bird-watchers). The 23rd IOC was attended by over 1000 ornithologists and bird-watchers from all over the world. The congress included over 700 presentations.

A wide range of topics, including biogeography, ecology, taxonomy, behaviour and molecular biology were covered in these presentations. The greatest strides in ornithological research have been made in the study of bird migration and in the use of molecular biology tools in resolving taxonomic problems. It was heartening to listen to presentations that questioned the validity of revised systematics of birds of the world by Charles Sibley and colleagues, that was published around 10 years ago based on molecular biology tools. Recent studies on galliform birds (pheasants, jungle fowl, peafowl, partridges, etc.) based on a number of attributes such as behaviour, colour pattern, morphological traits and also molecular genetics have suggested that the traditional Linnaean systematics may still be adequate for dealing with the often complex groups of birds.

Probably, the best component of the IOC was the two-day exhibition of fossils of birds unearthed in China. These 100–150 m.y. old fossils included sparrow-like birds to typical bird-dinosaurs. What was however disappointing was the general lack of participation from South Asia and Africa in the IOC. There were 13 Indians (although not all of them represented institutions in India), a couple of Pakistanis and none from Sri Lanka, Nepal or Bangladesh.

The papers from North America addressed issues of ecology, systematics and behaviour without specifically focusing on regional influences. Further, many of the general papers were based on laboratory experiments conducted in Europe and North America.

The 24th IOC is scheduled to be held during August 2006 at Hamburg (Germany). It may be most useful if we have a delegation of Indian ornithologists in this congress, since there has been for

*A report on the 23rd International Ornithological Congress held in Beijing during 11–17 August 2002.

long the suggestion that India should host a future IOC – maybe in the year 2014 or 2018. While this may seem a long way to go, most often it has turned out that preparations for inviting the IOC may itself take as many as eight years. As an elected member of the International Ornithological Committee for the years 2002–2006, I hope that we might be able to organize a symposium or round table on 'Recent advances in ornithological research in South Asia'. This might provide a forum where we could highlight the long-standing commitment that we have had in India for the study of birds, and also our scientific capabilities. The Government of India, through MoEF, CSIR, DBT, DST and UGC, should consider sponsoring a large number of Indian ornithologists to participate in the 24th and 25th IOCs (the 25th IOC is likely to be in Brazil). While these ideas are open to discussion, let us look forward to a good beginning.

R. J. Ranjit Daniels, Care Earth, 'Shri Nivas', No. 5, 21st Street, Thillaiganganagar, Chennai 600 061, India (e-mail: careearth@usa.net).

RESEARCH NEWS

Cocking the gun – First steps in the bacteriorhodopsin photocycle

M. K. Mathew

Bacteriorhodopsin (bR) served as the archetype for membrane proteins for two decades, before gracefully making way for relative newcomers like potassium channels and visual rhodopsin. Structure determination of bR was greatly aided by its organization into a hexagonal lattice in the purple membrane of the archaebacterium *Halobacterium salinarium*. Structures of a few other membrane proteins have since been determined, but mechanism in detail available for many soluble proteins remains elusive. bR remains the paradigm here with its well-characterized photocycle leading to the pumping of a proton from one side of the membrane to the other[1].

Members of the large family of seven transmembrane receptors respond to ligand binding by undergoing a series of structural transitions, leading to the formation of a conformational state capable of activating a transducing second messenger. The best-characterized example is visual rhodopsin where an intramolecular ligand, retinal, absorbs a photon and forms metarhodopsin II or MII. MII can then activate the G-protein transducin and thereby initiate a signal transduction cascade.

Light-adapted bR has all-trans retinal attached covalently to a lysine side chain via a protonated Schiff's base[1]. All-trans retinal is yellow, absorbing maximally at 480 nm. Interactions within the binding pocket shift its absorbance spectrum to 568 nm – the opsin shift. bR is purple-coloured, absorbing at 568 nm (bR_{568}), while the different cone pigments absorb at different wavelengths due to this opsin shift. Absorbing a photon initiates a photocycle, with a series of optically distinct intermediates in all rhodopsins[2]. The intermediates in bR are I, J_{610}, K_{625}, L_{550}, M_{412}, N_{520} and O_{640}, with the numbers in subscripts referring to the wavelength of maximum absorption of each intermediate. These intermediates had been identified by flash spectrometry – monitoring absorbance changes at each of several wavelengths after initiating the

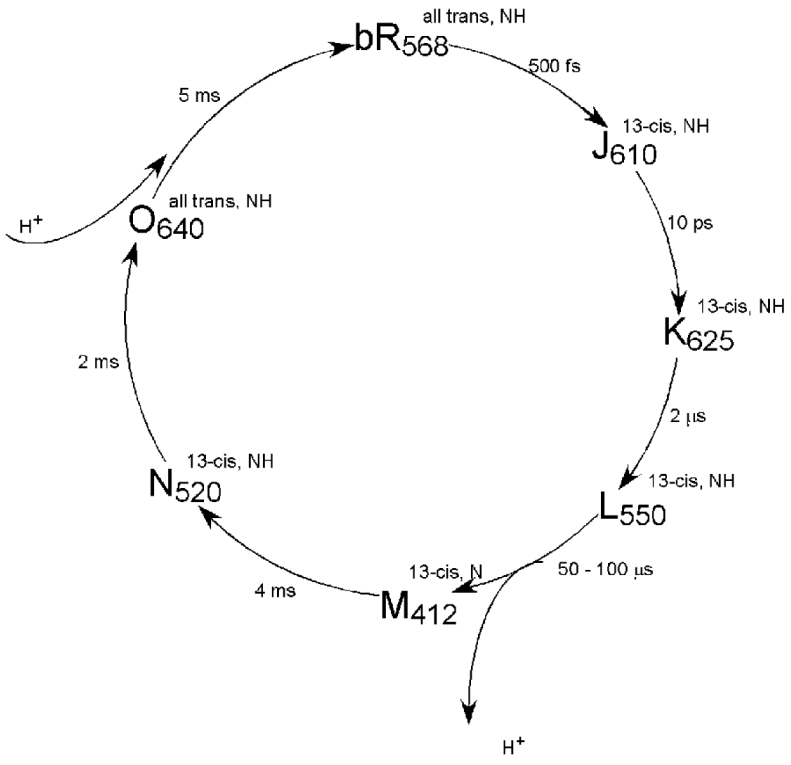

Figure 1. Photocycle of bacteriorhodopsin initiated on absorbing a photon of visible light. Ground state, light adapted bR absorbs maximally at 568 nm (bR_{568}) and its chromophore is all-trans retinal attached through a protonated Schiff's base (all-trans, NH). Intermediates J, K, L, M, N and O are listed with subscripts denoting the wavelengths of maximal absorption and superscripts indicating the configuration of the retinal chromophore and the protonation state of the Schiff's base linkage. A proton is released from bR on the extracellular side of the membrane on the same timescale as the formation of M, while uptake from cytoplasm occurs with kinetics similar to the reformation of bR.