

At this stage it is really of neither one sex nor the other, but may become either male or female.

In short there is no part in either sex that a part corresponding to cannot be found in the other sex, but differently developed. It is not as all containing their form that irregularity of development should often occur, making an individual of doubtful, or double sex, like the so-called hermaphrodites.

It has already been remarked that the part first distinctly developed is the spinal column. At first however, this is merely a jelly-like chain of connected cells, tapering at both ends and inclosed in a sheath, or investing membrane, which eventually becomes firm. This is called the notochord, and in man is only temporary, being succeeded by the true backbone and spinal marrow, which are formed gradually.

PLATE XXVI.

Figure 1. Head of human embryo of 5 weeks, magnified. *aa*. The two sides of the nostrils. *b*. The lobus frontalis. *cc*. Edge of the lobus frontalis. *dd*. Lobes of the upper jaw. *e*. Front part of the tongue. *f*. The ear. *gg*. Lower jaw. *hh*. Arches of the palate. *i*. The line showing where the tongue was originally divided into two lobes.

Figure 2. Magnified head of embryo of 6 weeks. *a. b. ab. c*. Rings of the nose. *cc*. Lobes of the upper jaw.

Figure 3. Magnified head of embryo of 6 weeks. *aa*. Rings of the nose, nearly closed. *bb*. Rudiments of lower jaw.

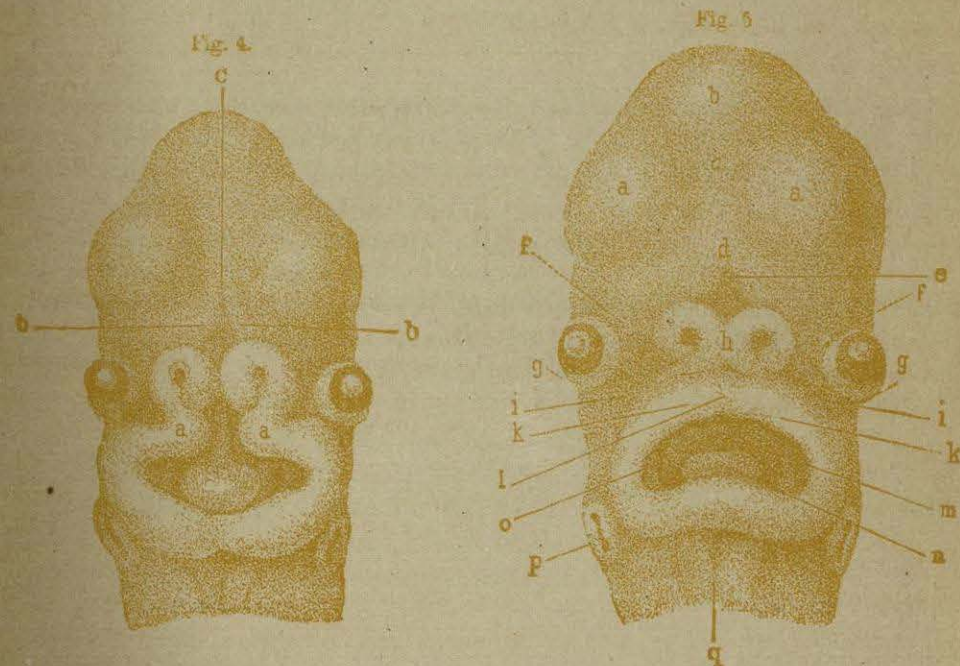
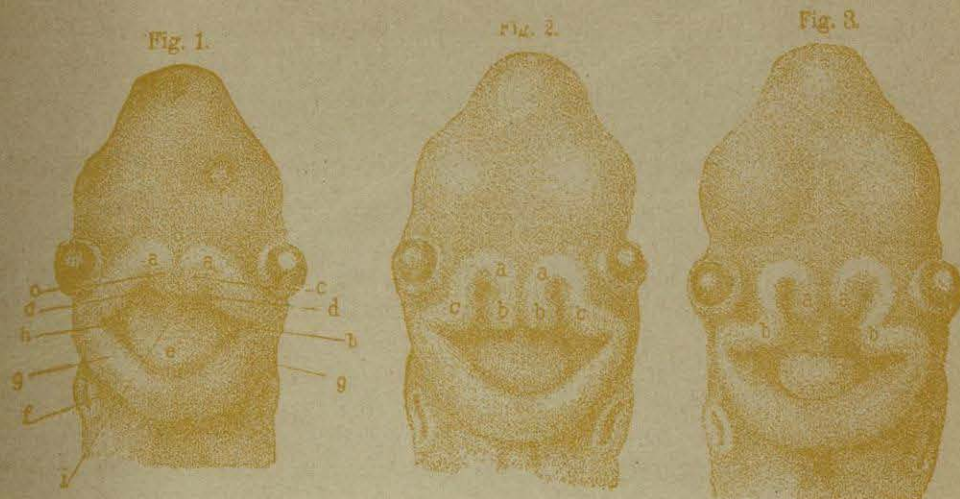
Figure 4. Magnified head of embryo of 7 weeks. *aa*. Rudiments of lips, nearly united. *bb*. Right and left frontal cartilages, a beginning of the frontal bones of the skull. *c*. The frontal sinus, or open space between the frontal bones.

Figure 5. Magnified head of embryo of 8 weeks. *aa*. The two hemispheres of the brain. *b., c. d.* Other parts of the brain and future skull bones. *e*. Upper part of the nose. *f*. Lachrymal canal. *gg*. Rudimentary eyelids. *h*. Point of the nose. *ii*. The cheeks. *kk*. Upper lip. *l*. Union of the upper lip. *m*. The palate. *n*. The tongue. *o*. Corner of the mouth. *p*. External ear. *q*. Throat.

The origin of many well-known deformities of the face can be easily explained from these figures. HARE LIP, for instance, is caused by the two portions (*aa*. in figure 10) not coming together, as they are in figure 11. Cleft palate is also caused in the same way.

The same law of development prevails with the eye, and all the other organs of the human body. The quantity of the mother's blood, and her nervous condition, at any stage of development, must exert a vast influence over the bodily development of the new being; and whatever influences it bodily, does so mentally and morally, through all its future existence. But how few human beings give rise to a thought or action, how few are acquainted with the fact. Dr. Combe says, "We have demonstrative evidence that a fit of passion, in a nurse, vitiates the quality of the milk to such a degree as to cause colic and indigestion, or even death, in the suckling infant. It is the child already born, and in so far independent of the parent, the relation between the two is that strong, it is unreasonable to suppose that it should be yet a stranger when the infant lies in its mother's womb, is nourished indirectly by its mother's blood, and is to all intents and purposes a part of her own body? If a mother and powerful emotion of her own mind exerts such an influence upon her

PLATE XXVI.



Head of Embryo at Five Weeks.

stomach as to excite immediate vomiting, and upon her heart as almost to arrest its motion and induce fainting—as we know it will—can we believe that it will have no effect on her womb and the fragile being contained within it? Facts and reason then alike demonstrate the reality of the influence, and much practical advantage would result, to both parent and child, were the conditions and extent of its operation better understood.”

A striking instance of the truth of this is mentioned by Baron Percy, connected with the siege of London, in 1793. Besides a violent and long-continued cannonade, the arsenal blew up, with fearful noise and destruction, spreading consternation all over the city.

Within a few months after the siege was over, sixty-two children were born, out of which number, Percy tells us, sixteen died at birth, thirty-three lived only eight to ten months, eight were idiots, and died before five years old, and two came into the world with fractured limbs! So that fifty-nine out of the sixty-two, or nearly two out of every three, were actually killed by the mother's fright!

Among other instances, I know of one in which the mother, when between two and three months pregnant, was for three weeks in constant fear of her life at sea from storms. Her child, a son, in all his after life has, beyond question, been a sufferer from this continued state of fear in his mother before birth. Nervous, excitable, prone to alarm and ungovernable impulse, he has been a constant source of anxiety to his friends, and of misery to himself. Finally, he became a wretched inebriate, and for a long time had to be kept under restraint. None of her other children, developed under better influences, exhibited the slightest tendency to anything of the kind, and yet the family likeness in this son was unmistakable.

Many other such cases could be given, but it is not necessary; it being now very generally acknowledged that habitual mental conditions in the mother during gestation can, and *do*, influence her offspring, both bodily and mentally. And it should be remembered that the influence may be good or bad. It is just as easy to thus impart to the child a healthy mind and body, with good impulses, as the reverse; and at some future day, it will be seen that the education (or proper development) of a child must begin *before birth*, and not be neglected, as now, till several years after. When this truth is practically acted upon, many evils we now vainly try to *cure* will be *prevented*.

We thus see that a child, before birth, and probably in the very germ, may be permanently affected by the quality of the mother's blood, or by her mental and emotional condition. After birth, it may be equally affected by the constitution or quality of her milk, which, in the same way, is dependent upon the state of her blood and the condition of her nervous system.

We will now describe, in detail, the appearance of the embryo at various stages of its development, so that the changes it undergoes may be better understood.

At the earliest observed period.—The embryo is about as large as a pin's point, and weighs not more than a grain. The rudiments of the spinal marrow resemble a small white thread. The eyes first appear on the sides of the head, like those of quadrupeds, and move round to the front later.

Three to four weeks.—At this period the embryo has the form of a serpent, its length being from 3 to 5 lines. The head is indicated by a slight swelling, and the lower end terminates in the umbilical cord. The beginning of the mouth is seen as a small cleft or gash, and the eyes are two black dots. The limbs show like two

stomach as to excite immediate vomiting, and upon her heart as almost to arrest its motion and induce fainting—as we know it will—can we believe that it will have no effect on her womb and the fragile being contained within it? Facts and reason then alike demonstrate the reality of the influence, and much practical advantage would result to both parent and child, were the conditions and extent of its operation better understood.

A striking instance of the truth of this is mentioned by Baron Ferri, connected with the eggs of London, in 1798. Besides a violent and long-continued commotion, the arsenic blew up with fearful noise and destruction, spreading devastation all over the city.

Within a few months after the birth of two children were born, one of which number, Ferri tells us, expired at birth, thirty-three hours only after its birth.

PLATE XXVII.

Figure 1. Head of human embryo at 2 weeks, magnified. *a. b. c. d. e.* Parts of the brain, which is now very large, in proportion to the rest of the body. *f.* The eye. *gg.* Rudiments of the face. *h.* The heart drawn upward.

Figure 2. Head of embryo of 16 days old, magnified. *a.* Rudiments of the upper jaw. *b.* Rudiments of the tongue. *c.* Rudiments of the under jaw. *d.* Rudiments of the bone of the tongue (os hyoides). *ee.* Rudiments of the frontal lobe of the brain. *ff.* Rudimentary eyes. *g.* The heart, separated from the face.

Figure 3. Magnified head of embryo at end of 3d week. References the same as in figure 2.

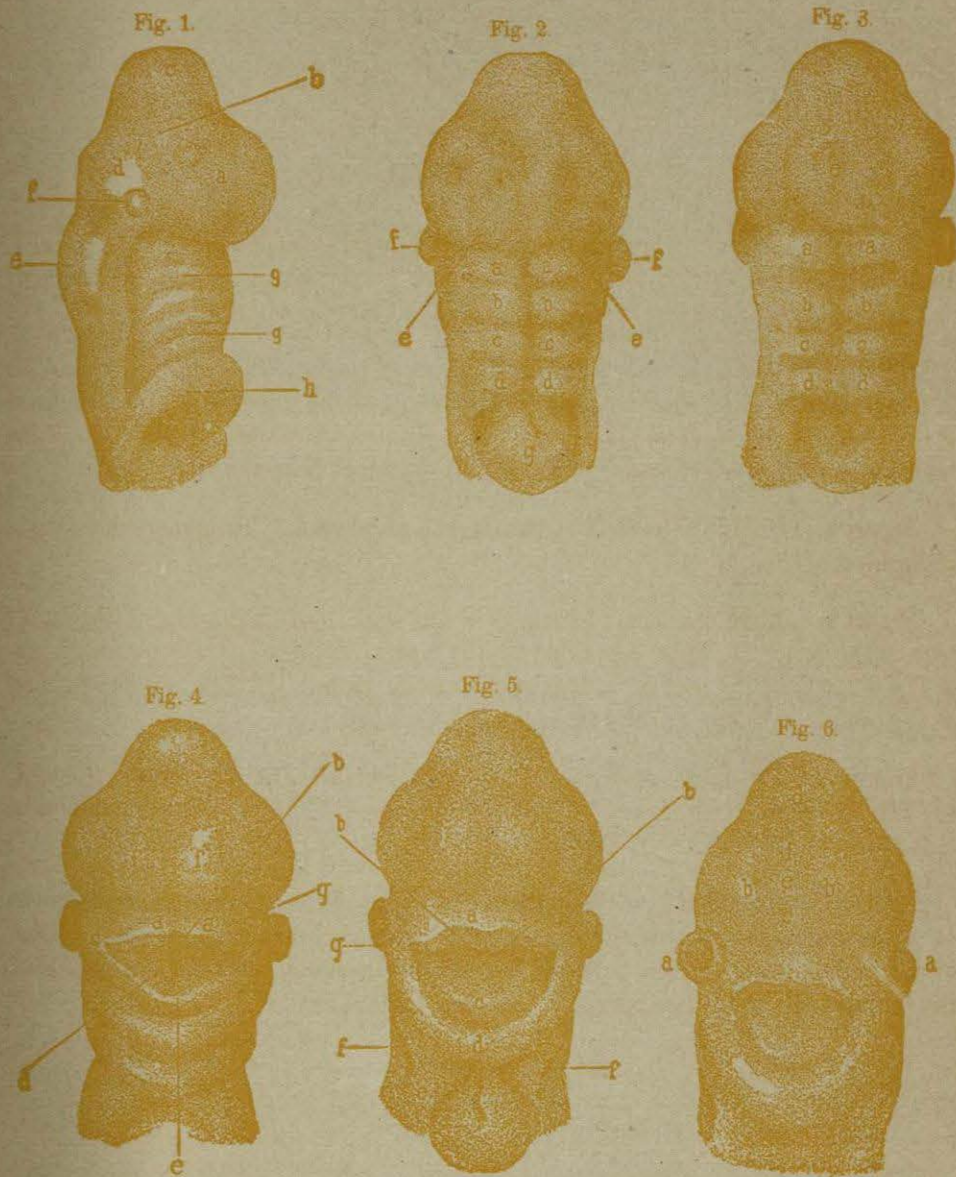
Figure 4. Magnified head of embryo in 4th week. *aa.* Beginning of the upper part of the face. *b.* First beginning of the nose. *c.* Corner of the future mouth. *d.* Open cavity of the mouth. *e.* Rudiments of the tongue. *ff.* The two hemispheres of the brain. *g.* Fissure of the future lachrymal canal.

Figure 5. Head of embryo of 4 weeks, magnified. *a.* The lobus frontalis. *bb.* The two sides of the nose. *c.* Tip of the tongue. *d.* The lobus mandibularis. *e.* Rudiments of the ear. *ff.* The opening of the ear. *g.* Ring of the eyelid.

Figure 6. Magnified head of embryo of 5 weeks old. *aa.* Eyes, closer together. *bb.* Hemispheres of the brain. *c.* Forehead. *d.* The corpora quadrigemina, a portion of the brain. *e.* Separation between the two hemispheres. *f.* First appearance of the fontanel, or open space between the bones of the skull.

We will now describe, in detail, the appearance of the embryo at various stages of its development, so that the changes it undergoes may be better understood. At the earliest observed period—The embryo is about as large as a pin's point and weighs not more than a grain. The rudiments of the spinal marrow resemble a small white thread. The eyes first appear on the sides of the head, like those of quadrupeds, and move round to the front later. Three to four weeks.—At this period the embryo has the form of a serpent, its length being from 3 to 5 lines. The head is indicated by a slight swelling, and the lower end terminates in the umbilical cord. The beginning of the mouth is seen as a small cleft or gap, and the eyes are two black dots. The limbs show like two

PLATE XXVII.



Head of the Embryo, at Various Periods, Magnified.

pairs of small warts. The abdomen is nearly filled by the liver, and the bladder is very large. The villosities, or rootlets, by which it absorbs nutriment from the surrounding fluid, are diffused all over the surface of the chorion, or investing membrane. At 25 days it is about as large as an ant, and somewhat like it in form. At the end of the first month it is as large as a bee, and resembles a small thick worm curled up.

Six weeks.—It is from 7 to 10 lines long, and weighs from 40 to 75 grains. The face now is marked off distinct from the cranium, and the head from the chest. Little apertures are distinctly visible, indicating the mouth, nose, ears, and eyes. The arms and hands are about the middle, and the fingers may be seen; the legs and feet are near the anus. The umbilical cord, or navel string, is formed, and the placenta begins to grow.

Two months.—Length 16 to 20 lines; weight 150 to 300 grains. The elbows and arms are now separate from the trunk, and the heels and knees show plainly. The nose, lips, and eyelids begin to take form, and the anus is marked by a dark spot. The clitoris or penis is formed, and rudiments of the lungs, capsules of the kidneys, spleen, and cæcum can be made out. Bone begins to form in the front of the skull, and in the ribs. The chorion and amnion membranes begin to come together, and the placenta assumes its permanent form. The vessels of the umbilical cord now begin to twist round one another.

Three months.—Length from 2 to 2½ inches; weight 1 to 1½ ounces. Head very large; edges of the eyelids in contact; mouth closed; fingers quite separated. The lower limbs are now larger than the rudimentary *tail*, which exists in the early stages before the limbs show at all. The clitoris or penis is very long; the two ventricles of the heart quite distinct; all parts of the brain much more developed. The placenta now is distinctly formed and isolated, while the umbilical vesicle and the allantois have quite disappeared.

Four months.—Now called the *fœtus*. Length from 5 to 6 inches; weight 2½ to 3 ounces. Skin tolerably firm, and rosy in color; mouth quite large and open; nails perceivable; sex indicated clearly by the form of the genital organs. The gall-bladder appears; navel at the bottom of the abdomen. Chorion and amnion perfectly united.

Five months.—Length 6 to 7 inches; weight 5 to 7 ounces. Head still very large, compared with the rest of the body. Hair appears; nails quite distinct. Heart and kidneys very large; germs of the second teeth appear. The meconium or fluid in the intestines becomes yellowish green.

Six months.—Length 9 to 10 inches; weight about 1 pound. Eyelids still grown together. The navel gets higher in the body; face purplish; hair white. Testes near the kidneys. Bony matter forms in the sternum, or breast bone.

Seven months.—Length 13 to 15 inches; weight 3 to 4 pounds. Skin rosy and thick. Nails not yet reach the ends of the fingers. Eyelids no longer grow together; gall-bladder contains bile. Brain firmer; testicles lower down. Middle of the body a little below the end of the breast bone.

Eight months.—Length 14 to 16 inches; weight 4 to 5 pounds. Skin covered with a sebaceous scum. Nails reach the ends of the fingers. Bone formed at many points. Brain shows convolutions. Testicles descend to the abdominal ring; middle of the body near the navel.

Nine months.—Full term. Length 17 to 21 inches; weight 5 to 9 pounds. Head

The embryo is nearly filled by the liver, and the bladder is very large. The villi, or rootlets, by which it absorbs nutriment from the surrounding fluid, are dilated all over the surface of the chorion, or investing membrane. At 25 days it is about as large as an ant, and somewhat like it in form. At the end of the first month it is as large as a bee, and resembles a small thick worm.

It is from 7 to 10 lines long, and weighs from 40 to 75 grains. It is now marked off distinct from the chorion, and the head from the chest. The quarters are distinctly visible, indicating the mouth, nose, ears, and eyes. The arms and hands are about 1/2 inch long, and the fingers may be seen; the legs and feet are near the same. The navel string is formed, and the umbilical cord is now 1/2 inch long.

PLATE XXVIII.

Figure 1. Human embryo at 7 weeks; natural size. *a*. The ear. *b*. Umbilical cord. *c*. Amnion. *d*. Chorion, reflected. *e*. Umbilical vesicle, now hanging only by a long pedicle. *f*. Tubes of the villous roots. *g*. Vessels of the umbilical cord, spreading on the inside of the chorion.

Figure 2. The same embryo magnified. *a*. The cerebrum, or front part of the brain. *b*. The third ventricle. *c*. Corpora quadrigemina. *d*. Cerebellum. (*a*, *b*, *c*, *d*. are all parts of the brain.) *e*. The ear. *f*. The arm. *g*. Leg. *h*. Hand. *i*. Walls of the abdomen, now closed over. *k*. Foot.

Figure 3. Embryo at 8 weeks; natural size. *a*. Embryo. *b*. Umbilical cord. *c*. Amnion. *d*. Chorion, reflected. *e*. Umbilical vesicle, now nearly all shriveled up. *f*. The villosities, or nutritive vessels. *g*. Marbled appearance of the inside of the chorion.

Figure 4. The same embryo magnified. *a*, *b*, *c*, *d*. Parts of the brain. *e*. The ear. *f*. Beginning of the neck. *g*. The eye. *h*. Upper arm. *i*. Elbow. *j*. Hand. *l*. Liver. *m*. Thigh. *n*. Knee. *o*. Foot. *p*. Umbilical cord. *q*. End of the spine, now shortening from the previous tail-like form, and rounding into the pelvis. *r*. Cavity of the mouth.

Figure 5. The same embryo seen in front. This shows how the mouth and nose begin to form, and the line *a* shows how the two sides, or walls, of the abdomen come together, and so inclose the internal organs. This line can be easily traced in adult life, especially in women, and is called the *linea alba*.

Two months.—Length 9 to 10 inches; weight about 1 pound. The navel gets higher in the body; has purple; hair white. Testes descend to the scrotum, or breast bone.

Three months.—Length 12 to 15 inches; weight 3 to 4 pounds. Skin rosy and smooth. Fingers not yet reach the ends of the fingers. Testes descend to the middle of the body.

Four months.—Length 14 to 16 inches; weight 4 to 5 pounds. Skin covered with a sebaceous scum. Nails reach the ends of the fingers. Bone formed at many points. Brain shows convolutions. Testes descend to the abdominal ring; middle of the body near the navel.

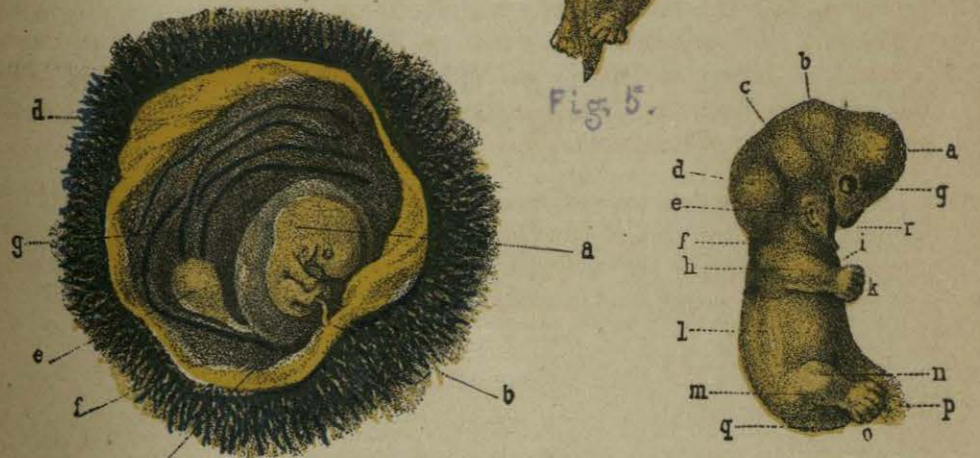
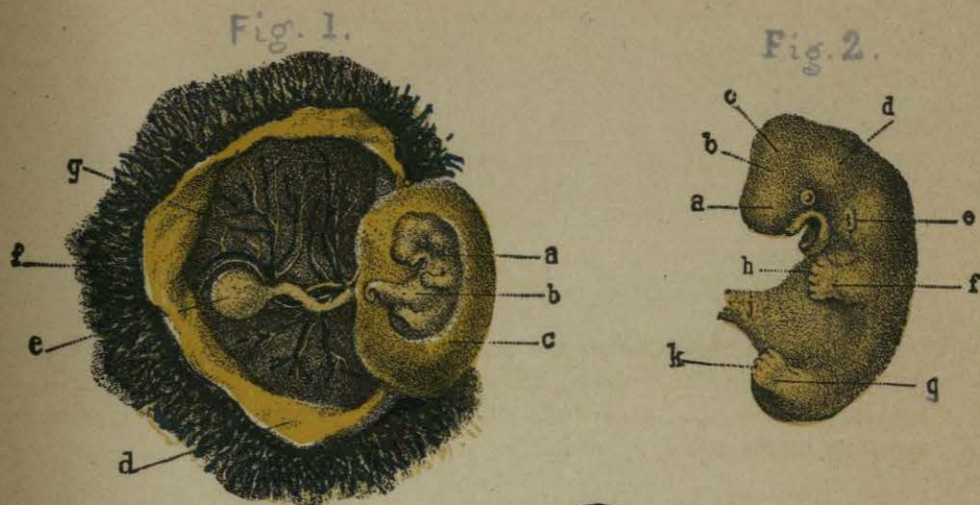


Fig. 3. Fig. 4. A Human Being at Various Stages.

covered with hair. Skin thickly covered with sebaceous scum. White and gray matter of the brain become distinct. Centers of bony formation at most important points. Liver descends to the navel. Testes descend into the scrotum. Middle of the body at the navel, or sometimes a little below.

Male children are larger and heavier, at birth, on an average, than female children. Dr. Joseph Clarke puts the average of males at $7\frac{1}{2}$ lbs. and females $6\frac{2}{3}$ lbs. He says those that weigh less than 5 pounds at full term, seldom thrive, or live long. Several instances are on record of children at birth weighing 15 pounds.

As a rule, more males are born than females, although in adult life females preponderate; which shows that more males perish, from various causes, before maturity. It is curious, also, that among illegitimate children the proportion of males is less than among those born in wedlock.

More male than female children are born dead, and more die during the earlier periods up to puberty. For a short time after puberty, more females die than males, but from 18 to 28, more males die than females. From 28 to 50, the deaths are most numerous among females, but after 50 the two sexes differ very little in this respect.

The accompanying plates show the development of the embryo at its early stages, with all the accessories.

In its earliest periods it will be seen to consist of three parts: the head, heart, and trunk. The limbs and other organs do not show till later. This shows the fallacy of the idea that the human being exists from the first, in its adult form, only very minute. In the early stages, man is a mere grub, or worm, and goes on from one inferior type to another above, and becomes a perfect man only at last.

The genital organs are the most irregular of all in their development. In some embryos, of three months, they are as much advanced as in others at four. Frequently it is difficult to distinguish the sex even at four and a half months. Up to three and a half months, the organs are the same in all, male and female, both in origin and development, so that when the different points are spoken of up to that time, they may be called either by the male or female names, but without its being understood that they are absolutely either the one or the other.

The first absolute sign of the genital organ may be distinguished about the fourth week, with close observation; but the exact period at which the divergence begins which makes the future being male or female, we do not know.

It is obvious, however, from the above explanations, that the male is a further stage of development than the female, of the same parts, and in a different direction. The most essential organs in the female, the *ovaries*, are internal, and the corresponding organs in the male, the *testicles*, are external! the *womb* is also internal, and the corresponding part in the male, the *prostatic vesicle*, is external, so that the male resembles the female turned inside out as it were.

This sexual difference is accompanied by other bodily differences, so that woman, as a rule, does not develop like a man. She is not *inferior*, in the vulgar meaning of the term, but she is not the same, and is adapted to a totally different sphere of life. Neither can with advantage take the place of the other.

...with hair. Skin thickly covered with sebaceous glands. While and ...
...of the brain become distinct. Centers of body formation of most important
...later descends to the nasal. Taste descends into the stomach. Mingle of
...of the neck, or sometimes a little lower.

Male children are larger and heavier at birth, on an average, than female children.
The female child has the average of males at 7 lb and females at 6 lb.
The weight that weighs less than 5 pounds at full term seldom survive in five
...of children at birth weighing 15 pounds.

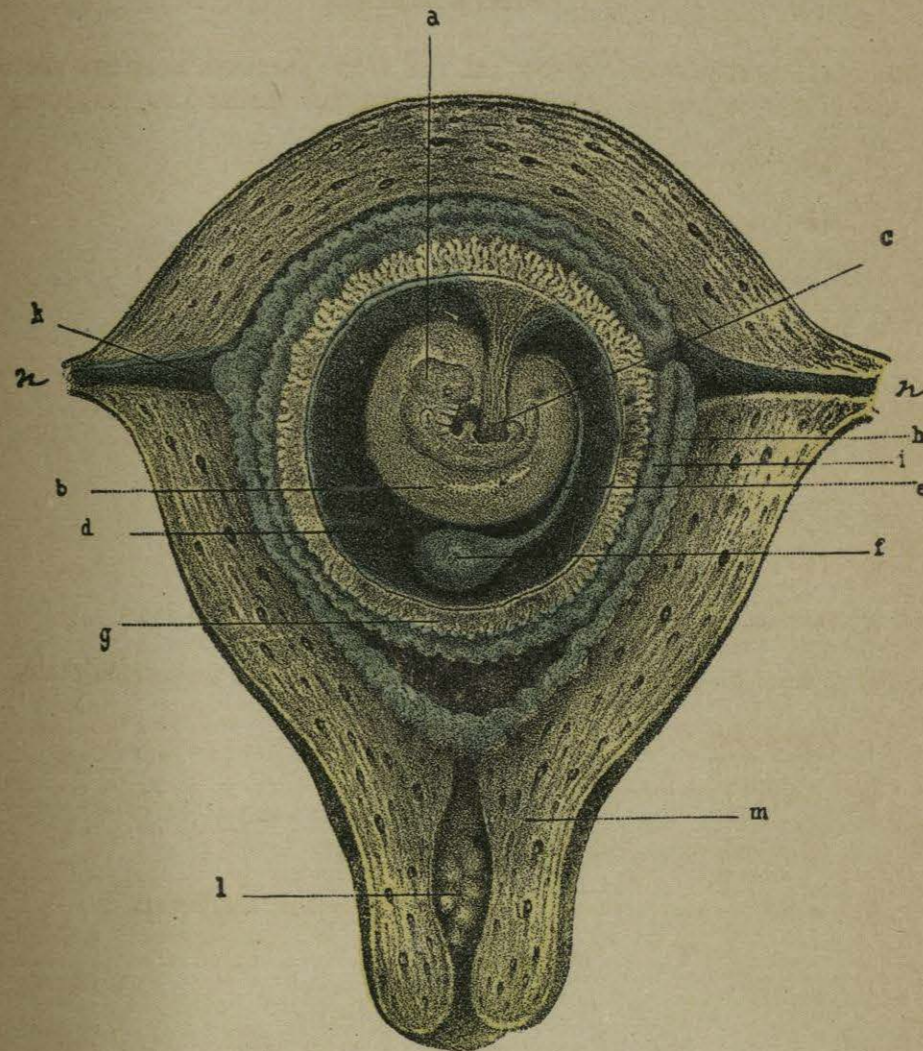
PLATE XXIX.

THIS PLATE IS INTENDED TO SHOW ALL THE PARTS REFERRED TO IN THE PRECED-
ING PLATES ON A MORE PERFECT SCALE; PROPERLY PLACED AND CONNECTED.

- a. The embryo.
- b. Amnion.
- c. The umbilical cord.
- d. Choroid space.
- e. Pedicle of the umbilical vesicle.
- f. The umbilical vesicle.
- g. The villosities surrounding the outside of the chorion.
- h. The decidua vera.
- i. Decidua reflexa.
- k. Part of the decidua terminating in the uterine end of the Fallopian tube.
- l. Mucous secretion in the os uteri.
- m. Wall of the uterus.
- nn. The ends of the Fallopian tubes.

The womb in this plate is supposed to be cut through, lengthways.

PLATE XXIX.



Section of Impregnated Womb

CHAPTER XXVIII.

FETAL NUTRITION.

THE manner in which the new being derives its nutriment, or the material by which it grows, is, in a great measure, unknown to us, though we certainly obtain some information about it by a study of the apparatus employed in the process.

For the first fifteen or twenty days the substance called the *vitellus*, which is analogous to the yolk of the ordinary egg, appears to supply most of the material that is required in the formation of the new being, if not all; and, indeed, this substance does not totally disappear till after the third month, though we cannot suppose it to be the sole source of nutriment then. It is also supposed, by some, that the amniotic liquor, in which the foetus floats, may afford some nutriment, either by being swallowed, or by being absorbed through the skin. It is certain that this fluid is nutritive, and there is nothing impossible in its absorption, though it is not very likely to occur to a sufficient extent. The idea that it can be swallowed, however, is erroneous, because the mouth of the foetus is firmly closed while in the womb; and besides, children have been born alive without *mouths*, and even without *heads*, and of course they could not have swallowed anything. It is now generally conceded by physiologists that the material required by the foetus, for its nutrition, is obtained from the blood of the mother, through the medium of the placenta, and the vessels in the umbilical cord. It is, however, a matter of dispute whether the maternal blood is sent directly, in its ordinary state, into the body of the child, or whether it first undergoes a preparatory process, which most modern authors suppose it does.

From the earliest period of gestation, the middle membrane, called the chorion, is covered, on its outer surface, with a number of small protuberances called *villosities*, which subsequently become true blood-vessels. About the fourth month these have increased very much in size and number, and have all become conglomerated into one mass, in form like a mushroom. This is called the *placenta*. It is almost entirely formed of blood-vessels, which seem to attach themselves at one end, by open mouths, to the open mouths of other blood-vessels on the inner walls of the uterus. At the other end these vessels are drawn together and lengthened out into a long tube called the *umbilical cord*, or *navel string*, which finally enters the body of the child at the navel, and so establishes the connection between it and the mother.

The blood-vessels in the placenta, umbilicus, and foetus, like those in the maternal body, are of two kinds, *arteries* and *veins*. The arteries, which come from the *left* side of the heart, carry the pure blood, which contains all the materials for forming and nourishing every part of the system. The veins contain the blood in its impure state, and take it to the *right* side of the heart, from whence it is forced into the lungs to be purified by the act of breathing. The blood is made impure by some of its constituents being absorbed, to form the different parts of the body, and by having thrown into it a quantity of waste and poisonous matter no longer needed.