all stress was thrown on the formation of a first-rate collection of books. Funds for expeditions were raised outside of the regular income. It soon was noted that New Orleans, as the gateway to Middle America, contained several private collections of archeological and ethnological objects, most of them comparatively small, but which, when brought together, would form an excellent nucleus for a Middle American museum. Fortunately, the greater part of the local collectors were well disposed toward the department, and thanks to their cooperation there has been gathered a small but quite select exhibit of objects from the field in which the department specializes.

Since it has become known that the department is interested in purchasing books and manuscripts relating to Middle American subjects, many rare items have been brought to New Orleans for sale. As a result it can now be stated that the library of the department contains one of the most complete collections of books and documents relating to the Maya, their country and history, among which are such rarities as the original of the famous documents of Mani in Yucatan, written in the Maya language, but in Latin characters (the oldest document of its type known, dated 1557), as well as several other sixteenth century documents in the Maya language. The collection of Nahuatl linguistics is remarkably complete. From the Gates library came such rare things as the original manuscript to Gilberti's vocabulary of the language of Michoacan, Mexico, and an original Father Olmos MS. The Mackie library held such a rare and charming item as the original edition of Vargas Machucas: Milicia, Indiana, printed in 1599, and with a full manuscript page in the hand of Robert Southey, poet laureate, author of "Maddox," who bought the book in Milan on the 16th of June, 1817.

During the New Orleans meeting of the American Association the collections and library of the Department of Middle American Research will be open, and a special exhibition will be made of the rare manuscripts, books, pamphlets and bindings, all intimately connected with truly American history and development.

In addition to this exhibit of the library of the Department of Middle American Research, the director plans an exhibit in connection with the association's scientific exhibition at the Municipal Auditorium.

The Carnegie Institution of Washington, which has been very active in research work in Middle America, plans to use about 1,000 square feet in the scientific exhibit hall for an exhibition of some of its Mayan work.

Facilities for excursions to Mexico City and Yucatan will be available. The United Fruit Company's ss. *Olancho* will leave New Orleans on January 2 in the afternoon. The round-trip with visits to Mexico City, the Pyramids of Teotihuacan, Puebla and Cuernavaca included will cost $165.00. Delegates will be returned to New Orleans on January 12. A boat for a ten-day round trip to Yucatan will leave shortly after the convention. The Yucatan trip with visits to various ruins, including Chichén Itzá will cost $150.00.

THE NATIONAL ACADEMY OF SCIENCES

AT the autumn meeting of the National Academy of Sciences, held in New Haven, Connecticut, on November 16, 17 and 18, the following papers were presented:

New concept of evolution based upon researches on the Titanotheres and the Proboscideans: HENRY F. OSBORN. (Printed in SCIENCE this week.)

The geological significance of the relief of western Central Asia: HELMUT DE TERRA (introduced by A. Knopf).

Coral reefs and sand reefs: W. M. DAVIS. Agassiz reported in 1898 that the southern or polar end of the Great Barrier Reef of Australia is determined by the equatorward drift of sands on a long sand reef, just as the northern or polar end of the much smaller coral reef of Florida is determined by the equatorward drift of sands on another long sand reef. Hedley, of Sydney, described in 1911 a remarkable increase of sea-bottom depth near the end of the Australian reef, as shown by comparing Admiralty surveys of 1869 and 1904; but he did not connect the increase of depth with wave action consequent upon the smothering of reef corals by encroaching sands. In certain areas the depth increase was reported to be from 20 to 30 to 200 or 300 fathoms. Such an increase seems incredible, but on inquiring of the Admiralty Office in London I was informed that both the earlier and later surveys were regarded as authentic. And in reply to a recent inquiry a tracing has been generously sent me showing the position of the 100-fathom line off the coral reef end in 1869, 1898, 1904 and 1911, and 1928. The line retreated from 2 to 4 miles in the first interval and from 2 to 3 miles in the second; but it advanced 1 or 2 miles in the third or latest interval. Hence there seems to be no question whatever that rapid changes in depth have taken place in the sea floor hereabouts during the last half century, primarily involving strong increases and secondarily moderate decreases of depth. No similar increase of depth has taken place near the coral reef end along the Florida coast: charts showing detailed soundings made in 1852 and 1931, copies of which have been provided me by the superintendent of the U. S. Coast and Geodetic Survey, indicate only moderate increases of depth, probably because the Florida coral reef does not stand so far off shore as the Australian reef; so that when the Florida corals were smothered by sand drift no great change of sea-floor depth was called for. The encroachment of the Australian sand reef appears to explain why

the Great Barrier Reef fails by a hundred miles or more to reach the southern limit of reef growth in the adjoining sea. And if a significant encroachment has taken place in the 35 years between surveys of 1869 and 1904, a much greater encroachment should have occurred since the present relation of land and sea were assumed some thousands of years ago. Similarly, in view of the former and much longer enduring relation of land and sea levels in an earlier epoch before an eastward down-tilt of the land margin and the sea floor introduced the present relation, it may be inferred that the equatorward encroachment of the sand reef on the coral reef of that epoch may have measured many hundred miles. Various significant consequences follow from this inference; the most important of them is that the equatorward extension of the sand reef during that earlier epoch may perhaps account for the 173 feet of quartz sand found below 427 feet of coral-reef rock in a recent reef boring a long distance north of the present coral reef end. The object of the present note is to call attention to this possible explanation for the occurrence of the quartz sands as an alternative to various other explanations that have been proposed.

The use of rock crystal by Paleolithic man: GEORGE GRANT MACCURDY. One of the first steps in the ascent of the ladder of culture was taken when man began to find artificial means of adding to the effectiveness of the powers with which nature endowed him. He found by experience that a club supplemented arm strength and the sharp edge or point of a flint chip was more serviceable for cutting and puncturing than nails or teeth. Before the close of the Stone Age he had experimented successfully with at least forty-seven varieties of stone, but not all of these were in use by the close of the Paleolithic period. His sources of supply were chiefly from the silicates; carbonates were also used to a considerable extent. Of the silicates the species known as quartz was found to be especially adapted to the needs of primitive man. There are two varieties of quartz—cryptocrystalline and phenocrystalline. The great bulk of Stone-Age implements was made of cryptocrystalline quartz in the form of flint, chert, chalcedony, hornstone, quartzite, etc. By comparison, implements of phenocrystalline quartz are rare indeed. This is an oxide of silicon and is known as rock crystal; it was not in use prior to the Mousterian epoch. In other words, the chipping of tools from rock crystal began with Neandertal man. In addition to its rarity rock crystal can not be chipped with the same ease as can flint. Complete tools of rock crystal dating back to the Mousterian epoch are exceedingly rare. We appreciate all the more the good fortune that has come to our American School of Prehistoric Research in the finding of seven perfect rock-crystal tools not only in one rock shelter but at one level in that rock shelter (the lower of two Mousterian levels). This shelter is known as Les Merveilles and is at Castel-Merle, near Sergeac (Dordogne). Upper Paleolithic deposits, especially Solutrean and Magdalenian, have yielded several rock crystal tools. Solutrean points of the laurel-leaf type, beautifully chipped on both faces, have been reported—one from Le Placard (Charente), one from Liveyre, near Les Eyzies (Dordogne), and one each from Badegoule, Balutie and Laugerie-Haute (Dordogne). Three rock-crystal tools of Magdalenian age have been reported—one from Laugerie-Basse (Dordogne) and two of indifferent workmanship from Le Perron (Haute-Loire). Since three adjoining departments in south central France—Charente, Dordogne and Corrèze—have yielded practically all the Paleolithic tools of rock crystal known to date, a single center somewhere near the headwaters of the Vézère might well have been the source of rock crystal supply for the Paleolithic sites in question.

The supposed 2-meter eustatic bench of the Pacific shores: DOUGLAS JOHNSON (introduced by W. M. Davis).

The new ganometric method of subdividing Plio-Pleistocene time based on the enamel foldings of the superior grinding teeth of the fossil and living elephants: HENRY F. OSBORN.

Clear Lake, California: W. M. DAVIS. Clear Lake, about 25 miles in length and from 20 to 40 feet in depth, lies 100 miles north of the Golden Gate and is the only lake in the Coast Ranges of California. It covers one of the many intermont basin plains of those mountains, and it results from a landslide of recent but unknown date which obstructed a deep gorge by which the drainage of the pre-lake plain was discharged through the enclosing highlands on the northwest. The lake rose until, on gaining a depth of 60 or 80 feet, it discovered in the mountains on the east another deep gorge, the head of which lies in a notch but little above the western base of those mountains. There the overflowing lake waters cut a cleft in the low notch at the gorge head and thus lowered the lake some 30 feet nearly to its present level. Later changes of small measure have been introduced by blasting away a rock barrier two miles west of the cleft and by building a dam in the cleft in order to control the outflow for irrigation. The prevailing level of the lake has thus been somewhat lowered. No other deep gorges are found in the basin-enclosing highlands. The two existing gorges, one of which formerly led out the drainage of the pre-lake plain, while the other now leads out the overflow of the post-landslide lake, appear to be of antecedent origin; but if so, the stream through the eastern gorge must have been defeated by basin-producing deformation at a well-advanced stage of basin development. Previous to that defeat, the single basin plain would appear to have had two outflowing streams of antecedent origin. This might seem impossible, if the smaller Laytonville basin plain, some 30 miles farther northwest, did not to-day possess two outflowing streams which follow deep-cut gorges and which are also apparently of antecedent origin, the divide between their heads being on the flat basin plain. Such paired basin-draining gorges can hardly be the result of erosion along fractures, for in that case they should be more numerous. They do not seem to be the work of consequent streams which flowed on the even surface of a previously deformed and completely filled basin, degrading the weak

filling of the basin in a broad plain, while they cut only narrow gorges in the resistant rocks of the basin-holding mountains; for there is no evidence that the basin was ever completely filled. On the other hand, it is difficult to imagine that the paired gorges are the work of small antecedent streams, for in that case two such gorges for a single basin would ordinarily be one too many. Yet, as the case now stands, an antecedent origin for the paired gorges seems more reasonable than any other. Hence the previously prepared eastern gorge, now followed by Clear Lake outlet, should be looked upon as the most remarkable feature of that interesting and picturesque district.

Submarine valleys: FRANCIS P. SHEPARD (introduced by W. M. Davis).

Biographical memoir of Raphael Pumpelly (read by title): BAILEY WILLIS.

The incubating python: a temperature study:[1] F. G. BENEDICT, E. L. FOX and V. COROPATCHINSKY. The incubating python, rarely observed in zoological parks, has been studied at the National Zoological Park in Washington, D. C. A thermoelectric survey of the temperature of the air around the snake and of the skin temperature of the snake (on the exposed surfaces, between the folds, and between the snake's body and the eggs) showed that the snake's temperature was definitely higher than that of its environment. Since under ordinary conditions snakes have a temperature a little lower than the environmental temperature, the incubating python is living under a special body-temperature regulation during the period of incubation.

The effect of exercise continued for several generations on the weights of the organs of the albino rat: HENRY H. DONALDSON. The captive albino rat of our laboratories is a mutant derived from the wild Norway rat. It differs from the parent stock in having a brain from 12 to 14 per cent. less in weight. This difference is not originally due to albinism, and therefore seems to be an effect of captivity. In captivity the rats usually have less opportunity for exercise than under wild conditions. The attempt was made, therefore, to determine whether an increase in the amount of exercise, by placing the animal in a cage with a revolving drum, would modify the weight of the brain. During the past 20 years three previous studies of this question have been made in our laboratory. They show that the weight of the brain may be thus increased from 2 to 3 per cent. The weight changes in other organs were also determined. All these experiments, however, were for one generation only. It was decided, therefore, to carry the same experiments through several successive generations, and thus determine whether there was any cumulative effect on the weight of the several organs. For this purpose two families were used—and each was carried through seven generations. All the rats lived their entire life in the revolving drum cage in which the exercise was taken voluntarily. One series of these was examined at 56 days of age—and the other at 220 days. The resulting changes in the fresh weights of 15 organs, including the brain, are here presented. The amount of difference in weight is represented by the percentage deviation of the tests from that of the controls, and it is seen in the 220-day series (chart) that in five organs of each sex (the gonads, kidneys, suprarenals, submaxillaries and heart), the changes are plus and large, while in two organs, the liver and the thyroid, they are minus—*i.e.*, these latter organs have increased in weight less than the controls. This change in weight is mainly due to alterations in the size of the formed cells, combined with a possible increase in the number of cells in some glands. The changes induced by seven generations of exercise are not greater than those following one generation—and there is, therefore, no cumulative effect; nor is there any such effect as between the last and first generations in the series of seven. When the deviations for the sexes combined in the 220-day series are compared with those shown by the 56-day series, it is seen (chart) that the smaller amount of exercise taken by the 56-day series has yielded changes in general similar to those of the 220-day series, but for the most part less marked. Exercise thus produces weight changes in a number of organs in the albino rat. In man similar changes in the heart and musculature have long been recognized, but it is not possible to carry out on man experiments of the type here described. Nevertheless, the physiological similarities between the albino rat and man warrant the inference that similar organ changes would take place in man, and thus become a factor in bringing about the beneficial effects commonly recognized as following vigorous exercise.

Experiments on early stages of rat embryos: J. S. NICHOLAS (introduced by R. G. Harrison). Previous experiments by the author have shown that rat foetuses are capable of continuing their development after certain types of experimental interference. While the technical difficulties are great, the results warrant additional investigation of the possibilities of embryonic development in mammals under experimental conditions. The results here reported are founded on two series of experiments, (1) the production of extrauterine pregnancies, and (2) the transplantation of total embryos into regions outside the abdomen. In the first series the production of extrauterine pregnancy was attempted by transplanting the embryo to various structures within the abdomen. The embryos became implanted upon mesentery, but generally were rapidly resorbed. Since the segmentation stages of development occur in the Fallopian tube, the pregnant females were operated upon on the third day after fertilization and the uterine horns severed from their upper connections with the tube, their lumina being occluded by ligation. Under these conditions the segmenting blastocysts drop into the abdominal cavity either to degenerate or to continue development. Development was secured in 2 per cent. of the cases (5 positive in 250). In order to test the capacity of the embryo to develop outside the abdominal cavity one horn of the uterus was delivered through an incision in

[1] From the Nutrition Laboratory of the Carnegie Institution of Washington, Boston, Massachusetts.

the body wall. Its proximal and distal parts were retained within the abdomen, while the uterine horn with its contained 8-day embryos was held in a pocket under the skin by suturing the body wall. Under the conditions of this experiment development proceeds normally, the fetuses are born at term and are viable. Transplantation of eight- and nine-day embryos in locations outside of the abdomen has been performed. The femoral triangle, muscle of the body wall and other locations have been tried. The most favorable site for transplantation thus far secured is the mammary gland. Embryos transplanted to this region undergo disorganized tissue formation. Muscle, both smooth and striated, cartilage, nervous tissue, gut and red blood cells, as well as placental cells, are differentiated and can be distinguished in sections through the graft. The tissues differentiate in their foreign locations in typical form but do not complete the organization of the individual.

The analysis of the factors determining the growth of a population of yeast: OSCAR W. RICHARDS (introduced by L. L. Woodruff). The growth of a population of a pure strain of the yeast *S. cerevisiae* Hansen derived from a single cell is measured for about 1,200 hours. The rate of increase of the population is constant until the waste products (by-products of fermentation) retard the increase by selectively eliminating the buds which have not had time to become resistant after they are independent of the mother cell. The population then reaches an equilibrium number and the first cycle of growth ends. As the sugar is rapidly used less waste products are produced and less cells are killed. The oxygen consumption is greatest then and food material is liberated by the cytolysis of the killed cells. This results in a more favorable medium and the population again increases until further growth is prevented by the accumulation of waste products in the medium and the utilization of the available food. If additional food is added just before the end of the first cycle of growth the growth continues to the same level as would be reached later at the end of the second cycle. The further addition of food does not result in additional growth. After the second growth cycle the structure of the cells changes and most of them gradually become resistant, resting cells. The remainder perish except for a very few hardy cells which continue to reproduce for a long time. The potentially unlimited growth of the cells is restricted and determined by the chemical changes in the medium.

The maturation of the egg of the sea-urchin Mespilia globulus: D. H. TENNENT. In this brief paper one section of a complete study of the history of the chromosomes during the oogenesis of the sea-urchin *Mespilia globulus* that has recently been completed by Dr. Toshio Ito, of the Medical School of Keio University, Tokyo, and myself, will be presented. The sac-like ovaries, at this time, are packed with oocytes, some of which are still in their growth stage. Sections show that the wall of the ovary consists of three layers, a thin outer layer, the coelomic epithelium, a middle layer of muscle fibers and an irregular inner layer of oocytes, the so-called germinal layer. The oocytes lie in an almost structureless lacunar matrix, within which there are also a few small, apparently amoeboid cells. As the oocytes increase in size some are crowded away from the wall, the number of full-grown oocytes lying in the center of the ovary thus increasing gradually. Two points should be emphasized. There is never any stalk of attachment and there is never a definite cellular egg follicle. All the cells lining the wall in which the nucleus is large or has begun to enlarge are oocytes. Maturation may take place while the oocytes are still in contact with the wall or after they have been forced to the center of the ovary. In only one, out of several hundred examples, have the polar bodies been given off from the surface of the egg adjacent to the wall of the ovary. As a rule, therefore, the animal pole of the egg has developed in the free, rather than in the attached surface. In maturing eggs lying in the lumen of the ovary there is never common orientation of the spindle with respect to a selected region. Prior to the onset of the growth stage in the oocyte the chromosomes disappear after reaching a diplotene stage. At the onset of the meiotic divisions they reappear as diplotene chromosomes in the nucleus of the fully grown oocyte. They become arranged on a typical amphiastral first polar spindle and during early anaphase stretch out as V's and rods. While the chromosomes are separating during the later anaphases and while the spindle system is moving toward the periphery of the egg, the outer aster becomes flattened, the outer end of the spindle finally becoming anastral. The surface of the egg above this blunt end is pushed out as a bud, into which the anastral end of the spindle and the outer chromosomal plate moves. On the equator of the spindle, in fixed and stained preparations, a belt of deeply stained granules constituting a "between body" may be seen. In slightly later stages these granules may be seen in the form of a complete ring surrounding the spindle, the ring seeming to constrict around the spindle, until, when separation is completed, it lies as a large granule or disc on the surface of the egg just below the separated polar body.

The chromosomes left in the egg become arranged on the second polar spindle, which is also at first amphiastral and whose outer end later becomes anastral as it moves out into the second polar body. Here again the phenomenon of a "between body," in the form of a ring that seems to constrict around the spindle, is evident. The second polar spindle and the "between body" interrupt the continuity of the thin jelly layer surrounding the egg that becomes evident about this time. This break in the continuity of the jelly layer explains the origin of the micropyle or funnel at the animal pole of the egg. It has been possible to observe the form and number of the chromosomes in this egg during both maturation divisions. The observations made on this material have made it clear that development from primordial germ cell to oocyte does not take place in the "germinal layer," they have afforded a satisfactory description of the number and form of the

maturation chromosomes, they have shown the manner of origin of the micropyle, and they have confirmed the conclusion reached by Jenkinson in 1911, to the effect that the animal pole of the sea-urchin egg is not at the attached, but at the free end of the egg.

Feather structure in the Phasianidae: STANLEY BALL (introduced by L. L. Woodruff).

Cancer and tuberculosis, with some comments on cancer and other diseases: EDWIN B. WILSON and HELEN C. MAHER.

Measures of certain human abilities throughout the life-span: WALTER R. MILES (introduced by Raymond Dodge). This investigation, conducted in the department of psychology at Stanford University, reports measurements on 335 boys and men and 528 women and girls. The age range was from 6 to 95 years. Effort was made to secure approximately equal numbers of people within the successive semi-decades. At first adults 50 years of age and older were studied. Later, the younger years were added for comparison. The study was conducted in two small cities by the establishment of laboratory annexes easy of access to the people who were to be examined. These individuals were solicited and sent by many different lodges, clubs, churches and other organizations of these cities. The clubs (not the individuals) were paid for this service in terms of the ages of those subjects supplied. The measurements were psychological (not medical or physical) and occupied a period of two hours broken up into half-hour sessions, with suitable rest intervals in between. The ability to organize and carry out simple movements with the hands was studied. There was practically no difference between males and females. In general, the performance of the dominant (right) hand was about 12 per cent. superior to that of the subordinate (left) hand. The maximum ability appeared in the age range 16 to 29, while ages 12 to 13 and 55 to 59 were each 14 per cent. slower. Ages 10 to 11 and 60 to 64 gave equal scores, both 18 per cent. below maximum group ability; 8 to 9, 25 per cent. below; 70 to 74, 33 per cent. and 85 to 89, 50 per cent. decrement.

Ability to respond to outside auditory signals with hand and foot were studied. Simple response of this character is very slightly faster for the hand than for the foot. On the average for adults 25 years old or older, the (unpracticed) time required is very close to one quarter of a second. The peak or standard ability in this function is maintained from age 18 to 55, where it averages close to one fifth of a second. Adults 75 to 90 average close to one third second, but approximately 20 per cent. of these older adults are as fast as the average for groups ranging from 25 to 90 years. Most of the abilities studied show an increase during the early years, a fairly long crest representative of maturity, and a regular decline rather than a sharp change. In the age period 75 to 85 the decrement scarcely ever exceeds one quarter to one third of the score value represented at group maximum. Decline appears to proceed regularly and slowly and the average old person can still perform as well as many of those who are in middle age, indicating that chronological age is by no means the sole factor accounting for performance ability. The investigation is being continued.

Experiments on the development and growth of limbs in the Amphibia: ROSS G. HARRISON. The vertebrate limb develops as a thickening of the mesoderm of the body wall, covered by epithelium (ectoderm), which is part of the general integument of the body. This thickening with its covering in the embryo is known as the limb bud. In the salamander, Amblystoma, the limb bud, while not sharply bounded like a stone in a mosaic, is nevertheless fairly definitely localized in the body wall ventral to the third, fourth, fifth and part of the sixth muscle segments. This system lends itself readily to a great variety of extirpation and transplantation experiments, which are the basis of the present investigation. The respective rôles of the two layers, ectoderm and mesoderm, in the development of the limb have been tested by grafting each separately to other parts of the embryo, by replacing each separately by corresponding tissue from other regions, by changing the orientation of one layer by itself and by combining tissues of two different species. Growth and pigmentation of grafted limbs have been studied in twenty interspecific combinations (between five species) in which the whole limb bud was transplanted. For the embryo from the stage with closing neural folds to the stages with tail bud, the evidence is overwhelming that the capacity to form a limb is inherent in the mesoderm—particularly that of the region described above—and that the ectoderm is not specifically differentiated. Grafting of trunk ectoderm to the limb region is followed by the normal development of the limb, while the reciprocal operations of limb ectoderm to other parts of the body never result in the development of a limb at the seat of the graft. Mesoderm of the flank put in place of mesoderm of the limb bud is followed by suppression of the limb, while mesoderm of the limb region grafted to the flank or, under certain conditions, to the head develops into a well-formed appendage. In contrast to ectoderm from the trunk, ectoderm from any part of the head, taken from embryos after closure of the neural folds, and made to replace limb ectoderm, suppresses the development of the free appendage, while permitting the development of the shoulder girdle. However, if the same ectoderm of the head, particularly of the gill region, is grafted in the same way just before closure of the neural folds the limb bud covered by it develops normally. When the whole limb bud is rotated 180° about the transverse axis of the embryo its laterality is reversed and frequently it is more or less completely reduplicated. If the mesoderm alone is rotated the result is essentially the same, but if the ectoderm alone is rotated normal development usually follows. However, in about 17 per cent. of the cases (9 out of 53) some tendency to reduplication is shown, which is not sur-

prising, since the ectoderm is known to be polarized in other respects and the combination is therefore disharmonic. In interspecific grafts of whole limb buds it is known that the graft grows at its specific rate, and in certain combinations with very different growth rates, limbs that are entirely out of scale with the body (either too large or too small) are produced. In fact, unless the animals are given maximal feeding, the grafted limb may even exceed both the host and the donor control limbs in growth. Similar results, though with perhaps slightly less quantitative differences, are obtained when mesoderm alone is grafted, but when ectoderm alone is grafted the effect on the growth of the limb is very slight. These results have not been subjected to all the requisite statistical tests. In any case, whether the effect of the ectoderm on growth of the limb is significant or not, the quality of the mesoderm certainly dominates the growth rate. The form of the resulting limb is very nearly if not precisely that of the species furnishing the mesoderm. This comes out strikingly both in appendages growing in their normal position and in those growing on the flank or on the head. The amount of webbing of the digits, which differs among the species used, may, however, be slightly influenced by the ectoderm. Even the reduplicating limbs that often arise from grafts placed on the flank have the specific character of the species from which the mesodermal graft was taken, and in only one or two doubtful cases resembled the limbs of the host species. Such limbs are therefore not produced from host tissues by induction. Induced limbs have been found in a few cases after grafting the nasal placode to the flank, as found by Balinsky and others after grafting various organ rudiments or even foreign bodies. In one case we obtained the remarkable paradox that one nasal pit grafted over the limb region suppressed the development of the normal limb, while the other nasal pit grafted to the flank produced by induction a limb where it would not normally have developed. The pigmentation of grafted limbs in normal location is approximately that of the host species except in combinations in which albinotic individuals (axolotl) take part. A grafted limb from a white embryo does not acquire pigment when placed upon a pigmented host and a graft from a pigmented embryo remains pigmented on a white host, as shown by Ruud (also by Schaxel for regenerative buds). These results are interpreted to mean that the pigmented individuals of the five species used have essentially similar pigmentary equipment, and that their coloration, even to a great extent the pattern, is determined by the internal medium of the organism. Only in the case of the white individuals, which lack pigment largely though not entirely, is there inability to respond to the internal conditions.

Differentiation of reflex and voluntary responses of the lid: HELEN PEAK (introduced by Raymond Dodge). The experimental facts regarding the distinction between reflex and voluntary reactions are incomplete and further investigation of the problem is needed in view of the interest in determining whether "conditioned" behavior is of reflex or voluntary origin. Lid responses dependent on instructions to wink voluntarily are of longer average latency than responses which are relatively independent of such instructions. Longer latency is, therefore, a distinguishing characteristic of voluntary response within certain limits. The present paper reports the investigation of certain other characteristics of these long and short latency responses, such as extent of closure, velocity and duration of closing and opening phases of the lid response. Five thousand photographic records of the lid movements of six subjects, reacting under four sets of instructions to auditory stimulation, show the following results: (1) The extent of closure in the long latency reaction is greater on the average than that of the reflex. (2) In the reflex response the promptness of opening the lid after closure increases with increase in the velocity of closure, *i.e.*, the faster the lid closes, the more promptly it opens. This suggests the operation of a mechanism akin to Sherrington's stretch reflex. (3) In the voluntary response the relationship, though not consistent, tends to be in the opposite direction, *i.e.*, the faster the closure, the slower the opening. (4) The voluntary response is distinguished by a greater delay in the opening phase of response with the following exceptions: (a) When negative adaptation has caused the closing velocity of the reflex to fall below a certain minimum, the opening duration is increased and becomes greater than that of the voluntary (subjects were unable to increase the duration of opening in reflex by deliberate effort); (b) when a subject was instructed to increase the promptness of opening in his voluntary responses, he was able to do so, but *only after practice.* (5) This evidence indicates that when responses are measured in terms of any of these characteristics, "reflex" and "voluntary" are not distinct categories but only convenient terms for distinguishing modes in continuous distributions of response.

The cats of Rancho La Brea; a climax in evolution: JOHN C. MERRIAM. The asphalt deposits of Rancho La Brea near Los Angeles have furnished a unique collection of fossil remains from the geological period immediately preceding the present. The collection consists of unmodified skeletons representing a wide variety of animals. It gives a picture of the life in this region at the time these deposits were forming. So far as known it is the largest body of material representing the life of this period that has been obtained from a single locality. The collection is also unique in that it contains a larger percentage of carnivorous animals than would be found in any normally balanced fauna. The cats of Rancho La Brea include numerous individuals from both the saber-tooth and true cat groups. At least six species are represented. They include two species of *Smilodon,* one lion-like cat recognized as *Felis atrox,* two pumas, both new species, and one smaller cat practically identical with *Lynx rufus* of the living California fauna. The large size and high stage of development of species in both groups mark a climax in evolution of this carnivore family. The paper presents results from an extended study involving several persons and institutions.

A preliminary report on functional psychoses: H. BECKETT LANG and J. A. PATERSON (introduced by W. D. Bancroft). Experiments with forty-six patients suffering from functional psychoses have shown a correlation between the type of insanity and the state of dispersion of the brain proteins. Schizophrenia is an over-dispersed type. Manic-depressive and epileptic patients are in a coagulated state. Sodium amytal and sodium rhodanate are helpful for diagnostic purposes. These will not displace known and applicable methods of therapy but may supplement them.

The physiological properties of bulbocapnin: WILDER D. BANCROFT. Bulbocapnin produces in cats a catalepsy which has been identified by Dr. Walter Freeman and others as corresponding to dementia praecox catatonia in man. If this were so, bulbocapnin should be a peptizing agent for proteins. Actually, it is a coagulating agent and brings a man out temporarily from the ordinary catatonic stupor. Sodium rhodanate and ephedrine counteract the action of bulbocapnin on rabbits. The bulbocapnin stupor in cats corresponds to what Dr. Lang calls benign stupor in man. This last is a coagulated state.

Induction of the ear by the medulla and its relation to experiments on the lateralis system in Amphibia:[1] L. S. STONE (introduced by R. G. Harrison). In the development of amphibians the ear and the lateral-line first appear as an acustico-lateralis placode in the ectoderm near the medulla of the primitive brain tube. The lateralis system soon separates from that of the ear as pre- and post-auditory placodes, parts of which give rise to ganglia and parts to migratory primordia that lay down lateral-line sense organs. This system when vitally stained is ideal for studies upon the phenomena of polarity and growth direction and what relation the establishment of these has to structures in its environment. For example, in the postauditory placode the anterior ganglionic pole near the ear and the opposite or posterior migrating pole are determined soon after the closure of the neural folds. This occurs before ear-forming cells can be completely isolated experimentally from it and at a period subsequent to that in which Dr. R. G. Harrison found the establishment of the polarity of the ear. In the early tail-bud stage the ear and the ganglionic pole of the lateralis placode can be excised without effect upon the migration of the opposite pole and the formation of lateral-line sense organs. If, however, a polarized or non-polarized placode is grafted to a new position upon the side of the body the ganglionic pole will differentiate, but the migratory pole lies dormant and is unable to organize itself into sense organ forming tissue unless a migrating primordium of the host eventually touches it. Then the growth direction of that of the graft is dominated by the host primordium. If, furthermore, one includes a portion of the medulla along with a polarized acustico-lateralis placode and places the graft upon the side of the body the lateralis placode goes a step further in the formation of a few sense organs, but still it does not migrate in the presence of well-formed brain tissue. The presence of the latter may have some connection directly or indirectly with the degree of development of the primordium to the point of sense organ formation. It can not be said that strange ectoderm prevented the initiation of migration, for control experiments have shown otherwise. The ear on the other hand was not normal. This may indicate that the lateralis itself could not be expected to be fully developed in all respects. At the moment migration is normally initiated a disconnection from the associated ganglion and the brain by transplanting the primordium to the side of the body far from its normal environment does not interfere with its ability to proceed in migration and to lay down lateral-line sense organs in the direction toward which its pole is oriented. Its growth direction may be entirely changed, however, if in its grafted position it lies so that a similar migrating primordium of the host touches it. Its growth direction is then dominated by that of the host primordium. Its power to reach the point when the migratory ability is initiated must therefore in part depend upon a phase in development during a stage when it is closely associated with the ear and the medulla. It was found to be practically impossible to eliminate all the ear-forming cells from the earliest stages in the ectoderm before the acustico-lateralis was even recognizable as a placode without eliminating the lateralis also. It was desirable then to discover what influence the medulla was normally exerting upon the ectoderm lateral to it. Therefore, the medulla-forming portion of the neural plate was transplanted to the side of the body and placed in such a manner that the lateral edge of the medulla touched the overlying body ectoderm. An incomplete ear with its ganglion was induced, but no lateralis placode. Since the center of the acustico-lateralis placode, *viz.*, the ear, was so feebly developed out of the indifferent body ectoderm it may indicate that the graft was taken at a time in its development when its inductive power was limited only to a selective part of the system, or that the ectoderm itself resisted the full influence of the medulla. It may indicate furthermore that the medulla has induced only the dominant part of the system and that if a well-developed ear could have been formed it in turn might have been able to induce secondarily the lateralis portion. Whatever the case may be it at least emphasizes the necessity of a new conception concerning the early development of these two interrelated systems in order to understand more fully the methods by which the polarity and subsequent migration of the lateralis is accomplished.

Discovery of Upper Eocene land mammals on the Pacific Coast: CHESTER STOCK (introduced by J. C. Merriam). In the stratigraphic column of the Coast Ranges of California the Sespe formation occupies a position between marine deposits of Eocene age and marine deposits of Lower Miocene age. North of the Simi Valley in Ventura County the Sespe is 7,470 feet

[1] From the Department of Anatomy, Yale University School of Medicine.

in thickness, rests with disconformable contact on the Domengine horizon of the Eocene and is conformable with the overlying Vaqueros marine beds of Lower Miocene age. Greenish and maroon shales and sandstones which are particularly characteristic of a conveniently recognizable middle division of the Sespe in the Simi anticline have yielded vertebrate remains. Occurrences of fossil mammals range vertically in the section from approximately 1,600 feet to 3,000 feet above the contact with the Eocene. The fauna includes *Paramys*, a creodont, insectivores, bunoselenodont artiodactyls, an agriochoerid, *Epitriplopus* (?), an amynodont and titanotheres. Some of the more important features of the discovery of this assemblage are: (1) The earliest Tertiary record of land mammals thus far known on the Pacific Coast; (2) the occurrence offers opportunity to establish on the basis of vertebrate paleontology the time relationships of the early Tertiary portion of the stratigraphic column of the Coast Ranges to the continental sequence as determined in the Rocky Mountains and western Great Plains; (3) several mammalian types in the fauna are structurally more advanced than related forms of the Upper Uinta Eocene and are evidently more primitive than forms known from the White River Oligocene; (4) added information is available concerning the geographic distribution of some early Tertiary mammals in North America.

Observations on individual growth: FRANZ BOAS.

The significance and inheritance of leg-length in dogs: CHARLES R. STOCKARD.

Conceptual categories in primitive languages: EDWARD SAPIR (introduced by C. Wissler). The relation between language and experience is often misunderstood. Language is not merely a more or less systematic inventory of the various items of experience which seem relevant to the individual, as is so often naïvely assumed, but is also a self-contained, creative symbolic organization, which not only refers to experience largely acquired without its help but actually defines experience for us by reason of its formal completeness and because of our unconscious projection of its implicit expectations into the field of experience. In this respect language is very much like a mathematical system, which, also, records experience, in the true sense of the word, only in its crudest beginnings but, as time goes on, becomes elaborated into a self-contained conceptual system which previsages all possible experience in accordance with certain accepted formal limitations. Such categories as number, gender, case, tense, mode, voice, "aspect" and a host of others, many of which are not recognized systematically in our Indo-European languages, are, of course, derivative of experience at last analysis, but, once abstracted from experience, they are systematically elaborated in language and are not so much discovered in experience as imposed upon it because of the tyrannical hold that linguistic form has upon our orientation in the world. Inasmuch as languages differ very widely in their systematization of fundamental concepts, they tend to be only loosely equivalent to each other as symbolic devices and are, as a matter of fact, incommensurable in the sense in which two systems of points in a plane are, on the whole, incommensurable to each other if they are plotted out with reference to differing systems of coordinates. The point of view urged in this paper becomes entirely clear only when one compares languages of extremely different structures, as in the case of our Indo-European languages, native American Indian languages and native languages of Africa.

The genesis of cerebellar tremor and its disappearance after removal of the cerebral hemispheres: J. F. FULTON (introduced by Yandell Henderson). One of the most striking locomotor disturbances encountered in the field of clinical neurology is the tremor associated with lesions of the cerebellum. Though recognized as the essential symptom of cerebellar deficit as early as 1824 (Flourens), its nature has remained obscure. We have therefore focused our attention upon the genesis of tremor following removal of the cerebellum (cats, dogs, monkeys and baboons) and have found that in the cat it does not appear until the fourth to the seventh day after the operation. Simultaneously with the appearance of the tremor, the animal commences to execute voluntary movements. In other animals in which tremor appears sooner, it is always coincident with the return of voluntary activity. Since the cerebellum had been removed the question arose as to what part of the nervous system was responsible for the tremor. On removal of one cerebral hemisphere in the decerebellated animal the extremities of the opposite side become rigid but continue to show associated movements unaccompanied by tremor. When the second cerebral hemisphere is removed, thus making a decerebellated thalamic preparation, great locomotor activity is seen in all extremities, but tremor is completely absent. We have thus far succeeded in keeping preparations of this character under observation for periods varying from one to three weeks. Further observations are being made on primates, in which the relation of the neocerebellum to the motor cortex is being studied. We conclude that cerebellar tremor is a phenomenon resulting from inadequate compensatory action of the cerebral hemispheres.

The rate of trophic impulses in nerves of cold-blooded vertebrates: G. H. PARKER and V. L. PAINE. The lateral-line nerve of the catfish transmits sensory impulses in one direction and trophic impulses in the opposite. The rate of transmission of the trophic impulses is very slow, approximately two centimeters per day.

(*To be continued*)

BOOKS RECEIVED

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