The probable error of a catalogue position for a fundamental star is less than 0".1. For two thirds of the stars including the fainter stars in general the probable error of the 1950 position is 0".3 or larger. The authors call attention to the need for reobservation of the larger part of the stars. They also suggest that many stars should be added to the list for the more uniform spacing required in photographic work.

One of the many valuable results of this work is that it makes possible the reduction of all star observations of the last two centuries on a uniform system.

The very large number of definitive proper motions all on a uniform basis will be of special value in many researches, and the catalogue will immediately meet a need in a wide field of statistical and positional investigations.

All those who have taken part in this production are to be heartily congratulated for a most excellent astrometric history of the brighter stars. The work is by far the most comprehensive and important of its kind ever undertaken, and it is a worthy monument to the genius and foresightedness of Professor Lewis Boss; to the zeal and ability of Professor Benjamin Boss and his collaborators; and to the generous support for over thirty years by the trustees of the Carnegie Institution of Washington.

H. R. MORGAN

QUANTUM MECHANICS

Principles of Quantum Mechanics. By A. LANDÉ. xii + 115 pp. New York: Macmillan Company. 1937. $2.25.

PAULI once said regarding quantum mechanics: "In analogy to the term relativity theory one could call modern quantum theory the theory of complementarity." The concepts of the fundamentals of quantum mechanics were clarified by Heisenberg's famous paper of 1927 on the uncertainty principle and Bohr's papers (1928–1930) on atomic theory and the description of nature. Landé's book tries to carry out the program of quantum theory as a theory of complementarity systematically. The great amount of material is covered in some 100 pages with great skill. The program of the book is set forth in an excellent preface and an introductory chapter on observation and interpretation. It is followed in part I by the elementary theory of observation: the principle of complementarity. The first paragraph of this chapter deals with the analogy between mechanics and wave theory (a short remark on the history of these considerations, which started with Bernoulli and were fully developed by Hamilton, might be of interest in a future edition.) In this first part the view-points of the corpuscular and wave theory are clarified. The second part deals with the principle of uncertainty and its application to standard experiments. Classical and quantum mechanical pictures and their correlation are discussed. This leads to the third part dealing with the principle of interference and Schrödinger's equation. The following chapter is devoted to the principle of correspondence between mechanics and wave theory. The term principle of correspondence, however, is not used in the same sense as used by Bohr—asymptotic coincidence between quantum frequencies and classical frequencies—but it refers "to all analogies and asymptotic coincidences of quantum mechanics with both the classical theory of charged particles of matter and with the classical hydrodynamics of a continuous density serving as a medium for matter waves." The book closes with a short mathematical chapter on the theory of transformations and the principle of invariants.

While we have now-a-days a great number of texts available, to introduce the student to the technique of wave mechanics, this book of Landé's will be of great value to student and teacher alike for the clarification of the fundamental concepts, their logical development and the connection between the different fields of mathematical development. May we express the hope that a future edition will include also treatment of subjects omitted now, such as photo-effect, Raman effect (as a classical effect), and one of the typically wave mechanical phenomena, "the tunnel effect."

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SPECIAL ARTICLES

INHIBITION OF PARTURITION IN THE RABBIT BY THE INJECTION OF ESTROGENIC HORMONE

THE corpus luteum is essential to the maintenance of pregnancy in the rabbit. It has been shown that parturition can be delayed and in many cases prevented for a considerable length of time if new corpora lutea are induced in the ovaries in the latter part of pregnancy by the injection of a suitable gonadotropic hormone, or if an active corpus luteum extract or progesterone, the pure corpus luteum hormone, are injected daily beginning a few days before term. It is well known that delivery occurs within 48 hours following removal of the ovaries at any time from the 20th to the 28th day of pregnancy. (Removal prior to the 20th day results usually in resorption rather than premature delivery of the foetuses.) One supposes, therefore, that in this species parturition is precipated,

in part at least, by the decline of the corpus luteum.

In an earlier note to SCIENCE (84: 161, 1936) we reported that the injection of an estrogen during the latter part of pseudopregnancy causes the corpora to persist in a functional manner. In view of the supposition that the corpora become non-functional shortly before parturition, we have carried out a series of experiments designed to test the effect of an estrogen given during the last few days of pregnancy, expecting, of course, that if its effect on the corpora be similar to that obtained during pseudopregnancy, the corpora of pregnancy would be maintained and parturition would be delayed. The results have shown this to be so. Daily injections of estradiol monobenzoate (Progynon-B) in doses varying from 50 to 500 i.u. per kilo beginning at any time from the 27th to the 31st day of pregnancy postponed delivery in most cases. In only one of nineteen animals did normal delivery of living foetuses occur at the usual time (32 days), and this was one in which injections were started on the 31st day. In fourteen of these animals parturition was delayed longer than 35 days. In the experiments thus far carried out the foetuses have been dead whether delivered or obtained by operation or autopsy. In no case as yet have we been able to obtain post-mature foetuses in animals in which parturition has been delayed with estrogenic hormone. They are killed within two days and are retained in utero. Animals killed on the 37th, 45th and 52nd days have shown macerated foetuses in utero and moderate-sized corpora lutea in the ovaries which microscopically looked very much like normal corpora. It will be remembered that the corpora of pregnancy look quite degenerate by the 35th day, *i.e.,* three days after normal parturition. It is also of interest that animals in which parturition has been prevented in this manner may show extreme necrosis of the uterine muscle. For instance, the animal killed on the 52nd day showed almost complete necrosis of the muscle overlying the foetuses. Delivery obviously would be impossible in such a case, but this can scarcely be considered the cause of the original delay in parturition, since animals in which the uteri were examined sooner showed less necrosis, and an animal subjected to laparotomy on the 32nd day showed no evidence of necrosis although the foetuses were already dead.

Control experiments have been made which indicate that the ovaries must be present if delay in parturition is to be obtained by the injection of estrogenic hormone. Four animals were castrated on the 27th day and injections of estradiol monobenzoate started the same day. Delivery occurred spontaneously on the 29th and 30th days, and living foetuses were present in all the litters. In three other animals the procedure was modified somewhat. Injections were started on the 29th and 30th days and the ovaries were removed three to five days later. All three animals delivered dead, macerated foetuses within three days after castration.

Our results show that the hormonic conditions present at the end of pregnancy may be altered in much the same manner as those at the end of pseudopregnancy. In each case the regression of the corpora is prevented by increasing the estrogen level. This indicates that there is normally no rise in the estrogen level at the end of pregnancy, as suggested by some authors.

The results which we have obtained call for an interpretation of the effect of estrogenic hormone in pregnancy in the rabbit different from that usually advanced. There are numerous references in the literature indicating that estrogens induce abortion. It has been shown that in the last third of pregnancy in the rabbit injection for only a day or two of estrogen results in premature delivery of dead foetuses within three or four days. We have obtained similar results by giving the hormone in single doses or for a limited time, but when repeated doses are given, the foetuses are retained. The explanation usually given for the abortive action of estrogen in pregnancy is that it increases the irritability of the uterine muscle to such an extent that expulsion of the foetuses takes place. Our findings suggest a different explanation. Under normal circumstances the corpora lutea are caused to remain functional during the latter half of pregnancy by some hormone elaborated by the placentas or foetuses (the presence of such a hormone has been demonstrated) but when an estrogen is given for a limited time, the placentas and foetuses are so damaged that they are no longer capable of maintaining the corpora. When the inhibiting effect of the corpus luteum hormone is removed, premature delivery of dead foetuses occurs, a result similar to that which follows castration, excepting that in the latter case the foetuses are usually living. When repeated, daily injections of an estrogen are given, as in our experiments, the placentas are injured in the same way and the foetuses die, but the corpora are maintained by the estrogen and as a result the foetuses are retained in utero.

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LOCALIZATION OF CALCIUM IN PARAMECIUM CAUDATUM

IN a series of preliminary microincineration experiments (unpublished) on the liver and brain of