Meetings

Arachnid Behavior

Investigators of arachnid behavior summarized their research and suggested areas for future studies at a symposium (29 Dec.) during the AAAS meeting in Cleveland, Ohio.

In a discussion of the behavior of mites, G. W. Wharton (Ohio State University) pointed out a great variety of behavior patterns for a group as diverse as the mites and ticks. Most of what we know about these forms is of a descriptive nature; there is a need both for comparative studies and for a correlation of behavior responses with physiological patterns. It was noted that there are many different types of sense organs, including receptors for humidity, pressure, light, and sound, and many of these are not well understood. Reproduction usually involves the use of spermatophores, but there is a wide range of reproductive activity that will require much research before it can be explained. Some of the most unusual behavior patterns are found among the parasitic mites and among those associated with ant colonies.

B. J. Kaston (Central Connecticut State College) noted that spiders also exhibited a great variety of behavioral responses. Some of the theridiid spiders live as commensals and even as parasites in the webs of orb weavers. Many spiders have evolved unusual methods for capturing their prey, including special webs, bolos, or even the use of a single strand as a spring. Some spiders of the genus *Scytodes* snare their prey by means of a gummy substance ejected from their poison glands. Recent studies have indicated that spiders can orient their webs by the use of polarized light.

Modern systematic studies should be based on an extensive investigation of the comparative morphology, ethology, physiology, genetics and ecology of the group involved (J. D. McCrone, Florida Presbyterian College). Unfortunately most systematic work on spiders has been based almost exclusively on the findings of comparative morphology. It was shown that in the case of *Lactrodectus*, the genus containing the black widow, it is possible to separate three closely related species by means of their behavior patterns in nest building, responses to irritation, and activity rhythms. These findings correlated well with biochemical studies of the spider's poisons. Much more spider systematic work should take into account comparative behavior patterns.

In reviewing the behavior of scorpions, H. L. Stahnke (Arizona State University) noted that satiated scorpions can survive long periods of time in a limited supply of oxygen. Hungry scorpions respond very quickly to changes in light intensity, while satiated individuals are slow to react. These facts emphasize how important it is to understand the physical state of the animal under investigation in behavioral studies. It was also shown that even in as uniform a group as scorpions there is a great amount of variation in responses and activities of different species. Thus one should not generalize on behavior of a group from the study of a few species. Scorpions eat small invertebrates and vertebrates which they can capture. The body fluids of the prey are imbibed and the solid parts discarded.

A. L. Edgar (Alma College) described opilionids as having three general types of life histories. In most, only one stage of growth occurs at any one time. In others, where some adults survive the winter, two different stages may occur simultaneously. In a few others, several stages may be found at one time. There is also evidence from Edgar's studies that unmated adults tend to live longer than mated adults.

Maturation and mating in *Leiobunum longipes* results in leg-pulling contests between males and "shepherding" of the female by the male after copulation. Proprioceptor organs are located on all appendages and act as an alarm system when stress occurs. Apparently many diverse types of sense organs are present, but their investigation has just begun. Most observations of opilionid behavior have been confined to northern species and much research is needed before a comparative ethology of the group can be written.

C. J. Goodnight (Purdue University) pointed out the paucity of information on the behavior of the whip scorpion. Available data indicate complicated behavior patterns similar in some respects to those of the scorpions. The phrynichids have a courtship pattern similar to that of the scorpions with their complicated mating ritual; they also use spermatophores.

This symposium pointed out the great variety of behavior patterns found among arachnids. While many observations have been made, a great many groups are poorly understood and much remains to be done before a comparative ethology of the group can be established. It was felt that arachnids make an ideal group for the study of comparative ethology. Once the behaviors of the different arachnid groups are better understood and analyzed, it may be possible to correlate behavior with physiological patterns.

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Initiation of Labor

An interdisciplinary conference on the initiation of labor was held in Princeton, New Jersey, 15–18 December 1963. Thirty-five scientists from nine countries attended the conference, which was intended to define the present status of knowledge in the field and to provide suggestions for research in areas of promise. The sessions were informal, without formal presentation of papers.

In the opening session the physiologic principles of the contraction of smooth muscle in the uterus were summarized by Walter Woodbury (University of Washington, Seattle). The change in the propagation of impulses over the uterus near term was pointed out. At term, impulses, once initiated, are continued over practically the entire uterus, whereas before this time propagation is much more localized. Uterine muscle, treated under appropriate conditions with progesterone, is blocked—that is, when it

is stimulated at one end only, that end contracts. The rest of the muscle lengthens passively due to the stretching from the stimulated portion. At term, however, a strip of uterine muscle stimulated at one end contracts over its entire length. Woodbury discussed the question of whether transmission from one muscle cell to the next is by way of a chemical transmitter, an electrical connection, or a cellular connection. He concluded that it is most probable that an electrical connector is involved.

Jean Marshall (Harvard University Medical School) reviewed the evidence that the contractile system of the uterus is ready to operate early in pregnancy. Gertrude van Wagenen (Yale Medical School) described her experiments showing that when the monkey fetus is removed pregnancy continues and the placenta is delivered at the usual time.

The effects of hormonal agents on uterine contraction were then considered. Roberto Caldeyro-Barcia (University of Uruguay) presented his experiments involving pregnant women which demonstrated that variations in intramammary gland pressure can be used as a measure of circulating oxytocin. These experiments show dramatically that oxytocin is released from the posterior pituitary during labor. At 20 weeks of pregnancy there is a sharp increase in the sensitivity of uterine muscle to oxytocin. A woman can undergo normal labor even though she lacks a posterior pituitary; for there are authentic cases of hypophysectomized women who underwent labor without the administration of oxytocin. This does not prove that they had no endogenous oxytocin, for oxytocin is produced in the hypothalamus, not in the posterior pituitary. Anna-Ritta Fuchs (University of Copenhagen) showed that the administration of alcohol inhibits the release of oxytocin from the pituitary. Administration of 100 milliliters of cognac eliminates the postpartum contraction of the uterus usually stimulated by suckling, that is, by the release of oxytocin. Comparable experiments in the rabbit by Fitzpatrick showed a dramatic increase in the amount of circulating oxytocin 10 minutes before birth. The amount of oxytocin is measured by the milk ejection potency of the extract. Caldeyro-Barcia then described experiments in which the concentration of oxytocin in the jugular vein was found to be much higher than the concentration in peripheral blood. The amount present in the jugular vein rises during labor and becomes maximal during the second stage. There are some 250 micro units of oxytocin per milliliter in the general peripheral blood during labor, whereas there are nearly 1000 micro units per milliliter in the jugular vein. Caldeyro-Barcia pointed out that oxytocin has little effect on uterine tonus but increases markedly the intensity and frequency of uterine contractions. Even a large dose of progesterone (600 mg) decreases the response of the uterus to oxytocin only very slightly. Estrogen and relaxin had no effect on the uterine responses to oxytocin. The effect of oxytocin on uterine muscle requires a certain concentration of sodium, potassium, and calcium; increasing the concentration of sodium increases the effect of oxytocin.

The role of progesterone in initiating labor was discussed by Arpad Csapo (Rockefeller Institute), who posed the question whether labor is initiated by releasing the brake—decreasing the progesterone block of uterine contraction—or by stepping on the accelerator, that is, by adding oxytocin. He presented experiments which sustain his hypothesis that labor is initiated primarily by a decreased progesterone block of uterine contraction. Hugo Jung (University of Freiburg) presented data which showed that uterine motility can be blocked by estrogens as well as by progesterone. Duncan Reid (Harvard University Medical School) pointed out that an aspect of the problem of great clinical inportance is the prevention of premature labor.

M. X. Zarrow (Purdue University) reviewed the possible roles of relaxin and concluded that relaxin is a hormone of pregnancy and is concerned with late pregnancy. It acts on the pubic symphysis, uterus, and mammary gland and interacts with the sex steroids. Recent evidence suggests that the relaxins from different species may differ slightly in their chemical properties and physiologic effects. Zarrow reported finding relaxin in human plasma but Kroc and Wiqvist could not detect it. Nils Wiqvist (Karolinska Hospital, Stockholm) reported that the rat uterus at 6 to 8 days of gestation is sensitive to relaxin (uterine motility is decreased) but later in pregnancy it loses this sensitivity. The change in sensitivity appears to coincide with the time when the ovary begins to make relaxin. Relaxin decreases uterine motility slightly in nonpregnant women but not in pregnant women. It seems clear that although relaxin does have some effects on certain biochemical properties of the uterus, such as its water and glycogen content, it is not of physiologic significance in determining uterine motility and the initiation of labor.

Robert Kroc (Warner-Lambert Research Institute) summarized recent findings on the chemistry of relaxin. It is a peptide with a molecular weight between 3000 and 10,000; it is rich in arginine and has at least one disulfide linkage. The usual preparations of relaxin are separated by starch gel electrophoresis into 10 to 12 components of which only the three that move as cations are physiologically active. The richest source of relaxin is the ovary of the pregnant sow.

Certain local effects of the placenta on uterine contractility were observed by making angiograms of women undergoing therapeutic abortions (Nils Wiqvist). The contrast medium was injected into the aorta with a catheter. Uterine contractions interfere with the flow of blood in all of the regions of the myometrium except those adjacent to the placenta. Allan Barnes (Johns Hopkins Medical School) described differences in the ionic content of the myometrium on the placental and antiplacental sides of the uterus. The placental side has a higher concentration of potassium and a lower concentration of sodium and chloride than the antiplacental side. The differences in the two sides of the myometrium disappear at about 38.5 weeks of pregnancy, at about the time when labor may be expected to begin. Experiments with uterine strips from rabbits in late pregnancy, described by Csapo, show that, upon stimulation, contraction occurs in the nonplacental region but not in the placental region of the myometrium.

In a discussion of the mechanism by which hypertonic saline infused into the amniotic cavity leads to premature labor, it was pointed out that there is a marked drop in estriol secretion. This decrease in secretion may cause an early death of the fetus. At this point the injection of progesterone derivatives that are water soluble may decrease the frequency and tonus of uterine contraction but does not de-

lay the abortion. It is possible that the saline kills the cells of the placenta and interferes with the production of progesterone and thus leads to the initiation of labor by releasing the brake. Alternatively, the saline may enter the maternal blood stream, making it hypertonic and stimulating the release of both antidiuretic hormone and oxytocin from the pituitary. It is known that women feel very thirsty during the treatment.

Louis Holm (University of California, Davis) described an interesting situation in which the fetus itself plays a role in the initiation of labor. In one strain of Holstein-Friesian cows the fetus is not delivered at the normal time but may remain inside the mother for months beyond the normal time of delivery. A variety of methods have been tried but all were unsuccessful in inducing labor in these cows. The newborn, if delivered by cesarian section, will die of hypoglycemia in 6 to 8 hours but will survive if treated with the appropriate adrenal corticoids. It appears that an inherited alteration in the pituitary-adrenal axis in some way prevents the fetus from signaling to the maternal organism that labor should begin. The fetal pituitary at term is only two-thirds normal weight and has a reduced number of acidophil cells. Somewhat similar conditions in other breeds of cattle and in sheep were described and it was noted that reciprocal crosses of horses and donkeys do not have the same gestational age.

John Biggers (University of Pennsylvania) described experiments in which one ovary of the mouse was removed. The other ovary then undergoes hypertrophy and produces a large number of eggs. After fertilization all of these blastocysts implant in a single horn because there is no connection between the two horns of the uterus in the mouse. The average length of gestation in the mice, each of whom had one ovary, was 19 days instead of the usual 20 days. Further experiments showed that the shortened gestation is due not to crowding in the one horn but to the overcrowding in the mother as a whole.

Jonathan Lanman (State University of New York, Brooklyn) reviewed the concept that the placenta initiates a homograft response in the mother and that rejection of the homograft initiates labor. After pointing out that if this were true a member of an inbred strain could not deliver its young, he described a beautiful series of experiments demonstrating that this phenomenon is not involved. It appears that trophoblastic cells are not antigenic. Perhaps an important factor is that the placenta, in contrast to grafts, has its own blood supply.

The clinical circumstances which may initiate labor were reviewed by James Walker (University of St. Andrews, Scotland). He showed that it is difficult to relate certain of these factors to the general concept that oxytocin initiates and progesterone inhibits labor itself. Zander had described a decrease in the concentration of progesterone in the blood in the week preceding labor, but Walker could detect no general pattern in the concentration of progesterone before labor. At term the concentration of progesterone is much greater in the uterine vein than in the maternal peripheral veins. Analyses of the amount present in peripheral blood do not provide a reliable index of the progesterone secreted by the placenta.

In the final session the physiologic findings of the conference were summarized by Ernst Knobil (University of Pittsburgh) and the clinical findings were summarized by Ernest Page (University of California, San Francisco). Other participants in the general discussion were Willard Allen (Washington University), Richard Blandau (University of Washington), Geoffrey Dawes (Cambridge University), Rune Eliasson (Karolinska Institute,) Frank Fremont-Smith (AIBS), Fritz Fuchs (University of Copenhagen), Harry Gordon (Albert Einstein), Carl Hartman (Margaret Sanger Research Bureau), Eileen Hasselmeyer (NIH), Evelyn Johnsen (NIH), Elsa Keiles (NIH), William Little, (NIH), Franz Rosa (NIH), Kenneth Ryan (Western Reserve University), Sydney Segal (University of British Columbia), and Margaret Thomas (Children's Bureau).

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The transcript of the discussion will be published with Jean Marshall as scientific editor.

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Prenatal Irradiation: Effects on the Development of the Central Nervous System and Postnatal Behavior

The effects of prenatal irradiation on the central nervous system and postnatal behavior were discussed at a workshop conference held in Washington, D.C., 4–6 October 1963. The discussions were devoted exclusively to American and Russian research in this field.

The opening session was chaired by E. Furchtgott (University of Tennessee), who reviewed the Soviet literature on this subject; additional material was prepared by W. R. Stahl (Oregon State University). A major portion of the Soviet presentations concentrated on the recently translated book by I. A. Piontkovskoyo, *Effects of Ionizing Radiation on the Functions of the Higher Nervous System of Progeny* [Medzig, Moscow, 1961 (AEC-tr-5553)].

In this review of this work, the similarities and divergencies between the American and Soviet approaches to this area of research became apparent. This was made evident, in the Russian research, by the use of behavorial variables reflecting Pavlovian types of performance processes. Unfortunately, their omission of detailed descriptions of research methodology, including those pertaining to control of stimulus parameters, radiation dosimetry, nature of subjects, and so forth, made critical appraisal difficult. However, their research has demonstrated a variety of alterations on the central nervous system with dosage levels as low as 1r per day for a 20-day period. In addition, they, more than we, have utilized interdisciplinary approaches to this problem and have integrated results at the behavioral, anatomical, and physiological levels. However, they also have not found clear dose-response relation at the low dosage levels used, and have also observed differential effects on male and female progeny after prenatal irradiation. The Russians appear to have the same difficulty that we have in trying to explain those results. It was the consensus among the scientists attending this conference that although Soviet accomplishments were comparable to ours, there was a definite need for us to foster a greater emphasis in interdisciplinary research for this important research area.

K. R. Brizzee (University of Nebraska) served as chairman of the ses-