when these were examined on September 6 that all the eleven were females.

According to Mr. McCann this is the third consecutive year that medusae have appeared in Andrew Jackson Lake. Each time they have lasted about 45 days, at the end of which time they more or less suddenly disappeared. This year they disappeared about August 3 or 4, according to Mr. McCann. None could be found when the lake was visited on August 14. As far as the writer knows, this is the first record of freshwater medusae in Tennessee.

EDWIN B. POWERS
UNIVERSITY OF TENNESSEE

HUNTING IN SOUTH AFRICA

MY attention has recently been drawn to more than one attempt, by advertisement and otherwise, to entice overseas sportsmen to the Union of South Africa with promises of facilities for big and small game hunting. These promises are couched in language that is unjustifiably optimistic, not to say misleading.

There is still much good hunting to be had in many parts of South Africa but mostly on privately owned farms, where in many cases game is carefully preserved. Speaking generally, game is to a great extent strictly protected by law throughout South Africa, particularly in the Transvaal, and permits for shooting certain species of game are only granted in those districts where those particular species are fairly numerous.

Roan antelope are being strictly protected everywhere. Only in special circumstances will permits be issued for shooting oribi, reed buck and sable antelope. Permits to shoot wildebeest, zebra, kudu, impala and waterbuck are only issued in those districts where these animals are sufficiently plentiful. Permits to shoot elephant, hippo, rhino and giraffe are not to be obtained. Even a farm of 10,000 acres well stocked with game might easily be deserted by game, other than birds, after a week or two of intensive shooting, and disappointment is bound to be the lot of many who come to South Africa on the strength of such promises.

Sportsmen who propose visiting South Africa in the hope of getting some big or small game hunting will be well advised to make the closest inquiries before concluding arrangements with persons offering hunting facilities. The Wild Life Protection Society of South Africa is prepared to give advice on game to any one who desires to visit the Union of South Africa on a shooting trip.

J. W. H. WILSON

THE STRUCTURE OF THE INSULIN MOLECULE

IN the article entitled "The Structure of the Insulin Molecule" in the issue of SCIENCE for August 12, two corrections should be made. There should be substituted for "with six slits whose centers give an octahedron," the following: "which by parallel displacement of faces through $\pm a/2$ becomes an octahedron with the same distance between parallel faces and consequently." On page 149, line 16, first column, 66° should be substituted for 6°.

D. M. WRINCH

ABSTRACTS OF PAPERS READ AT THE AUTUMN GENERAL MEETING OF THE AMERICAN PHILOSOPHICAL SOCIETY

AT the autumn general meeting of the American Philosophical Society held in the hall of the society on Independence Square, Philadelphia, on November 18 and 19, the following papers were presented:

Agriculture and current population trends: CONRAD TAEUBER. Reproduction rates in the farm population indicate an excess of approximately two thirds above replacement needs per generation, but rates of reproduction for the non-farm population are not now sufficient for permanent maintenance of present numbers. Within the farm population there is wide variation, rates of reproduction in the native white group ranging from 1.00 in Connecticut to 2.11 in Utah and rates among Negroes ranging from 1.47 in Arkansas to 2.14 in North Carolina. In general, rates are higher in the South than in the North and West; among Negroes and other colored groups than among whites, and among foreign than among native stocks. There is an inverse relationship between level of living and population fertility ratios. While no single factor serves to account for the differentials in the rates of reproduction within the farm population, significance attaches to the nature of the prevailing agriculture. The population engaged in a rationalized, commercial agriculture tends to have lower rates of reproduction and is less elastic for population growth than that engaged in a less commercialized, more nearly self-sufficient agriculture. This relationship is especially clear in areas with approximately the same plane of living; rates of reproduction in the Southern Appalachians tend to exceed those in the Cotton Belt. Changes in farm population between 1930 and 1935 illustrate the same principle. Some of the areas where commercial agriculture is dominant lost population throughout that period, whereas areas with less highly commercialized agriculture more frequently retained their own natural increase and received migrants from non-farm areas.

The social environment as a factor in population

growth: WARREN S. THOMPSON. Not only is there evidence of a general nature that social environment affects the birth rate, but also that a large part of the differences in the birth rates as between individuals and groups are accounted for by the practice of contraception. In industrially backward countries like China, where the mores are favorable to early marriage and the raising of many children, the birth rate is high and seems likely to remain so. In many countries in Europe, notably Germany, a definite attempt is being made to influence the mores or climate of opinion in favor of earlier marriage and larger families. It seems probable that these efforts are having some effect, although it is too soon to speak with assurance. In those parts of the United States where the birth rate remains relatively high, the mores are favorable to raising large families although the economic conditions are not. If the economic motive is the chief motive leading to the practice of contraception, it must be distinguished from necessity, since the birth rate appears to be lowest in the comfortable and well-to-do classes. If the time should come when the community would like to exercise control over the birth rate, it can not do so intelligently unless the motives which actually lead to the practice of contraception have been studied carefully. Until it is clearly known why such a large proportion of the population prefers families too small to insure reproduction, it will not be possible to take measures to change this situation if it is desired to do so.

Intrinsic factors in population growth: FRANK W. NOTESTEIN.

A study of psychological factors in relation to fertility: JOHN C. FLANAGAN.

Voluntary and involuntary aspects of childlessness: CLYDE V. KISER. However important may be the practice of deliberate family limitation among urban couples for the purpose of postponing or spacing pregnancies, it appears that childlessness among women married ten years or more is an involuntary situation. This conclusion seems justified from data recently collected by the Milbank Memorial Fund with the help of the National Committee on Maternal Health. For an exploratory investigation of the problem of childlessness a questionnaire was devised for use among a selected group of married white women residing in four boroughs of New York City, representing all socio-economic classes. The schedule provided for entries concerning previous births and pregnancies. Women reporting that they had never been pregnant were asked to supply information concerning the extent of contraceptive practice since marriage. Furthermore, the childless women were asked to state whether their failure to bear a child had been a disappointment and whether they had ever sought medical advice regarding this condition. A sifting of the returns yielded a group of 291 women who had never been pregnant despite the fact that they had been married ten years or more and were under forty years of age at the time of marriage. Among these, three fourths stated that they had done nothing since marriage to prevent conception, and only 14 per cent. stated that they had regularly and constantly resorted to contraceptive practice. Furthermore, approximately two thirds of the never-pregnant women stated that their failure to have a child had been a disappointment to them, and 57 per cent. stated that they had actually consulted a physician in order to learn why they could not conceive. Similar investigations in other areas are needed for more general results, but it appears that even in a metropolis the practice of contraception can not be held responsible for any major share of permanent childlessness.

Mortality in relation to widowhood: MORTIMER SPIEGELMAN. The general improvement in mortality in the last century has resulted in an appreciable reduction in the chances of widowhood for both man and wife. A married man under age 50 to-day is less than half as likely to lose his wife by death in the course of the year than he would have been one hundred years back; for wives, a corresponding benefit of the same magnitude extends only up to age 40. Since the family is the social unit through which the growth of the population may be influenced, the notable reduction in the chances of widowhood at the young ages of married life, apart from other factors, has, to some extent, enlarged the potentialities for population increase. In the case of native white married women in Pennsylvania, it is found, on the basis of the latest available data (1930), that among wives of ages 20 to 24 the chances of becoming a widow in the course of a year were 2.9 per 1,000; in the age group 30 to 34 years, the chances were 4.8 per 1,000, and, for wives ten years older, namely 40 to 44 years, the chances of widowhood mounted to 9.5 per 1,000. Among men, the chances of becoming widowed in the course of a year were 3.8 per 1,000 in the age group 30 to 34 years; 5.5 per 1,000 in the age group 40 to 44 years, and 9.6 per 1,000 at ages 50 to 54 years. At every age above 34, for a married man, the chances of his own death occurring within one year are greater than the chances of his becoming widowed by his wife's death in that period. Furthermore, his chances of death increase more rapidly with advancing age than his chances of becoming widowed; on the other hand, for a woman beyond age 27, the probability of widowhood within the year is greater than the probability of death; for her, the chances of widowhood increase faster with advancing age than the chances of death.

Technological advance in relation to population trends: WALDEMAR B. KAEMPFFERT.

Prospective development of cultural patterns in rural America and their possible influence on population trends: CARL CLEVELAND TAYLOR.

Anthropological aspects: HARRY L. SHAPIRO.

The heavy electron: KARL K. DARROW. The "heavy electron" is an interesting example of a physical concept now engaged in forming itself under our very eyes. Of electrons, protons and alpha-particles it can be said that their charges and charge-to-mass ratios are determined directly, and serve for defining them; we then observe

whatever other qualities they possess, such as ionizing-power, and associate these with their measured charges and masses. When however a physicist speaks of a heavy electron he is not speaking of a particle of which the charge and the mass have been measured: quite the contrary! Of heavy electrons the charge and the mass can not as yet be measured, and we are forced to base our definition of them upon what for the other particles we regard as secondary qualities. He may be speaking of a particle of which the ability to penetrate great thicknesses of heavy metal is much greater than, according to current theory, that of an electron ought to be. He may be speaking of a set of data which indicate the existence of two distinguishable kinds of particles (the distinction being made on the basis of some other property than charge and mass) where he expected to find one kind only; he may or may not be convinced that one kind consists of electrons, but at any rate he is debarred from believing that both do. In a very few but most significant cases, he can be pretty sure that a particle has exhibited an ionizing-power different not merely from what theory suggests but also from what observation confirms for an electron. Also there is reason for supposing that a particle of mass intermediate between those of electron and proton would be a welcome thing to postulate as a constituent of nuclei. To summarize: there is a variety of mysterious phenomena, of which the mysteries could perhaps be explained by assuming particles of a certain mass between those of electron and proton; if it should finally turn out that the same particle will serve for all, then the heavy electron will be established as a feature of modern physics.

The radioactivity of indium produced by slow neutrons: ALLAN C. G. MITCHELL. Ordinary indium can be made radioactive by exposure to slow neutrons. The source of the neutrons is a mixture of 200 milligrams of radium and 5 grams of beryllium which emits neutrons at a constant rate. Radioactive indium produced by slow neutrons is characterized by three periods: one of 13 seconds, one of 54 minutes and one of 45 days half-life. The period of 45 days is one of the longest ever produced by irradiation with slow neutrons from a radioactive source. Ordinary indium foil was bombarded for *six months* by neutrons from the radium-beryllium source. After irradiation the indium was placed upon a Geiger counter and its activity measured. Aside from the two short periods, already known, the long period was discovered. The activity of the long period was found to be only 2.5 per cent. of that due to the 54-minute period, indicating that it was caused by a substance formed from the rare isotope of indium (4.5 per cent. abundance) by neutron capture. The short periods due to the more abundant indium isotope were investigated after short irradiations. The beta and gamma ray spectra associated with these periods were carefully studied, and it was found that an energy level system could be drawn up which is analogous to the well-known diagrams of this type used in describing visible spectra. Furthermore, the two periods of 13 seconds and 54 minutes, belonging to the same isotope In^{116}, are said to be isomeric. Such isomeric periods can exist only if they have energy levels which are close together and which have quantum numbers differing by a considerable amount. The two energy levels in question were only 0.3 million volts apart. Quantum numbers for all states were assigned.

Adsorption calorimetry and an account of some measurements at low temperatures: RALPH A. BEEBE. The adsorption of a gas on a solid surface may be (1) activated adsorption or (2) van der Waals (physical) adsorption, and only the former of these is in general related to the catalytic activity of the adsorbent material. Because of the great difference in the characteristics of the energy changes occurring during the two types of adsorption, the calorimetric determination of the heats of adsorption provides useful evidence in deciding whether a given process belongs to the activated or the van der Waals type. A vacuum adsorption calorimeter is described which is designed to eliminate the troublesome experimental difficulties arising from the temperature gradients within the instrument. It has been shown that a gas may be held in both the activated and the van der Waals state on the same surface. Frequently the two types occur in well-separated temperature ranges, the activated type being characteristic of the higher temperature. In certain cases, however, activated adsorption is found even at liquid air temperatures occurring concurrently with the low temperature van der Waals process. In the present investigation, heats of adsorption at $-183°$ C. have been measured calorimetrically using the six gases, argon, hydrogen, deuterium, carbon monoxide, nitrogen, and oxygen on a reduced chromic oxide surface. The order of magnitude of the heats indicates that all these gases, except argon, are in part held in a state of activated adsorption as well as in the van der Waals state even at the low temperature of $-183°$. Moreover, in the experiments with carbon monoxide, nitrogen, and oxygen, the complex form of the time-temperature curves on a partially covered surface leads to the conclusion that the adsorbed gas changes over on the surface from an initial van der Waals state to a final state of activated adsorption.

The living state of matter in the range of low temperatures: ALEXANDER GOETZ. It has been proven in the past that small living cells containing little water or being entirely dehydrated (such as spores, certain bacteria, infusoria) can survive temperatures close to the absolute zero. Cells possessing larger quantities of water have a high mortality when cooled due to the crystallization of the cell contents. It is known in general that the transition from a (colloidal) liquid into a solid—when cooled—can take place in two ways: either a crystalline conglomerate is formed where the molecules are aligned into their respective crystal lattices and where consequently the molecular arrangement of the liquid is changed in favor of a thermodynamically stable configuration—or the liquid arrangement is preserved to a large extent in a vitreous solid ("glass"). In this case the substance is thermodynamically not in equilibrium. Which of the two alter-

natives is chosen depends upon the rate of cooling and upon the relative stability of the molecules in the liquid. Applying these principles to live matter one should expect that the possibility for life (viability) should be preservable for all cells if they could be transformed into a vitreous state when cooled. It is probable that the successful freezing experiments are due to the small tendency toward crystallization of dry or nearly dry cells. The author reports experiments with yeast cells where the physical conditions of cooling were especially favorable to cell vitrification, resulting in a reduction of the high cold-mortality to a few per cent. (cooling rates of approximately 1,000 degrees per second, temperatures between $-182°$ and $-252°$ C., special cooling media). In similar experiments a temperature range was found in which devitrification (between ca $-100°$ and 0° C.) takes place in vitrified cells, *i.e.*, a gradual destruction of the "latent" life by the transition of the vitreous state into the crystalline. This phenomenon permits the calculation of a thermodynamical constant descriptive of the live system investigated.

Vascular adjustments of diving animals during apnea: LAURENCE IRVING. When breathing of a mammal is arrested, blood flow decreases through the muscles and increases through the brain. This adjustment of the circulation provides for the respiration of the brain during apnea and appears significant in the endurance of asphyxia. Carbon dioxide is the most familiar single stimulus for respiratory adjustments, and is known to produce a decrease in muscular and an increase in cerebral blood flow in most mammals. In the muskrat and beaver, however, CO_2 does not decrease muscular blood flow as it does in other mammals and therefore would be ineffective in activating the vascular adjustment against asphyxia. In addition, CO_2 is not as effective in increasing the breathing of seals, muskrats and beaver as it is in land mammals. The respiratory adjustments of diving animals resemble those of land animals, except that the divers execute the adjustments quantitatively more effectively. Diving animals show extreme respiratory adjustments, which are nevertheless mammalian in type and which may be used to indicate the small adjustments which land mammals make to avoid asphyxia during apnea. The failure of CO_2 as a respiratory stimulus in divers implies that CO_2 is not effective in activating the quick internal responses which mammals in general make to escape asphyxia during apnea.

The effect of CO_2 in water upon respiration of fish: F. E. J. FRY, E. C. BLACK and LAURENCE IRVING. When the pressure of CO_2 is raised fresh-water fish become more susceptible to lack of oxygen. The catfish is one of the least sensitive to CO_2, and the bass is one of the more sensitive species. Examination in this way of fifteen species of fish from Opeongo Lake, Ontario, shows that each species may be mathematically distinguished by its sensitivity to CO_2. Not only are specific distinctions shown by effect of CO_2, but sex and size differences have appeared as well. The effect of CO_2 conforms to the expectation from known characteristics of the blood, showing a relation to the internal physiological description of respiration. The occurrence of different susceptibilities according to species, size and sex coincides with the fact that fish of a given species, sex and size range together in particular and often restricted environments. The fish examined represent the typical population of a large lake characteristic of the Canadian Pre-Cambrian land surface. This experimental method indicates that we may use known factors of the internal respiratory processes of fish to determine their position and movements in their external environment. The implication is that the known effect of CO_2 upon internal respiratory transport presents the internal sensitivity which activates the fish in selecting a range and that the combination of CO_2 and O_2 in the environment provides the external stimulus which by affecting the internal sensitivity governs their range and migratory movements.

Factors in the progressive depletion of the world's mammalian faunas: FRANCIS HARPER. During the Christian era the world has lost by extinction about 72 forms (species or subspecies) of mammals. They are distributed as follows: Australia, 9; Malay Archipelago, 3; Asia, 4; Europe, 6; Africa, 9; North America, 24; West Indies, 13; South America, none; Falkland Islands, 1; Galapagos Islands, 2; oceans, 1. Approximately 75 per cent. of these losses have occurred during the past century, and 50 per cent. during the past half century. Thus the rate of extinction is being steadily accelerated. In addition to the mammals already extinct, some 350 or 400 others may be considered vanishing forms. Insular faunas, partly by reason of the circumscribed nature of their habitats, are particularly vulnerable to attack or competition by man and by certain mammal pests introduced by him. There may be a further reason for the decadence of insular faunas in some cases, such as that of the West Indies, in the virtually total lack of native mammal predators; these would doubtless have played a beneficial rôle by eliminating the unfit individuals, and thereby contributing to the survival of the fittest individuals, among the species preyed upon. The primary factor in the depletion of the world's mammalian faunas is civilized man, operating either directly through excessive hunting and poisoning, or indirectly through invading or destroying natural habitats, placing firearms in the hands of primitive peoples, or subjecting the primitive faunas of Australia and of various islands to the introduction of aggressive foreign mammals, including fox, mongoose, cat, rat, mouse, and rabbit. Comparatively few species seem to have died out within the past 2,000 years from natural causes, such as evolutionary senility, disease, or climatic change. The chief hope for the survival of the larger mammals of the world lies in the establishment and maintenance of a sufficient number of sanctuaries.

Sex-determination and reproductive economy in the wasp Habrobracon: P. W. WHITING. As viewed from the aspect of modern genetics, sex-determination in insects related to the honey-bee has been very puzzling. The males come

from unfertilized eggs and are therefore fatherless, receiving a single set of hereditary elements from the mother alone. Females developing from fertilized eggs have a double set, one from each parent. The ratio of sex-determining factors should be the same in the double set as in the single, so that it has not been clear what causes sex difference. The small parasitic wasp Habrobracon, a close relative to the honey-bee and having the same peculiar type of reproduction with fatherless males, is easily and rapidly reared in the laboratory and its heredity has been intensively studied. It has been shown that certain abnormal sterile males resulting from inbreeding are not fatherless but develop from fertilized eggs. They have the double hereditary set. Why, then, are they males instead of females? The question has been answered by breeding experiments showing that there are two kinds of normal males, each with different sex-determining elements, X and Y. Females have a combination of the two different male sets, X + Y. The abnormal sterile males produced by inbreeding have either one or the other male set doubled, 2X or 2Y, and therefore have the same ratio of sex-determining elements as the normal males, but the female is necessarily different being a combination X + Y, of the two normal types of males, X and Y. Inbreeding not only results in sterile males, but also in many unhatchable "bad" eggs. The problem as to why these bad eggs and sterile males do not occur in cross-breeding is now being studied.

Mating types, toxic interactions and heredity in Paramecium aurelia: T. M. SONNEBORN. I. *Mating types:* The individuals of *Paramecium aurelia* are of diverse mating types; when the proper types are brought together, they give an immediate agglutinative sex reaction. There are six different mating types, but conjugation occurs only between types I and II, between III and IV and between types V and VI. In any one stock, not more than two types occur, and these are always two that interbreed. The species thus consists of three groups of stocks, with conjugation occurring freely between stocks of the same group, but not at all between stocks of different groups. The three groups of stocks not only contain different pairs of mating types, but also react sexually and conjugate at different temperatures and at different periods of the day. II. *Toxic interactions:* Two stocks produce toxic substances that kill animals of other stocks. The two toxic substances produce characteristically different effects prior to death, and each acts differently on the three groups of stocks of *P. aurelia* and on certain other species of Paramecium. These substances play an important role in natural selection, for, when a stock that produces a toxic substance and a susceptible stock are grown together, the latter is soon completely killed off. III. *Heredity:* Some stocks contain only mating type I, others contain both mating types I and II. The latter condition appears in all hybrids between these two kinds of stocks. In backcrosses to the pure type I parent, the conditions in the two parental stocks segregate in a 1:1 ratio. In the F_2 generation, they segregate in a ratio of 3:1. Inheritance thus appears to follow simple Mendelian rules and to depend upon a single pair of micronuclear chromosomes. In one stock in which two other mating types (V and VI) occur, the inheritance ratio depends upon the temperature prevailing during the process of nuclear reorganization (at conjugation and immediately thereafter). In this case the genetic differences appear to depend on the macronuclei, not the micronuclei; and the type of macronucleus formed depends at least in part on environmental conditions at one stage in the life. Thereafter, the effects are inherited through many fissions until the macronucleus disintegrates.

The Bornean species of the myrtaceous genus Syzygium Gaertner: E. D. MERRILL. In modern times most botanists have considered *Eugenia* Linnaeus as a collective group, although various attempts have been made from time to time to establish generic segregates; approximately 2,500 binomials have been published. A compilation of data appertaining to endemism for various regions in the Old World tropics shows the following: British India (85 species, 53 per cent. endemic); Siam (90 species, 26 per cent. endemic); Indo-China (68 species, 47 per cent. endemic); China (49 species, 55 per cent. endemic); Malay Peninsula (141 species, 60 per cent. endemic); Java (70 species, 45 per cent. endemic); Philippines (182 species, 81 per cent. endemic); and New Guinea (117 species, 85 per cent. endemic). Within the *Eugenia* complex no less than 36 generic segregates have been proposed by this or that author since the genus was established in 1753. With the exception of *Syzygium* Gaertner and *Jambosa* de Condolle, these proposed segregates have not been recognized or adopted by other than the individuals who proposed them. Approaching our problem with a consideration of *Eugenia* Linn. *sensu latiore,* we find that it is possible and practicable to reduce the *Eugenia* complex by the recognition of two small generic segregates for certain Old World species, that *Syzygium* and *Jambosa* can not be distinguished by any single character or combination of characters; that *Eugenia* may properly be restricted to the American species, with a relatively few in the Old World tropics; and for the bulk of the Old World species *Syzygium* is the proper generic name, as this group can be distinguished from the New World *Eugenia* by definite flower, seed and inflorescence characters. The Bornean species now approximate 160 species, of which 45 representatives of *Syzygium* are described as new.

White River Artiodactyla: WILLIAM BERRYMAN SCOTT. The White River was the first of the Tertiary time divisions in which the Artiodactyla became the predominant type of mammals. Eight families of Artiodactyla have been defined in the White River beds, and six of these are extinct, having left no descendants behind them. The two families which are still in existence are, first, the peccaries or wild swine and, secondly, the camels, which for the remainder of the Tertiary period were one of the most abundant of the North American groups. Within the camels there were several distinct, more or less parallel, tribes or phyla, which ultimately led to the grotesque

giraffe-like camels at one extreme, and the small, exceedingly slender, gazelle-like camels at the other. The six extinct families are all exceedingly bizarre creatures, which had incredibly small brains, a feature which no doubt was important in leading to their extinction. These families are described in the forthcoming monograph in considerable detail, and it has become possible to classify them in a satisfactory way.

Evidence for a logical sequence of roof types on Maya buildings at Piedras Negras: LINTON SATTERTHWAITE, JR. The Maya Indians were the most southeasterly of several groups of great temple builders in what is now Mexico and Guatemala. Apart from several beautiful architectural styles, not considered in the paper, the unique Maya contributions to Middle American architecture were the corbeled masonry vault as roof support and great ornamental towers or "combs" rising from the roofs. The earliest known Maya temples and palaces were roofed with thatch—that is, palm leaves laid like shingles on peaked wooden frames or trusses. Excavations of the University Museum, University of Pennsylvania, have shown that at Piedras Negras, Guatemala, a ruined Maya city, less than half were roofed with the masonry vault. Earlier buildings had been destroyed to make way for these vaulted buildings. Other evidence is referred to which indicates that the city grew to full size before vaulted roofs were introduced. During the work of the 1937 season, prosecuted with the aid of a grant from the American Philosophical Society, the ground plans of several temples of the pre-vault period were worked out. To become intelligible the plans require us to suppose that roof-combs once rose from the thick foundation masses forming the rear walls of the temple chambers. With these combs in place a nearly flat plastered concrete roof in turn becomes necessary for a probable reconstruction of the fallen roofs. Lacking the vault, these must have been supported on horizontal wooden beams. The paper discusses briefly the relative advantages and limitations of vaulted and beam-and-concrete roofs, their distributions and datings in Middle America and the elements of which they are composed. Evidence is presented for believing that at Piedras Negras all the structural principles, materials and techniques necessary for building beam-and-concrete roofs were known in early times when temple roofs were still being thatched. It is concluded that the Maya may have borrowed the beam-and-concrete roof from Mexican neighbors in early times; or that they may themselves have invented it, as well as the vault. In either case roof types probably first appeared in the Piedras Negras district in the order (1) thatch, (2) beam-and-concrete, (3) vault. In this order roofs became increasingly permanent and increasingly difficult and costly to build.

The excavation of Tell el-Kheleifeh (Ezion-geber) by the American School of Oriental Research: MILLAR BURROWS. The archeological survey of Transjordan by Nelson Glueck, director of the American School of Oriental Research at Jerusalem, showed that there was extensive copper mining and smelting in the Arabah during the Early Iron Age. This recalled the biblical account of commercial activities under Solomon, including the establishment of a seaport at Ezion-geber on the Red Sea. Iron Age pottery found at Tell el-Kheleifeh, near Aqabah, pointed to this as the site of Ezion-geber. Preliminary soundings were promising, and the American Philosophical Society awarded a grant for excavation, which Glueck carried on during March, April and May of this year. Remains of mud-brick buildings belonging to four periods of occupation, from before the time of Solomon down to the seventh or sixth century B.C., were uncovered, including an elaborate copper refining plant, with extraordinary flues and drafts. Small finds indicate that the manufacture of copper and iron implements was practised also. Imported objects attest the active commerce by ship and caravan for which this port was a center. Further witness of commercial relations is borne by a jar inscribed with South Arabian characters. An Edomite inscription on a jug and eleven impressions of the seal of "Qaus-'anal, servant of the king," on jar-handles of the seventh or sixth century B.C. were found. The pottery, while related to that of the Early Iron Age in Palestine and more closely to the Edomite pottery hitherto found in Transjordan, is in some respects distinctive. Ledge and horn handles, not elsewhere found in this period, are especially characteristic. About two thirds of the mound, including the highest part, remain to be excavated. A second campaign is planned for next spring, if possible.

The Ihyā' 'Ulūm al-Dīn of al-Ghazzāli: NABIH AMIN FARIS. The *Ihyā' 'Ulūm al-Dīn* is the *magnum opus* of al-Ghazzāli, the greatest Moslem theologian after Muhammad and one of the noblest and most original thinkers of all time. He may be likened to Thomas Aquinas, whom he influenced, but his personal contribution to the theology was more considerable than that of Aquinas. He also influenced Pascal and left his impress on Christian and Jewish scholasticism in general. The *Ihyā' 'Ulūm al-Dīn* consists of four large volumes and contains more than a thousand closely transcribed manuscript pages of the folio size. The first two volumes treat of the outward forms of worship, while the last two deal with the inward nature of religion. In it al-Ghazzāli grafts mysticism onto Islam and establishes its orthodoxy. For this reason he has been called the St. Augustine of Islam. Through this book al-Ghazzāli led the Moslems back from scholastic labors upon theological dogmas and minutiae to living contact with the Word. Through it he insured for Sufism a firm and permanent position in the "Church" of Islam. Above all, through it he brought philosophy and philosophical theology within the range of the ordinary man. The unique position which it occupies among the Moslems is summed up by the words of Hājji Khalīfah, the foremost Turkish writer of the seventeenth century, who said: "Should all other Moslem writings be destroyed, the *Ihyā'*, if spared, would make up for all the loss." Consequently, alongside of the ossified system of the traditionalists, the *Ihyā'* is earnestly studied; and in that study, without doubt, is the hope for the future of Islam.

Musical composition by American Moravians from 1742–1842: ALBERT G. RAU and HANS T. DAVID. An appropriation from the Penrose Fund of the American Philosophical Society was made to the Moravian Seminary and College for Women, of Bethlehem, Pa., for the purpose of making a critical catalogue of original compositions by American Moravians during the one hundred years from 1742 to 1842. Out of a mass of two thousand or more manuscripts found in various Moravian churches in Pennsylvania, Maryland and North Carolina, we secured some four hundred that were original compositions made in this country by sundry Moravian musicians for the enrichment of the liturgical seasons of the church. Most of these are anthems for four or eight voices, with orchestral accompaniment of strings, with the addition also of wood wind and brass in some cases. Of the ten men whose works we examined, five were born on this continent. The obvious musical continuity in the series indicates a transfer of musical technique from the older to the younger workers in very evident fashion. Only a few of the works are secular, but these are extremely interesting. Among them is a series of Parthien or suites for wind instruments, obviously used for serenading purposes, and a group of six quintets for two violins, two violas and violoncello, which have been definitely determined to be the oldest compositions in sonata form composed in America.

SPECIAL ARTICLES

THE OCCURRENCE IN NATURE OF "EQUINE ENCEPHALOMYELITIS" IN THE RING-NECKED PHEASANT

THREE pheasants were received for diagnosis on October 6, 1938, from a locality in Connecticut. These birds had been on range and were found in a more or less helpless or partially paralyzed condition and died before being shipped. The sender, Mr. Edward H. Mulliken, reported the finding of dead wild birds as well as pheasants following the hurricane of September 21. These pheasants presented no gross lesions, though the brain substance was rather soft. This was attributed to post-mortem change, the birds having been three days in transit. In view of the paresis that had been observed, the brain of each was inoculated into white Swiss mice intracerebrally in groups of 4 to 6, using large animals about six months old. All these mice were either dead or moribund on the fourth day, there being no noticeable difference in the course of the infection in any of the three groups.

A fourth pheasant was found sick in the same region and was received dead on October 18. There was a caseous mass around the gall bladder, which had evidently been ruptured. A suspension of the brain of this bird also killed large Swiss mice on intracerebral injection in from 4 to 5 days. This strain was carried through a second passage in mice.

Culture media inoculated with infective brain from mice of each of these groups furnished no growth either on gross or microscopic examination. The infection from one of these four pheasants was chosen arbitrarily for serial passage in mice. Young Swiss mice weighing 12 to 15 grams died in about 48 hours after intracerebral and in 3 to 4 days after intraperitoneal injection. Many of the animals developed a flaccid paralysis of the hind legs, though a few showed hyperexcitability. Occasionally a mouse, apparently well, would go into a convulsion, leap into the air and die a few minutes later after the manner of mice infected with herpes. This strain has been carried through 10 passages in mice. The titre of the virus in the brain is high; the intraperitoneal injection of 0.2 cc of a 1 to 10,000,000 dilution of infective mouse brain killed 1 of 6 mice. Guinea pigs, injected subcutaneously or intraperitoneally with a heavy suspension of infective mouse brain, died within 2 to 4½ days.

The course of the pheasant infection in mice and in guinea pigs presented characteristics which are strikingly similar to those of equine encephalomyelitis. Dr. Peter Olitsky, of the Rockefeller Institute, kindly supplied serum of a rabbit immune to eastern encephalomyelitis. Small amounts of this serum (0.1 cc) afforded complete protection to mice against 100,000 minimal infective doses of virus of the pheasant strain. The virus and serum were mixed and injected intraperitoneally, without preliminary incubation, into young Swiss mice (12 to 15 grams).

A few tests have been made of the susceptibility of other birds to the virus from the pheasant, using an inoculum of infective mouse brain. Two adult quail which were injected intracerebrally died after 4 and 5 days and the virus was recovered by the inoculation of brain tissue into mice. Of two injected subcutaneously, one died after 5 and the other after 10 days. Mice remained well following inoculation with the brain tissue of the quail dying after ten days. Therefore, the cause of death in this bird is doubtful. Fifteen newly hatched Rhode Island Red chicks were obtained. The virus was carried serially in these chicks through 4 passages, chiefly by subcutaneous injection. In the first and second passage all the chicks died, but in the third and fourth the course of the infection became progressively more uncertain. Six chicks injected intracerebrally died in about 48 hours; 9 were injected subcutaneously and 7 died at varying intervals. The virus was recovered by the intracerebral injection of mice with the brain tissue of a chick dying in the fourth passage after subcutaneous injec-