

natn. Acad. Sci. U.S.A. 71, 2843; 1974). The importance of ontogenetic and regulatory effects in molluscan population genetics is emphasised by the work of J. Heller (Hebrew University of Jerusalem) on the Israeli snail *Xeropicta*, an annual species. Adult *Xeropicta* in the mountains are dark coloured, those in the coastal plain pale. As the mean annual temperature is higher in the plain than in the mountains, this accords with the common poikilotherm pattern in which populations from hot places have a higher reflectivity of solar radiation than do those from cool. However, there are great annual fluctuations in temperature in Israel, and in the summer the snails are under extreme solar stress. They adjust their shell reflectivity to ensure that they absorb the requisite energy from the sun during the brief growing season, but are protected from excessive heat at other times; in the mountains they are born pale and become darker, while in the plain they are born pale but become paler. The structural genes controlling shell polymorphism are expressed only at the correct period of the life cycle. Ontogenetic effects are also found in the Caribbean snail *Cerion* (S. J. Gould, Harvard; D. Woodruff, University of California, San Diego). This genus shows a great variety of morphological types. Simulation of the growth process shows that simple alterations of the growth rate early in development can lead to startling differences in adult shell form. Developmental plasticity (perhaps promoted by polymorphism in the genes regulating growth rate) allows each species to attain a multiplicity of adult forms attuned to particular habitats. This may allow a single species of *Cerion* to fill the ecological niches occupied by several species of mollusc on dunes in southern Europe.

Molluscs show a range of sexual strategies from complete outcrossing to obligate parthenogenesis. They are therefore useful in research on the evolution of sex, particularly as the degree of outcrossing can be estimated from the zygotic proportions at loci controlling protein polymorphism. G. McCracken (University of Tennessee) and R. K. Selander discussed the European slugs which have colonised the US. There is great variation in the degree of outcrossing, with some species adopting a mixed strategy of sexual and asexual reproduction. Measurement of the niche breadth of several species on an ecologically well-characterised experimental plot shows that the three species with the broadest niche are present as monogenic and asexual strains. This is hard to reconcile with models which predict that sexual species have more evolutionary flexibility than do asexual.

The conference demonstrated that although the single helix of the snail's shell may be less central to modern genetics than the double helix, it continues to provide important tests of evolutionary theories. □



100 years ago

A proposal has been set on foot for lighting the Sheldonian Theatre, Oxford, and the Camera of the Radcliffe Library with the electric light. It has long been regretted by many members of the University that the Sheldonian Theatre is not available in the evening for any purposes of public interest, however great, for want of lighting. The neighbourhood of the Bodleian Library has, however, been a bar to any proposal for lighting by means of gas or any ordinary method. The care with which the heating apparatus of the Theatre has been inclosed within a fire-proof chamber is sufficient evidence of the importance attached by the curators of the Theatre to absolute security in this respect. The development of the electric light has now rendered it possible to illuminate public rooms by a process absolutely free from danger of fire. It has been adopted largely in the reading-rooms of our public libraries, and notably in the reading-room of the British Museum.

Herr Zehfuss has lately given (*Wied. Ann.*, 4) some personal experiences of the phenomenon of "after images of motion". These after images may be had, e.g., in a train, if one look at a point on the horizon for a little, then turn to look at (say) a horizontal fibre in the wood of the carriage, or close one's eyes. Motions then seem to be still perceived; in the latter case, e.g., a stream of sparks seems to be moving to the right (or if the point originally looked at have been between the observer and the horizon, there is a stream of sparks above going to the right and one below to the left). Herr Zehfuss offers a physiological explanation, in preference to the partly psychical ones proposed by Plateau and Opperl. Each individual nerve rod, he supposes, has special blood-vessels, which, when the original image of a moved object goes to the right, directs the course of the blood to that side, just as in ordinary light the decomposed blood is promptly replaced by fresh. By this preponderant direction of blood to the right a heaping up occurs in each retinal element on the right, which gives rise to return currents as soon as the outer cause has ceased to act. As the blood flows back there arise, in consequence of the specific excitability of the rods, those spark-streams, which are projected as elementary motions to the right.

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High-resolution imaging of laser-driven implosions

from Lynn R. Veaser

HIGH-RESOLUTION imaging of the radiation (mainly electrons, neutrons, X-rays, and alpha-particles) emitted by laser-driven DT fusion implosions is difficult because such radiation cannot easily be focused. Nevertheless, imaging could be an extremely useful diagnostic tool, especially for comparison with the extensive computer modelling now being carried out for laser-fusion compressions. Neutron imaging has not been achieved because the fluxes are small and the efficiency for detecting neutrons is low. Electrons are generally affected by the strong electric and magnetic fields in the laser plasma but X-rays and, if the fields are not too strong, alpha particles, can be imaged by pinhole cameras.

Unfortunately, to produce a high-resolution image, a pinhole camera must have a tiny aperture and this will cause low sensitivity. If additional signal strength is needed it is necessary to use more than one aperture. The resulting image, or shadowgraph, is a superposition of the images from all the apertures, and it is not useful or recognizable unless a real image of the source, similar to that seen for a single aperture, can be reconstructed from it. The two-step process by which this imaging and the subsequent reconstruction are done is known as coded-aperture imaging.

Coded-aperture imaging has been used by astronomers for a number of years to

image X-ray stars, and it is employed in the field of nuclear medicine to enhance the signal-to-noise ratio and the resolution in radiographing body organs; but, because of the difficulties involved in fabricating the complicated microscopic apertures needed for ultra-high resolution, its application to laser plasma has been delayed for some time. Recently, however, groups from the US laser fusion laboratories at Livermore and Los Alamos have reported the use of coded-aperture techniques in imaging of imploding laser-driven fusion targets.

Ceglio and Larsen (*Phys. Rev. Lett.* 44, 579; 1980) used a Fresnel zone plate (in this case a series of concentric gold rings with radially decreasing apertures and held together by thin struts) as a coded aperture to measure the X-rays from a thin glass microballoon which had been filled with DT fuel and irradiated with about 20 TW of laser power. They obtained X-ray images from the shadowgraphs by optical reconstruction; each shadowgraph was illuminated with a coherent light source, much as is done in holography, producing a magnified image of the initial source. The experiments were done at the Shiva laser facility of the Lawrence Livermore Laboratory.

When a high-power laser pulse strikes a target surface, it generates a plasma which includes a significant number of high-energy (suprathermal) electrons. The