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Thesis
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On

The Fatal Circulation

By

Wm. L. Wilson.
Total Circulation

Anatomically and Physiologically Considered

An investigation into the circulation of the blood in the fates is a subject in a theoretical point of view must afford a considerable to the Anatomist and Physiologist, afford a considerable amount of interest. It is a subject which has occupied the attention of many ranking highest in the profession both in ancient and modern times, and in the present treatise I cannot presume even to hold a place with those of the present day or many who have gone before, but any object is simply in the present instance, so far as my information and judgement can guide one to bring together the most important facts, experiments, and theories which from time to time have been advanced by those who have previously devoted their attention
Attention to the subject, so that if possible better to enable us to understand the true nature of the Circulation of the blood in the foetus, a subject which hitherto has been the occasion of much controversy and variety of opinions. The vessels which are for the purpose of conducting the blood in the foetus, possess several peculiarities of which have not only attracted the anatomist but also that of the physiologist. Among the latter sect, however, there has always existed a diversity of opinion as to the influence produced upon the course of the foetus by the peculiar arrangement of its vessels. But before entering into a detailed discussion about the various arguments which have been advanced by the supporters of different views, it will be necessary in the first place to examine minutely the anatomy of the fetal vessel, and more particularly those parts which are most intimately connected with the points of controversy; i.e., in describing the anatomy of the different parts it is my object more particularly to point out those peculiarities which are more immediately concerned in the direction of the blood, than to give a minute detailed description of all the blood vessels of the
The parts, my object being not so much to teach the Anomy as to point out the parts which concern us most in arriving at a Correl. Conclusion regarding the Physiology of the Circulation.

The parts which are necessary for the circulation of the fetus and do not exist in common with those of the adult. The circulation of the blood in the adult.


At the birth of the fetus these all cease to be useful and the Child begins as it were its own independent course. The fetal portion of the placenta is composed principally of the extremities of the umbilical arteries and vein and are arranged in tufts each resembling a complicated net-work. These have no direct communication with the Mothers but are steeped as it were in the passive and nutritive blood from her, where both these essentials are absorbed.

The proper relation between the placenta and Mother is now placed beyond the pale of doubt.

Through the arduous experiments and investigation of the late Dr. Reid - suffice it for our purpose.
-purpose at present to adopt this principle without further comment as it is not on this that we would here wish to enlarge. The Umbilical Arteries and Vein from the Cord. The two arteries arising from the iliacs of the foetus and pass up by the fundus of the bladder and proceed along the anterior wall of the abdomen until they reach the umbilicus through which they pass then proceed along the vein in a spiral manner till they reach the placenta. The Umbilical Vein may be said to arise from the placenta and pass from thence to the umbilicus of the foetus, through which it passes and is directed towards the anterior margin of the liver, and then backwards on its under surface in the Umbilical fissure of that again until it reaches the transverse fissure where a small branch, the ductus venosus, is carried upwards to the Vena Cava inferior, occupying the posterior part of the longitudinal fissure; and as the vein lies in the anterior part of the longitudinal fissure, two branches are given off to supply the substance of the left lobe, and the smaller ones for the lobulus Spigelii, but the greater part of it turns to the right, and
And passes along the transverse fissure and terminates in the Vena Porta. The Vena Cava Superior and Inferior are better to be considered together as it will enable us better to understand the deductions which will afterwards be made owing to their relative size and position. The size and direction in which the superior and inferior Cava enter the Annulus differ somewhat from each other. The inferior is considerably larger than the superior, and it enters the Annulus in a direction quite the reverse of that of the superior, i.e., the inferior in joining the Annulus is directed upwards and backwards while the superior is downwards and forwards. The Foramen Oval is an opening in the inter-annular septum and is situated at its under part of it, encroaching somewhat upon the upper margin of the Vena Cava inferior. It owes its existence principally to the incomplete formation of the inter-annular septum, which is never complete till after birth. It is also furnished with a Valve, called the Valve of the foramen oval. The valve arises from the left side, and gradually advances over the foramen and thus as the valve becomes more matured the septum of the Annulus is more and more complete.
The Eustachian Valve, exists at the part where the Vena Cava ascendens enters the Atrium; it is a thin Valvulare fold of Membrane the upper Margin of which is Concave and terminates in two processes or Cornua which are lost on each side of the foramen ovale. the right projecting somewhat further up than the left. On the other hand the lower Margin is Convex or rather Continuous with the anterior and left border of the Vena Cava inferior. The Eustachian Valve does not, however, always exist as such in the foetal heart, for within the first twelve weeks, as Mendel by Traut, the orifice of the Vena Cava ascendens is Continuous with the foramen ovale opening directly into the left Atrium. After the first twelve weeks, we have the formation of the Eustachian Valve which at the earlier months of development is still Proportional larger, but towards the end it becomes smaller and smaller, till in the adult nothing but the bare rudimentary remains can be observed, on which notwithstanding retains the name of Eustachian Valve. The Ventricles vary in the relative size of their parts, the right being at first the smaller, but afterwards becomes the larger of the two, and at birth the relative
Relative size is about equal, the difference of those Cavities being so slight that they are scarcely worth of notice. The Arteries Arteriosus forms a connection between the pulmonary Artery and aorta. The pulmonary artery before entering the lungs gives off the large branch—the Arteria Arteriosus—which goes to join the arch of the aorta immediately after the origin of the left subclavian artery.

Having now carefully directed attention to the whole of the most important parts of anatomy in the circulatory system, we will next proceed to the consideration of their physiological functions, which from the various theories propagated by almost every writer on the subject, will require, in order that we may arrive at anything like a satisfactory conclusion, a most strict investigation. But in this, it is impossible, indeed it would be superfluous to recapitulate all that has been advanced at different times upon the subject. It will be sufficient for our purpose to select the theories of a few of the most celebrated physiologists who have devoted their attention more particularly to the subject.

We shall begin as the first part of the
the Circulatory system of the fetus with that of the placenta. This at one time was a much controverted question it being generally believed that the blood-vessels communicated directly with those of the mother, and thereby conveyed the maternal fluid as it circulated in her system direct to the fetus. This theory as I have mentioned before may now be considered as fairly exploded as the researches of Dr. Reid and others have clearly shown that no actual vascular communication between the mother and the placenta of the fetus does exist. In short it is now unanimously agreed, by all modern physiologists, that the placenta supplies the place of the lungs because of the fetal blood becoming purified by that of the mother. Likewise of the placenta in almost the same manner as the blood becomes purified in the lungs by the air. The placenta produces the chemical change in the blood which fits it for the support of fetal life. Many of our credible physiologists, such as Magendie, Richet, Müller and others, were ignorant of this fact, for after having made several examinations of the fetal blood, they could not, judging from appearance perceive that there existed any difference in colour between the
the blood contained in the veins, and that contained
in the arteries. It seems strange how those physiologists
could not have observed any difference between the
two kinds of blood, for we find that Dr. Luffey,
Chapman, Bostock, and Campbell, had all observed
the difference in colour between the arterial and venous
blood of the fetus. From the placenta the
purified blood passes along to the fetus through
the umbilical vein where part of it is conveyed
at once to the ascending cavity, while the other and
greatest portion of it flows through the vena porta
into the liver, from whence to the ascending cavity
through the hepatic vein. At this point in the cavity
the pure blood from placenta is mixed with a
quantity of impure blood returning by the vena from
the trunk and lower extremities. The blood in the
inferior cavity is now carried upwards to the right
auricle and there mixes with that of the superior
cavity or passes at once through the foramen oval
into the left auricle, which we will afterwards en
deavour to explain. From the left auricle it passes
to the left ventricle and from thence into the
ascending aorta and there gives off a sufficient
supply for the head and neck and upper extremities,
Extremities, and the remainder passes along the arch and mingle with that of the descending aorta. The superior cava returns the blood from the head and upper extremities, and opens as we have noticed, into the right auricle where it empties its contents. From here it passes into the right ventricle and from thence along the pulmonary artery and ductus arteriosus, the greater portion being sent through the ductus arteriosus into the descending aorta. The blood of the two ventricles here unite and pass down the aorta to supply the trunk and lower extremities. A portion of the blood current is by means of the umbilical arteries conveyed back to the placenta to be oxygenated and again sent back to the fetus, and thus the circle continues.

This is a brief description of the course which the blood passes through the heart and vessels of the fetus; but we have in this omitted purposely to mention exactly what course it is in our belief, that the blood takes from the inferior cava through the heart. This is the point where there has, and still is, so much diversity of opinion. One class of Physiologists hold that the heart acts as a single organ, the others that
that its functions are double. Salustius I believe was amongst the first to direct attention to the peculiar
of the construction of the fetal heart and the probable effect it had in directing the course of the blood from
the inferior Cava, and through him was recognized as the theory of the figure of eight. Circulation. This
theory was first denounced as a fanciful hypothesis and altogether unadmissible. But the more
recent experiments of Dr. J. Reed and Kilian have proved at least that his theory was correct.
Dr. Campbell in his work upon Midwifery takes particular notice of the circulation of the fetus and
gives it there as his decided opinion that the blood of the superior and inferior Cava enters
in the right auricle completely before (pouring before) filling any other cavity of the heart and expresses
himself thus: "That the superior and inferior Cava empty their contents into the right auricle, and
by the active contraction of this auricle part is forced into the corresponding ventricle, and part
into the left auricle." After giving a statement
of the principal grounds upon which Haller and
Salustius advocated for the non-intermittent had
founded their hypothesis; he refers us to the
the authorities of M. M. Brehat and Mayende both being of the same opinion with himself and opposed to the other theory. He further adds, "That it is impossible for two streams to be poured into the same cavity without moisture of them on the contraction of this cavity for the evacuation of its contents." From these statements we are led to infer that it is at this part of his argument that understood that the action of the anules were not simultaneous and that the one had to depend upon the action of the other for its supply. Had such been the case it certainly would have been difficult matter to understand or explain by what possible means two fluids could meet in the same cavity and then be propelled in their respective courses without interruption. But such is not the case the fact being that the two anules are filled at the same time and that, too, when they are in a comparatively quiescent state. It cannot be otherwise from the circumstances of this being a direct open communication between the two cavities. Again the contractions of the anules are simultaneous.
synchronous and although there be a direct
open communication between them the former
ovale is furnished with a valve which although
it does not prevent the filling of the left
annule while in a gaseous state, will
nevertheless while the annules are in a state
of contraction, greatly prevent the possibility
of further admittance. I cannot understand
how it was possible for him to have made
such a mistake with reference to the contraction
of the annules for in another part of his
work he distinctly states “That the annules
contract at the same instant and so do the
ventricles, but each set of ventricles contract
alternately.” Thus though being aware of the
fact that they contracted at the same instant he
could nevertheless find time to allow the blood
to be churned in the right cavity before being
passed off to the left. Magendie advocated
somewhat similar opinions and more particular-
ly regarding the admittance of the blood of
the superior and inferior carot in the
right annule before passing to the other
parts of the system. His statements ar
are subject to the same objections as will be shown more fully afterwards both from an explanation of the natural construction of the parts concerned and from experiment. It appears also that he had entirely overlooked the existence of the ductus arteriosus, which, as he says, are easy to conceive. Bostock, who denounces Laënnec's theory of the figure of light circulation as a fanciful hypothesis, accounts for the ease existence in the fetus of the foramen ovale and ductus arteriosus as only being tolerable for the simple purpose of facilitating the transmission from the fetal to the respiratory life by increasing the number of parts concerned, and thereby under a less mechanical change necessary in any one direction. Here the foramen ovale and ductus arteriosus are indispensable in the end of the fetus which will be clearly demonstrated in another part and so far from the foramen ovale only serving the purpose asserted to it by him. We find that as the fetus advances near and nearer to maturity, the foramen becomes smaller and smaller and at birth is nearly obliterated.
altered altogether. Dr. Churchill in his work on Indrahy in speaking of the supply of pure blood being sent to the brain and upper extremities than what is sent to the lower parts of the body denies the possibility of any such thing taking place from this circumstance that no such transmission of pure blood across the atricle through the foramen ovale can take place because of the effects of gravity of the descending current from the superior cava.

It is difficult to understand how it is possible for any Physiologist to raise such an objection and more especially regarding the circulation of the foetus. Pacific gravity really and truly can have nothing to do with the arowtude of the current. Suspend an infant by the heel and its face will soon become compressed, and if continued for any length of time death would be the consequence this is from the effects of gravity. But for another before it was born it might be day after day in the same position without any consequence. And the reason is simply, because it floats in a bag of fluid...
which counters the effects of gravity from its presence equally on all sides.

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nearly obliterated altogether. We conceive it to be unnecessary to proceed further with what has been advanced from time to time on that side of the controversy and we hasten to consider how far Sabatian theory is consistent with the peculiar arrangement of the parts of the fetal heart. The succussion valve the construction of which we have already described belongs entirely to the functions of the fetal heart and forms as it were a division of the right auricle into two segments, a superior and inferior, but in order to elucidate more clearly the functions we will examine it in conjunction with the openings of the superior and inferior Cava into the Auricle. The orifice of the inferior Cava at the upper margin of which is the Valve, is directed towards the foramen ovale, and the orifice of the superior Cava looks directly into the right Auricle’s Ventriculus opening. See page 5. It is evident from the close proximity of this Valve to the upper margin of the inferior Cava and from thence passing upwards towards the Cavity and foramen ovale, it must for a certainty direct the ascending current towards
Towards the entrance of the left Auncle and that more especially seeing that the opening of the Cava looks in the same direction. It is possible that a slight intermixture may take place in the open part of the Cavity, and that a portion of the blood from the Superior Cava may be carried through to the left Auncle, but that proportion must be very small, for the reason, that the two Currents flow in opposite direction, the one backwards the other forwards, and also from the quantity emptied into the Auncles being much greater than that from the Superior, and consequently its Current will be stronger, and it cannot not only fill the left Auncle, but at the same time transmit a considerable quantity to the right Auncle, which in the course of doing so will in all probability flow back the descending Current with all it is carrying its portion to each. The quantity of blood conveyed to the heart by the inferior Cava must be about a third or more of the quantity which is returned by the superior as it has only the blood to return which is
is required for the head and neck and upper extremities which though proportionally larger develop are nevertheless smaller than the whole of the lower parts of the body; besides a third more, alone will be required for the placental circulation, because the umbilical vein is of about equal size with the superior vena. The foramen ovale is an opening in the interauricular septum which is of the greatest consequence in the economy of the living fetus. Indeed without this communication the proper functions of the heart could not have been performed, and the labors of the whole circulation would have had to be sustained by the right side of the heart; and even here were it not for the intervention of the ductus arteriosus the circulation could not have been continued at all. By this opening the blood is transmitted to the left side of the heart so that the right left as well as the left ventricle receives a supply of blood which enables it to perform its share in the circulation of it through the system. In the adult, the cavity is quite sufficient to carry on the systemic circulation, but sup for this to have been the case in the fetus.
Fetus, we can easily see how insufficient such an arrangement would be. The quantity of blood which is required for the circulation of the fetus is proportionally greater than that for the adult. Owing to the large quantity used in the placental circulation. In the adult one cavity is for the pulmonie circulation and the other for the systemic, but in the fetus the placental and systemic circulations cannot be separated, so that any one cavity either right or left would necessarily have had to carry on both, which would have been double the work of one cavity in the adult. The placental circulation of the fetus corresponding to the pulmonie of the adult. If one cavity had had to perform the whole work of the circulation of the fetus up to birth, it would then have been much more capacious and in a higher state of development than the others so that when the change took place at birth, from the one state of circulation to the other there would have been a great want of proportion and probably an incapacity for the work required.

The importance of this circulatory dependence considered must be very apparent its existence being actually
actually essential for the existence and development of the fetus apart from any other consideration. The foramen ovale is also furnished with an valve the uses of which may be considered as twofold: the one for facilitating the occlusion of the foramen after birth, the other to prevent to a certain extent the regurgitation of the blood during the contraction of the auricle. The ductus arteriosus is an important structure in the fetal economy the absence of which would cause the same inconvenience to the circulatory system of the fetus, as the opening to communication of the foramen ovale likewise to the umbilical arteries. The pulmonary artery of the fetus conveys to the lungs only a sufficient quantity of blood as is necessary for their nourishment in their present state of collapse, which is again returned to the left side of the heart by means of the pulmonary veins. In the adult the pulmonary artery is filled with venous blood and the veins with arterial, the opposite is only the case of what occurs here in the fetus, and the same as what takes place in the Umbilical Cord—the arteries returning venous blood to the Placenta and the veins conveying arterial to the fetus. The left Ventricle forces its contents
Contents into the Ascending Aorta and round its arch, and here also an interruption takes place at the junction of the ductus Arteriosus with the aorta. This junction takes place at that portion of the arch where it begins to curve downwards a short distance beyond the origin of the branches given off by the arch to the head and upper extremities. By this arrangement it is evident that when the blood is forced through the aorta from the left ventricle that these branches which arise from the arch will be first supplied and that with no other kind of blood than that from the left ventricle, as it is impossible from the direction of the current in the aorta for the blood of the ductus Arteriosus to force its way backwards against the flowing stream.

We have now so far as it could be deemed necessary entered fully and minutely into both the anatomical and physiological peculiarities of the fatal blood vessel and its circulation and drawn such conclusions as are concerned the arrangements of the parts fully warranted us to do. And we beg now in Conclusion of this part of our subject, only
to refer briefly to the physiological experiments of Dr. E. Reid and Hilian. Hilian proved from carefully conducted experiments that a fluid passing through the ductus arteriosus and the arch of the aorta at the same instant did not intermit, but at the juncture of the ductus arteriosus with the aorta, and that the branches which arose from the arch for the head and upper extremities were filled with the same fluid as was injected into the ascending aorta. Dr. E. Reid, a most excellent experimental Physiologist, devoted his attention principally to the admixture of non-admixture of blood in the right auricle, and for the purpose of satisfying himself and others upon this much controverted question, he performed several experiments by injecting into the superior and inferior caves two liquids of different colors, and he found, that the Eustachian valve served the purpose of directing the arterial blood current of the ascending cave through the foramen ovale into the left auricle, whilst it also assists to direct the content of the
of the descending canal into the right ventricle, both ventricles being filled with their respective fluids, and with or no intermixture with that contained in the left ventricle, but to some extent in the right. From all that has now been stated respecting both theories, viz., the mixture or non-intermixture of blood which passes to the right auricle, or whether the heart of the foetus acts in the capacity of a double or single organ, we cannot but come to the conclusion, that it is virtually a double organ, and acts in the same way and serves the same purposes in the foetus as in the adult. For instance, in the adult the right ventricle is filled with venous blood and so is the left ventricle of the foetus; the blood is sent to the lungs for purification by the right ventricle in the adult, and so is it to the placenta by the foetus. The pure blood is sent by the left ventricle for the nourishment of the body in the adult, and so it is from the left ventricle in the foetus; only the head and upper extremities must necessarily
necessarily receive a greater proportion than the other parts of the body; but of this we will speak immediately. The harmony is beautiful, and upon reflection we could scarcely have expected that it should have been otherwise; for what is the fates to the adult, but the self and same individual, only slightly differing from each other, in the circumstances of existence. Indeed we might have reasoned, a priori, that whatever disparity there might be between the arrangement of parts in the fetal and adult hearts, that in the dispensation of the all-wise Creator, would only be lent to those same ends which the creature being the organ was intended to do, in maintenance of a separate and independent existence.

After having arrived at these conclusions, it may now reasonably be asked, for what purpose is it that the finer blood is sent to the left side, and from that to the head and upper extremities, in preference to any other of the other parts of the body, instead of being moved, as was, and is believed by many, in the first cavity, and os
be circulated to all parts of the body alike?
And why if it was intended that the left side of the heart was intended to receive nothing but pure blood, was not the septum or subaortic valve, a complete septum? The latter of these questions is easily answered! Because by experiment it has been proved that the valve above serves for directing the blood as completely as if it had been a regular septum. If had it been a septum, instead of a valve with a free margin, the quantity of blood which would have had to pass through the left side, would have been double that which would have to pass through the right. But by this Valvular contrivance, so to speak, both are made equal, and the labour divided.

To the former, the only reason generally assigned for such an arrangement is, that the brain, being an important organ, and of delicate texture, and the centre of the whole nervous system, absolutely requires, for its life, growth, and proper exercise of its functions, a purer and better supply of blood than might
suffice for the growth and development of any of the other tissues of the body. This we believe to be, if not the only reason for such an arrangement, at least one of the greatest importance. We can easily understand what an important position the brain holds in the animal economy, it is the Centre of the nervous system, and the slightest derangement in any of its parts affects the whole system. And if it be a delicate, tender, sensitive organ in maturity, how much more so, must it be in foetal growth. In maturity any change in the state of the blood, such as may arise from a vitiated atmosphere, a poison in the system, a want of its natural constituents, would first affect the brain and nervous system, and thereby disturb any limbment of the body. But the fetal brain being more delicate, slighter causes would affect it. If venous blood circulating in the adult brain would be certain death, how could we expect it would be otherwise in the foetus? Moreover, the poorer blood being sent to the brain (and upper extremities)
is not confined to the latter growth and development of those parts alone, for by invigorating and strengthening the brain, we add a power and a stimulus to the whole frame. Other reasons of a secondary kind might be adduced, but as we deem this paramount to all others we shall leave it as it is.

Dr. Charnelle in writing in favour of the admixture of blood, admits that a quantity of purer blood circulating in the head and upper part of the body, would cause better growth and development, but at the same time, he denies that this is the case. "The presumed effects," he says, "are not produced because we have the intestines, etc., etc., as perfectly formed as the brain!" On the other hand many have adduced it as a reason for the non-intemperance of the blood, that the head and upper extremities were proportionally larger than the trunk and lower extremities; and this they account for by the upper parts being supplied with purer blood than the others. We of course agree with the latter, and first of all we know that fitness
the finest blood is sent to the head and upper parts of the body, and that the upper parts of the body, though perhaps as more perfect are certainly, proportionally larger than the lower. And it could not have been otherwise because as Dr. C. admits himself a quantity of finer blood circulation in the head and upper parts of the body, would cause better growth and development.

Before concluding we have still one other organ connected with the fetal circulation which demands our attention, and we shall only advance a few remarks upon it, in so far, as it is more immediately connected with our subject viz., the fetal liver. The fetal liver is remarkable for its great size; in the early fetus it nearly occupies the whole of the abdominal cavity, and at the full period of 8 or 9 it still descends an inch and a half below the margin of the thorax, overlaps the spleen on the left side, and reaches nearly down to the crest of the ilium on the right side. The proportion is as 1 to 18 or 20 of the
body in the new-born child, whilst it is about 1 to 3 in the adult, being nearly double the size from the body in proportion to the body at birth from what it is in the adult.

Physiologists are not quite agreed as to the true nature of the functions the liver has to perform in the fetus, but judging from its size and position, there can be little doubt than that it has a very important function to perform peculiar to the fetus apart from what it has to do after birth, as at this time it begins to decrease and continue so that the liver of a newly-born child weighs one-fourth heavier than that of a child of eight or ten months old. The liver, says Carpenter, “seems to be engaged in some peculiar life, in the purification of the blood (as appears from the accumulation of meconium, which is chiefly altered bile, in the intestinal canal at birth); but at the same time it is serving as a blood making organ and this is probably its principal function before birth.” Many are the Physiologists who have written upon the liver, each attempting to give
setting forth what they believed to be the distinctive uses of this liver organ, but nearly all of them ascribe to it different functions. Bovet and Dumas, then, it was for the formation of red globules. Bryce, that it acted as a reservoir for the blood until the livers were able to receive it. Fournen, that it deprived the blood of carbon and hydrogen. St. Hilaire, that it was for the formation of bile. Miller, that it formed bile, separated fatty matters from the blood, and also deprived it of carbon and hydrogen. Lee, that it secretes albumen, and as on with many others. However, it is not within the province of this treatise, however, to enter more minutely into the subject, and it is sufficient for our purpose to accept the explanation as quoted from Carpenter, that it is a blood anatomic, and de-
so that during the sudden transition of the fetus from one state of existence to the other, it may be enabled to supplement to the system the blood which must pass from it at the establishment of the pulmonary circulation. Before the child is born, every thing in the circulation is acting in regular order there being neither more nor less blood than what is required. The lungs at this time are in a collapsed state, and are receiving but a small quantity of blood, such only as is sufficient for their support. Now, when the child born it begins to breathe, and in a very short time it expands its chest fully. Their cells and capillaries are opened up, and are filled with air and blood. Now then, is a new cavity suddenly opened up, and supplied with a large quantity of blood. Where then can the lungs receive this quantity of blood? Certainly not from the general system because such a sudden extraction of blood from the heart would give such a shock as would cause it to cease acting altogether. Neither is it
it from the placenta because the placenta loses nothing, for whether connected or not it its size remains the same. May we not then very pretty infer that knowing the liver to be so large and so well supplied with blood before birth and diminishing so much after birth that it is this organ that which gives out the necessary quantity so that the equilibrium of the circulation may still be kept up. The liver of the fetus is like a sponge saturated with blood, and with the first efforts of the child at inspiration then for the first time is the liver compressed and so on with every effort of the child to breathe. Thus we venture to say that the liver has apparently a very important function to perform in the circulation of the fetus at its transition.

"Sine esperantia stil et sine postest"