2. From the Civil Aeronautics Authority—Comprehensive study of the whole method of selection and training of pilots. This is a very considerable task which is extending over two years, and which involves work at many institutions of learning.

3. From the National Resources Planning Board—Study and report on industrial research in the United States.

4. From the Advisory Commission to the Council of National Defense—(a) Study and report on the whole problem of utilizing domestic low-grade manganese ores; and (b) Study and report on the erection of a tin smelter to refine low-grade tin ores from Bolivia.

5. From the Army and Navy—Numerous problems concerned with National Defense. Some of these are handled by permanent committees of the academy and some by special joint committees. Many of them involve much and long-continued work and the expenditure of large sums of money.

These are but samples picked at random from a long list.

FRANK B. JEWETT

ABSTRACTS OF PAPERS

A white-flowered race of Datura from aged seed which is genetically distinct from similar white races in nature: ALBERT F. BLAKESLEE and A. G. AVERY. In *Datura stramonium* there are two color forms, one with white flowers and green stems, the other with purple flowers and stems. In the current manuals they are recognized as distinct species, *D. stramonium* and *D. tatula,* but differ only in a single pair of genes located in the ·18 half of the 17·18 chromosome. From seeds aged 7½ years, a recessive white-flowered type segregated out in the F_2 generation which was indistinguishable in appearance from the wild whites. When crossed with a standard white from nature, the F_1 plants were purple, a fact which showed we were dealing with a new gene for white. By appropriate tests this new gene has been located in the ·16 half of the 15·16 chromosome. The possibility that more than one recessive gene might be responsible for the different wild whites was tested by crossing standard white testers with over 400 white races from nature. If any of these whites had been determined by a different gene from that responsible for the white flowers of the tester, their F_1's would have been purple. The F_1's, however, were all white, a fact which proves that there was only one gene for white flowers in the 400 races. Since these races were secured from widely separate parts of the world, including all the continents, and represented all the recurrent chromosomal types found in nature, it is probable that no new gene for white flowers in this species has become established in the wild. In *D. ferox,* a gene for white flowers which is located in the ·4 half of the 3·4 chromosome causes the corolla and stamens to be white and the stem and leaves above the cotyledons to be green. In flower color the herbaceous Daturas are limited to two types—purple and white.

Physiological differentiation of Astragalus in response to selenium: SAM F. TRELEASE (introduced by W. J. Robbins). The growth of *Astragalus racemosus* and *A. pattersonii* in solution and sand cultures was greatly increased by the element selenium (as selenite or selenate) in concentrations up to 27 ppm., and the plants accumulated large quantities of selenium. Selenium seems to be an essential mineral element for these species of *Astragalus.* In marked contrast, *A. crassicarpus* was not stimulated by selenium in the culture solution but was instead poisoned, being severely injured by 0.33 ppm. and killed by 9 ppm. This species is able to absorb only small quantities of selenium, and its physiological response is like that of wheat, buckwheat, soy beans or tobacco. *A. racemosus* and *A. pattersonii* are indicators of seleniferous areas. But *A. crassicarpus,* since it is neither benefited by selenium nor poisoned by the very low concentrations existing in natural soils, does not serve as an indicator. Field studies in collaboration with Professor O. A. Beath have shown thus far that twenty-three other species are like *A. racemosus* and *A. pattersonii* in being selenium indicators, whereas many other species of *Astragalus* resemble *A. crassicarpus* in being indifferent to selenium in natural soils. The indicator species fall into six of the twenty-nine groups into which M. E. Jones divided the genus *Astragalus* on the basis of morphological characters. All members so far examined in the groups Bisulcati, Ocreati, Podo-sclerocarpi and Preussii are selenium indicators; and no member studied in the groups Uliginosi, Flexuosi, Inflati, Homalobi, Angophylli and Hypoglottides is a selenium indicator. The groups Galegiformes and Lonchocarpi seem to require revision, since each includes both indicator and non-indicator species. Physiological differentiation of *Astragalus* with reference to selenium provides a new approach to the division of this difficult genus into groups representing relationships and evolutionary development.

Sensitivity of gladiolus corms during an artificially prolonged rest period: FRANK E. DENNY (introduced by B. O. Dodge). Although gladiolus corms when freshly harvested are dormant, they pass through this rest period, usually in one to three months, and then will germinate promptly when planted. This rest period may be prolonged for many months or for two years or more with certain varieties by the simple expedient of replanting the *freshly harvested* corms in *moist soil* and *storing at room temperature* or preferably at about 27° C. With the passage of time, corms with a rest period artificially prolonged in this way become sensitive to low temperatures, such as 0° and 5° C. Germination can then be induced by short periods of chilling such as 48, 24, 12 or even 6 hours, depending on the variety and the duration of the period of enforced rest at the time of the exposure to cold. During this long rest period the corms show an exceptional type of respiration. When first removed from the soil after a sojourn in it of several or even a few months, the carbon dioxide production at the temperature which prevailed during the storage in soil is very low, approximately 2 to 10 mg CO_2 per kg per hour. This low rate is maintained, however, for only 4 to 8 hours,

when the rate rises rapidly until within 24 to 48 hours it reaches 20, 40, 80 or even more than 100 mg. From this maximum the respiration curve falls gradually until after 5 to 7 days the original low rate is reached, this being maintained indefinitely. In spite of this great change in respiratory activity the rest period is not broken, but these corms retain their dormancy, may be again planted in soil and become available for another respiration test. The curve is again given by a subsequent test, provided the period in the soil following the first removal is approximately three months. During the first few hours after removal from the soil (when the rate is low and rising) the volume of oxygen taken in is much larger than the volume of carbon dioxide given off, approximately two to three times as large; but at the time of the maximum rate, and in the entire period during the falling rate, even to the time of the secondary minimum, the volumes of O_2 and CO_2 are equal.

Growth of excised roots and heterosis in tomato: WILLIAM J. ROBBINS. Excised roots of two inbred lines of tomato and the heterotic F_1 were grown under sterile conditions in liquid media. The seeds from which the excised roots came were furnished through the courtesy of C. B. Lyon. The roots were grown in a mineral salt-sugar solution supplemented with thiamin, with thiamin and vitamin B_6 or with thiamin, vitamin B_6 and nicotinic amide. Under the experimental conditions used the roots of the hybrid grew more in all three types of solutions than those of either parent. The roots of one parent showed a greater response to vitamin B_6 than to nicotinic amide, the roots of the other parent showed more response to nicotinic amide than to vitamin B_6. The roots of each line showed a characteristic morphology. It would appear that hybrid vigor is not limited to the top of the plant and that a study of the growth of excised roots of inbred parents and their heterotic offspring may throw light on the physiological basis for hybrid vigor.

Theoretical and experimental studies on protoplasmic streaming: WILLIAM SEIFRIZ and NOBURO KAMIYA (introduced by A. N. Richards). Protoplasm is often in active motion. In certain lowly plant forms, this motion, known as protoplasmic streaming, occurs in one direction only at a time. Reversal in direction of flow takes place rhythmically. The phenomenon is best illustrated in the slime molds. Hypotheses on the mechanism of protoplasmic streaming have been numerous. Surface tension, hydration, electroendosmosis and contractility are some of the forces which have been held responsible. The technique known as "time lapse" in cinematography has revealed a rhythmic pulsation of the plasmodium or body of a slime mold. The senior author regards this rhythmic contractility as the mechanism responsible for protoplasmic flow. The contraction and expansion of the plasmodium is perfectly synchronized with the outward and inward flow of the protoplasm. The theory is extended to include all forms of protoplasm. Rhythmic movements of tissues exist in virtue of the innate attribute of contractility in the protoplasm of which they are made. The chemical or physical basis of protoplasmic contractility is probably to be found in the contraction of folded protein molecular chains. The next step in our studies was the measuring of the motive force responsible for protoplasmic flow. The junior author set about to accomplish this. Through the development of a suitable technique it has been possible to oppose the force which moves protoplasm. A single strand is selected and so placed in a divided chamber that one half may be subjected to pressure while the other half is left unopposed. If, by this means, the protoplasm, where observed, is held still, the counter-pressure applied is a measure of the motive force responsible for streaming. The counter-pressure which is just sufficient to keep protoplasm quiet changes rhythmically. The range of this pressure, and therefore of the vital protoplasmic force, is between ± 25 cm of water. Instantaneous values of the balance pressure, taken every five seconds, and plotted against time, yield undulating curves which reveal such characteristics as frequency, amplitude and irregularities of the rhythm in protoplasmic activity. One of the most extraordinary of these is the presence of more than one rhythm: in short, protoplasm is a polyrhythmic system.

Formation of crystalline cellulose in plastids of living cells: WANDA K. FARR (introduced by C. B. Davenport). In 1934, uniform-sized, cellulose crystallites ($1.1\ \mu \times 1.5\ \mu$) were identified in cell membranes from various parts of the plant kingdom by means of microscopic, chemical and x-ray diffraction analyses. During the period of cell membrane formation these cellulose particles appear in the outer regions of the cytoplasm of a living cell, such as the cotton fiber, arranged end to end in orderly, single rows. The particles are coated with a viscous substance which holds them together to form the fibril and the fibrils, layer upon layer, to form the cell membrane. In the course of these earlier observations of the formation of plant cell membranes by cellulose particles and cementing substance elaborated in the protoplasm of living cells, no clue was obtained as to the mechanism of formation of the particles. The tropical marine alga, *Halicystis ovalis,* proved to be excellent material for the solution of this problem. Upon the inner surfaces of the membranes of its chloroplasts are formed, successively, rings of varying diameter and equal thickness. These rings fragment directly to produce the uniform-sized cellulose particles. In many types of cells of higher plants colorless plastids produce cellulose particles by essentially the same mechanism. In chlorophyll-containing cells of the higher plants, starch is formed in the chloroplasts and cellulose in separate plastids containing no pigment. Starch formation was observed in plastids of living cells before 1850. Cellulose formation has been more elusive and the mechanism which we now find in operation has been hitherto undescribed.

Observations on parasites and inclusion bodies in certain intestinal protozoa: DAVID H. WENRICH (introduced by C. E. McClung). Bacterial and fungoid parasites of Protozoa have been known for more than half a century. They were earlier seen in various kinds of free-living species, but during the past thirty years an increasing attention has been given to such parasites associated with endozoic Protozoa. Some of these associated organisms

are ectozoic and others are endozoic. Some may be symbiotic; for example, in the flagellate, *Lophomonas striata*, from the intestine of cockroaches, rods of the genus *Fusiformis* seem always to be present, persisting through division and encystment. Members of the genus, *Sphaerita*, considered to belong to the fungoid group, Chytridiales, are intracytoplasmic parasites, while members of the related genus, *Nucleophaga*, are intranuclear. Kirby (*Proc. Third Internat. Cong. for Microbiology*, 1940) has recently called attention to an extensive list of both ectozoic and endozoic forms associated with the Protozoa in termites. The present report is confined to associates of certain of the intestinal flagellates and amoebae of man and some other vertebrates. I have previously reported short oval rods adhering to the surface of *Trichomonas hominis* and of Diplococcus-like forms adhering to *T. vaginalis*. Short rods have recently been found on the surface of *T. augusta* and *T. batrachorum* in frogs and toads. In amphibian hosts, also, long slender rods are frequently found on the surface of *Monocercomonas* (*Eutrichomastix*) sp. and apparently the same kind on the surface of *Retortamonas dobelli* from the same hosts. Intracytoplasmic rods of various types have been found in trophic stages of *Chilomastix bettencourti* and trophic and cystic stages of *Giardia simoni* of rats and mice, and in *Trichomonas augusta* and *Chilomastix caulleryi* of amphibia. I have found species of *Sphaerita* in the flagellates, *Trichomonas muris, T. parva, T. minuta* and *Chilomastix bettencourti* (trophic and cyst stages), from rats and mice; in *Trichomonas augusta, T. batrachorum, Retortamonas dobelli, Hexamastix* sp. and *Monocercomonas* sp. from frogs and toads. I have also found members of this group in the parasitic amoebae, *Entamoeba coli* (trophic), *E. histolytica* (trophic and cyst), *Endolimax nana* (trophic and cyst), *Iodamoeba bütschlii* (trophic). There is evidence that there may be two species of *Sphaerita* in *T. muris*. There is also evidence that a flagellate may rid itself of parasites by detaching a blob of cytoplasm containing them from the posterior end. Evidence indicates that *T. augusta* also rids itself of parasites in the same manner. I have found intranuclear parasites, possibly belonging to the genus *Nucleophaga*, in *Trichomonas muris* and in the following amoebae: *Endolimax nana* (trophic and cyst), *Iodamoeba bütschlii* (cyst), *Entamoeba histolytica* (cyst), *E. muris* (trophic and cyst) and *E. ranarum* (trophic). Rather homogeneous inclusions have been seen in the cytoplasm of *Trichomonas muris, T. augusta* and *Chilomastix bettencourti* trophic stage. While these may be some special type of food or some unrecognized parasite, they are also similar to the intracellular inclusions of metazoa associated with filterable viruses.

Mating and metabolism in Paramecium calkinsi: EDGAR J. BOELL and LORANDE L. WOODRUFF. The respiration of two mating types of *Paramecium calkinsi* has been measured by means of the Cartesian diver technique in order to establish the normal rate of oxygen consumption for this species, and, in addition, to determine whether a physiological basis for the difference in mating behavior between the types can be discovered. The mating reaction in this species is represented generally by the formation of a clump ("agglutination") of large numbers of individuals of both types from which pairs of Type I and Type II animals then emerge. In animals in which the mating reaction consists of clumping with subsequent pairing, the average rate of oxygen consumption per animal per hour is 0.25 mμl for Type I and 0.28 mμl for Type II. This difference possibly is due only in part to a real metabolic difference between the types, since the average size of Type II animals is slightly greater than that of Type I. When the physiological state of the Paramecia is such that neither clumping nor pairing will occur, the oxygen consumption is much larger than when both of these phases of the mating reaction are manifest. The average respiratory rates for Type I and Type II animals are then, respectively, 0.43 and 0.48 mμl per animal per hour. Occasionally, the mating reaction consists only of the clumping phase—the mass of individuals then breaking up without the formation of pairs. In such cases, where clumping but no pairing occurs, the individuals of one type show the low rate of oxygen consumption characteristic of Paramecia which will both clump and pair, whereas the individuals of the other type respire at the typically high rate of animals in which mating tendency is absent. The results indicate that an inverse relationship exists between metabolic level and mating tendency and that clumping without pairing will occur between animals in which one type possesses a low rate of metabolism, while that of the other is high. Further evidence that clumping requires that a low metabolic level (and hence a positive mating tendency) exist in only one of the mating types is seen in the fact that clumping between living Paramecia of one type and a dead animal of the other sometimes occurs.

The composition of snake populations: EMMETT R. DUNN (introduced by D. H. Tennent). (1) Snake populations are made up of a few common species and a larger number of rare species. In general the commoner tenth of the species make up half the population; the rarer half of the species make up a tenth of the population. This relationship was first worked out for four areas in Panama, with snake faunas of many species, represented by some ten thousand individuals collected at random. It has been found to hold good as far north as California and Pennsylvania, and on faunas of as few as seven species. (2) The Panama areas each have a quite similar list of species, but a quite different list of dominant species. (3) The abundance of individuals in nature, as shown by the Panamanian statistics is not correlated with wideness of range of the species, number of species in the genus or number of genera in the family.

The primitive streak in embryos of the Macaque monkey: GEORGE L. STREETER. In embryos of the Macaque monkey, and probably of man and most mammals, the primitive streak is found to be in direct line from the primordial germ-plasm of the one-cell stage. In accepting the principle that development consists in proceeding from the more general to more specialized cells, the primitive streak is to be designated as the locus of the second

order of such specialization, the first being when the auxiliary elements of the egg separate themselves from the true formative elements. The primitive streak in a strict sense is not ectoderm any more than was the original one-cell egg. From it, however, the primary embryonic tissues known as ectoderm, mesoderm and endoderm are derived. This step constitutes a second order in specialization, and the derived cells are therewith limited in their potentialities to their particular types of development. That is to say, the primitive streak is not a defined embryonic tissue but constitutes what remains of the primordial mother cytoplasm, changed only in being drained of the specialized cells that are moving out and away from it to fulfil their various limited careers.

A single series vs. many pairs of sex factors in the wasp Habrobracon: P. W. WHITING (introduced by C. E. McClung). Snell (*Proc. Nat. Acad. Sci.*, 21: 446–453) postulated that sex differences might be determined by many pairs of independently segregating Mendelian factors. If the members of any one or more of the pairs were different, the wasp would be female: otherwise it would be male. It has now been shown that these factors do not occur in separate pairs, but in a single series (alleles). This has been done by tagging them with the gene causing fusion of antennal segments. The gene fused has been introduced into two stocks having different sex factors. In each stock the sex factors proved to be similarly linked with this gene. Therefore these sex factors must be in a single series.

Artificial mixing of incompatible germ-plasms in Drosophila: HERMANN J. MULLER. It has often been asserted that the differences between "good species" of animals, such as those which give sterile "mules" when crossed, are probably not Mendelian or chromosomal, and that the findings of geneticists therefore do not concern the more fundamental features of living things. As genetic analysis of such differences would require the obtaining of mixtures of various kinds—"recombinants"—that would only arise in the later generations of crosses between the two contrasted types, the impossibility of breeding the first generation hybrids has hitherto hindered a direct attack on the above problem. *Drosophila melanogaster* and *D. simulans* are examples of two such "good species," which in nature yield only sterile hybrids. We have found it possible to circumvent the difficulty inherent in this sterility, and to obtain and distinguish, in the first generation of this species cross, the types that would be characteristic of the second generation, derived from a back-cross between the sterile hybrids and pure *melanogaster*. The method involves the crossing of triploid *melanogaster* females, which produce eggs with some extra chromosomes, by x-rayed *simulans* males, which produce sperms with some incapacitated chromosomes. This situation provides opportunity for some of the offspring to receive two chromosomes of a given kind from one species and none of that kind from the other species, while at the same time, in the case of other kinds of chromosomes, they receive one chromosome from each species. Study of the different types thus produced gives evidence that those differences between these species which cause their hybrids to be sterile morphologically abnormal or inviable are dependent upon the properties of their chromosomes. The abnormalities can be analyzed into a series of effects, each of which results (as in Dobzhansky's crosses between different "races" of *Drosophila pseudoobscura*) from the inharmonious interaction of a factor or factors in a given chromosome derived from one species with another ("complementary") factor or factors in chromosomes from the other species. A "recombinant" female having all its major chromosomes from *melanogaster* and only minor chromosomes (the Y and one fourth) from *simulans* was normal and fertile—the only fertile hybrid—a result that verified the whole interpretation. By breeding this female the minor chromosomes were established in stocks which otherwise were purely *melanogaster*. It was found that in this *melanogaster* setting various genes of these minor chromosomes fail to act in precisely a normal manner. This supports our inference that the number of cryptic genetic differences between species far outrun those causing obvious differences between them or those working in a "complementary" way to cause abnormalities of their first-generation hybrids.

Cancer in catfish; pathology and transmission: BALDUIN LUCKÉ and HANS SCHLUMBERGER (introduced by Peyton Rous). Experimental cancer research has hitherto been done mainly with warm-blooded animals, because it has generally been thought that among the more primitive cold-blooded vertebrates, neoplasms are rare and consequently not readily available for investigation. However, a systematic search has revealed that various kinds of neoplasms, similar in structure and behavior to those in mammals and birds, are actually common among the lower vertebrates. Of such tumors one of the most suitable for studying certain phases of cancer is an epithelioma which frequently affects the catfish (*Ameiurus nebulosus*). During the past year the number of tumor-bearing fish obtained from streams in New Jersey and Pennsylvania has exceeded one hundred. This cancer usually occurs as a large, red, fleshy mass on the lips or the dental plates; less often it involves other parts of the mouth and rarely it extends to the skin. Sometimes the tumor becomes so massive as to prevent closure of the mouth. In approximately one third of the cases, a secondary tumor develops on that part of the opposite lip in direct contact with the primary growth. Histologically, the neoplasms consist of masses of epithelial cells which at first grow in an outward direction and show little tendency to invasion. But as the tumors become larger, they extend into adjacent tissues, and not infrequently they are seen to have pushed into vessels, where they form emboli. Experimentally, we have transmitted the neoplasm to fish of the same species by implanting it in the cornea of the eye, where it readily becomes established. The rate and mode of growth of the transplanted tumors have been followed over periods of several months by periodic examination of the living tumors. This was done by throwing a beam of light onto the

tumor, which was then observed through the transparent cornea with the microscope. It was thus learned that this cancer always develops according to a definite structural pattern, namely, in the form of undifferentiated membranes which gradually thicken and become more compact. In this manner growth continues until the tumor fills the cornea.

Cyclic changes in the mammary gland of the monkey: CARL G. HARTMAN and HAROLD SPEERT. A large and controversial literature has arisen concerning changes in the human breast in relation to the menstrual cycle. Since the phenomena accompanying the cycle in man and monkey parallel each other in so many respects; and since the monkey breast is so well adapted for study and is readily obtainable the matter was investigated in a series of nine regularly menstruating monkeys. It was found that there is a definite cycle when ovulation has occurred, none in the absence of ovulation. The chief changes consist of enlargement of the lobules and dilatation of the ducts. These changes begin to be manifest several days after ovulation and occur in accelerated tempo until they reach their maximum in the late premenstruum. The relation of these findings to the physiological action of estrogens and progesterone will be discussed.

The piezo-electricity of beta-quartz: A. W. LAWSON (introduced by D. W. Bronk). In distinction to the generally accepted belief that beta-quartz is not piezo-electric, the existence of piezo-electricity in quartz above 575° C., originally observed by Osterberg and Cookson, has been confirmed. Piezo-electricity was observed in small crystalline fragments of quartz up to about 800° C. by the "click" method. A suitably cut quartz bar was excited to longitudinal vibration which could be detected by both the click method and measurement of the impedance of the quartz with a peak voltmeter up to about 650° C. The observations suggest that the disappearance of piezo-electricity in beta-quartz at higher temperatures attributed by Osterberg and Cookson to the appearance of a new phase is due to the rapidly increasing electrical conductivity of the quartz.

Relative acid strengths in various solvents: MARTIN KILPATRICK (introduced by A. N. Richards). It has been shown experimentally that the ratio of the dissociation constants of the substituted benzoic acids to that of benzoic acid yields a sequence of relative acid strengths which differs from solvent to solvent. In general the meta and para substituted acids become relatively stronger in solvents of low dielectric constant while the reverse is true for ortho substituted acids. The effect of the meta and para substituents can be interpreted in terms of electrostatic effects, but the observed effect with decreasing dielectric constant is greater than the theoretical.

(*To be continued*)

OBITUARY

HENRY McELDERRY KNOWER

HENRY MCELDERRY KNOWER, son of Captain Edward C. Knower, U. S. A., and Mary D. (McElderry) Knower, was born in Baltimore, Maryland, on August 5, 1868. His death, at the age of 71, occurred in his native city on January 10, 1940. He was educated at schools in Baltimore and at the Johns Hopkins University, where he received the A.B. degree in 1890. Continuing there as a graduate student under the late Professor William K. Brooks, he was awarded the doctorate of philosophy in 1896. During this period he served as assistant for two years and the last year he held the Adam T. Bruce fellowship.

After obtaining his Ph.D. degree Knower was appointed to an instructorship in biology at Williams College but returned to Baltimore the following year and in 1899 became instructor in anatomy in the Johns Hopkins Medical School, where he remained ten years, the last year as associate. From Baltimore he was called in 1909 to the University of Toronto as lecturer in anatomy, and in 1910 he became professor and head of the department of anatomy at the University of Cincinnati. After his resignation from this post in 1924 he served as visiting professor at the University of Georgia (1925–27) and then as professor of anatomy at the University of Alabama until 1929. From 1930 to 1932 he was associate professor of anatomy in the Albany Medical College of Union University. His last appointment was that of research associate in biology at Yale University (1933–37).

In the late nineties Knower attended a number of sessions at the Marine Biological Laboratory, Woods Hole, and in 1908 became a regular summer resident. He served there as librarian from 1909 till 1919, during which period the library grew rapidly and was well arranged and catalogued.

In 1897 he married Miss Virginia Du Barry, who survives him. They had two children, Henry Du Barry, whose death late in 1939 was a severe blow to his father at a time when he himself was critically ill, and Virginia (Mrs. William A. Moore, of Bronxville, N. Y.). There are five grandchildren.

Knower's first research work dealt with the embryology of termites, in which he became interested on an expedition to Jamaica in 1891. This was the subject of his doctoral dissertation, which was published in Volume 16 of the *Journal of Morphology*. After his appointment in anatomy his interests naturally shifted to problems more closely related to that field. He became absorbed in the study of the development of the vascular system, first through the demonstration of the lymph hearts and vessels in embryos from which the systemic heart rudiment had been removed. In Dr. Mall's department during this period there was