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ABSTRACTS OF PAPERS PRESENTED AT THE CHAPEL HILL MEETING OF THE NATIONAL ACADEMY OF SCIENCES

Vacuolation a factor in the division of animal cells: H. V. WILSON. Division of the animal cell is usually described as brought about through the activity of an outer denser layer, the ectoplasmic layer, which by a process of constriction or in some other way cuts the mass in two. This idea irresistibly comes into the mind as we observe the segmentation of living eggs. Only a part, however, can be learned from such observation. The interior must be seen and sections become necessary. Sections through early stages in the segmentation of fish eggs (shad, sea bass) and of the small holoblastic egg of a gephyrean worm (Thalassema) all show the following points. (1) The cells are not complete in the sense that each shall have an ectoplasmic layer of its own. Adjoining cells are separated only by single partition walls, the partition being common to the two cells. (2) A cell may enter upon division before it is completely separated by a partition from its sister cell. (3) A partition wall is foreshadowed by an arrangement of vacuoles which in sections appears as a row. (4) The partition itself appears piecemeal and is very often observable in the interior of the mass when it has not yet formed at the surface. (5) The pieces of the developing partition bear such relations to the vacuoles as to force the conclusion that they are formed as lateral thickenings of the vacuolar walls, the thickened areas uniting and the vacuoles eventually disappearing.

Can mitochondria be used to identify mammalian germ cells?: GEO. T. HARGITT (introduced by H. V. Wilson). There are two main views regarding the functional germ cells of mammals: (1) These are all direct descendants of primordial germ cells arising in the early embryo; (2) while embryonic germ cells are present, they usually degenerate and the functional germ cells arise secondarily from the germinal epithelium of the gonad, either in the immature or adult animal or in both. It has frequently been stated that evidence of the first view is furnished by the form of the mitochondria, germ cells possessing granular mitochondria and all other cells filamentous or rod-shaped mitochondria. Post-natal stages of male and female rats have been studied to test the latter claim.

In the female, the germinal epithelium, follicle cells, fibroblast cells and the epithelium of Fallopian tube and uterus characteristically have filamentous mitochondria. Oocytes near the germinal epithelium and in the cortex of the ovary have rod-shaped mitochondria; the ova in primary follicles either short rods or granules or both; ova in Graafian follicles finely granular mitochondria; corpora lutea and atretica mostly granules and some short rods. As the ovum grows, the few rod mitochondria are gradually replaced by fine granules which become more numerous. The number and form of mitochondria would seem to be indicative rather of activity than of cell specificity, especially as the original filamentous mitochondria of the follicle cells become transformed into granules as the corpus luteum develops and becomes active. The germ cells of the male follow a different course. Up to 21 days post-partum the large cells of the seminiferous cords, usually designated as primordial germ cells, typically contain large granular mitochondria, and such cells divide mitotically during this period. Other cells of the cords have filamentous mitochondria. After 21 days the usual cell generations of the spermatogenetic cycle begin to develop. From this time granular mitochondria are rarely seen, but all the cells of the seminiferous tubules, whether germ cells or Sertoli cells, are possessed of rod-shaped mitochondria, either straight, or in rings and loops. Reports on various adult mammals show that the mitochondrial content may change in amount and form during the spermatogenetic cycle; and observations on several mammals indicates that they do not all agree in the mitochondrial form at different phases of germ-cell history. It would seem, therefore, that the form of the mitochondria can not safely be used to distinguish germ cells from other cells.

Studies on fragments of centrifuged Nereis eggs: DONALD P. COSTELLO (introduced by H. V. Wilson). When the unfertilized eggs of Nereis limbata are centrifuged at 66,000 times gravity for 60 to 80 minutes, the interior protoplasm becomes stratified and the eggs are elongated into a dumb-bell form. Due to their shape, the eggs usually orient in the centrifuge with the polar axis perpendicular to the axis of centrifuging. Egg fragments were obtained by cutting the dumb-bells, after removal from the centrifuge, by hand with micro-needles. Three types of cuts were made: "upper," across the neck of the dumb-bell; "lower," across the lower edge of the yolk zone; and "intermediate," through the yolk zone. The centripetal fragment contains the germinal vesicle, and its cytoplasmic constituents differ from those of the centrifugal fragment. Upon insemination, either fragment or both may be activated. While activated centripetal fragments usually cleave, the centrifugal fragments never do so. The centripetal fragments produced by the "upper" cut rarely develop into larvae bearing prototrochal cilia, although they may attain a sufficiently advanced multicellular condition. Ciliated larvae develop frequently from the "lower" centripetal fragments, less frequently from the "intermediate" centripetal fragments. These experiments indicate that some substance in the centripetal hemisphere, probably derived from the germinal vesicle, is essential for development; and that materials near or below the neck of the dumb-bell of the centrifuged Nereis egg are essential for the development of a larva bearing prototrochal cilia.

Experiments on the relation of nutrition to the composition of the body and the length of life: H. C. SHERMAN, H. L. CAMPBELL and C. S. LANFORD. The influence of food becomes more apparent when the experiments are continued beyond a single generation. In second (or later) generations the calcium content of the body is found to differ widely throughout the period of most rapid growth and measurably also in the fully developed adult, according as the calcium content of the family food supply is only slightly above the level of minimal adequacy or is considerably higher. Adult vitality and length of life also average higher in the families whose food supplies contain liberal rather than low margins of surplus of calcium above the merely adequate level. Experiments with reference to the relation of the level of intake of vitamin A (proportion of butterfat in the diet) upon growth, length of life and vitality of offspring will also be discussed briefly.

Nicotinic acid in the treatment of canine blacktongue and human pellagra: DAVID T. SMITH and SUSAN GOWER SMITH (introduced by Wm. deB. MacNider). In September, 1937, Elvehjem, Madden, Strong and Woolley, of the University of Wisconsin, published their preliminary report that nicotinic acid cures canine blacktongue. By December, 1937, their results had been confirmed by Street and Cowgill, of Yale, and Dann, of Duke. This was followed by a more extensive study by Smith, Margolis and Margolis (1938) of Duke and Sebrell, Onstott, Fraser and Daft (1938) of the U. S. Public Health Service. Smith, Margolis and Margolis showed that the vitamin potency of nicotinic acid is not injured by autoclaving at 15 pounds pressure for six hours. Recent work by the same investigators at Duke has shown that a dose of 0.1 mg per kilogram, given daily for 10 days, fails to cure blacktongue, 0.2 mg per kilogram is slowly effective, but 0.5 mg per kilogram gives rapid and dramatic cures. Doses of 10.0 mg per kilogram were no more effective than 0.5 mg. The Goldberger blacktongue-producing diet is primarily deficient in the pellagra-preventing factor, but is partially deficient in thiamin chloride (B_1) and riboflavin. Sebrell, Hunt and Onstott; Zimmerman, Cowgill and Fox (1937) observed the riboflavin deficiency and Margolis, Margolis and Smith[1] at Duke the B_1 deficiency. Nicotinic acid cures the primary deficiency and gives as good results as liver or yeast with the first two consecutive attacks of blacktongue. After the third attack the oral lesions are cured, but the animals do not gain weight. If the secondary deficiencies are corrected by giving B_1 and riboflavin along with the nicotinic acid dogs can be maintained in good condition for as long as 12 months. Pyridine B—carboxylic acid diethylamide (Coramine) cures blacktongue at levels of 5 to 10 mg per kilogram. Although larger doses are required it has the advantage of being less toxic and will protect the dogs from a new attack for much longer than the maximum doses

[1] Detailed accounts of the blacktongue experiments by Margolis, Margolis and Smith are in press (*Jour. Nutrition*) at the present time.

of nicotinic acid. Patients with pellagra have been cured with nicotinic acid by Fouts, Helmer, Lepkovsky and Jukes (1937); Smith, Ruffin and Smith (1937); Harris and Hassan (1937); Spies, Cooper and Blankenhorn (1938); and France, Bates, Barker and Matthews (1938). The dose used by Smith, Ruffin and Smith was 1.5 mg per kilogram each day. This was three times the minimal effective dose in the dogs. Ruffin and Smith have obtained dramatic cures in 10 cases of acute pellagra with this dose of nicotinic acid. Toxic symptoms appeared in one patient and in 5 normal medical students after taking 1 gram of nicotinic acid daily for 5 days. There is, however, a large margin of safety between the effective dose and the toxic dose. All the evidence indicates that the pellagra preventive factor of Goldberger is nicotinic acid.

The polarity potential of the human eye: WALTER R. MILES. The human eye, in common with other tissues of the body, shows fairly constant electrical potentials. The anterior portion is positive and the posterior or retinal area is negative. The potentials can be led off from the tissues just next the eye somewhat as the heart currents are led off by connecting a patient's wrists and the left ankle to a measuring instrument. Very small metal foil discs are attached to the skin with adhesive on either side, above and below each eye. These electrodes are connected through a vacuum tube microvoltmeter to a delicate galvanometer, the deflections of which are photographed. The eye now acts as both battery and switch, since turning the eye changes the contact relationships of its front and back with the electrodes. The farther the eye is turned in the orbit the stronger the potential indicated on the galvanometer, and as long as the eye remains fixed at one point, the potential holds steady at a value dependent on the eye's position. When their eyes are turned 30° from the primary line of regard, which angular distance may be used as a standard test, children and adults show potentials ranging from .0002 to .002 volt from each eye. The amount of light falling on the eye at the time of measurement makes only a small difference in the result. One eye may differ markedly from its mate, just as people differ among themselves. Repeated measurements on the same person as a rule agree well. Apparently the eye potential is not easily disturbed by the minor defects which interfere with visual efficiency. That it is inherent in the tissues or tissue relationships of the eyeball, rather than derived from the eye muscles and tissues lining the orbit, is indicated by the fact that the potential is absent when the eyeball has been removed. Patients with one glass eye do not give a potential on that side, even though much of the muscle tissue remains. The fundamental cause of the polarity potential in the eye remains to be discovered. Preliminary data on the possible influence of various factors are presented.

The Oligocene-Eocene boundary in the Rocky Mountain and Pacific Coast regions: WILLIAM BERRYMAN SCOTT. The Far West of the United States, including the Rocky Mountains and Pacific Coast provinces, contains the most wonderful museum of ancient mammalian life known in the world; and no more convincing proof of the theory of evolution can be found than is given by the successive developments of various lines of mammalian descent, such as horses, camels, rhinoceroses, etc. In order to make this evidence available to naturalists, it is essential that the chronological order of the deposits which contain the fossils shall be established beyond doubt; and the paper deals with a small part of the Tertiary period, namely, the Upper Eocene and Lower Oligocene, and the problem of fixing the boundary between these two divisions of geological time; more especially in the great series of fresh-water river and lake deposits which are found in the high plateau of southern Wyoming, northern Utah and the adjoining parts of Colorado, where aridity tends to prevent the growth of the cover of vegetation. The formations in question are all of continental origin, partly lake deposits, partly river deposits. In southern Wyoming the areas usually assigned to the Middle Eocene or Bridger stage are in two separate basins; one around Fort Bridger, extending for many miles in every direction from that center; the other east of the Green River, which extends down to the foothills of the Uinta Mountains and around the east end of those mountains into Colorado and Utah. The subdivision of these beds has given rise to considerable controversy because of the gradual change from one stratigraphical subdivision to another. There is no question as to the order of succession, but as to the boundaries where the lines should be drawn. The Upper Eocene or Uinta formation is clearly subdivided into three substages, which are called respectively A, B and C. Above these comes the thick Duchesne River, and this is generally regarded as the summit of the Eocene, but I am more inclined to consider it the basal member of the Oligocene. In southern California there is a very thick bed of continental origin known as the Sespé. This is some 7,000 feet thick and rests unconformably upon marine Eocene and is overlain unconformably by marine Miocene. It seems thus to represent the whole of the Oligocene. In the lower part of the Sespé is found a fauna very similar to that of the Duchesne River, and the upper part resembles that of the John Day in eastern Oregon.

Origins of cave faunas: A. S. PEARSE (introduced by Ross G. Harrison). Yucatan is a great sheet of limestone which has been uplifted from the ocean in rather recent times. Its caves and cenotes contain a number of interesting troglobites which throw some light on the origins of cave faunas. Caves have been populated by invasions from ocean, epigean and subterranean bodies of fresh water, and land. Animals have occupied caves in order to secure shelter and to take advantage of the stability of environmental conditions, especially temperature and humidity. Of some three hundred species collected in the caves of Yucatan, most are such as may be found elsewhere. Less than a tenth are troglobites. Though caves are continually occupied for longer or shorter periods by animals from other habitats, few become adapted to life in caves to such a degree that they show characteristic lack of pigment, degenerate eyes,

attenuation of tactile organs, lack of seasonal periodicity in reproductive activities, etc. Cave bats fly continually into the epigean world and bring back materials which directly or indirectly constitute important food resources for small animals. In Yucatan certain troglobite diplopods belonging to the Genus Yucodesmus show specific segregation which has apparently been brought about by isolation. Cave crickets and crustaceans, on the contrary, are widely distributed; the former perhaps because they spread above ground during humid, dark periods and the latter because they emigrate through ground waters.

Structure and automorphisms of semi-simple Lie groups in the large: N. JACOBSON (introduced by S. Lefschetz). The present paper attempts to fill in several gaps that appear in the literature relating Lie algebras to continuous groups. It is shown that semi-simple Lie algebras over the field of real numbers are in (1–1) correspondence with semi-simple Lie groups in the large (equivalence defined by local isomorphism), simple Lie algebras with simple Lie groups. We also give a new set of linear groups which serve as representatives of the classes of locally isomorphic simple Lie groups. Omitting a finite number of exceptions these are simply the important geometric linear groups with real, complex or quaternionic elements (*e.g.*, unimodular, orthogonal groups). We determine the group A of continuous automorphisms of the "unexceptional" groups and discuss the structure of A/A_0 where A_0 is the component of the identity of A.

Spiraling compound curves: T. F. HICKERSON (introduced by H. V. Wilson). This paper presents a study of compound curves of various types with a view of inserting transition spirals providing a gradual change of curvature from one branch to the other of the compound curve. At the junction of two curves of different radii, called the point of compound curvature, there is an abrupt change of curvature similar to that existing at the point of tangency of a straight line with a circular arc. For the latter condition, the use of a transition spiral to effect a gradually increasing change of curvature from the straight line to the circle is a well-known and well-established procedure in both railroad and highway design. The circular curve is here shifted radially inward far enough to make room for the spiral. This radial shift depends upon both the degree of curvature of the circular arc and the desired length of transition spiral. In the analogous case of a compound curve, one of the curves must be considered fixed in position, while the other curve is shifted radially a small distance (p) to facilitate the transition. If the flatter curve remains fixed, the sharper curve is shifted inward; but if the sharper curve remains fixed, the flatter curve is shifted outward. As in the case of the transition from a straight to a circular path, the amount of shift for either curve depends upon the total change of curvature and the length of spiral affording the transition. The length of spiral varies theoretically as the cube of the speed of cars (in miles per hour) and inversely as the radius of the curve. Two right-hand or left-hand circular curves separated by a short tangent are treated as special cases of compound curves. Here the alignment is much improved in appearance and riding qualities by the substitution of uninterrupted continuous curvature with transition spirals in the place of the intervening short tangent.

Plant disease fungi constantly evolving new types: E. C. STAKMAN. Evolution is a very real and active process in many of the most destructive plant disease fungi. There are many different parasitic strains, and new ones are continually being produced by hybridization between existing strains and by sporting or mutation. How a multitude of new types or strains arise in a single species of smut fungus is illustrated well by the corn smut fungus. Several years ago a single reproductive cell of this fungus was isolated and its offspring propagated in the laboratory. Within a few months 162 distinct strains of this one fungus had been produced by mutation among the descendants of the original single cell. During the past several years more than a thousand types have resulted from the progeny of two single germ cells which were mated. In all, there were developed several thousand types among the progeny resulting from the union of these two single cells. The number of strains that can be produced by hybridization and sporting or mutation in this one fungus is almost unlimited. Some of these strains differ from each other in their appearance on nutrient media in the laboratory, some in physiologic characters and some in parasitism; naturally, therefore, there are numerous parasitic strains of such smut fungi and new ones are continually being produced. Extensive investigations also have been made of some of the most destructive rust fungi, particularly that causing the stem rust of wheat and other small grains. Within the single species of fungus that causes the stem rust of wheat there are varieties which in general look alike but differ in behavior. Thus there is one well-known variety of stem rust that can attack wheat and barley but not rye and oats; there is another that can attack rye and barley but not wheat and oats; and still another that can attack oats but none of the other small grains. Under the microscope they all look very much alike, but their parasitic appetites differ. And the subdivision into strains goes still further: more than 150 parasitic strains of the variety of stem rust that attacks wheat can be recognized by their parasitic effect on twelve varieties of wheat. Furthermore, new parasitic strains are continually being produced by hybridization between existing strains on the barberry plant, which is the alternate host for the rust. This natural evolution of new types of plant disease fungi does not occur only in the laboratory but is going on in nature, as is evident from results obtained during the past few years. About ten years ago, for example, a new parasitic strain of the wheat stem rust was found for the first time in the Middle West. Within ten years it has spread to virtually the entire North American continent and has become by far the most prevalent strain. It is particularly important because it is especially severe in its attack on a variety of wheat which had been resistant prior to the advent of the new strain of rust. The fact that so many types of plant disease fungi exist within a single species and that new ones are continually being produced makes it impera-

tive that the evolution of these disease fungi be studied carefully in order that breeders of crop plants may keep a stage ahead of nature as a breeder of new types of plant disease. In the past, new varieties of crop plants often have been produced which were resistant to a given disease for several years, only to have a new strain of the disease organism pop up to attack the same variety later. There is therefore a contest between breeders of resistant varieties and nature as a breeder of new types of plant diseases. The development of disease-resistant varieties in many cases, therefore, must be a continual process.

The distances of 1,350 stars determined at the Leander McCormick Observatory: S. A. MITCHELL and D. REUYL. The year 1938 marks the completion of one hundred years of measurements of stellar distances or parallaxes. By the year 1910 there had been determined the approximate distances of 100 stars. Photographic work was started at the University of Virginia late in the year 1914. A volume soon to be published will give the details of 650 stars, bringing to 1,350 the grand total of McCormick parallaxes. These trigonometric parallaxes directly determined are in close agreement with the parallaxes derived at the Mount Wilson Observatory by indirect methods by the spectroscope. The McCormick program includes relatively faint stars of large proper motions and also all the brightest stars accessible for observation from our latitude. The material covers stars of all spectral types and hence the results permit a comprehensive study of intrinsic stellar brightnesses or absolute magnitudes. Of particular interest for the investigation of problems of stellar stability is the question of the reality of a gap between "giants" and "dwarfs" for K and later types, and also the question of "intermediate" white stars and "white-dwarfs." For the nearest stars, the trigonometric parallaxes have a higher accuracy than the spectroscopic. The recent claim that the spectrum of the faint star Wolf 424 shows it to be our nearest neighbor in space has not been substantiated by McCormick measures. There are at least 30 nearer stars.

Some recent observations of sunspot spectra: HAROLD D. BABCOCK. With the 150-foot reflecting telescope of the Hale Solar Laboratory in Pasadena and a new concave grating spectrograph a reconnaissance has been made of two regions of the sunspot spectrum hitherto unexplored. The more fruitful of these is in the infra-red, $\lambda\lambda 9900$–11200, where many striking differences are found between the spectra of spot and solar disk. The other is in the ultra-violet, where atmospheric and instrumental scattering of light imposes much difficulty. The observations have been made on spots of only medium size. With more favorable conditions further additions to our knowledge may be expected. The behavior of several interesting elements as shown in the infra-red is described qualitatively and found to be in agreement with Miss Moore's observations in the visible region.

The interpretation of showers below thick layers: L. W. NORDHEIM (introduced by Arthur H. Compton). With the assumption of the barytronic nature of the hard component of the cosmic radiation a large part of the electron showers under thick layers of heavy materials and underground can be explained as due to collision secondaries of fast barytrons. This hypothesis leads to the following results which are, at least, in good qualitative agreement with observation: The number of showers of a given size will be nearly independent of the atomic number of the generating material. The fraction of soft intensity in equilibrium with the hard component underground is of the order 20 per cent. (observed about 25 per cent.), the ratio of single secondaries and small showers to hard rays emerging from lead as obtained from cloud chamber observations checks very well with theoretical estimates. It follows, furthermore, that a considerable fraction of the soft intensity at sea level must be due to the same cause. It is, however, likely that contributions from other processes, though quantitatively of lesser importance, are not entirely negligible. The above explanation could not be maintained with protons as primaries, as they can not produce electron secondaries of sufficiently high energy.

Adiabatic nature of β-decay: M. H. HEBB (introduced by E. C. Kemble). It would appear at first glance that the change in nuclear charge in a β-transformation should be non-adiabatic with regard to the atomic electrons, since the time required by the β-particle to reach the outermost shells can be much shorter than the atomic periods. The experiments of Crane and Halpern for detecting the neutrino require an adiabatic β-process, *i.e.,* that the atomic electrons pass adiabatically from the ground state appropriate to the initial nuclear charge to that for the final nuclear charge during the β-decay. The above authors have given an experimental proof, which tends to show that the β-decay is adiabatic. We shall present theoretical arguments to the same effect.

Disintegration of atomic nuclei by high-energy radiation: JAMES B. FISK (introduced by E. C. Kemble). In analogy with the process by which electrons are ejected from atoms by light waves, it has recently been possible to eject neutrons from a number of atomic nuclei by high energy gamma rays. This method has been used to produce disintegration of H^2 and Be, using natural radioactive sources of gamma radiation; and disintegration of Cu, Ag and Zn, and a number of other elements using the much more powerful gamma ray resulting from the process in which a proton is captured by the Li^7 nucleus. The Lithium gamma ray has energy of approximately 17 million electron-bolts, that is, approximately 9 M.E.V. more than the average energy of binding of a neutron to a nucleus. This type of disintegration has also been studied using the gamma rays produced in the bombardment of boron by protons. In this process the strongest gamma ray is 12 M.E.V., and the corresponding theoretical probability of disintegration is approximately twice that for the lithium gamma ray. This method of investigation of the properties of atomic nuclei is a very powerful one, and, as gamma rays of other energies become available through the use of higher voltage apparatus, should prove as useful as the corresponding photoelectric effect for atoms.

Flotation of some highly dispersed phases: FRANK K. CAMERON (introduced by Claude S. Hudson). It has been found that the phase rule applies to an aqueous suspension of a solid of colloid dimensions if the ion concentration at the surface be considered as the only significant varying intensity of the solid phase. When plotted against the pH of the liquid phase, boundary curves and transition points are found of the familiar types. An added reagent, if it dissolve with acquisition of a different sign, will be adsorbed by the solid, and if water-repellent, the adsorption complex may be floated. On these principles a simple technique has been developed for the rapid quantitative determination of a flotation agent for a colloid.

General relations governing the solubility of organic substances in water: PAUL GROSS (introduced by Roger Adams). Experimental determinations of the solubilities in water of a large number of slightly soluble organic substances, at different temperatures, have yielded data which on first inspection seemed devoid of regularity. While it has not been possible as yet to give anything approaching a complete quantitative picture of the factors involved, the influence of certain general factors has become apparent. These have been brought out by recalculating the solubilities as vapor solubilities after first demonstrating experimentally that the concept of the vapor solubility is applicable to systems of this type. These vapor solubilities show surprisingly simple quantitative correlations with the molecular volumes of the organic molecules. Treatment of the data for several series of related compounds in this way brings out the effect of polarity in the solute molecule on solubility and also shows the importance of London-Van der Waals type forces in determining the magnitude of the solubility values. The significance of the large values of the temperature coefficients of the vapor solubilities is also discussed.

Solid-liquid equilibrium and the interatomic potential curve for argon: O. K. RICE (introduced by Claude S. Hudson). Previous investigators, in attempting to find potential curves for interatomic forces, have generally assumed a simple combination of an inverse sixth power attractive potential and an inverse higher power or exponential repulsive potential, and have made use of equation of state data or the Joule-Thomson coefficient and theoretical considerations to fix the parameters. It is found in the present investigation that it is possible to make an estimate of the mutual potential of two argon atoms for a small range of interatomic distances close to the minimum of the potential curve by use of the melting parameters. The slope of this portion of the curve is considerably greater than anticipated, but it may be joined on smoothly and in a practically unique way to an inverse sixth power curve at larger interatomic distances. The whole may then be completed by use of data on the Joule-Thomson coefficient, giving a curve which is believed to be more nearly correct than any hitherto proposed.

The oxygenation of diisobutylene at elevated pressures: R. W. BOST (introduced by Roger Adams). The action of molecular oxygen on diisobutylene has been studied at pressures ranging from 100 to 150 pounds per square inch and at temperatures around 100° C. These studies were carried out in specially constructed bombs whose temperature could be controlled within narrow limits and were attached to a pressure-recording device, thus enabling one to follow the reaction closely. The reaction products consisted of organic peroxides, aldehydes, ketones and acids. When diisobutylene is oxygenated in the presence of solid potassium hydroxide, peroxides are absent.

Size of seed and other criteria of polyploids: ALBERT F. BLAKESLEE and H. E. WARMKE. For determination of the chromosomal constitution of members of a polyploid series, ultimate dependence must be had upon microscopic examination of their chromosomes. Two reservations to this criterion are (1) the fact that a plant may give a $4n$ count and yet be unbalanced in two sets to form a $4n+1-1$ individual and (2) the fact that under certain conditions, such as colchicine treatment, both $4n$ and $2n$ sectors as well as sectors with chromosomal deficiencies are common on the same plant. The difficulties involved in examination of chromosomes suggest desirability of short-cut methods of determination. The following criteria have been found useful in preliminary separation of the even-balanced $4n$ from normal $2n$ individuals and with some modifications are usable with other members of the polyploid series. (1) Larger pollen grains in $4n$ flowers. Presence of a few $1n$-size grains common in tetraploids not yet explained. (2) Larger $4n$ seeds. (3) Larger stomata. (4) Leaves increased in width, thickness and depth of green color. (5) Larger size of floral parts. (6) Shorter, stouter fruits. For odd-balanced types (*e.g.*, $1n$ and $3n$) criteria (3) to (6) are usable, but the proportion of aborted pollen grains is a better criterion. In a study of the effect of polyploidy upon the sex and sex mechanism of a series of dioecious plants, it is difficult with the female individuals to use the best criteria of polyploidy (actual chromosome determination and pollen size). Doubling chromosome number does not prevent the sex expression of maleness and femaleness in such species. For example, in hemp which had been treated with colchicine, $4n$ male flowers were determined, first by pollen size and later by chromosome counts in pollen mother cells. Females were determined provisionally by thickness of leaves, size of stomata on floral bracts (which appears a more reliable criterion than of those on leaves), but especially by the seeds, which were distinctly larger than those of $2n$ controls. Such large seeds of presumptive $4n$ females when pollinated by $4n$ males gave rise to male and female offspring, of which all the males were $4n$ and all the females appeared $4n$ by the tests already mentioned. An intersex plant was determined to be $3n$ by chromosome counts in pollen mother cells. Stomata on its floral bracts were intermediate in size between those of $2n$ and $4n$ individuals.

Further experiments on the behavior of the "dominant" lethal, I, of Neurospora: B. O. DODGE. Because a cell provided only with nuclei that carry the "dominant" lethal, I, can not develop vegetatively to any great

extent, there has been some question whether it is possible to obtain asci homozygous for this factor. These experiments prove that occasionally ascocarps in which the asci are homozygous, II, for the lethal can be obtained. Another question arises as to whether interspecific crosses can be made when one of the parents carries this factor I. When *Neurospora tetrasperma,* the 4-spored species, carrying the lethal, I, is mated against *Neurospora sitophila,* the 8-spored species, the resulting asci so far obtained have been 8-spored, as might be expected because 8-sporedness is dominant over 4-sporedness. Some evidence had previously been obtained to indicate that this factor may revert or lose its power altogether to bring about abortion in heterozygous, Ii, asci. When the lethal was introduced in these interspecific crosses it was not effective in bringing about indurated ascus abortion in the first generation in these experiments.

(To be concluded)

PLACER MINING AND THE ANADROMOUS FISH OF THE ROGUE RIVER

By Professor HENRY B. WARD
UNIVERSITY OF ILLINOIS

THE wide-spread pollution of streams and lakes in the United States is well known and recognized not only by all students of natural history but by many others whose love of nature and contact with existing conditions have made them painfully conscious of the situation. The demand for correction or limitation of these conditions is based on the damage done to water supplies essential for the population in given areas, on the destruction of fish life and other aquatic organisms, both plant and animal, that play an essential part in the economy of nature, and on the serious limitation or total destruction of recreational opportunities connected with the water bodies involved.

Abundant evidence has been secured in specific cases to justify the complaints and to call for corrective legislation. The protection of drinking water supplies is generally acknowledged to be essential. Scientific studies have definitely connected the destruction of the fish life with the dumping of manufacturing wastes into various rivers or the discharge of large volumes of domestic waste in untreated sewage. Even before the condition of the water had become so marked as to deter adults or youths from utilizing streams or lakes for recreation, health boards had interdicted such practices on the basis of demonstrated contamination of the water. Increasing volumes of polluted water have become of such national concern that the last Congress devoted much time to the discussion of the problem, although unfortunately the emasculated measure adopted at the last moment was generally unsatisfactory and wisely vetoed by the President. One new phase in the relation between the fish fauna and the environmental conditions it encounters in a particular locality has been subjected to careful study with reference to a factor which appears not to have been investigated previously.

In many places the fish supply of our rivers constitutes a natural resource of high value, though often overlooked and sadly neglected. Recently attention has been directed to the influence of local practises on the welfare of the fish in the stream. The Rogue River in southwestern Oregon has long been famous for its steelhead and salmon. Within recent years the run of these fish has fallen off materially, and some have attributed the decline to an increased activity in placer mining which adds to the stream a considerable volume of earthy material washed down from the hillsides of the valley. On the other hand, the gold-bearing soils constitute a valuable natural resource, the development of which has contributed materially to the welfare of the area and of the state. This conflict of interests led to legal controversy in which the need for more accurate determintaion of the facts involved became evident.

I was asked to make an independent and all-sided study of the river in order to ascertain the accuracy of the complaint, the extent and character of any damage done to the fish, and when the damage was determined to consider how the placer mining industry might modify its practises for the protection of the fish. I was assured of perfect freedom in carrying out my studies and in publishing the results. The report[1] just completed contains some biological observations of such character as to justify their presentation here in brief.

The charge brought against the placer mining industry maintained that it discharged into the river an amount of waste inimical to the welfare of the fish. No one doubted that during the active season the run-off from placer mining added to the stream a considerable amount of silt and that material in miners' terminology was "waste." Superficial inspection had convinced people generally that the stream "looked bad," but in the complaint no real evidence was offered as to the effects on the fish. The rusty-red, muddy

[1] "Placer Mining on the Rogue River, Oregon, in its Relation to the Fish and Fishing in that Stream. An ecological study made for the Oregon State Department of Geology and Mineral Industries." Bull. No. 10.