

displacement actuators. Townes pointed out that modern telescopes are already so complicated that these actuators do not represent a great increase in complexity.

Among the highlights of the meeting were discussions of unusual galaxies such as quasars and Seyferts by M. J. Rees (University of Cambridge) and by the chair-person of the scientific organizing committee, M. H. Ulrich (European Southern Observatory). Rees considered how measurements of the shape, location and fine structure of a quasar imaged by a foreground gravitational lens could be used to deduce the distribution of mass in the lens. In the most likely case where the lens is a massive galaxy, angular fine structure in the quasar image on a scale ranging from one arc second down to one micro-arcsecond could be used to distinguish mass contributions in the lens that range between entire galaxies and single stars. Since there is, at present, roughly 70 orders of magnitude uncertainty in the mass of the paramount contributor to the unseen mass in galaxies (ranging all the way from massive neutrinos to million solar mass black holes), such measurements are of considerable interest.

Finally, there was discussion of the future of large telescopes and, specifically, whether large single apertures (up to 10- or 15-m diameter) are preferable to somewhat smaller telescopes operating as an interferometer. As might be expected, no consensus was achieved. R. Angel (University of Arizona) lamented that the Multiple Mirror Telescope on Mt Hopkins in Arizona is the first real technological innovation in 50 years in optical astronomy. But it seems clear, from the impressive results already achieved by the CERGA group and others and by the range of novel proposals presented at the conference, that high angular resolution ground-based and space-based optical and infrared astronomy has a bright future. □

From embryo to teratocarcinoma in tissue culture

from Brigid Hogan

MOUSE teratocarcinomas are well established as a versatile model system for the study of gene expression and cell interaction during early mammalian embryogenesis. In culture, aggregates of the pluripotent stem cells, known as embryonal carcinoma (EC) cells, differentiate into embryoid bodies resembling the inner cell mass of the early mouse embryo. At first, these structures consist simply of an outer layer of endoderm surrounding a solid core of epiblast (or primitive ectoderm) cells, but many subsequently develop a quite complex organization, with various tissues derived from endoderm, ectoderm and mesoderm. However, the most dramatic evidence for the ability of EC cells to differentiate in an orderly and coherent sequence is undoubtedly their behaviour when injected into normal mouse blastocysts. Here, the cells integrate with the host inner cell mass and in the course of development may contribute towards most tissues of the chimaeric offspring.

Impressive as these results are, the degree of chimaerism obtained after injecting EC cells is unpredictable, to say the least. With some cell lines, the probability of an EC cell differentiating into normal tissues is very low, and cells which fail to do so may give rise to tumours. With other cell lines, the frequency and extent of chimaerism is much higher, although still unpredictable, and only in few tissues is the contribution more than 50 per cent. One of the most

celebrated chimaeras was "Terry Tom", a mouse in which nearly all tissues, including sperm, were populated by derivatives of EC cells of the OTT 6050 line, which had been maintained in the laboratory for more than 8 years as an ascites tumour^{1,2}. The prospect of generating more mice like Terry Tom, carrying germ cells derived not only from standard EC lines but also from teratocarcinoma cells selected *in vitro* to carry specific mutations, or new DNA sequences, ideally inserted into specific chromosomes, has inspired an immense amount of effort.

One of the ultimate goals of this work is to engineer strains of mutant mice which can act as models for human genetic diseases³, so male mice, which can transmit chromosomes to large numbers of offspring, are particularly prized. But, in spite of the fact that EC cells carrying specific nuclear or mitochondrial mutations⁴, human⁵ or rat⁶ chromosomes, or foreign DNA⁶ have been generated and in some cases injected into blastocysts and incorporated into chimaeric offspring, the colonization of the male germ line remains elusive. One reason for this is undoubtedly the fact that all the established EC lines so far used for genetic manipulation have an XO karyotype — that is, they have lost the Y chromosome during prolonged culture. For this reason, it would be very useful to be able quickly grow new teratocarcinoma cell lines from normal male embryos, insert genetic material or mutations into them, and make chimaeras, either by blastocyst injection or by the simpler technique of aggregation with monula-stage embryos⁷. Recent successes with nuclear transplantation in mouse eggs⁸ may

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100 years ago

STUDENTS of Cretaceous geology will regret to hear that Griffiths, the well-known "fossil man" of Folkestone, has been disabled for many months by rheumatism, brought on by constant exposure during the past twenty-five years, in which he has daily extracted from the wet and slippery tract of Gault clay in Eastweir Bay the remarkable series of mollusca with their pearly nacre preserved, plants, corals, crustacea, and reptilian remains that ornament not only the private collection of those who make the Gault a subject of special study, but the national museums both of this country and of the New World. In addition to collecting by far the most perfect specimens of the

Gault fauna and flora hitherto obtained, Griffiths has rendered an important service to science in carefully noting the bed or horizon from which each specimen was procured, which identification has formed the groundwork of the divisions which English geologists have been able to make in the Gault, and the correlation of these zones by M. Barrois and others with deposits occurring on the Continent. In consideration of these results, carried out by a working man under the difficulties of a struggle for life with circumstances, and the rigorous weather of the English Channel coast, it has been thought advisable to appeal to English geologists to raise a small fund which should render it unnecessary for work to be carried on when dangerous to health, and to tide him over present difficulties.

The evening *fête* of the Royal Horticultural Society was held on the 28th ult. in the Gardens at South Kensington. Coloured

lamps were disposed about the lawn, and here and there the cool plash of fountains was to be heard. The Siemens and Maxim electric lights were placed in the upper part of the Gardens, and in the lower part were two tents illuminated by the Brush electric light, and containing the plants of a flower-show, which continued next day. Brilliant effects were obtained with coloured fires behind the trees and the spray of the fountains.

There was recently landed at Marseilles a magnificent zebra which the King of Choa, Menelick II, has sent as a present to the President of the French Republic. This zebra, called from Abyssinia by two Marseillais. The Société de Géographie, to which it was addressed from Aden, has intrusted it to the Marseilles Zoological Garden.

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