never been seen to reverse, even when watched for as long as a week. This fact can also be demonstrated by staining a living *Amœba* with neutral red. The stain becomes concentrated in the tail, which can then be seen to keep its identity for long periods of time. Dr. Goldacre also described how the fate of the tail region can be followed during cell division, and how the tail seems to determine the plane of the division furrow. This furrow is first evident anteriorly, and the tail region is the last part to divide and separate. He therefore suggested that the tail of an *Amœba* may play some important part in the organization of the cell, surviving possibly throughout its whole life by passing from parent to daughter.

The third contribution to the symposium was a paper by Prof. H. G. Callan (St. Andrews); but since he was unable to be present it was read in his absence by Dr. Ann R. Sanderson. A description was given of recent research on amphibian oocyte nuclei, with particular reference to their chromosomes. These nuclei have the attraction that when they have been extracted from the yolky cytoplasm they are large enough to be visible to the naked eye. Investigations have shown that there are at least two, and probably three, materials forming the nuclear sap: a fluid phase extending through a jelly phase, and probably an even more rigid centrally placed jelly in which the chromosomes are embedded. The whole is surrounded by a membrane pierced by close-packed hexagonal pores.

The chromosomes themselves have been the subject of considerable observation, the necessary preliminary being the development of a technique for their extraction. In *Triturus* newts the growing oocytes contain chromosomes in the diplotene of meiosis. These chromosomes are almost 800 μ long and are arranged in pairs joined at one or more points of contact. They are of the type known as 'lampbrush', and it is their peculiarity that loops of material sprout out from the chromosome axis and return to their points of origin. There are many structures along the lengths of lampbrush chromosomes which enable one to map them. In a given position there may be a loop which is short and thin, or long and fuzzy, and there are also well-defined regions concerned with the production of nucleoli. When fully formed, these nucleoli detach themselves and migrate to the nuclear membrane. With all these structures available for matching chromosomes, it is possible to show that the contact points between pairs of chromosomes occur in homologous regions, although they differ in different nuclei. Indeed, they show the same type of variation in position as is shown by chiasmata. The paper ended with the suggestion that the great value of this oocyte material may prove to lie in what it can teach of gene activity, for in examining these lampbrush chromosomes one may really be seeing genes in action.

The session ended with a paper by Prof. W. S. Bullough (Birkbeck College, London) on hormones and cell replacement in the epidermis. The research involved was not strictly cytological, but was rather an example of what can be achieved in biological and biochemical work by the use of cytological methods. It had earlier been shown that the most critical single factor determining the rate of epidermal cell replacement is the rate of energy-production inside the cells. Since it is known that a number of hormones affect the rate of production of energy, a study has now been made of their effect on cell division. Epidermal cells are normally half-starved for glucose, apparently because of their poor powers of absorption of this sugar from the surrounding medium. Insulin is well known to assist the uptake of glucose from the blood by stimulating the hexokinase reaction, and it was found that it also has this effect on epidermis *in vitro* as evidenced by an induced doubling of the rate of mitosis. It is also known that the pituitary growth-hormone inhibits the hexokinase reaction, and experiments have shown that *in vitro* it powerfully inhibits cell-division. This result suggests that a re-examination of the actions of this hormone is now due, and that the substance may prove to have been misnamed. Possibly its ability to promote growth may be through the induced secretion of other hormones such as insulin.

Attention was then turned to the action of the œstrogenic hormones, which also stimulate epidermal cell-division both *in vivo* and *in vitro*, and evidence was briefly reviewed which indicates that they too act by facilitating the hexokinase reaction. However, *in vivo* the stimulus they exert is only short-lived, and a reaction quickly sets in. This appears to be due, at least in part, to some stimulus to the adrenal cortex, which then actively secretes hormones similar to cortisone. Both *in vivo* and *in vitro* cortisone depresses the rate of production of energy and of epidermal mitosis. Androgens do not induce over-activity of the adrenal cortex with growth inhibition, and this fact suggests a reason for the larger body-size of so many male mammals.

The session ended with a lively discussion, ranging in subject from protozoans to cancer.

APPLICATION OF RADIOACTIVITY TO MINERAL DRESSING

THE third Sir Julius Wernher Memorial Lecture of the Institution of Mining and Metallurgy was given on September 22 at the Royal Institution before a gathering of mineral-dressing engineers who had come to London from many parts of the world to attend the first symposium on this subject to be held in Great Britain. The lecturer, Prof. A. M. Gaudin, Richards professor of mineral engineering in the Massachusetts Institute of Technology, chose for his subject "The Application of Radioactivity to Mineral Dressing".

Radioactivity can be used in three ways—as a research tool, for the control of plant processes, and in the direct separation of radioactive from inert minerals. Beta- and gamma-radiation is employed, the limitations of the alpha-rays making them unsuitable. Such properties as self-diffusion, adsorption across the liquid/solid interphase of minerals suspended in fluids, rates and site packings, as well as the mode of movement are of critical research importance in the exploration of surface phenomena used in the process of froth flotation. Prof. Gaudin's lecture not only showed some of the work which is being done but also gave fascinating glimpses of possible new methods of mineral-dressing research. In the complex field of attrition, the use of labelled particles of a closely defined size-range as part of the total mixture of wide-ranging sizes fed into an attrition mill is throwing light on the selective grinding which goes on among these sizes under controlled conditions. Natural radioactivity is in use in north-west Canada to actuate sorting mechanisms which segregate the uranium-bearing ore from inert

material, and the same process is being studied for possible use with artificially induced, short-lived radioactivity (gamma-radiation) for a selected mineral such as one containing beryllium.

Another incipient aid to fundamental work promises to be the differentiation between slightly varying crystals of what are loosely grouped as the same mineral. For example, galena (lead sulphide) could be thought of as being just galena; but minute traces of impurity and minute variations in its lattice structure and discontinuity make profound differences in its behaviour, both in study and in its practical concentration from its ores. These differences can be greatly magnified by the use of suitable radioactivating techniques.

The Lecture provided an admirable introduction to the symposium held at the Imperial College of Science and Technology, London, by the Institution of Mining and Metallurgy during the following three days, when about forty papers were presented and at which a wide variety of research and practical aspects of this important and growing technology was examined. In recognition of his distinguished services, honorary membership of the Institution of Mining and Metallurgy was conferred on Prof. Gaudin before he gave the Lecture.

RESEARCH COUNCIL OF ALBERTA

REPORT FOR 1951

THE thirty-second annual report of the Research Council of Alberta*, describing the work of the Council in 1951, again stresses the work on the bituminous oil sands; and preparation for the Athabasca Oil Sands Conference, which was sponsored by the board of trustees of the Oil Sands Project, made heavy demands on the Research Council's staff. The terms 'bituminous sand' and 'tar sand' have now been dropped, because of their false implication, in favour of 'oil sands'. Laboratory investigations have confirmed the presence of vanadium in the oil sand, both as a mineral and as a component of the oil, especially in the resin and asphaltene fractions. Some work was done on the characteristics of the flow of sand suspensions, including a study of the friction factor in pipes, as well as on the electrical resistance of oil sand and its breakdown under a high potential difference.

A balanced programme of studies on coal included a study of the absorption spectra of oxidation degradation products of Alberta sub-bituminous coals in aqueous solution, of the cleaning of coal with cyclone washer equipment, analytical and physical testing, and of the physical properties of magnetite, Burmis iron ore, loess, limestone and tailings from a zinc refinery with reference to their suitability for the preparation of the media used in dense-media processes of cleaning coal.

A reconnaissance pleistocene survey was made of the Lake St. Ann map area, and the Gasoline and Oil Testing Laboratory again surveyed gasolines sold in the area and initiated a study of viscosity data at low temperatures on aviation lubricating oils diluted with aviation fuel, and one on the effect of storage time on preformed gum, and on 5-hr. and 16-hr. potential gum tests on aviation fuel. The pyrolysis of natural gas, the partial oxidation of butane, and the National Research Council's Pidgeon process for carbon black received attention, while irrigation soil-survey work on the Bow River project was started and the William Pearce project was continued. A re-survey of the Edmonton map sheet was commenced, and work on the Sturgeon Lake sheet resumed. The investigation of biological cycles continued, particularly with reference to the fluctuations of wild life in northern latitudes, and measurement of ultra-violet solar radiation continued with the thorium photo-cell and with a zirconium photo-cell in spite of adverse conditions. A list of publications of the Council is appended.

* Thirty-second Annual Report of the Research Council of Alberta, 1951. Pp. 32. (Edmonton: Queen's Printer, 1952.)

A WAVE-RECORDER FOR USE IN SHIPS

By M. J. TUCKER

National Institute of Oceanography

ALTHOUGH sea-waves have been recorded for a number of years using shore-connected pressure-measuring instruments or inverted echo-sounders laid on the sea-bed, collection of exact information about waves, studies of the growth of waves relative to the wind, and studies of ship motion and of coastal changes relative to the waves have always been retarded by the absence of a reliable method of continuously recording waves from a ship in deep water.

Some measurements have been made by a method in which an observer stations himself at such a height that the top of a wave comes just level with the horizon when the ship is on a fairly even keel in the trough. Much more accurate measurements have been made by stereo-photogrammetric methods using cameras with a long base-length mounted high on the ship.

Neither of these methods is satisfactory for obtaining a continuous picture of changing wave conditions, and for this purpose the best method until recently has been that employed before the Second World War by the Deutsche Versuchanstalt für Luftfahrt for the study of seaplane landings in a variety of wave conditions. In this method a pressure recorder was suspended on a steel wire 100–200 ft. below a flat lens-shaped float: because of the rapid attenuation of wave-pressure with depth, the recorded pressure fluctuations were mainly due to the recorder following the vertical movements of the float on the surface. A correction could be made for the residual wave motion at the depth of the recorder when the presence of long waves made this necessary. The pressure fluctuations were recorded by a diaphragm connected to a diamond which scratched a spiral record on a polished steel cylinder rotated and moved along its axis by clockwork. The scratch recorder has been replaced in Great Britain by an electrical pressure recorder the output of which is transmitted to the attendant ship by wireless or by a buoyant cable, but the basic idea is the same. Measurements have also been made by an apparatus attributed to Froude and which consists of a buoyant graduated pole held vertical by a weight on its lower end and kept steady in the water by a drogue of relatively large area suspended on 200 ft. of wire from the bottom of the pole. The movements of the water up and down the pole are usually observed visually or photographed, but on a recent voyage of the R.R.S.