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Transfer of Gamma Globulin from Mother to Offspring in Mink.*† (30117)

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The transfer of immunoglobulins from mother to offspring occurs by different mechanisms in various species, and can be roughly correlated with the type of placentation. For example, immunoglobulins in man are transferred *in utero*, in the cow post partum *via* the colostrum, and in mice by both methods. During the study of Aleutian disease of mink (*Mustela vison*), we have made observations on the mechanism of transfer of immunoglobulin from mother to offspring. It is known that young mink have maternal antibody(1), but no study of the mechanism of transfer has been reported.

Materials and methods. Ranch raised pregnant female mink were obtained from the Utah Mink Growers Cooperative and were judged to be free from Aleutian disease on the basis of serum protein electrophoresis(2).

Mink 6.4S gamma globulin and albumin were prepared by ion exchange cellulose chromatography and were homogeneous by electrophoretic, ultracentrifugal and immunologic tests. The proteins were trace labelled with I^{131}. Six female mink were given 165 to 500 μc I^{131} gamma globulin and 2 were given 500 μc I^{131} albumin by intracardiac injection ½ to 10 days before delivery. The animals received potassium iodide in their drinking water throughout the experiment. At time of delivery, some kits were immediately removed, and others were allowed to nurse. Colostrum was removed from no more than 2 of the mothers eight breasts. Maternal and kit serum, colostrum, and milk were examined for trichloroacetic acid precipitable radioactivity using a well type scintillation counter.

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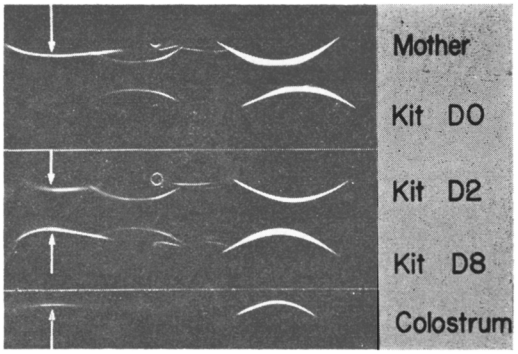

FIG. 1. Immunoelectrophoretic pattern of maternal mink serum and colostrum, and of her kits at time of birth and at 2 and 8 days of age showing gamma globulin (marked with arrows) in maternal serum and colostrum. No gamma globulin is present in kit serum at time of birth; it is present but weak at 2 days of age, and is similar to mother's gamma globulin arc at 8 days of age. Anode is to the right.

Immunoelectrophoresis of serum, colostrum, and milk was done by the micromethod of Scheidegger(3) using anti-mink serum antibody prepared in rabbits by repeated injections of whole normal mink serum.

Results. Using immunoelectrophoretic techniques, mink kits showed no detectable gamma globulin in their serum at the time of birth, while after nursing one or more days, a gamma globulin precipitin arc was present. After 8 or more days the intensity of the gamma globulin arc of the kit serum was indistinguishable from that of the mother. Gamma globulin and albumin were present in the colostrum, and in the milk for at least 21 days, which was the last observation made. Fig. 1 shows the immunoelectrophoretic pattern of a mother's serum and colostrum, and the serum of her kits at the time of birth and at 2 and 8 days of age.

At the time of birth, 11 kits from the 6 litters showed no I^{131} gamma globulin in their serum. The colostrum at the time of birth contained 33 to 59% of the maternal serum concentration of gamma globulin. At 2 days of age, the mink kit's serum had 24 to 30% of the maternal serum concentration of I^{131} gamma globulin, while by 8 days it had risen to 60 to 80% of the maternal serum concentration.

The 2 mothers receiving I^{131} albumin had 41 and 70% of the serum concentration of I^{131} albumin in their colostrum, and the kits at birth had 0.5 to 7% of the maternal serum I^{131} albumin concentration. Unfortunately, these 2 mink failed to nurse their kits, so that no determination of albumin transfer *via* the colostrum could be made.

Discussion. The present study shows that mink are born without detectable gamma globulin in their serum, and subsequently acquire it from the mother *via* the colostrum and milk. Mink have a hemochorial type of placenta(4) similar to that of the dog, and in dogs it has been shown that the majority of antibody puppies receive is transferred post partum, only about 3% of the maternal antibody titer to distemper virus being transferred to the puppy prior to birth(5). Mink colostrum and milk contained labeled gamma globulin at a concentration less than that of the maternal serum, and similar to the ratio of serum : colostrum concentration of albumin. In dogs the antibody titer of colostrum may be slightly higher than the maternal serum titer, but there is no evidence of a marked ability to concentrate gamma globulin in the colostrum. Both mink and puppies(6) can absorb intact proteins from the gut for at least the first 8 days of life. In contrast, in the bovine species the calf is born without gamma globulin and can absorb it *via* the gut only during the first post partum day. To counterbalance this short period of gamma globulin transfer the cow's udder has the ability to concentrate gamma globulin from the serum to the colostrum. The cow has colostral levels of gamma globulin up to 10 times the serum concentration, while the albumin concentration is only 1/25 that of the serum(7). The absence of a mammary concentrating system for gamma globulin in mink and dogs is compensated for by a relatively long interval after birth in which the young can absorb gamma globulin intact from the gastrointestinal tract.

Summary. Newborn mink have no detectable gamma globulin, and acquire gamma globulin from the mother *via* the colostrum and milk. Gamma globulin concentration in the colostrum was less than that of the maternal serum.

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Plasma 17-OHCS Response of the Infant Rhesus Monkey to a Noninjurious, Noxious Stimulus.* (30118)

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In a previous study(1), the 2-day-old rhesus monkey was found to have a resting plasma 17-hydroxycorticosteroid (17-OHCS) level of the same magnitude as adult animals. In addition, the 4-hour plasma 17-OHCS response to ACTH was 2-fold that of the adult, while the rate of cortisol metabolism was the same as the adult. In view of these data, which indicate that the infant monkey has a functional adrenal cortex, the present study was initiated to determine if all the other components of the central nervous system (CNS)—hypophyseal—adrenocortical axis also are functional in the 2-day-old monkey. The approach selected for this purpose was to determine if the newborn monkey would respond to a noninjurious but noxious stimulus. Such a stimulus could be assumed to be effective *via* some CNS mechanism acting to release ACTH, rather than by acting directly on the hypophysis or adrenal cortex.

The noxious, noninjurious stimulus chosen was that of bodily restraint and rotation. This choice was based upon our observation that such a stimulus induces a maximal rate of plasma 17-OHCS elevation in the adult monkey.

Methods. Eight two-day-old rhesus monkeys (*M. mulatta*) were restrained by being wrapped securely in cloth diapers and then manually rotated head over heels for one hour at approximately 3 revolutions per minute. This rotation rate produced no observable evidence of nausea or other vestibular disturbance. Blood samples were obtained from the saphenous vein immediately before and after one hour of restraint and rotation and always within 20 minutes of the hours of 9:00 and 10:00 a. m. As a control group, 6 additional 2-day-old rhesus monkeys were subjected to the blood drawing procedure only.

All blood samples were centrifuged within 30 minutes after withdrawal and the plasma frozen at −15°C. Plasma concentrations of 17-OHCS were determined by a micromodification of the Eik-Nes method(2).

Since the initial 3 of the eight rotated infants showed marked elevations of plasma 17-OHCS following rotation, it seemed apparent that the infant monkey was exhibiting a "stress" response. To assess the degree of this response relative to the maximal response of which the infant adrenal cortex was capable, studies on the remaining 5 of the rotated infants included a measurement of adrenocortical capacity as determined by the one-hour response to an intramuscular injection of 4 units/kg of ACTH (Acthar Gel, Armour). This dosage had previously been found to produce a maximal rate of plasma 17-OHCS elevation in the adult. The ACTH tests on the infants were conducted 2 days following rotation when the animals were 4 days of age. The response to ACTH at 4 days was assumed to be the same as that at 2 days of age since it was previously ob-

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