give evidence in legal disputes centred on such geological phenomena as metalliferous lodes with an unfortunate tendency to stray at depth onto a neighbouring claim. The seismologists who gathered in 1958 to do their bit in preventing man from blowing himself up simply did not possess the knowledge assumed of them. Fifteen years later they still do not possess the knowledge needed to monitor underground explosions faultlessly; but they do have a greater knowledge of themselves. Indeed, in summing up the failings of the earlier years, Thirlaway could well have written an appropriately grave epigram: "We were persuaded to appear as witnesses to testify about what we did not know".

But although the embarrassing lack of knowledge where knowledge was (perhaps naively) expected was the most important single difficulty that Thirlaway and his colleagues had to face, matters were hardly helped by the circumstances in which this deficiency became clear. The seismologists who were precipitated into science politics in the late 1950s hardly surprisingly felt themselves to be in an alien environment. "We did not enjoy the public gaze in which often we had to work; we had little or no experience in handling the news media. . . . We were not careful enough to separate fact from opinion and comment for the benefit of our officials; we did not give sufficiently direct answers to simple questions; we filled our answers with technical terms and jargon as though addressing professional societies rather than State officials. . . ." In short, insofar as the politics of science was concerned, the seismologists as well as the science were in the Stone Age; they were, as Thirlaway admits, innocents abroad in the tough political arena.

In his now-published lecture Thirlaway also admits much more. But it is nearly Christmas, the season of goodwill and charity; and I shall not act against traditional precepts by spoiling a good story completely. Thirlaway's confessions need to be read in their full form without the aid of an interpreter. But how full is full? Surely there could be more? Could Thirlaway be persuaded to testify about what he does know to the length of a book? To take the point quite seriously, the early (and later) days of forensic seismology form an important, though neglected, part of the history of the interactions between science and politics. It would be a pity if the full story were to be lost.

INSECT EYE

Duality of Vision

from our Insect Physiology Correspondent

IT has long been held that separate photopic and scotopic mechanisms for day and night vision, such as are well recognised in vertebrates, do not exist in insects. The most familiar effect of the duality of human vision is the so-called 'Purkinje shift'—a change in the wavelength to which the eye is most sensitive as the light becomes more dim. Such a change was demonstrated in *Drosophila* many years ago by Fingerman and Brown, but the tendency has been to find other explanations for this observation. In recent years it has been shown by Goldsmith *et al.* in flies, and confirmed by Carlson in moths, that prolonged vitamin deficiency, extending over many generations, induces a loss in visual sensitivity which affects the longer wavelengths more than the shorter wavelengths and the ultraviolet; a result which is reminiscent of 'night blindness' in man; and Cozens found that dark adaptation in insects involved a two step process, not related to pigment migration, suggesting the separate existence of photopic and scotopic mechanisms.

In 1972 S. L. Swihart, while studying the waveform of the electroretinogram (ERG) of diurnal butterflies and moths, found that different components responded differently to drugs, inorganic ions and the like, and differed from each other in regard to flicker fusion frequency, latency and spectral sensitivity, as well as to light adaptation. All this strongly suggested the existence of retinal duality. Swihart (*J. Insect Physiol.*, **19**, 2035; 1973) has now investigated this question systematically, applying the sort of tests from which the existence of the dual system of vertebrates has been inferred.

Swihart has shown (1) that there is a change in the flicker fusion frequencies on adaptation to night vision; (2) that there is a change in the slope of the curve of "stimulus energy *vs* response" and, as was to be expected, the photopic receptors have a higher threshold and lesser slope than the scotopic; (3) there is a break in the curve of activity in visual interneurones as the energy of the stimulus is steadily increased; and (4) the electric potentials recorded as evidence in the ERG are already operating in the pre-emergent (pharate) adult butterfly and are therefore unlikely to be originating in neural structures.

Finally, Swihart has formulated a theoretical model of the insect eye, based on the duality concept, which can reproduce quantitatively the changes obtained experimentally in the ERG records in respect to flicker, in both waveform and amplitude.

POPULATION ECOLOGY

Vole Demography

from our Animal Ecology Correspondent

THE regular occurrence of sunspots, the cycle of ozone content of the atmosphere, the quality of vegetation and the activities of predators have variously been held up as the explanation of rodent population cycles. There seems a need among ecologists to look for just one factor as the sole directive agent.

It is therefore refreshing to read Lidiker's paper on the regulation of an island population of *Microtus californicus* in which no single controlling factor emerges with more importance than any other (*Ecol. Monogr.*, **43**, 271; 1973). Lidiker studied the voles on Brooks Island in San Francisco Bay from their arrival there in 1958 until 1971—a period of thirteen years. Such long-term studies are invaluable and regrettably rare, but infinitely more useful than the short-term studies upon which much ecological creed is built.

A few voles reached Brooks Island from a neighbouring islet 230 yards away in the summer of 1958 and for the following 2 years the population increased very rapidly. During the study a variety of censusing techniques were used, but most of the sampling was carried out on a trapping grid of between 0.08 ha and 0.49 ha. After the initial 2 years of rapid increase the population settled down to a regular pattern of numerical change. Reproduction started about 2 months after the start of the rainy season (November); a period of high corpus luteum production and large litter sizes began about 3 months after the start of the rains; the build-up to peak numbers did not occur until very late in the breeding season; body growth was halted for about 5 months from the start of the dry season; moulting occurred in two discrete seasons, May to June and September to November; and, finally, winter densities alternated high and low. The 2 years of colonisation were typified by numerous births within a month of the rains starting, a rapid growth of the population early in the breeding season, and a continuous high density showing no winter decline. Clearly then some factors operated during the 11 years of 'stability' which did not operate in the colonisation years.

The pattern of wet and dry seasons has an important, but not altogether understood, influence on dynamic processes. The vegetation responds within 5 days to the start of the rains, yet the rodent population takes 2 months. Lidiker thinks that those individuals that have passed the dry season, usually at high density, suffer some kind of physiological damage. The marked population increase starts when their few offspring themselves start to breed. The influence of physio-