tinue her quotation from the Appendix VII of the 1921 Indian Census, where we read that, though cohabitation begins with puberty, "in the majority of cases the first child is born the third year of effective marriage." Alden Clark[3] has pointed out, furthermore, that returns from maternity hospitals place the first parturition at 18.3 to 19.4 years. At the Madras Maternity Hospital only 10 out of 3,000 cases were under 15! Besides, we learn also from the 1921 census that only 399 out of 1,000 girls were married at 15, which would seem to indicate the average age at menarche is over 15 rather than under 13!

Among gynecologists Dr. Henry Vignes seems to be the only one to recognize the principle suggested in this paper. He says in his "Physiologie Gynécologique" (Paris, 1929), p. 55: "The onset of menstruation does not mean the capacity for conception; many girls who are just beginning to menstruate conceive with difficulty. Godin says that the age of maturity (nubilité), when the individual is capable of reproducing, is about five years after puberty." Dr. Vignes, moreover, kindly sent me a copy of the article "Nubilité" by Mondière in "Le Dictionnaire des Sciences Anthropologiques" (1890?). This gynecologist spent some years in Cochin-China, where he gathered certain data (first menses, first parturition, number of children, menopause, etc.) concerning 960 Annamite, 106 Chinese and 87 Cambodian women. He found that the first menstruation took place on the average at 16¼ years in the Annamites, at 16½ in the Chinese, at 16 10/12 in the Cambodians; the first parturition in these groups at 20½, 16 10/12 and 22½ years, respectively, despite their early marriages. He therefore concludes: "Maturity (nubilité) is often confused with puberty, which is a very different thing, for maturity signifies the faculty of normal reproduction."

This interval between the appearance of the first manifestations of sexual activity and the ability to conceive doubtless explains the Trobiand Islanders' ignorance and denial of physiological paternity and the corollary thereof, a matriarchal form of society, as set forth by Malinowsky in his "Sexual Life of Savages" (London and New York, 1929). Contact with white man has not yet made any headway in convincing the natives that sexual intercourse has any relation to procreation.

Malinowsky is, nevertheless, well-nigh baffled by the fact that despite the absolutely unrestrained and promiscuous sex life of the young Trobiander from childhood on, pregnancy among young unmarried girls is extremely rare—perhaps one per cent. "Can there be any physiological law," the author asks, "which makes conception less likely when women begin their sexual life young, lead it indefatigably, and mix their lovers freely?"

It seems highly reasonable that Malinowsky's predicament is explained by the facts presented in this paper, namely, that the first menstruation (*puberty*) marks merely an early manifestation of a train of events (*adolescence*) which only after three or four years on the average lead to ovulation and conception, the proof of *maturity*.

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[3] *Atlantic Monthly*, February, 1928.

THE ETIOLOGY OF EPIZOOTIC ENCEPHALOMYELITIS OF HORSES IN THE SAN JOAQUIN VALLEY, 1930[1]

EARLY in July, 1930, scattered cases of a peculiar disease of horses which involved the central nervous system began to attract the attention of the livestock owners in certain parts of the San Joaquin Valley. A gradually increasing number of cases was reported from most sections of this region throughout the month of August. With the onset of cool nights the disease disappeared. The peak of the epizootic was reached in the middle of September; no cases were reported after November. From the records of the tallow works and incomplete survey studies it has been estimated that a total of approximately 3,000 horses and mules succumbed to the malady or were sacrificed on account of its sequelae. Close to 6,000 equine animals developed recognizable symptoms. About 50 per cent. of these cases terminated fatally. On one ranch with 687 horses and mules 67 contracted encephalomyelitis and 32 died.

At first the malady was quite generally diagnosed by veterinary practitioners as equine botulism but the spread of the epizootic suggested an infectious disease with an incubation time of from 1 to 2 weeks. Observations revealed febrile reactions preceding the onset of the symptoms which were manifest in form of psychic and motoric disturbances. Signs of fatigue, somnolence, and occasionally excitability, were followed by incoordinated action of the limbs, disturbed equilibriums, grinding of the teeth, paresis and paralyses which varied and were largely dependent on the lesions produced in the innervation centers of the nerves in the brain and the spinal cord. Inability to swallow, paralysis of the lips and bladder, amaurosis, etc., were quite common. In the mild cases which were able to rise recovery was as a rule uneventful and without demonstrable sequelae, but about half were so severe that they terminated fatally in 3 to 8 days or became so obviously hopeless on ac-

[1] From the George Williams Hooper Foundation and the Division of Veterinary Science, College of Agriculture, University of California, San Francisco and Berkeley, California.

count of the complications in form of decubitus, pneumonia, etc., that they were destroyed for humane reasons.

Aside from a slight general icterus and moderately succulent lymph-nodes, and parenchymatous changes in the liver and kidneys no gross anatomical lesions were found at autopsy. The spleen was not enlarged. As a rule the spinal fluid was slightly increased and showed 12 to 30 cells per cmm, mostly lymphocytes and a few leucocytes. The brain and cord were moist and injected.

The most obvious and striking microscopic changes in the brain consisted of hemorrhages around the vessels of the olfactory bulb, brain-stem, medulla and cord. Infiltration of the perivascular sheaths and spaces due to mononuclear and polymorphonuclear cells was variable in intensity. "Cuffing" of the veins and arteries was definite in the advanced cases of the disease. Scattered patches of infiltration in the gray and occasionally in the white matter were common. The distribution of the inflammatory foci differs from that commonly seen in typical Borna disease. Nuclear inclusions of the character described as typical of Borna disease by Joest and Degen were absent. Infiltrations in the lumbar plexus, semilunar and other peripheral ganglia suggest a wide distribution of the virus.

Blood cultures prepared from 10 horses were sterile while the spinal fluid of 11 horses sacrificed or dead on account of encephalomyelitis gave cultures of haemolytic and non-haemolytic streptococci. Certain sections of the brain of a few horses (4 out of 10) contained the same organisms in small numbers. They were non-pathogenic for rabbits and horses on subdural and intravenous inoculation. They were considered secondary invaders without etiologic significance.

Attempts were made to transmit the infection to rabbits by subdural and intracerebral injection of 20 per cent. brain and cord suspensions. The animals failed to manifest definite symptoms. Although moderate febrile reactions of short duration were recorded, the rabbits recovered promptly. Suspensions of the central nervous system of 8 equines sacrificed at different stages of the disease were tested on horses by intra-ocular, intranasal and intracerebral injections and feeding. The brain material from a case in the early stages of the infection produced on intra-ocular injection a fatal malady which was clinically indistinguishable from the San Joaquin Valley disease. Successive passages through horses, monkeys, rabbits, guinea-pigs, rats and mice and reverse transmissions from these animals have as a rule been successful. Clinically as well as anatomically the experimental disease is an acute virus infection identical with the spontaneous equine encephalomyelitis. The infective agent has thus far been demonstrated in the central nervous system by experimental inoculation from two field cases (horses No. 10 and 13). The failures in seven other attempts may be due to the selection of non-susceptible experimental animals, uneven distribution or absence of the virus in the central nervous system of the cases of prolonged duration (autosterilization) or unsuitable administration of the material. For example, the brain suspension of an acute case of encephalomyelitis tested on rabbits, horses and a monkey only produced a mild disease in the latter animal. The serum of this recovered monkey continues to neutralize the virus of horse No. 10.

Recent experiments indicate that the guinea-pig is regularly susceptible for the horse virus and the most suitable animal for an extended study of the disease and its causative agent. In these rodents the disease manifests itself in the form of a febrile reaction, flabbiness of the abdomen, hunched cat pose, salivation, tremors, trotting motions and death in from 4 to 6 days following the intracerebral injection of brain suspensions or filtrates. Not only intracerebral but intranasal instillations of brain emulsions have successfully transmitted the virus to guinea-pigs and rabbits, but not to horses.

The virus survived in one experiment preservation at 4° C. in 50 per cent. neutral glycerine for 12, 21 and 31, but not 105 days, when tested on horses and guinea-pigs. It is filterable through Berkefeld V and N candles and retains its activity in a dilution of 1:1000 although the incubation time may be slightly prolonged.

The nature of the immunity of the horse is unknown. Sera of spontaneously recovered or resistant horses fail to neutralize the virus while the sera of recovered rabbits, guinea-pigs and monkeys may contain antiviral substances.

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