of the square as seen previously in the full picture. Though this colour persists—or rather is not seen to change so long as one looks down the tube at the unchanging square, it alters instantly on glancing at a new surround and back down the tube. This persistent memory and sudden change of judgment suggest activity of brain, not eye, and binocular comparison confirms it.

Experiment 6. A binocular match was made as in Experiment 4, and suddenly the surround to the small square was removed by interposition of the tube at the left eye. The binocular match was immediately upset and for restoration needed an *RGB* mixture close to the proportions for the monocular match, though the white surround to the comparison field made a perfect match unobtainable.

This experiment shows that when the surround field is abolished in the left eye the encoded message (as judged by the colour match in the right eye) changes at once to the normal 'pink message'. But it is not seen to change if viewed without binocular comparison. The decoding mechanism in the brain, therefore, either is insensitive to this change of message or it deliberately compensates for it. The first possibility is excluded by the fact that a much smaller alteration in nerve message produced by slightly changing the red/white ratio of the projection lights is easily detected.

We thus arrive at the surprising conclusion (though familiar to psychologists as an example of 'colour constancy') that when the same square is observed through the tube and in the open, the brain in some way recognizes the identity and in its decoding exactly compensates for the change in the message which it receives : and, indeed, when a green square is matched binocularly and then has its surround abolished, the sensation experienced is not that the square goes pink, but that the comparison card suddenly gets more green—at least if one's attention is fixed primarily upon the square. But I am trying to avoid speaking of my sensations !

Conclusions

This article reaches some over-simplified and rather obvious conclusions about the difficult subject of colour appearance.

(*a*) It is easier to analyse by colour matching than by colour naming.

(*b*) Monocular matches are simply the sum of the matches made with each component of projection alone. They follow Grassmann's law and the logic of three cone pigments.

(*c*) Colour appearance may depend on the surrounding field and its past history. These alter the encoding of nerve messages by the eye, and decoding by the brain.

(*d*) The extent of the former may be measured by binocular matches, the extent of the latter by memory matches.

(*e*) The eye–brain model postulated is crude, but it reveals some of the complexity which underlies the sensation of colour.

[1] Land, E. H., *Proc. U.S. Nat. Acad. Sci.*, **45**, 1, 115 ; 4, 636 (1959).
[2] Judd, D. B., *J. Opt. Soc. Amer.*, **50**, 254 (1960).
[3] Karp, A., *Nature*, **154**, 710 (1959).
[4] Stiles, W. S., Thomas Young Oration. *Phys. Soc. Year Book*, **44** (1955).
[5] Grassmann, H., *Ann. Phys.* (Lpz.), **89**, 69 (1853).
[6] Wright, W. D., *Researches on Normal and Defective Colour Vision* (Henry Kimpton, London, 1946).

OBITUARIES

Prof. P. G. H. Boswell, O.B.E., F.R.S.

Few geologists have accomplished more in the face of chronic ill-health than P. G. H. Boswell, emeritus professor of geology of the Imperial College of Science and Technology, London, who died on December 22, 1960, at Ruthin, North Wales, at the age of seventy-four. Not only did he contribute close on 150 publications, including several memoirs and books, but also he was for long vigorously engaged in teaching and administration at the Universities of Liverpool and London, in the conduct of learned societies, and in proffering geological advice to various industrial and public undertakings.

Born at Woodbridge, Suffolk, in 1886, he developed during adolescence such an absorbing interest in the geology of his native county that in 1912 he abandoned teaching in an elementary school so as to concentrate on geology by studying under W. W. Watts at the Imperial College. While there he continued his researches on the Pliocene–Pleistocene succession in East Anglia and helped to correlate Early human phases with those of the Glacial Period, besides devoting much attention to the Chalk and to an assessment of the magnitude of the Eocene unconformity in the London Basin.

It was while investigating the Tertiary rocks that his thoughts turned to the possibility of using their detrital mineral assemblages for correlating particular horizons. This led him to specialize in the quantitative and qualitative aspects of sedimentary petrology which were to prove so helpful in deciphering the palæogeography, tectonics and climatic conditions of past epochs, and so valuable in connexion with the search for glass-making, moulding and refractory sands during and after the First World War. Shortly after his appointment to the chair of geology at Liverpool in 1917, Boswell started his protracted researches, lasting more than twenty-five years, into the stratigraphy and tectonics of the Silurian rocks of the Denbighshire Moors. Even though some of his structural interpretations have been assailed, there is no doubt that most of his observations, gathered together in a volume on the *Middle Silurian Rocks of North Wales* (1949), will stand the test of time. Always actively interested in the applications of geology to civil engineering, his advice during the planning and construction of the Mersey road tunnel contributed in no small measure to the success of that major project.

In 1930 he was invited to succeed Watts as professor of geology at the Imperial College, but his tenure of the chair was comparatively brief, for he was compelled to resign eight years later because of ill-health. Nevertheless, he continued his work in North Wales and his consulting practice until 1953 ; thereafter, though gravely incapacitated, he still wrote a number of papers on thixotropy, greywackes and allied subjects, ending with a treatise on muddy sediments, to be published posthumously.

Boswell had been president of the Geological Societies of Liverpool (1921–23) and of London

(1940–41), of the Prehistoric Society (1936), and was successively general secretary (1931–35) and general treasurer (1935–43) of the British Association, besides being president of Section C (Geology) in 1932. Other honours included the Bigsby Medal of the Geological Society of London (1928), election to the Royal Society (1931), and honorary membership of many scientific societies at home and abroad; he was made O.B.E. in 1918. He will be remembered with affection and esteem by all his former colleagues and by generations of students, not least by those he inspired at Liverpool during the hey-day of his career.

DAVID WILLIAMS

Prof. E. T. Bell

E. T. BELL, who died in 1960, was born at Aberdeen in 1883. His schooldays were spent in Great Britain, but he attended university in the United States, where he spent the whole of his adult life. He occupied a number of university posts, culminating in his tenure of the chair of mathematics at the California Institute of Technology, Pasadena, 1927–53.

As a schoolboy, Bell came under a mathematical teacher of rare distinction, E. M. Langley, of Bedford, and on Langley's death wrote with warm appreciation of being shown something of the mode and content of modern mathematics by an inspiring teacher, and in particular of being introduced at school to the theory of numbers and to elliptic functions. His research work was mainly in these fields, and he made significant contributions to the classical theory of numbers, the field of rational arithmetic and of Diophantine analysis.

Bell's name, however, was well known outside the restricted circle of professional mathematicians, by the series of books, from about 1930 onwards, in which he endeavoured, with substantial success, to explain modern mathematics to the intelligent layman. Of these books, three deserve special mention. In *Mathematics, Queen and Servant of Science* (1952), a conflation of two earlier volumes, he described the dual nature of mathematics, its remoteness from prevalent crude materialism and its extraordinary knack of becoming vitally relevant to material concerns. If there are two cultures, mathematics, belonging to both, is the essential bridge between them. *Men of Mathematics* (1937) relates the outstanding mathematical discoveries of the ages to the men who made them; sufficient personal detail is given to allow the reader to see mathematicians as human beings, but emphasis throughout is on their contributions to mathematics. Something of the same theme runs through *The Development of Mathematics* (1940), which is not an encyclopædic history of the subject, but a narrative of carefully chosen main trends, themselves presented through typical major episodes; it is a graphic map of the main roads, and omission of byways and dead ends is deliberate and justifiable. Even so, the amount of information and opinion packed into 550 pages is extraordinary.

Bell's facts are almost always sound, his style is clear and exuberant, his opinions, whether we agree with them or not, are expressed forcefully, often with humour and a little gentle malice. He was no uncritical hero-worshipper, being as quick to mark the opportunity lost as the ground gained, so that from his books we get a vision of mathematics as a high activity of the questing human mind, often fallible, but always pressing on in the never-ending search for mathematical truth.

T. A. A. BROADBENT

NEWS and VIEWS

Royal Geographical Society: Medals and Awards

H.M. THE QUEEN has approved the award of the Royal Medals for 1961 of the Royal Geographical Society as follows. *Patron's Medal:* Mikhail M. Somov, deputy director, Arctic and Antarctic Research Institute, Leningrad, for polar exploration and research; *Founder's Medal:* John Bartholomew, editor, *The Times Atlas of the World*, for contributions to cartography.

The Council of the Royal Geographical Society has made the following awards. *Victoria Medal:* Prof. W. William-Olsson, Stockholm School of Economics, for contributions to economic geography; *Murchison Grant:* Prof. K. M. Buchanan, University College, Wellington, New Zealand, for contributions to economic geography; *Back Grant:* Eric H. Brown, University College, London, for geomorphological research; *Cuthbert Peek Grant:* Martin W. Holdgate, Scott Polar Research Institute, Cambridge, and leader of the Royal Society's Expedition to southern Chile; *Gill Memorial:* Cuchlaine A. M. King, University of Nottingham, for glaciological and coastal research; *Mrs. Patrick Ness Award:* R. M. L. Mason and A. R. Hanbury-Tenison, for their trans-continental exploratory journey in South America.

Statistics at Birkbeck College, London: Prof. D. R. Cox

THE establishment of a chair in statistics at Birkbeck College, University of London, marks the fulfilment of a scheme the authorities have had in mind for some few years of establishing statistics at the College. Birkbeck College is a college of the University of London reserved for students who are in full-time occupation, so that the majority of the students attend only in the evening. In the past, the object of the College was to provide a university education for students who, for financial or other reasons, were unable to secure this in the normal way; but the development of university education in Britain has introduced many new elements. It is now much easier for a student to secure full-time education; on the other hand, there is now a need for many more men with qualifications in two allied subjects, and the College is finding that more and more of its students are fitting into this class. In particular, there are many who have taken degrees in mathematics who wish to obtain a qualification in statistics, and in developing this new department, the College has the needs of these students particularly before it. The department will provide courses for postgraduate and undergraduate students.