Placenta as a barrier to infection

Kenneth Brown

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THE PLACENTA AS A BARRIER TO INFECTION

KENNETH W. BROWN

SENIOR THESIS
presented to
University of Nebraska College of Medicine
Omaha, 1940
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INTRODUCTION

Infections of the fetus in utero and the mechanism of these infections are problems which warrant further scientific investigation. It is recognized that almost all the diseases that may affect a pregnant woman may be transmitted to the fetus. Few references in the literature, however, make mention of the part played by the placenta as a "barrier" medium in this connection. Most of the articles being written on those cases in which the infection was transmitted through the placenta to the child in utero.

It is my firm belief, and I propose to offer evidence in this paper to help prove, that the placenta is a selective "barrier", allowing the passage of non-infectious products, antibodies, etc., but barring toxic materials, bacteria and the like. It is my contention that disease occurs in the fetus by way of the placenta only in those cases in which the placental tissue is injured or in some way weakened.

Much of this work was compiled from the maternity records of the past five years at the University of Nebraska Hospital, the Douglas County Hospital, and from answers to fifteen letters sent to hospitals scattered throughout the country. In this connection I would like to quote from a letter received from Dr. Carroll E. Palmer, Passed Assistant Surgeon of the U. S. Public Health Service, showing the difficulty in obtaining
records for this type of study:

"I am sorry to say that the U. S. Public Health Service does not possess the kind of information requested by you.... Probably the best source for information of this kind would be found in good hospitals with a large delivery service..... I may add, however, that beginning 1940 the birth certificate in many states contain a question on complications of the mother during pregnancy."

I wish to thank Drs. McGoogan, Eggers, Tollman, all from the University of Nebraska staff; Dr. Fleischman, of the Douglas County Hospital; Dr. William E. Studdiford, of the Bellevue Hospital of New York City; Dr. Frederick C. Irving, of the Harvard Medical School, and the many others for their help and kind advice in preparing this paper.
The fetal period of life is, as we all know full of wonders. There is the wonder of its anatomy, as revealed by the study of the mechanism, which shows such accurate adaptation to the varying needs of the various months of antenatal life. There is the wonder of its physiology, the marvel of the mechanism in action, with all its minor wonders of fetal circulation, respiration, nutrition, excretion, motion, and sensation. There is the mystery of the inter-relation with semi-independence of the maternal and fetal economies, the intertwining of two lives. There is the transition of birth, accomplished as a rule so smoothly and yet so complicated, so profound--truly a wonder among wonders.

To study and discuss each separately would require the best time of a human life, and even then with the rapid progress in medicine I doubt if we would be able to have the works written before it would have to be revised.

In our present modern knowledge of obstetrics, medicine, etc., it seems to be a matter of no little importance to understand the possibilities, modes, methods of prevention, etc., of antenatal infection and the effects on the child in utero. Likewise, it seems only natural to start that study with the placenta.

"The placenta connects the fetus to the uterine wall, and is the organ by means of which the nutritive, respiratory, and excretory functions of the fetus are carried on. It is com-
posed of fetal and maternal portions." DeLee (3).

"The fetal portion of the placenta consists of the villi of the chorion frondosum; these branch repeatedly, and increase enormously in size. These greatly ramified villi are suspended in the intervillous space, and are bathed in maternal blood, which is conveyed to the space by the uterine arteries and carried away by the uterine veins. A branch of an umbilical artery enters each villus and ends in a capillary plexus from which the blood is drained by a tributary of the umbilical vein. The vessels of the villus are surrounded by a thin layer of mesoderm consisting of gelatinous connective tissue, which is covered by two strata of ectodermal cells derived from the trophoblast; the deeper stratum, next the mesodermic tissue represents the cytotrophoblast or layer of Langhans; the superficial, in contact with the maternal blood, the syncytiotrophoblast. After the fifth month the two strata of cells are condensed to a single layer of somewhat flattened cells." Gray (9).

The maternal portion of the placenta is formed by the decidua placentalis. The changes involve the disappearance of the greater portion of the stratum compactum, but the deeper part of this layer persists and is condensed to form what is known as the basal plate. Between this plate and the uterine muscular fibres are the stratum spongiosum and the boundary layer; through these and the basal plate the uterine arteries
and veins pass to and from the intervillous space. The endothelial lining of the uterine vessels ceases at the point where they terminate in the intervillous space which is lined by the syncytiotrophoblast. Portions of the stratum compactum persist and are condensed to form a series of septa, which extend from the basal plate through the thickness of the placenta and subdivide it into the lobules or cotyledons seen on the uterine surface of the detached placenta.

The fetal and maternal blood currents traverse the placenta, the former passing through the bloodvessels of the placental villi and the latter through the intervillous space. The two currents do not intermingle, being separated from each other by the delicate walls of the villi. Nevertheless, the fetal blood is able to absorb, through the walls of the villi, oxygen and nutritive materials from the maternal blood, and give up to the latter its waste products. The blood, so purified, is carried back to the fetus by the umbilical vein. It will thus be seen that the placenta not only establishes a mechanical connection between the mother and the fetus, but subserves for the latter the purpose of nutrition, respiration, excretion and certain selective powers of preventing, or at least attempting to prevent, toxic and deleterious material from passing to the fetus.

"At term nearly every placenta will show, on careful inspection, whitish, nodular, hard areas, occupying the fetal or
maternal surface, or both, and varying in size from a pinhead to several centimeters. These structures are called infarcts, and several varieties are found having different causation, though little is positively known on this point."

DeLee (3). Montgomery (3) calls them necroses. In general there are three views as to their causation. Ackerman (3) believed a periarteritis or endarteritis existed in the villi and produced obliteration of the vessel lumen, with consecutive necrosis of the villus' stroma, then of the villus' wall, and consequently clotting of the blood in the adjoining inter-villous spaces. Steffeck, von Franque (3) and many other investigators believe that endometritis and decidual overgrowth and consequent necrosis of the villi with fibrin deposition are the cause. Primary alteration or desquamation of the chorioic epithelium, which is not abnormal in the last weeks, causes deposition of fibrin and infarct information, according to Hirschmann (3). It is probable that there is truth in all these theories, and that the first explains the multiple infarcts on the fetal surface; the second, the infarcts on the maternal side and placenta marginata; the third, the microscopic infarcts made up of necrotic ectodermal cells which are constantly found in ripe placentas.

Frazer (6) says, "In the very young active organ there is an orderly arrangement of the vascular tree from the distribution of the main vessels in the fetal surface to their ultimate destination in the cotyledonous areas."

6.
"There are numerous fine branches of both arteries and veins but a directness of blood supply through the cotyledons, a rapid return of fluids as well as an abundant anastomosis between the two placental arteries. In the old placentae there is a marked lessening in number of the finer vessels, lack of compensatory circulation through lessening of anastomotic network, shrinkage of cotyledonous circulation with ultimate infarction in some areas." DeLee (3). This infarction, a part of the ordinary senescence of mature placentae, seem to be the result of primary degeneration of the placenta and is significant in two respects: (1) It may result in injury to the fetus, if very severe, by limiting fetal blood supply, and more significant to this discussion, (2) It may render the placenta susceptible to disease processes.

"Clinically, infarcts cannot be diagnosed, but their existence can be expected in cases of nephritis, heart disease, syphilis, endometritis, and when they were present in previous pregnancies." DeLee (3). In a study of 1000 placentas, Harer (10) found the following interesting facts:

<table>
<thead>
<tr>
<th>Pathological Changes</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infarcts (5mm or larger)</td>
<td>650 cases (65%)</td>
</tr>
<tr>
<td>Placentosis</td>
<td>350 cases (35%)</td>
</tr>
<tr>
<td>Cysts</td>
<td>473 cases</td>
</tr>
<tr>
<td>Fibrosis and calcification</td>
<td>380 cases</td>
</tr>
<tr>
<td>Hemorrhage</td>
<td>307 cases</td>
</tr>
<tr>
<td>Placentas showing average pathology</td>
<td>104 cases</td>
</tr>
<tr>
<td>Placentas showing excessive pathology</td>
<td>78 cases</td>
</tr>
</tbody>
</table>

The occurrence of a high percentage of pathological changes in the placentas from a group of patients with an unusually low
incidence of clinical anomalies leads to the conclusion that such changes must be considered as senile degenerative changes taking place in an organ whose life span is barely sufficient for the proper performance of its physiologic functions. The infarcts interfere with function of the villi and so induce endarteritis, thrombosis and necrosis of the affected villi.

Montgomery (22), in 1933, taking 400 consecutively placentas in the Obstetrical Department of Jefferson Medical College Hospital, using only histologic sections in those instances in which there were abnormal complication or gross evidence of pathology found 250 were broken by a lesion of some sort or another. It is possible if many small sections of the others were made there would have been many more.

At the Michael Reese Hospital routine examinations are done on blood drawn from the umbilical vessels. Of 374 consecutive blood cultures it was found that only 34 or 9.09% were positive. Placentas were examined in all instances. Of these only 12 or 3% showed definite inflammatory changes. The clinical histories of these 12 cases showed that all the labors were prolonged and in 10 cases the mother had intrapartum fever. The bag of waters in all instances had been ruptured more than 24 hours with the exception of one case (11 hours).

The inflammatory changes in the placentas were all essentially the same. The characteristic picture, when well developed, consists in an intra and subchorionic barrier of leucocytic in-
filtration. These leucocytes appear to migrate from the superficial fetal blood vessels. It is evident that there is a positive chemotaxis which invariably draws the leucocytes toward the fetal cavity.

The maternal surface on the other hand was little or not at all involved, but here and there in the more severe grades of placental reactions, and closer to the periphery gatherings of leucocytes are not uncommonly seen.

From this most of the bacteria seem to come from the vagina where normally, present, or from being introduced manually.

Physiologically the placenta may be considered as a permeable membrane falling into the third type in the classification of Höber (12) who describes permeable membranes as (1) sieve-like, those allowing permeation of substances if the holes are large enough. (2) solvent-like, those composed of a homogeneous layer of water-insoluble substance which allows permeation of substances soluble in the permeating layer, and (3), surface films monomolecular in character and resembling sieves in structure but having some special properties in selective absorption not understood. In general, then, the placenta has the power of preventing noxious substances and infectious agents from crossing it. However, certain of these agents are able to pass the placenta, especially if it has been weakened by infaction, infection, or such.
Colloidal dyes and particulate matter introduced into the blood stream of pregnant animals fail to reach the fetus. The placenta appears to be an impenetrable barrier for inert colloids, and experiments show that even colloidal metabolites reach the fetus only after they have been split into simpler substances by enzyme action, hydrolysis, and other chemical processes. Goldmann (31) noticed that when he injected colloidal dyes, such as trypan-blue and pyrrhol-blue, into pregnant mice and rats, the placentae and the fetal membranes stained very deeply with the coloring matter, but none of it reached the fetus.

Dyes (colloidal), injected into the amnion cavity, were introduced into the fetus with perfect ease. Here, however, it was noticed no dye could be found in the maternal circulation, liver, kidney, or urine where we would expect it to be.

The extensive researches of Fusserow, Fehling, Aantz, Wiener, Beneche, Krukenberg and Preyer (31) have demonstrated the passage of gases and dissolved crystalline substances from the maternal into the fetal circulation.

For many years there was less clarity concerning the passage of formed substances (such as proteins and fats) through the placenta. It is now believed, mainly from the experimental work of Ascoli, Bonnet, Hofbauer, and Goldmann (31) that such substances are not directly transmitted through the placenta, but must first undergo a breaking down in the epithelium of the
chorion before assimilation by the fetal blood-stream is possible. Hofbauer considers the activity of the choronic epithelium as comparable in many respects to absorption by the intestinal mucosa.

Jassinsky (31) in 1867 injected a suspension of carmine into pregnant dogs and although the animal died from this procedure in about 20 minutes, he observed that the substance did not reach the fetal circulation but was held up in the placenta.

Hoffman and Langerhans (31) state that after injecting a nearly full-term rabbit with carmine, they found no trace of the dye in the fetus.

The most complete observation on the behavior of the fetus toward injected foreign colloids are those of Goldmann (31) who studied the mouse and the rat with great care. Into a number of pregnant mice and rats he injected colloidal solutions of the benzidine dyes, pyrrhol-blue and trypan-blue. The dyes are practically non-toxic to living tissue. The result was that in every instance the tissues of the mother became deeply stained, the dye appearing in the form of blue granules in many of the cells of the body. On opening the uterus of such a vitally stained animal the fetuses were found unstained, the dye apparently having been prevented from entering their bodies by the placenta and membranes, all of which were dark blue. On examining sections of the placenta and membranes,
Goldmann found that the dye had been absorbed by many of the fetal cells and appeared in the form of blue granules within their cytoplasm; to this circumstance he attributed the failure of the dye to reach the fetal circulation. In the placenta he observed the dye in the fetal ectoderm, particularly in the giant cells or angioblasts, and in the entire chorionic epithelium of the labyrinth which separates the maternal decidual cells, as well as the mesenchyme of the villi and the endothelium of the fetal capillaries. He saw further that the dye was very abundant in the endodermal cells of the inverted yolk sac.

Concerning the significance of vital staining in the placenta, several opinions have been advanced. Schlect (31), in 1907, believed that the chief function of the vitally stained chorionic cells is to protect the fetus from toxic substances in the maternal blood stream. Goldmann (31) sees in them a group of cells which are tremendously important in the storage of nutrient material for the fetus. He was led to this view by demonstrating that these same cells are normally laden with glycogen and give staining reactions for iron and fat.

Thus, we have seen three possible theories of the mechanism of the placenta as a barrier. First, that of being a mechanical membrane; second, that it may act as an absorbing body, and third, the leucocytic theory that assumes that the
normal placentae contain disease-resisting leucocytes which protect the fetus, and if over-come may be a mode in which disease is transmitted to the fetus.

In reviewing the literature as the cause of fetal deaths it is of interest to note diseases complicating pregnancy comes last in the list prepared by Antonio Villarama (27).

His list:

Obstetrical interventions .......................27.56%
Placenta previa ..................................16.93%
Obstetrical interventions complicated by
  co-existing pathological entities ............13.51%
Prolonged labors ................................9.30%
Undetermined ...................................6.12%
Eclampsia .......................................5.94%
DISEASES COMPLICATING PREGNANCY ............4.86%
   (A great percent of these being premature)

Of the 2192 patients delivered in the University of Nebraska Hospital in the past five years it is of interest to note there were only 66 cases (0.30%) in which the mother was infected with disease before delivery. These cases include all types of diseases from mild colds to tuberculosis. Tabulated, they make an interesting picture:

Result of Cases studied at the University Hospital
June 21, 1934 to June 20, 1939

<table>
<thead>
<tr>
<th>Description</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients delivered</td>
<td>2192</td>
</tr>
<tr>
<td>Number of babies</td>
<td>2228</td>
</tr>
<tr>
<td>Maternal mortality</td>
<td>15 or 0.68%</td>
</tr>
<tr>
<td>Fetal mortality</td>
<td>113 or 5.07%</td>
</tr>
<tr>
<td>Prematures</td>
<td>42 or 1.84%</td>
</tr>
<tr>
<td>Stillborn</td>
<td>44 or 1.97%</td>
</tr>
<tr>
<td></td>
<td>(Atelectasis, premature separation of placenta, collapsed cord, injuries from delivery)</td>
</tr>
<tr>
<td>Pre-eclampsia, toxemias</td>
<td>9 or 0.40%</td>
</tr>
<tr>
<td>Congenital deformities</td>
<td>9 or 0.40%</td>
</tr>
<tr>
<td></td>
<td>(Congenital heart, atresia of gut, etc.)</td>
</tr>
<tr>
<td>Unknown</td>
<td>66 or 0.30%</td>
</tr>
</tbody>
</table>

13.
Prenatal infections of the mother..................66 or 0.30%
Rheumatic fever........3 effect on fetus......0
Endocarditis............4 effect on fetus......1 (premature)
Decompensated hearts...8 effect on fetus......2 (premature)
(cause unknown)
Tuberculosis............1 effect on fetus......0
(Tuberculosis............4 effect on fetus......0
(active)
(Tuberculosis............4 effect on fetus......0
(non-active)
Pneumonia..............3 effect on fetus......0
Pyelitis.................16 effect on fetus......0
(Pneumonia..............3 effect on fetus......0
Pyelitis.................16 effect on fetus......0
(One had atresia of
Cystitis.................. 5 effect on fetus......0
the esophagus; the
Meningitis.............. 1 effect on fetus......1
other was a premature)
(General septicemia.... 1 effect on fetus......0
Scarlet fever.......... 1 effect on fetus......0
Acute coryza......... 19 effect on fetus......0
(General septicemia.... 1 effect on fetus......0
(One had atresia of
the esophagus; the
other was a premature)

In the above series only six babies died of infected
mothers, in none of these six cases could a record of an autol-
psy be found. Four of these babies, however, were premature
infants which could easily explain their deaths. One of the
babies had a congenital malformation which might account for
its death. The one remaining died after a caesarean section
of a mother infected with meningitis, the mother died and no
report could be found to determine if an autopsy was performed
on the child. Allowing for a benefit of doubt that this child
did die from the transmitted infection, we find only 1.5% mor-
tality of infants of infected mothers in the past five years
at the University Hospital.

Time does not permit discussion of each of the above cases.
It probably should be emphasized there were no microscopic
examination of the placenta made in any of these cases.

We, therefore, cannot say if pathology was present or not in the placenta. I do believe McCord (17) has a very good point in his statement, "I do not think it possible for any organism to be found in the baby without placental pathology."

Of the most composite cases for my study taken from the records of the University Hospital is that of Mrs. F. J. This patient gave birth to three live babies; in two of her pregnancies she was infected, once with pneumonia, once with active rheumatic fever.

Case Record

Mrs. F. J., white, married, gravida 4, para 2, entered the hospital for the fourth time on November 10, 1939, complaining of intermittent cramping pains in her abdomen for 24 hours. The patient was diagnosed to be in labor. In her history it was found she had had a severe pneumonia in October and still had a dry crackling cough, small rales over the entire right chest. The breath sounds were slightly accentuated over the entire right chest, decreased resonance over the entire right chest. The patient had a 2 plus albuminuria, dependent edema of the extremities and lower abdomen, patches of glistening white exudate on the retina of both eyes, enlargement of the heart. Impression: pregnancy in ROA; low reserve kidney; questioned delayed resolution of pneumonia; right heart hypertrophy. On 11-11-39, the patient gave birth to a normal, healthy male child. On 11-16-39, the patient became dyspneic and died within 24 hours.

In her first pregnancy, which occurred in 1935, the patient had active rheumatic fever and gave birth to a normal healthy girl.

The patient's second pregnancy was uneventful.

Today, the three children are living and are apparently in good health.

15.
It would be quite difficult to discuss fully every disease occurring in the pregnant mother. For that reason I am taking only those I believe to be the most prevalent and the most interesting.

Probably the most important and most questioned transmittable disease is that of tuberculosis. In the literature there seems to be quite a discrepancy as to whether the infection is transmitted through the placenta or not. Hess (11) believes in comparison with the acquired tuberculosis, the congenital form is almost a rarity, taking place only when a blood vessel of the villus becomes eroded or ruptured and allows the passage of the bacilli into the fetal blood. In 1915 Slemons (24) stated that, although he believed the organism did pass through the placenta to the fetus and could be demonstrated in both, they arrived in the placenta rarely from the maternal blood but more commonly after ascent from the vagina and cervix and primary infection of the amniotic fluid. This theory seems applicable to DeLee (4) cases in which infants dying before or at birth showed organs filled with virulent bacteria, streptococci or pneumonia, and in which the illness of the child seemed to be independent of the mother; the mother being only indirectly affected or not diseased at all.

To quote an excerpt from a letter written by Dr. Studdiford (32) of the Bellevue Hospital. "In the past five years,
we have taken care of sixty patients with pulmonary tuberculosis, and to my knowledge we have not as yet seen a baby who acquired a tubercular infection congenitally."

Johnson and Meyers (14) admit the possibility of transplacental infection but felt that they could not so classify any of their cases. The majority being explained by aspiration of amniotic fluid following infection of the amniotic sac after premature rupture of the membranes.

Only one active case of tuberculosis has been recorded in the University Hospital. This patient showed active lung lesions by the x-ray and a positive sputum. The patient was delivered and the child immediately taken from her. Ten days after birth the child had a negative Mantoux skin test and showed no signs of tuberculosis.

Irving (32) reports 66 cases of tuberculosis of the lung at the Boston Lying-in Hospital during the past five years. Of these there were seventeen nonviable infants, 45 infants were normal on discharge, two were stillborn infants and two infants died after delivery. It cannot definitely be said the nonviable infants and the tubercular mothers were related or not. Neither did Dr. Irving mention if there had been any post-mortem on the dead infants.

In looking at the records at the Douglas County Hospital it seems odd that there has only been five women infected with tuberculosis that have given birth to children in the past

17.
few years. Of these five, every child with one exception lived and is in good health today. One mother gave delivery to a still born baby and no autopsy was performed.

The latest active case at the County Hospital is that of Mrs. E. L. who presents a classical example of a tubercular mother giving birth to a perfectly normal healthy child.

Mrs. E. L. had been in the best of health until the fall of 1934 at which time the patient was thought to have pneumonia. After a time the patient did not improve and was taken to the hospital. Here she was found to have a positive sputum and x-ray plates of her chest showed complete involvement of the left lung and slight involvement of the right lung. The temperature of the patient ranged around 103-104; she was very exhausted and was given a poor prognosis. A phrenectomy was performed and with bed rest and the proper treatment, improved. In the summer of 1937 the patient thought she was well enough to stay at home. After two months at home, however, the patient did not do so well and returned to the hospital.

At this time the patient was 20 years old and pregnant—her first pregnancy. In May, 1938, after an uneventful prenatal period, the patient gave birth to a normal healthy 7 pound, 10 ounce baby. The child was taken from the mother to live with the grandmother and today is living and periodic check-ups fail to reveal any tuberculosis in the child.

I believe we can safely say that transmission of the tubercle is probably a very rare condition, with very few authentic cases on record. It is difficult to decide just how some of the cases reported as having been transmitted, did occur.

In the majority of cases the placenta was not examined carefully; in many others, there were no autopsies performed. A classical example of this is noticed in a case presented by White and Porter (28).
Case Report

Mrs. N. P., 32 years old, primigravada with history of mother dying of tuberculosis. Also one sister died of tuberculosis. The patient was exposed in both of these cases. On physical examination nothing of any importance was found, careful examination of the lungs was negative. After eight hours of labor the patient gave birth to a 7 pound, 8 ounce baby girl. The baby's temperature was 98.6 after birth but within 24 hours was up to 103, the temperature then dropped in 8 hours to 101 and to normal within 24 hours. Beside the fever the baby showed nothing except dryness of the skin. On the third day the baby was put to the mother's breast and seemingly got along fine until the end of the first week—at this time it became drowsy and moderately irritable. On the 11th day the baby was tested for tuberculosis by the skin test which proved negative. At this time the WBC was 17,900 and the baby failing in strength. The child failed to improve and on the 46th post delivery day, died.

A post-mortem examination showed the child to have generalized miliary tuberculosis. The nurses, physicians, mother and father were all x-rayed but no infection was found in any one of them.

The authors believed if this were due to a blood stream infection, it must have occurred after the 7th or 8th month of pregnancy or the child would have died in utero or have been a marasmic infant. They believed it to be infected in the last few days of prenatal life or possibly early in labor.

In the above case no mention was made of the possibility of the infection being transmitted by the mother's milk, nor was the placenta examined in detail to disprove infarction or the like being present.
Only nine authentic cases of typhoid fever being transmitted through the placenta could be found in the literature. The percentage in which this disease has occurred in the pregnant mother cannot be found. No cases were found in Omaha, nor were there any reports of any in the literature or letters received from various hospitals.

From 1888 to 1905 only six authentic cases of mothers being infected with anthrax is reported. These are all positive cases, that is in each case the child had the disease after birth, but no mention is made again as to whether the placenta was examined or if an autopsy was performed to rule out the possibility of some other cause of death to the infant.

There is a great difference of opinion as to whether malaria can be transmitted through the human placenta. Wickramasuriya (29) believes, "Some sort of breach in the placenta has to be assumed in all cases of transplacental foetal infection. The massive infection of placenta with parasites and high temperature which such infection engenders, together with the effects of the toxic products of the parasites themselves must undoubtedly induce pathological changes in the placental substance."

Wislocki (30) states, "Transmission of malaria from
is a rare circumstance. H. C. Clark (30) states that cases diagnosed as congenital malaria probably indicate that some accident had occurred in the placenta, because fetal blood is practically never positive at the time of birth, regardless of the degree of infection of the mother. He believes that "many of the cases now reported as congenital malaria suggest immediate postnatal infection as their history and as the pathological and clinical records testify".

"In reference to the role of the placenta in malaria", Clark (30) says, "sluggish blood sinus with a large endothelial surface, a higher internal body temperature and red blood cells burdened with parasites of a certain age beyond the ring form, seem to be important factors in the localization and development of the parasite."

In Wislocki's (30) studies of the placenta of the mother with malaria, it is of interest to note the placenta does most certainly act here as a "barrier". "Malaria parasites are present in the placenta in great abundance within the erythrocytes in the intervillous spaces".

According to Wislocki (30) "Malaria induces the accumulation of large numbers of monocytes and lymphocytes in placental circulation. Of these cells, the monocytes phagocytize, abundantly, pigment released by the activity of malarial organism (this pigment, partly melanin, is found in the maternal blood). These phagocytic monocytes do not penetrate the fetal
tissue, but do enter the masses of fibrin formed on the villi which are denuded of syncytium at these sites."

"The villi including stroma and covering chorionic syncytium are anatomically normal and not visibly affected by the malarial organisms or their products". It is unlikely that malarial organisms can enter or penetrate the chorionic syncytium, so that the transmission of malaria from mother to fetus occurs rarely, if at all.

Garcia (7) presents two cases in which the mothers were infected with malaria, and in which he believed was through the placenta. The possibility cannot be eliminated that in these cases the infection took place at the time of labor as a consequence of injury to the placental barrier which permitted infected material to flow from the maternal to the fetal circulation. In favor of this view is the fact that only a few parasites were found in the infant's blood in both cases. Had the infection of the fetuses occurred at some time previous to labor there would have been found a larger number of parasites in their circulation, showing various stages of development, instead of only a few young forms as was found. Also, as Garcia points out, "direct inoculation of the parasites from the mother into the child may occur as a result of skin abrasions taking place during the act of birth". Doubt is cast upon the authenticity of reports of congenital malaria based on mere findings of the parasites.
in the blood of the newly born children.

In a paper presented in 1925 by Blacklock and Gordon (7), they reported they had not found parasites in the blood of the cord or child in twenty-three cases of the newly born infants examined, although it was often found in the placenta and in the blood of the mother.

Van den Branden (7), at Leopoldville, examined the blood of fifty-five mothers and infants and found positive parasites in every mother but in no infant. The placental blood was found infected only once.

With the above findings and reports I believe we can justly question if malaria can at all be transmitted through the human intact placenta.

Only one case could be found in which it was thought epidemic cerebro-spinal meningitis occurred to the child in utero. Although an entirely different disease entity, acute anterior poliomyelitis should be considered here. Much has been written concerning this disease, but there are only a few scattered articles pertaining to the relationship of it to pregnancy.

The transmission of the disease from the mother to child in utero can occur. In only one of eight reported cases found is there any suggestion of intrauterine poliomyelitis and that was by Miller (21), the child being born with a bilateral club
foot. Miller, however, points out that in view of the frequent occurrence of this deformity, it cannot be concluded that it is the result of a transmitted intrauterine poliomyelitis.

The question of the transmission of immunity has been recently studied by Aycock and Kramer (1) who, in order to determine whether or not the low incidence of poliomyelitis in children under one year of age, was due to a temporary maternal passive immunity, tested the blood sera of twelve mothers together with the sera of cord blood from their newborn children, for the presence of the neutralizing substance for the virus of poliomyelitis. The sera of ten mothers (83%) and ten infants, with a complete correspondence between mother and infant, showed that immunity was present. These results may be taken as an indication that where the mother is immune to poliomyelitis there is a passive transmission of the immunity to the infant. Again, we notice the selective power of the placenta.

Fetal purpura, according to most authors, like fetal cerebro-spinal meningitis, seems to be one of the rarest of diseases which may be transmitted from the mother to her unborn infant. Most of the cases which have been reported would seem to have been the results of the traumatism of labor, and not true instances of the purpuric disease; others appear
to have been examples of hemorrhages into the skin after birth.

It used to be thought streptococic infections in the pregnancy mother was invariably fatal to the child. However in the past few years this idea has changed considerably, now the majority of authors believing the transmission of the streptococcus from the maternal blood to the fetal blood occurs only when the barrier action of the placenta has in some way been injured.

Only twenty-five authentic cases can be found in the literature in which the diseases caused by the streptococcus was thought to be transmitted to the child in utero. Most of these cases are recorded from several years back and it is questioned if much study was made other than blood cultures of the newly born child, which of course could easily have contacted the infection by other means. At the Bellevue Hospital in New York City, they have no record of any patient who has transmitted a streptococcus infection to the baby congenitally. Only one pre-natal streptococcus infection is on record at the University Hospital in the past five years, the mother dying four days after delivery but the child showing no evidence of infection.

In this connection it is noteworthy to mention the placenta barring the transmission of the streptococcus but allow-
ing the passage of a specific antibody. The work done by Lippard and Wheeler (18) shows the concentration of anti-
streptolysin in the cord of the infant even higher than that of the mother, due to its ability of storage or to its own production of it. "Work indicating the Blanching Power of the placenta blood was as strong if not stronger than anti-
toxin maternal serum and convalescent scarlet fever serum. This can most certainly be interpreted as the placenta taking increased precaution from scarlet fever". Toomey and Myron (26). Most assuredly we can say in this connection that the placenta is a specific barrier.

It is generally thought the streptoccus hemolyticus accounts for a great percentage of acute bacterial endocarditis cases. Since other organisms do cause the disease, it is almost impossible to classify them except as "bacterial endo-
carditis". Jensen (13) states in his recorded cases of 48 pregnant mothers with endocarditis, twenty-four of the in-
fants died which he believes was the result of prematurity and not to the transmission of the organism. He believes in rare cases the organisms have been transmitted to the fetus but the percentage is very very small.

An interesting case along this line was found from the private records of Dr. Leon S. McGoogan (19) in which the mother had a definite acute malignant endocarditis and did not transmit it to her child.

26.
This woman was twenty-five years old, had her last period in October, 1934. In February of 1935 the patient had a severe streptococci sore throat. Seemingly the patient improved and in June, 1935 developed pain in her right flank, complained of urinary frequency, had a temperature of 102 and a slight vaginal discharge. In twelve hours the patient delivered a 7 pound, 4 ounce normal child. Twenty-four hours after delivery, the patient had a chill, her temperature rose to 102, pulse 110-120. She was thought to be suffering from a pyelitis but a catheterized urine specimen and cystoscopic examination ruled this out. Consultation was called, a blood culture proved positive in twenty-four hours for streptococcus viridans, and the patient was diagnosed as acute malignant endocarditis. The patient failed to improve with treatment and died on the 18th day after delivery. Today, the child is five years old and is in excellent health.

Whether rheumatic fever and rheumatic heart disease is caused by the streptococcus is still a matter of opinion. In Jensen's (13) book "The Heart in Pregnancy", the treatment, diagnosis and prognosis of rheumatic endocarditis is discussed fully. However, no mention is made whatsoever as to even the possibility of the child obtaining the disease. Surely if it were very prevalent he would have at least mentioned it. Only five cases could be found in the literature in which the fetus
was infected through the placenta.

In the past five years only three cases of active rheumatic fever has been recorded in pregnant women at the University Hospital. In none of these cases did the child seemingly suffer from the mother's condition. Four cases of endocarditis is reported but the etiological factor was not known, one of these had a premature delivery and the death of the child was attributed to the prematurity.

In discussing streptococcic infections a word should be mentioned in regard to the pneumococcus. Browne (2) is definitely of the opinion pneumonia in the pregnant mother, although very serious to her health and life, is not transmitted to the child in utero. He considered the child contracting the disease during or after labor only.

Only seven authentic cases in the literature between 1884 and 1934 are recorded in which seemingly the child in utero was infected through the placenta. In the letters received throughout the country, no cases of congenital pneumonia is mentioned. At the University Hospital during the past five years, only three pregnant women had pneumonia, in all three cases the child was born in good health and remained in good health at least for the post-natal period in the hospital.

"Fellner quotes 19 cases of Schauta's clinic, DeLee(4)
and only one case did he feel the fetus was affected."

DeLee believes the pregnant woman with pneumonia loses her fetus in the form of a miscarriage or such in more than 50% of the cases. This does not conform with the very small number of cases at the University or to the findings of the majority of authors.

Some writers believe these recorded cases in the literature should be classed in the group with fetal sepsis rather than in a division by themselves. In every case, they believe, the child obtained the pneumonia in connection with septic conditions.

In the foregoing discussion an attempt has been made to cite as many diseases of the pregnant woman as possible and to show the placenta does, in different ways, prevent the fetus in utero from contracting these diseases. It has been my ambition to at least bring to the minds of the reader a question of the authenticity of cases reported in the literature in which the placenta failed to prevent the fetus from obtaining noxious agents from the maternal blood stream.

Just how these positive cases can be explained is, in the minds of some, still a question. I shall not attempt to isolate any one explanation as I believe there are several ways in which the placenta is not infallible; there are many ways in which the fetus in utero can become infected besides through the placenta, and there are, as stated above, quite a few errors (I believe) in the reported cases.
There is no need to again go into the discussion of the large percentage of placentas with infarctions. If the number, quoted by Harer (10) of placentas showing pathologic-al changes is correct, it is remarkable the fetuses are not more often infected through these breaks of continuity. Seemingly, however, the placenta does act as a barrier even if there is some pathological change. It seems logical if the placenta does have an infarction present there must, therefore, be other mechanisms present to bar the infectious agents from entering the fetal blood stream.

That it may act as an absorbing body, as thought by Wislocki (30); or that the leucocytes present in the placenta resists the entrance of undesirable substances as proposed by Schlecht (30), are two theories, at least, that can explain the protective mechanism of the placenta although infarcts are present. If, however, these infarctions are so numerous that the other possible resisting properties are over-whelmed--then, it stands to reason the child is quite apt to acquire the various harmful principles.

In this connection McClean (18) calls our attention to the work of Duran-Reynals, who in 1933 reported that filtrates from invasive strains of staphylococcus and streptococcus contain a soluble factor which causes a marked and immediate increase in the permeability of the tissues and which enhances the infection produced by these organisms. They believed, "This
mechanism might be due to a splitting and swelling of the collagen bundles so that they are distorted and the normal close woven appearance is lost”. Using the virulent type I of the pneumococcus, they found immediate diffusion through tissue in several dilutions up to 1:50; similar results were obtained with the Corynebacterium diptheriae, Clostridium welchii, etc. Surely, then, it is plausible that a bombardment of these organisms on the maternal side of the placenta will weaken the protective membrane, especially if it is already impaired by necrotic areas.

The other two mentioned methods of interpreting the recorded cases of apparent transmitted infections in utero can be discussed together.

The work of Slemons (24) shows that not a few types of organisms infect the child in utero after ascent from the vagina and cervix causing primary infection of the amniotic fluid. As stated before, occasionally we find infants dying before or soon after delivery in which the organs were filled with deleterious organisms and yet the mother was only indirectly or not at all diseased. It is reasonable that some cases, at least, can be interpreted on this basis; especially in those (Case of Mrs. N. P. of the Douglas County Hospital) in which the mother from the standpoint of our present day methods, was not infected, and yet her child was.
Similarly, many cases of questioned transmitted infections by way of the placenta can be explained by the fetus aspirating amniotic fluid following infection of the amniotic sac after premature rupture of the membranes. Johnson and Meyers' (14) series pursue this line of thought; they believed the majority of their cases of congenitally infected babies took place in this manner. In the twelve, of a series of 374, placentas showing inflammatory changes studied at the Michael Reese Hospital, ten occurred in women whose bag of waters had ruptured more than twenty-four hours before delivery, subjecting the soon-to-be-born-child to numerous organism from the partuent canal.

However, in examining closely the positive cases described in the literature, we find a very small minority in which any mention of the time of membranal rupture occurred.
SUMMARY

1. A brief review of the anatomy of the placenta has been given with special emphasis to the mature placenta, showing the great percentage of infarction present; suggested theories as to the causes of these infarctions, and their possible significance.

2. The physiology of the placenta has been discussed with special reference to its ability as a protective membrane. In this connection the experimental work with the various dyes have been described in full.

3. Three theories as to the mechanism of the placenta as a barrier to infection has been presented, namely, (1) as a mechanical membrane, (2) as an absorbing body, and (3) as a disease-resisting leucocytic barrier.

4. All the deliveries of the past five years at the University Hospital have been tabulated, showing the number of infected pregnant women and the very small (1.5%) percentage of transmitted infections to the fetus in utero.

5. All the well known diseases of the pregnant women have been mentioned, and in each an argument as to their transmissability through the placenta has been given. The majority of the material being obtained from the literature; from the files at the University Hospital; from the Douglas County Hospital.
records; from private cases in Omaha; and, from answers of various hospitals throughout the country.

6. Mention is made of the "selective" power of the placenta in allowing the passage of immune bodies from the maternal blood stream to the fetus, but preventing any injurious products from passing from the mother to the child in utero.

7. An attempt has been made to explain the cases in the literature in which diseases seemingly were transmitted through the placenta, namely, (1) infarctions being so numerous that the other modes of resistance are overcome, (2) the possibility of other modes of infection, and (3) the question as to the authenticity of some of the reported cases.

CONCLUSIONS

From the literature; from observations in reviewing the records for the past five years at the University Hospital and the Douglas County Hospital; from reading the answers to letters sent to eminent obstetricians and pathologists throughout the country, there is no doubt in our minds the placenta is a powerful selective barrier to infections. Only in those rare cases in which the deleterious products overcome the three-fold barrier action of the placenta can we be justified in saying the placenta has failed to protect the fetus in utero. Even then, we must carefully and scientifically rule out other possible modes of infection.
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Dr. Kenneth W. Brown,  
420 South 36th Street,  
Omaha, Nebraska.  

Dear Dr. Brown:

In the past five years we have taken care of approximately sixty patients with pulmonary tuberculosis, and to my knowledge we have not as yet seen a baby who acquired a tubercular infection congenitally.

We have no record of any patient who has transmitted a hemolytic streptococcus to the baby congenitally although I know of one such case which occurred at the Sloane Hospital around 1926 or 1927.

We have had no patients suffering from small pox, chicken pox or measles during labor.

Hoping this gives you the information you desire, I am

Sincerely yours,

[Signature]

P.S. Dr. Fritz Irving of the Boston Lying-In Hospital knows of a patient delivered I believe in Montana who suffered from small pox at the time of labor and in whose placenta lesions interpreted as those of small pox were found. I believe the baby also showed small pox. You might write to Dr. Irving for the details of this case.
25-9, Oct 3, 1934 L, period severe
Strep or Feb, 1935 (chord). Seen
May 8, 1935 Dr HI, Chicago
Noncytic anemia
13.0, 13.5 ml (nor 110)

Swelling of hands
Through Feb until afternoon of June 27, 1935 — gain
11# urine — (alk or sugar) unifecut
Pain in rt. flank; frequency of urin, temp 102, sp. wgt.
Bloody diet. Early labor
4 delivered after 12 hrs.
Baby 7.47 — normal.
Chill 24 hrs after delivery
Temp 102 — pulse 110 — 120
Calb, urine — may for back
+ W/P cells
That pyelitis — day chills
104°, cystoscopie neg.
Consultation — report
July 1st: Pale, anemia
101°, 120, pulse 90
Eye, Nas, throat, lungs
Thyroid — all neg
Enlarged rate of mount
...

fat —
anaemia
neg. urine
many egg all
para
+
B. culture 24 hrs.
(strep. neg. dotics

Weig — Acute Endocard.
Died — 15 days after
Delivery
No Sharp — most
acute she's ever seen

No Past

Baby — 5 yrs old

Good habit!
March 18, 1940

Dr. Kenneth W. Brown
The University of Nebraska
42nd and Dewey Avenue
Omaha, Nebraska

Dear Dr. Brown:

I have your letter of March 4 in regard to your paper on "The Placenta as a Barrier to Infection." While I agree with you that I have received short notice, I can give you the following information from our files with the immediate results of the babies so far as our Hospital is concerned. To follow these cases through to completion, you of course understand would be a considerable undertaking and one in which I do not feel justified.

There were 66 cases of tuberculosis of the lungs at the Boston Lying-in Hospital during the past 5 years. Of these there were 17 nonviable infants, 45 infants normal on discharge, 2 stillborn infants and 2 infants that died. There was 1 case of tuberculosis of the cervical lymph nodes with a normal infant, 1 case of tuberculosis of the spine with a normal infant, 4 cases of tuberculosis of the kidneys with 3 nonviable infants and 1 normal infant, 1 case of scarlet fever with a normal infant, 1 case of mumps with a normal infant and 3 cases of tuberculosis of the hip with normal infants. In addition, there is the case of small pox, a transcript of the fetus and placenta is enclosed.

Sincerely yours,

Frederick C. Irving, M.D.

FCI:EB
Enclosure
Name: Mrs. M. G.  Age: 25 years  Dr. Chester W. Lawson
Smith Clinic
Glasgow, Montana

History: Mother has small pox, miscarried fetus and placenta - small pox. L.M.P. July 26, 1935. Nov. 10, patient became ill with smallpox. On 12/15, pains in lower back and abdomen began, membranes ruptured and on 12/16 a dead fetus was delivered followed by placenta.

Gross: The specimen consists of a somewhat macerated female fetus with a C.R. length when straight of 135 mm., and a foot length of 27 mm. Scattered over the entire skin, but most marked on the skin of the head, are small, opaque, slightly raised areas which vary from less than 1 mm. to 1.5 mm. in diameter. One section is taken of these for microscopic study from the region of the left lateral chest wall. It is striking that there are more on the face than elsewhere as is the case of smallpox during extrauterine life. The fetus - aside from these skin lesions - is not remarkable.

The cord measures 17 cm. in length and is slightly macerated. It is attached to a placenta which measures 7 cm. in diameter and 2.2 cm. in thickness.

The maternal surface of the placenta is pale, yellowish grey with distinct cotyledons. There are occasional small specks beneath the decidua which are probably sinusoids filled with blood. The cut surface reveals pale avascular tissue with a small subchorial hemorrhage 1 x 1.5. There is no gross lesion to account for the fetal death from the examination of the placenta. The membranes are not remarkable except for a small amount of physiological blood clot on the maternal surface, and some maceration of the amnion.

Impression: Complete miscarriage of macerated but otherwise normal fetus, 17 plus weeks estimated menstrual age, and essentially negative immature placenta: due to smallpox.

Microscopic: Four sections of premature placental tissue show massive infarction necrosis of the placenta due to intervillous fibrin deposition about the villi which are the sites of acute syncytial and subsynctial necrosis just as fibrin deposits on any injured vascular wall. In these necrotic areas there are many polymorphs, lymphocytes, and monocytes. In all, but more especially the latter, there are inclusion bodies (Guarnieri) some of which are vacuolated with peripheral dark staining masses, - others show only the dark staining irregular bodies.

These villi are coarsely branched and almost completely avascular due to fibrous ingrowth in the fetal vessels here as in the chorion, and the stroma is densely fibrous where not involved in the acute necrotic processes. Only occasional villi are not involved in the infarction process and these have a somewhat knotted thick syncytium. The
decidua shows areas of focal necrosis similar to those in the villi, and there is some recent hemorrhage on and in its surface. The chorion is infiltrated, diffusely, by white blood cells.

We may interpret these findings thus: some toxic factor (variola virus) caused necrosis of villous epithelium leading to fibrin deposition and infarction necrosis. This may have been the primary factor in the fetal death or an overwhelming infection of the fetus itself by the virus may have been the primary factor - study of the fetus shows it was infected. The obliteration of fetal vessels suggests fetal death was coincident or slightly antecedent to the infarction, and evidences a direct toxic effect on the fetus.

There are giant cells containing inclusion bodies evidencing a direct variola infection of the placenta.

Diagnosis: Complete miscarriage at 17 weeks estimated menstrual age.

Normally formed fetus with smallpox pustules in skin.

Immature placenta with massive infarction necrosis, villous necrosis and intervillous fibrin deposition, obliteration of fetal vessels, acute inflammation of chorion, acute focal necrosis of decidua.

Signed: Hugh H. Nuckols, M.D.
Resident Pathologist.
Kenneth W. Brown
University of Nebraska
College of Medicine
42nd and Dewey Avenue
Omaha, Nebraska

Dear Mr. Brown:

In answer to your request for information concerning "The Placenta as a Barrier to Infection", the record librarian has examined our files for the last five years and we have found 3 cases infected with measles, 1 strep. throat, 1 malaria, 1 tuberculosis, unspecified, and 24 pulmonary tuberculosis cases. However, we have had no follow-up on these cases and so have no information regarding the effect on the child. We are very sorry we cannot accommodate you in answer to your problem.

Very truly yours,

Willard S. Calden, M.D.

Willard S. Calden, M.D.
RESIDENT, OBSTETRICS & GYNECOLOGY

WSC:JC
Case history from Dr. Leon S. McGoogan---original at the Immanuel Hospital.

Case history of Mrs. N.P. taken from the Douglas County Hospital.

Case history of Mrs. F.J. taken from the record at the University Hospital. 6536

Case of Mrs. M.G. taken from copy of history sent by Dr. Fredrick Irving. Original from the Smith Clinic of Glasgow, Montana.
CASE OF MRS. FREDA JONES: Entered the University Hospital for the first time complaining of albuminuria found by the out-call students. The patient is white, married, female, age 24, Gra. 4, Para 2, has had intermittent pains for one week, was due yesterday, which was November 10, 1939. Patient has gained 9 lbs. in the last two weeks, shows dependent adema of the extremities and lower abdomen. On rectal examination, the head is engaged two to three fingers dialated. The patient's blood pressure on admission is 152/86. The patient's illness: One month ago the patient had Pneumonia and was in period for three weeks, recovered except for a dry, hacking cough and has been unable to do any work because of shortness of breath. Has had some swelling of her feet and has gained 9 lbs. in two weeks. The patient gives a history of having a swelling of feet with her previous pregnancy and last Tuesday, when she was checked in the clinic, she had a 2 + Albuminuria. She was put on a protein diet and sent home. She was thought to be in labor two nights ago, called the out-call student and found a 3 - albuminuria. This was reported to Miss Brown who suggested hospitalization.


The History: Pneumonia in 2-22-37 at which time she was in labor. Rheu. fever. She has had no operations. Her first labor was short, was complicated by hypertension and she had three blood transfusions. This pregnancy was 6-18-35.

History of first pregnancy: She was 20 years old and entered the Hospital for the first time 6-18-35. On July 6, her chest was xrayed and there was found to be a moderate cardiac enlargement with gross prominence of the pulomonary conus and enlargement of the left auricle, also showing some enlargements of all chambers consistent with mitral disease. At this time she had a 3- albuminuria,
complained of severe supraorbital headaches and marked swelling of feet and legs. Her blood pressure was 160/100. She was on a salt free diet and put to bed. On 7-12 the patient developed a severe pain in the right side of the chest, was x-rayed and found to have a pulmonary infarct with considerable fluid in the right pleural cavity. She delivered on 6-23-35 and gave birth to a normal well-developed baby boy, who cried spontaneously and was of good color. On 6-25-35, the patient developed a persistent, hacking, dry cough and on 7-9-35 was diagnosed as Pneumonia and mitral stenosis, the Pneumonia being on infarction basis. The patient, after a stormy post-partum, was dismissed on 8-10.

The laboratory work done in the hospital at this time on 7-10-35 found she had a white blood count of 25,000, H.B. 57%, and R.B.C. 3,420,000; Blood culture negative and her blood sedimentation time was 6mm in 8 min, 12mm in 15 min, 18mm in 22 min., 24mm in 31 min. She had an immediate positive direct Vandenbarg. At the time of dismissal from the Hospital the child gained its normal weight for that age and was in apparently good health and is living today in good health.

Her second pregnancy: She was three weeks past term when she entered the Hospital on 9-22-37. At this time she had a blood pressure of 150/90, was induced and on 9-25 gave spontaneous delivery to a live, baby boy. She had an uneventful post-partum period, was dismissed from the Hospital 10-5-37.

Family History: Her father is living and well; Mother died of heart-trouble; 5 brothers living and well; 1 sister living and well; husband living and well; two children, 4 years and 7 years old, living and well.

History by systems: She had had a dry persistent, hacking cough for one month,
odyspnea for years. Her G.I.: Gained 20 lbs. weight, appetite good. Bowels irregular, frequent laxatives. Her G.U.: Negative Her menstrual history: She began when 12 years of age, Q 30 days, no pain. Her last LMP was 2-2-39. Her Px well developed, is well nourised, somewhat obese female, skin normal, muscle tone good, some generalized edema. The fundus of the eyes reveals small patches of glistening, white exudate on the retina of both eyes, the ears are negative, nose and throat negative, blood pressure 130/85. On examination of the chest, small, crackling rales over the entire right chest; the breast sound, slightly accentuated over the entire right chest, decreased resonance over the entire right chest. Respiratory movements are equal on both sides but there is action of the extra respiratory muscles; fremitus is equal on both sides. Examination of the heart sounds are clear, regular and has a gallop rhythm. The heart is enlarged to the right by posterior right sternalborder and to the left is enlarged. Abdomen: The patient is markedly obese, especially from the waist down. She has great pads of fat over both hips and buttocks and has an immense apron of fat extending down the abdomen over the pubic region. The great obesity of this larger part of the body is greatly out of proportion to the slight amount of obesity of the upper part of the body. Impression pregnancy is ROA; low reserve kidney; is questioned delayed resolution of the Pneu; right heart hypertrophy and beginning failure; metabolic obesity on a glandular basis.

The patient, when in labor on 11-11-39, gave birth to a normal, healthy male child. Midforceps were applied, Mother was given 1/6 of a grain of morphine and 1/150 of a grain of atropine and 71/2 grain caffein. The patient seemed to get along fairly well until 11-16-39 at which time she complained of a continuous nausea but was unable to vomit anything. She was given a sedative but progressively began more dyspnic and very apprehensive. About 10 o'clock in the morning, she was given 1/2 cc of adrenalin twice, but no improvement was noticed and the patient died.
Dr. Kenneth W. Brown,  
The University of Nebraska,  
College of Medicine,  
42nd and Dewey Avenue,  
Omaha, Nebraska.

Dear Dr. Brown:

Your letter of February 19 has been referred to me. I am sorry to say that the U.S. Public Health Service does not possess the kind of information requested by you. There are occasional references in various studies to the relation of infection in mother to loss of offspring. However, there are none, to my knowledge, which are extensive enough to be conclusive. Probably the best source of information of this kind would be found in good hospitals with a large delivery service. The other two essentials for a successful study of this question are, of course, that the hospital keep complete and accurate records, and that there should be no bias in the selection of patients. I may add, however, that beginning with 1940 the birth certificate in many states contains a question on complications of mother during pregnancy. It may be hoped that many states will use the information which will thus become available to study problems similar to the one you propose.

I regret that I am unable to be of assistance to you.

Very sincerely,

Carroll E. Palmer  
Passed Assistant Surgeon  
Child Hygiene studies
February 27, 1940

Mr. Kenneth W. Brown,
The University of Nebraska, College of Medicine,
42nd & Dewey Ave.,
Omaha, Nebraska

Dear Mr. Brown:

Replying to your letter of February 19, the information you request is all contained in our records but is not readily available for use. It would take quite a bit of effort and time to get this. I am sorry that your request cannot be complied with.

Very truly yours,

DEPARTMENT OF CHARITIES
LOS ANGELES COUNTY HOSPITAL

P. Berman,
Chief, Medical Service, Unit I
Fresno County Hospital,
Fresno, California,
Att: Office of the Supt.

Gentlemen:

I am preparing a paper for the University of Nebraska Medical School on "The Placenta As A Barrier To Infection".

In looking over the literature, I find very little mention made to the Placenta as a barrier, most of the articles being on the permeability of the organ. I am wondering if it is possible to obtain some information in this regard from your hospital. I realize this is asking quite a lot, but if I could have a tabulated record for the past five years of those patients delivered in your hospital that were infected (Tuberculosis, Malaria, Streptococci infection, Small Pox, Chicken Pox, Measles, etc.) during pregnancy and the results in their child after delivery, I am sure it would not only be appreciated but would make a much more interesting paper.

This material must be obtained and presented by March 31, 1940.

Thanking you for your trouble and hoping you will be able to send this information soon, I am

Very truly yours,

Kenneth W. Brown

NOTE:— Sorry, but we have no record of having above mentioned infections in our delivered maternity cases for period mentioned.

GENERAL HOSPITAL OF FRESNO COUNTY
Dr. Kenneth W. Brown  
420 South 36th Street  
Omaha, Nebraska 

Dear Doctor Brown:

Referring to your request of February 19, I have been instructed by the Department of Obstetrics to inform you that it will be glad to make its records available to you, should you desire to go over them. Unfortunately, no cross file has been maintained with reference to such acute infections as you are interested in, and it would therefore be necessary to assign someone to examine each of the 10,000 records involved. As you can well imagine, such a survey is too great for us to handle. These records, however, will be available to you any time you wish to go over them.

Yours very truly,

Edwin J. De Costa, M.D.  
Secretary, Department of Obstetrics & Gynecology
February 27, 1940

Mr. Kenneth W. Brown
42nd and Dewey Ave.
Omaha, Nebraska

My dear Mr. Brown:

I have your letter of February 19th which was referred to me from the Administrative Office of this Hospital.

I am in sympathy with your study and would like to help but it would be quite impossible to do the tabulating which would be necessary at the present time.

Very truly yours,

Norman F. Miller, M.D.