On the construction of the human placenta : an historical sketch / by Francis Adams.

From the Author

ON THE CONSTRUCTION

OF THE

HUMAN PLACENTA.

AN HISTORICAL SKETCH.

BY FRANCIS ADAMS, LLD., M.D.

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PREFACE.

I AM induced to re-publish the following Papers, which appeared originally about ten years ago in the LONDON MEDICAL GAZETTE, in consequence of my attention having been of late forcibly directed anew to the subject on which they treat, by discussions that have recently taken place in the Medico-Chirurgical Society of Edinburgh anent the important physiological questions,—Whether the mucous membrane of the Uterus be cast off at the moment of conception, to form an envelope for the ovum and a bond of connection between the embryo and its parent: and, whether it be fairly torn off during the process by which the full-grown fœtus is ejected from the seat of its incubation? or, Whether this membrane remains uninjured and unconnected with the fœtal appendages during the whole process of Utero-gestation?

It cannot but appear singular that any doubt should exist on these simple questions, in an age so remarkable for scientific progress, and in one of the most learned cities on the face of the earth. Yet, unfortunately, it is so; for, if the subject was previously dark and perplexed, it must be admitted that it has not been suffiiciently illumined by the new light which has been recently cast upon it. Indeed, one is almost tempted to apply to this disquisition the words of an ancient Father in the Church with regard to a puzzling dogma in Theology, that "the more he read on it the less he understood it, and, the more he wrote on it, the greater difficulty did he find in expressing his meaning."

I cannot but think that one cause of the unsatisfactory results of all such inquiries has been the fragmentary manner in which they have been taken up and conducted. For, no sooner do we plunge into any one of these discussions than we find facts stated and principles assumed which we demur in recognising as settled; and, consequently, when we hesitate in admitting the premises, we are equally unprepared to grant the conclusions. The object of the present Historical Sketch is to do away, at any rate, with this objection, by presenting to the reader a comprehensive and continous exposition of the whole subject, from the earliest dawn of Physiological Science up to the present date. Some good, I flatter myself, will necessarily result from this method of investigation.

Another and a still greater cause of the slowness with which this, and indeed all new truths in science gain ground in this country, is the pertinacity with which the people of Great Britain, and more especially of Scotland, cling to every opinion which has obtained the sanction of what are now looked up to and worshipped as "Great Names." This is so much the case, that I am not afraid to maintain, that scarcely did our forefathers, three hundred years ago, submit their judgment more slavishly to the dogmas of Anselm and Dun Scotus, and to those of Aristotle and Galen, than their descendants of the present day submit theirs to Knox and Chal-

mers in Theology,—and to Newton and the Hunters in Science. To give one example:—perhaps the most brilliant discovery in Natural Philosophy of which the present century can boast is Dr. Young's Undulation Theory of Light. Now, when this new opinion was first propounded by its most ingenious author about forty years ago, it was immediately pounced upon, and, I may say, trampled in the dust by the sages of the Edinburgh Review; and all this for no other apparent reason but because, forsooth, the new doctrine ran counter to a dogma of the "Immortal Newton." At all events, so completely was the heresy suppressed for a time, that it was never more heard of on this side the Channel until it was recognised as a great truth by a high continental authority, Arago; when, as a matter of course, it rose into honour. May I be permitted then, reverently and respectfully, to address my learned friends in Edinburgh and say—"Ye men of Modern Athens, I perceive that in many things ye are too superstitious"! that is to say, you are too prone to Hero-worship, and to refuse an impartial hearing to any one who professes strange doctrines not recommended by what you now regard as respectable authority.

For this mental condition the only true remedy, as far as I know, is the diligent study of the History of Science; for when the student comes to learn from examples, that those whom he has idolized as the "Demigods of Fame" squabble among themselves, like the "ancient Divinities of Olympus," and manifest not a few of the weaknesses of ordinary mortals, he learns to moderate his devotion to any one of them, and to cultivate the habit of relying more upon his own judgment, and less upon theirs.

By such as are disposed to take up the investigation of our present subject in the spirit now indicated, I confidently flatter myself, that this little work, albeit it does not carry with it the *prestige* of a "Great Name," and has not emanated from any of the celebrated seats of Learning but from the Alpine region of the Far North,

aut laudatus erit aut excusatus.

F. A.

Banchory, March 29, 1858.

ON THE

CONSTRUCTION OF THE PLACENTA,

AND THE MODE OF COMMUNICATION BETWEEN THE MOTHER AND THE FŒTUS IN UTERO.

It cannot but appear remarkable that, considering the industry and success with which Fœtal Anatomy and Physiology have been cultivated, both in ancient and modern times, there should still be the greatest discrepancy of opinions among anatomists regarding the construction of the human Placenta, and that physiologists should be equally at variance as to the mode by which the fœtus draws nourishment from its parent. The Hunters, indeed, were long supposed to have finally settled both these questions; but of late years it has been admitted by many original inquirers who have re-examined the subject, that a considerable portion of the Hunterian hypothesis is based on erroneous principles,—so that it must either be rejected altogether, or be subjected to important modifications. Still, however, no well-defined theory has been established in the place of it, and descriptions have been recently given by eminent authorities on anatomy, containing the most contradictory statements as to the facts of the case; so that altogether the subject of the Placenta may be justly pronounced to be the great *opprobrium medicorum*. What makes this state of matters the more to be lamented is, that indisputably the subject is one of the utmost importance, as affecting the practical views of the physician and surgeon in urgent cases of almost daily occurrence: for example, the rules for the management of uterine hæmorrhage as laid down by our highest authorities in midwifery during the last sixty or seventy years, are all founded upon the Hunterian hypothesis; and if *it* be now admitted to be untenable, surely it becomes the duty of every obstetrical practitioner to reconsider his principles treatment, and abandon such as are based on a false doctrine. I think myself called upon, therefore, to state explicitly the grounds upon which my own opinions are founded, and shall embrace the present opportunity of reviewing the literature of the whole subject, from the earliest times down to the present period. This seems to me to be the only legitimate way of getting the question set at rest; for, when all the views which have been ever entertained on it are fairly before us, there are certainly some admitted tests of truth which will enable us to decide what opinions are true and what are based on error. I shall endeavour to execute my undertaking

within as narrow bounds as possible, by confining my attention to such doctrines as possess importance from having been extensively received, —dealing only with the larger facts of the case, and avoiding all prolixity of detail, or the use of terms not properly defined. I purpose, then, to divide the literature of the subject into five periods, giving—1st, The opinions which prevailed anciently, and down to the discovery of the circulation by Harvey; 2d, The opinions held by Harvey and his followers; 3d, The opinions held by the physiologists of the eighteenth century, and more especially by Haller and the Hunters; 4th, The opinions held by Dutrochet, Velpeau, and others; 5th, The opinions held by the advocates of the Cell theory at the present time. I shall then draw my conclusions from the whole.

PERIOD I.—*On the opinions which prevailed anciently and down to the discovery of the circulation by Harvey.*

The opinions advanced in several of the Hippocratic treatises, as *De Natura Hominis*, *de Natura Pueri*, *de Septimestri*, *de Octomestri*, &c. &c., I shall not dwell upon at any length, since it is now generally acknowledged that these works are not the genuine productions of the great Hippocrates, and the physiological doctrines contained in them are crude and not very well defined. I may just mention that the original of the embryo is there assumed to be the male semen,* but that the earliest appearance of the embryo in the uterus is pretty accurately described, as being enclosed in its chorion, which is said to be a membrane like that which encloses the egg within the shell, and through which membrane blood is absorbed for the nourishment of the fœtus (p. 386, 387, ed. Kühn). The fœtus is further said to breathe by means of its umbilical cord (p. 388). The opinions advocated by Aristotle on this subject are of a general nature, and the text in the passage containing the fullest exposition of them appears to me to be corrupt (*de generat. animal.* ii. 7.) He would seem to have derived his information on this subject mostly from observations made, either by himself or his predecessor Democritus, on sheep and cows, as is evident from his description of the cotyledons, a term which, like many others, he misapplies to the human placenta, and represents them as being the instrument by which the fœtus derives a sanguineous pabulum from the mother.† The appearance of the chorion he describes with considerable accuracy (*l. c.*) We shall pass on, however, to Galen, who is the great ancient authority on physiology, the principles of which he may be said to have fixed during fourteen succeeding centuries, that is to say, during the remainder of the period of

* I may just mention that this system of embryology, although now entirely exploded, found an able advocate towards the end of the 17th century in the celebrated Anthony Leeuwenhoek, who strenuously attacked the doctrine of Harvey and De Graaf, and thought he had proved, from microscopical observation, that the male semen, and not the female ovum, is the original of the embryo in all animals. His treatise on the subject, entitled "Anatomia et Contemplationes," is undoubtedly the best defence of the Hippocratic hypothesis which has appeared in modern times.

† The term *cotyledon* occurs in the Hippocratic collection. It is often misunderstood and misapplied both in ancient and modern works on Fœtal Anatomy It cannot, strictly speaking, be properly applied to any other animal except the ewe. The term is derived from κοτύλη, which was originally applied to the acetabulum, or cavity in which the head of the femur is rotated, See Homer, *Iliad.* v. 305.

which we are now treating. He devotes an entire treatise to the investigation "Of the Formation of the Fœtus in Utero," (vol. iv. p. 652), and also treats of it at considerable length in his great work "On the Uses of the Parts," and in other of his works. Now it is beyond all doubt that he holds there is a direct communication between the mother and the fœtus, by means of an artery and vein running from the uterus into the placenta. The rationale of his doctrine on this point will be readily apprehended by any one who rightly understands his general theory regarding the arteries and veins, which was briefly this,—that every part of the animal frame is supplied with spiritual or ærated blood by means of arteries, and with alimentary blood by veins—the one to maintain its innate heat, and the other to provide its pabulum. Galen, then, adopting the Hippocratic dogma, that the male semen is the original of the fœtus, naturally enough supposed that it must derive both its spiritual and alimentary blood from its mother through the usual channels by which the parts of the adult body are supplied with them. He states distinctly that the chorion is not connected with the uterus at any other point, except where the blood-vessels of the mother enter. He further compares the vessels which unite to form the umbilical cord, to the roots of a tree; and those which proceed to the liver of the fœtus, to its branches.

The treatises referred to above contain also many curious observations, correct descriptions of parts, and ingenious speculations in philosophy; but all these we must pass over as not bearing directly on the point which we have more particularly under consideration. From what we have stated, then, it will be clearly seen that Galen decidedly maintained that there is a vascular connection between the mother and fœtus in utero. Galen being, as it were, the autocrat on all professional subjects, during many succeeding ages, it would be vain to look elsewhere for anything original, either in observation or speculation, during the whole of this period. We may just mention that the same descriptions and the same hypotheses, with little or no variation, are given by Aëtius, one of his more immediate successors, who appears to hold very decidedly that the vessels of the cotyledons are formed from the prolongations of the uterine artery and vein into the semen, and that from the re-union of them the umbilical cord is constituted.* This hypothesis was held as late as the beginning of the 17th century by Fabricius of Aquapendente, the celebrated master of the still more celebrated Harvey, who keenly defends it against the strictures of Arantius, the only physiologist, as far as I am aware, during the whole of the period we are treating of, that had ventured to call in question the dogma of Galen. Fabricius thinks he silences Arantius most effectually by a mode of argumentation, which, at all times carries great weight with ordinary minds, who find it extremely convenient to escape from the labour of reflection and observation by taking shelter under the authority of great names. "Am I," he says, "to embrace this opinion along with a single individual in preference to so many learned men who have maintained the contrary?" It is but justice, however, to the memory of Fabricius, to state that even

* Opera xiii. 2, 3.—The original of this part of the works of Aetius has never been published, but through the kindness of a learned friend in Oxford, I obtained a copy of the two chapters referred to above, from the MS. belonging to the Bodleian Library.—*Cod. MS. Bodl. Canon*, Gr. 109, f. 330.

at the present day there is scarcely a work more replete with original matter on the subject now under consideration than his treatise *de formato fœtu*. In it he has described and delineated most faithfully the appearances of the fœtal and maternal apparatus connected with gestation in a great many animals; so that, if he missed the truth himself, he deserves credit for having forwarded the progress of others in the search of it; and, as by his descriptions and demonstrations of the valves of the veins he brought his pupil to the very verge of his discovery of the circulation, so by his labours on fœtal anatomy and physiology he had the merit of leading Harvey and his followers to the adoption of those very sound views which, as we shall presently see, they entertained respecting the connection between the mother and the fœtus in utero. And at the same time we may draw a useful lesson from his mistakes; as, for example, the following is a memorable instance of the influence which preconceived opinions have in distorting the mental vision, and making a man of even a cultivated mind believe that he sees things exactly as he fancies he should see them. Fabricius affirms, as if from personal observation, that in the bitch, the ewe, and the cow, the vascular connection between the uterus and fœtus can be readily recognised, and he infers that this connection must exist in all other animals of the same class, although it cannot be so easily demonstrated in some of them.* How egregiously Fabricius deceived himself on this point we shall have an opportunity of proving demonstrably in the next section.

Period II.—*Opinions held by Harvey and his followers.*

Harvey having disturbed the established opinions on so important a subject as the functional office of the arteries and veins, it was naturally to be expected that many other received doctrines in physiology which hinged on the old theory would be destined to undergo a corresponding modification. This was accordingly the case with regard to the subject now under investigation, which, moreover, was one to which Harvey had devoted most particular attention, as being connected with his investigations "On Generation." This work accordingly abounds with most interesting observations on the connection between the mother and fœtus, and, also, evinces a very respectable acquaintance with polite literature and the higher philosophy of the ancients; so that, even at the present day, it may be read with much interest and advantage. The only thing which prevented Harvey from taking a correct view of this subject was his scepticism with regard to the discovery of the *lacteals*, which had been demonstrated by Aselli a few years previous to the announcement of his Theory on the circulation.† His views, then, are in some respects not so complete and accurate as those of his immediate successors who admitted this discovery—I mean De Graaf,‡ Ruysch,§ Needham,‖ Swammerdam,¶ Drelincourt,** Bartholinus,†† Steno,‡‡ Hoboken,§§ and Malpighi,‖‖—illustrious names!—whose works every person who would wish to understand perfectly the physiology of

* Op. cit. ii. 3.
† See the English edition lately printed by the Sydenham Society, pp. 604-5.
‡ De Mulier. organis, 15. § Observatiuncula de Ove, &c. ‖ De formato fœtu.
¶ Miraculum Naturæ. ** De conceptione adversaria. †† De Ovariis Mulier.
‡‡ Acta Medica Haffniensa, vol. i. p. 210. §§ De secund. vitulin. ‖‖ De Utero, &c.

generation will find it to his delight and improvement—

"Nocturna versare manu, versare diurna"

These distinguished inquirers take the only method which ever can lead to a correct and satisfactory view of the structure and functional office of the human placenta—namely, by studying its analogues through the whole class of Mammals, from its lowest and simplest form up to Man. No one who is at all familiar with their works can fail to recognise the advantage of thus taking a general view of the whole subject, and tracing a certain type of structure through all the orders of the class. My necessary limits on the present occasion preclude me from doing anything like justice to the enlightened views contained in their works, and I must content myself with giving such an outline of their opinions as, I trust, will serve to make them intelligible to the reader. I shall, at least, without further preamble, now attempt an abridged exposition of what they have written regarding the connection between the mother and fœtus, in the orders *Ruminantia*, *Rodentia, and Bisulca*, taking under each head the guidance of the author whom I look upon as being most successful in his method of illustrating it. On the ruminants, I shall principally follow Hoboken, whose treatise "de Anatomia Secundinæ Vitulinæ" I regard as being the most complete monograph on a single subject in physiology with which I am acquainted. According to him, in the earlier months of gestation the embryo is entirely nourished by means of a gelatinous juice, which is secreted by the womb, and imbibed by the pores of the chorion. At some period of the process, not stated by Hoboken, and never exactly determined by myself, the parts of the vaccine secundines which are the analogues of the human placenta, are formed in the following manner:—The umbilical vessels immediately after issuing from the navel of the fœtus, divide into from sixty to eighty ramifications, which radiate to the circumference of the ovum, and then attach themselves to as many points on the chorion, where they gradually are formed into those protuberances called the *fœtal cotyledons* by the ancient physiologists, and *carunculæ* or *placentulæ* by Hoboken, Needham, and other physiologists of that age. Corresponding to, and in intimate connection with these placentulæ, there are an equal number of cellular protuberances on the inner surface of the uterus, called *glandulæ* and *uterine cotyledons* by the physiologists, these being all formed by the increased developement of the uterine structure, in consequence, no doubt, of the stimulus of impregnation imparted by the placentulæ. It is of the utmost importance, then, to remark that Hoboken has clearly described and delineated the chorion as surrounding the whole of the secundines, including these *placentulæ*, which last are therefore completely separated from the maternal parts in contact with them by a fold of the chorion; so that neither do the umbilical vessels of which they are principally composed protrude through this membranous envelope, nor do any of the uterine vessels enter it from without: in a word, Hoboken, De Graaf, Malpighi, and all the others referred to above, are agreed in holding that there is no vascular connexion between the cow and her calf, and that the latter is nourished not by the blood of its mother, but by an alimentary juice secreted from it. The process by which this nutritious fluid is separated from the maternal blood, and is transmitted into the fœtal apparatus of vessels composing the placentulæ, is compared by Hoboken to filtration and transcolation, although

at the same time, he does not fail to intimate that these terms are used in a figurative sense. In this account of the cotyledons, fœtal and maternal, and their functional offices, Hoboken is supported by all his contemporaries, and most especially by Malpighi, who gives a very accurate description of these parts in his work "De Utero et Viviparorum Ovis." The *glandulæ* or *maternal cotyledons*, he says, are liberally supplied with arteries and veins which secrete "a copious juice like to ptisan." He also describes most graphically the *placentulæ*, and the appearance they put on if slowly separated in water from the *glandulæ* to which they are connected, when the radicles of the placentulæ may be seen divided into numerous capillaries, which present the beautiful appearance of a forest. These radicles or tufts, he distinctly says, are every one of them supplied with branches of blood-vessels from the fœtus. Hoboken, in like manner, states, that these vessels of the placental tufts consist of an artery and a vein. Entertaining the views which we have described of the complete separation of the placentulæ of the fœtus from the adjoining parts of the mother, he approves highly of Aristotle's comparison of the former, to the roots of a plant, which imbibe nourishment to the trunk through its pores (spongioles) without the aid of any vessels from without. With regard to the Ruminants, then, these physiologists regard it as being proved by actual observation, that there is no vascular connection between the mother and the fœtus, and that the latter is nourished by means of a nutritious liquor secreted from the blood of the mother. And here I may be permitted to observe that, having had ample opportunities of verifying these statements, I am quite satisfied of their correctness, and, in particular, I can have no doubt, from my own personal observation, that the *placentulæ* are inclosed in a fold of the chorion, and the *glandulæ* covered by the lining membrane of the uterus; that, consequently, there is a most complete separation of the maternal and fœtal parts, and therefore that there is no rupture of vessels at the separation of the secundines of the ruminants.

We shall next briefly examine the case of the *rodents*, and in the present instance, shall take for our guide, De Graaf, who has given the fullest and most accurate description I have ever seen of the process of fœtification in the rabbit. For the first seven or eight days after impregnation, the ovum draws all its nourishment from the fluid secreted by the uterus, and yet, as De Graaf remarks, it is wonderful to see how full it is of liquor on the seventh day. This juice he shows to be albumen, from its coagulating by heat. During the early stage, then, it is obvious that the ovum or rudimentary fœtus draws all its nourishment through the pores of the chorion. The first traces of a placenta are visible on the ninth day; when it is more fully developed, it is found to consist of two portions, a white and a red, both of which, as De Graaf remarks, are clearly formed within the chorion, and come away along with it. It has evidently no vascular connection with the uterus; this I can affirm from personal observations to be clearly shown towards the end of gestation, although it is not so evident towards the middle of the term, when the placenta is so closely agglutinated to the uterus as might lead a careless inspector to believe that there is a vascular connection. The uterus, too, I may further mention, from my own observation, although it has no prominence on its inner surface corresponding

exactly to the *glandulæ* of the ruminants, is much thickened where the placenta is attached, and its blood-vessels there are enlarged. De Graaf, and all the other physiologists of that age, arrive at the conclusion that, in the case of the rabbit, the placenta is altogether a portion of the fœtal apparatus, and that at birth there is no rupture of any vascular connection between the mother and fœtus. Needham adds, that, with some slight differences, the same type of structure prevails in the hare, the shrew, the Indian sow, the mouse, the mole, and the hedge-hog.

In the ewe the construction of the different parts is very similar to that of the cow, as already described; that is to say, the fœtal placentulæ are nearly one hundred in number, and are inserted into as many protuberances on the surface of the uterus, having the appearance of the vinegar-cruets of the ancients, and hence they were called *cotyledones*, or *acetabula*; for it was from observations upon sheep that the term *cotyledon* in fœtal anatomy took its origin. Now, it is distinctly affirmed, in particular by Steno, but is also assumed and acknowledged as an indisputable fact by the others, that between the fœtal and maternal parts there is no vascular connection, and that the nourishment of the fœtus is derived from a milky liquor secreted in the cotyledons of the mother. Here, again, I beg leave to add my own testimony in favour of the statements just quoted from Steno and his contemporaries; for, from actual inspection, I can positively affirm that the parts of the fœtal lamb, are not connected to the mother by any vessels, and the fœtus is evidently supported, not by blood but by a thick mucus derived from the cotyledons of the mother.

As stated by Needham, the same mode of construction, with scarcely any perceptible difference, exists in the goat.

In the sow, as Needham and several of the others have correctly remarked, there is no appearance of any distinct placenta or placentulæ from beginning to end of gestation, there being merely a general thickening of the chorion all around, and the connection between the mother and fœtus particularly loose. In the mare, too, the fœtus is supported for the first half of the period, solely by an alimentary liquor imbibed by the pores of the chorion; and, even in the latter months, the small tubercles which form on it cannot properly be compared to the placentæ or placentulæ of other animals. The physiologists of the 17th century then came to the conclusion, that in all the inferior orders of Mammals there is no vascular connection between the mother and fœtus; that the latter is nourished by an alimentary juice which percolates through the pores of the lining membrane of the uterus, and is imbibed through those of the investing membrane of the fœtal secundines. These enlightened inquirers do not fail, likewise, to point out the analogy which here prevails between the oviparous and viviparous animals; but their observations on this head we have neither time nor space to give, and shall proceed to expound their views with regard to the *human placenta*.

I may mention, then, in the first place, that Harvey does not hesitate to aver, that he decidedly agrees with Arantius in denying that there is an inosculation between the vessels of the uterus and fœtus, and does not scruple to declare that it was either envy towards Arantius or undue veneration for the ancients, that made Fabricius controvert this doctrine. He calls the placenta *hepar uterinum* and *mamma uterina*, that is to say, he held it to be analogous to these parts in the adult. It is to be borne in mind

that, as stated above, Harvey did not believe in Aselli's discovery of the lacteals, and accordingly he most probably agreed with the ancients in holding the liver to be the great organ of sanguification. One can readily see, then, what led him to compare the placenta to the liver. His comparison of it to the mammæ, of course implies that he held it to be an organ for preparing an alimentary fluid for the fœtus. Caspar Bartholinus, and Wharton, held very decidedly and distinctly opinions in the main coinciding with those of Harvey. Wharton in particular expresses himself with great precision on this subject, contending that the vessels of the fœtus terminate in the placenta, and those of the uterus in that portion of it which is in contact with the placenta; that there is no inosculation of vessels between them, nor any rupture of the uterine vessels at the separation of the placenta. He further holds that it is a nutritious fluid like the albumen of an egg, and not blood, which is attracted from the uterus by the placenta (Adenographia, Sec. 35.)* Reyner de Graaf, with great ability and force of argument, contends in like manner that there is no vascular connection between the uterus and the placenta, and that the latter organ is an appendage of the chorion. Among other facts which he adduces in proof of this position, he calls attention to the circumstance that in extra-uterine pregnancy a placenta is not wanting, as it certainly would be if it were not a portion of the fœtal apparatus. He holds that the vessels of the placenta suck in a nutritious fluid resembling milk from the mother, in the same manner as the meseraic veins absorb chyle from the intestine in the adult. He further compares the extremities of the umbilical vessels to the roots of trees, and decidedly maintains that at the expulsion of the secundines there is no rupture of any vascular connection (De Mulier. Org. 15). The same theory is defended and espoused by Drelincourt, Swammerdam, Needham, and the other physiologists of the 17th century, without one dissentient voice, as far as I am aware, and including in their number the great father of microscopical anatomy, MALPIGHI. I could have wished to give Malpighi's description of the placenta entire in this place, but it is too long for my limits; and, standing by itself, it would not be readily understood by those who are unacquainted with the Latinity of that age. I must content myself, therefore, with giving a short abstract of his views.

He sets out with admitting the difficulty which he found in describing the uterine parts connected with gestation, but says he will give the results of his own observations *after repeated dissections of women who had died immediately after delivery, or about the seventh month of pregnancy*. After giving a general description of the enlarged structure of the uterus, and more especially of its sinuses, he states, that, on the separation of the chorion and placenta there are discovered "certain pellicles which, during gestation, adhered to the inner surface of the uterus, but several of which are attached to the chorion and placenta:" he adds, "they are soft, mucous, and easily torn." (These pellicles, by the way, are evidently the *decidua* of the Hunters, to which so much importance has been attached

* Ruysch expresses himself in language particularly strong and precise to the same effect, namely, that no blood-vessels pass from the uterus to the placenta, but merely a juice percolated through the glandular body of the uterus, and that the fœtus forms its own blood, from which the placenta, in a great measure at least, derives its growth. Clerici et Manget, Bibl. Anat.) i. 551.

by them and their followers.)* The placenta itself he describes as consisting of a contexture of umbilical vessels, supported by a substance peculiar to itself. He says, that, as the cotyledons (of the ruminants) are possessed of a peculiar structure, which gives support to their vessels and serves the purpose of a sieve or strainer to them, so in like manner the placenta, which is, as it were, an aggregate of cotyledons, namely, of parts which enter the vaginulæ of the uterus, is composed of a congeries of the umbilical vessels. He says that the surface of the placenta by which it is attached to the uterus is unequal, consisting of appendices, which enter the sinuses and cavities of the uterus, like cotyledons. He concludes his treatise with stating that the placenta absorbs a juice secreted by the uterine vessels.† It thus appears that the first person who described the placenta with the aid of the microscope found it to consist entirely of ramifications, of the fœtal vessels along with a peculiar structure for giving them support. Malpighi, therefore, concurs with his contemporaries in holding the placenta to be a portion of the fœtal appendages. I cannot leave this part of my subject without giving the opinion of that ingenious physiologist, Mayow, as delivered by him, in his celebrated treatise, "De Respiratione Fœtus." He says: "As the lacteal vessels deriving their origin from the membranes of the intestines receive a nutritious juice, as it were, by a process of straining through their membranes, and convey it to the mass of the blood, so also in the egg, and in other conceptions, it is to be supposed that a nutritious juice, properly concocted, reaches the mouths of the umbilical vessels only by percolation through these membranes."

And here I would request the reader to remark the evidence which these extracts cursorily given furnish that the physiologists of the 17th century had very correct ideas regarding secretion and absorption through membranes—that is to say, of the processes now denominated *endosmose* and *exosmose*; that they did not hold that the lymphatics are the only absorbents in the animal frame; and further, that they were aware that these absorbent vessels, whether sanguineous or lymphatic, do not terminate by patulous orifices on the free surface of membranes. Setting out, then, from these accurate premises, it is not so much to be wondered at that these eminent men arrived at correct conclusions on the question now on hand, more especially considering that they took an enlarged view of the whole subject, beginning with the more simple modes of structure, and ascending to the more complex. What these conclusions were, I shall briefly recapitulate before concluding the present section.

They held, then, that, in all the orders of mammals, the fœtus is nourished by an alimentary juice secreted from the blood of its mother, and not by blood itself;—that in the earlier stage of gestation this liquor is absorbed through the simple pores of the chorion, or external envelope of the ovum;—that in the lower orders of the class this mode of conveying the nourishment to the fœtus continues to the end of the process,—as, for example, in the sow; while in others, as the mare, it prevails during the first five or six months;—that all the higher orders have placentæ, either

* See Appendix B.
† De Utero et Viviparorum ovis Dissertatio.

solitary, or divided into a greater or smaller number of separate masses ;—that these placentæ and placentulæ are altogether portions of the fœtal apparatus, and are mere appendages to the chorion, *within a fold of which they are enclosed* ;—that the maternal structures subservient to the nourishment of the fœtus are entirely separate from the placenta and the rest of the fœtal secundines, and consequently that the fœtal and maternal parts are not united together by any vascular connection.

Such were the tenets of our forefathers in the profession 200 years ago ; and, most assuredly, I think, all must admit that if these, their opinions, are not true, they wear, at least, the semblance of truth, and are in conformity with what is acknowledged as such in all the departments of natural science. Here we seem to see developed a rule of which every department of the microcosm and the macrocosm furnishes parallel examples, namely, simplicity in the general plan and diversity in the particular application of it. Take, as an example of the former, the construction of the respiratory organ in the whole class of mammals, and the planetary motions throughout our system of the other, and the same diversified uniformity will be discovered in both. In short, we no where find in nature anything anomalous ; there is no object throughout all its works which stands by itself, is regulated by peculiar laws, or is constructed upon a particular model.

It thus appears that the opinions held by the illustrious physiologists of the 17th century seem to possess the genuine stamp of truth whether tried by the direct evidence of the facts upon which they are founded, or by the general tests of what is acknowledged to be truth in other sciences. But perhaps it will be objected that, if these their opinions had been really true and well-founded, they ought to have stood the test of time, and not have yielded, as we shall presently see they did, to the prevalence of a different hypothesis. But, to this objection I would reply, that, although I in so far agree with the Roman philosopher, that, "opinionum commenta delet dies, Naturæ judicia confirmat," I must protest that it is only the long, the very long lapse of time, that can be reasonably recognised as a test of what is true and what is false in scientific hypothesis. Thus, for example, the true system of the universe, as now universally acknowledged, was taught by Philolaus more than 300 years before the Christian era ; was admitted by Aristippus, and probably by Plato, his contemporaries ; but immediately afterwards was coldly received by Aristotle, and after the lapse of some 400 years, was rejected by Ptolemy, who propounded a false hypothesis, which superseded the true system for more than twelve centuries. And when the true system was again espoused by Copernicus, in the beginning of the 16th century, did it meet with a general and ready reception ? Far the contrary ; most of the lights of the learned world, during nearly 100 years, refused to adopt it. Bacon rejected it, George Buchanan thought he had refuted it, (V. de Sphærâ) Milton hesitated in deciding whether it be the earth or the sun that moves ; Tycho Brahe propounded a new Hypothesis, and Galileo, after demonstrating the truth of the Copernican system, recanted, and professed himself to have been in error. *

* The following references relative to the ancient authorities who advocated the true system of the universe may be interesting to the reader. Diogenes Laertius, *in Vita Philolai* ; Cicero, *Acad. Quæst. IV.* ; Plutarchus, *De Facie in Orbe Lunæ* ; Archimedes, *Arenarius*. I need not give references to the modern authorities—See Whewel's Hist. of the Inductive Sciences.

So difficult is the discovery of truth, and so slow its progress in the world, obstructed as it is by the ignorance, the contending interests, and the prejudices of mankind! I have indulged in these general reflections in order to prevent the reader from too hastily drawing the conclusion that the opinions which we have just described cannot have been well founded, otherwise, as we shall presently see, they would not have been lost sight of for a time, and been superseded by a different hypothesis. As it was, however, from the time of Harvey to the end of the 17th century,—that is to say, during more than 50 years, they constituted the acknowledged creed of the profession on this subject.* In the succeeding century, however, as will presently appear, they did not long remain unchallenged.

Period III.—*Opinions held by the Physiologists of the 17th century, and more especially by Haller and the Hunters.*

One of the first steps towards the overthrow of the theory, which we have now been expounding, was taken by the anatomist Cowper, when he announced that the lacteals all terminate in the free surface of the intestinal canal by patulous mouths (osculis hiantibus.)† Following up these new but mistaken views which he had adopted, he straightway pretended to show, by mercurial injections, that the umbilical vessels in the placentula of a cow could be injected from the uterine artery.‡ Both these doctrines are advocated by Manget in his "Theatrum Anatomicum," published at Geneva, A. D. 1717, (vol i. p. 306. v. ii. p. 139.) He does not hesitate to declare it as his opinion that there is a transfusion of blood from the vessels of the mother into those of the fœtus, and a mutual circulation of the same between them. Noortwyk,§ Roederer,‖ Gibson of Leith,¶ and others, concurred in advocating these views. There were not wanting eminent men, however, who still stood up for the theory of Harvey, and denied the force of the objections recently stated to it by the authorities just mentioned. Among these the most celebrated was Dr. Alexander Munro *primus*, the father of academical medicine in Scotland, who, in his most interesting treatise "On the Nutrition of the Fœtus," decidedly contends that there is no vascular connection between the uterus and placenta, and shows most satisfactorily, how Noortwyk had fallen into the mistake of supposing that such a connection does exist. He states that he had examined the bodies of five women who had died with child, and that the following were the results: "In all of them I found a thick, fungous, succulent, cellular substance between the muscular part of the womb

* I may mention in proof of this statement, that, in the great anatomical work of Clerc and Manget, published at Geneva in 1699, there is not a single author who disputes the truth of the theory of De Graaf and Malpighi.

† I am not sure, however, that Cowper was the first to make this announcement—indeed, I suspect W. Cockburn must have preceded him. Cockburn at all events, distinctly describes the lacteals as arising by open mouths in the intestinal canal; he says, "Lacteorum vero *orificia in intestina hiare*, licet non sint satis spectabilia docet contenti succi color Albicans, &c."—*Œconomia Animalis.*

‡ See Drape's Anthrop.

§ Uteri Anatom. § 6, No.

‖ Icones Uteri humani, &c. 1759.

¶ Edinburgh Medical Essays, vol. i.

and its villous coat, through which numerous thin-coated vessels passed, and in this cellular substance the sinuses were. Excepting its sinuses it resembled the internal coat of the intestines.* I was ignorant of this structure when I began the dissection of the first woman, and, therefore, when I cut through the firm muscular part of the womb, aud saw this fungous substance, I imagined it to be the placenta. I was surprised to find the cohesion of this supposed placenta to the womb so firm; but persisted to separate the muscular part of the womb from it, till having torn a little of the fungous substance, *I observed the smooth, tense chorion, from which the fungous substance separated most easily, as it did likewise from the placenta*, by only gently pressing the ovum with one hand, and raising the womb with the other, without the assistance of any other instrument. I avoided this mistake in dissecting the other four impregnated uteri, which I had occasion to examine afterwards, and then had the villous coat entire, *and the smooth chorion spread over all the secundines.*" He goes on to show, from Dr. Noortwyk's own account of his dissections. that "the doctor must have persisted in the error which I committed in dissecting the first impregnated uterus, which I had occasion to examine, and brought off the internal cellular substance and sinuses of the womb with the ovum, in which case all the appearances would be exactly as he has described them." He distinctly describes the placenta as "*being covered on the side next to the womb, with a membranous continuation of the chorion.*" To Slade, who had pretended to show the communication between the vessels of the *glandulæ* and *placentulæ* in cows, he answers "that having tried the experiment variously, he had come to the very contrary conclusion, and that he could not be more certain of any thing than that there is no anastomosis or continuity of these vessels in cows."

The following passage will explain his physiological views: "Were I allowed to illustrate the communication between a mother and her child in the womb, by a gross comparison, I would say that the uterine sinuses are to a fœtus what the intestines are to an adult; the uterine blood poured into the sinuses being analagous to the recent ingesta of food and drink. The liquors sent from the umbilical arteries to be mixed with the uterine blood, resemble the bile, pancreatic juice, and other liquors separated from the mass of blood. The umbilical veins, and those on the surface of the chorion, take up the finer part of this compound mass, as the lacteal and meseraic veins do from the contents of the guts: but the grosser parts of the blood in the sinuses are carried back by the veins of the womb, as the excrements of the guts are discharged at the anus."

Whether or not any attempt was made to answer the arguments contained in Monro's essay, or how they could have been answered, I am alike ignorant, but certain it is that the opinions of Noortwyk soon afterwards found an advocate of such celebrity as raised them to a degree of importance which they would not otherwise have attained.† I allude to

* I beg the reader to remark how analagous these appearances are to what is seen in the glandulæ of the cow.

† The Medical Essays and Observations published by a society in Edinburgh, in and about the year 1737, contain certain papers which show, in a very interesting manner, the unsettled state of professional opinion in Scotland, regarding the placenta, about that period. See in particular "Observations on the Placenta," by Dr. Thomas Simpson of St. Andrews.

Haller, who about this period was rising to be one of the most eminent authorities in physiology and medicine. Haller, it is true, admits, in a letter to his pupil, Dr. Donald Munro, son of the aforesaid Dr. Alexander Munro, that he himself had never made any original observations on the placenta; but, notwithstanding this admission, there can be no doubt that the authority of his name would go far to sanction any opinions which he advocated. Haller, then, decidedly held that all the absorbent vessels terminate on free surfaces by *patulous mouths* (osculis patentibus), and that there is a mutual connection of vessels between the mother and fœtus in utero. (See *Primæ Lineæ*, § 769 and 891). I have seen it stated, indeed, in certain recent publications, that Haller did not believe in an anastomosis between the vessels of the mother and the fœtus in the placenta*; but I cannot conceive any language more express than that which he uses in support of this doctrine. He says—"Respondentibus ex utero in placentæ venas arteriis exhalantibus, tum placentæ arteriis ad uteri magnas venas hiantibus."—*l. c.* He does not hesitate to declare it as his opinion, that in the manner now described, by means of the placenta, a humour of a milky nature is at first transmitted to the fœtus, *and ultimately blood*. In proof of this doctrine that the fœtus is supplied with blood from its mother, he appeals to the well-known phenomena of menstruation and uterine hæmorrhage,—to injections "lately performed by distinguished men," whereby mercury and wax had been thrown from the uterine vessels into those of the placenta,—and to the fact that a fœtus had been known to be formed without a heart, in which case, as he argues, the whole of the blood must have been furnished by the mother.† Here, then, we find described a most extraordinary mode of communication between the vessels of the mother and the fœtus, the veins of the fœtus sucking in blood from the arteries of the mother, and the veins of the latter sucking it back from the arteries of the fœtus! Thus were the arteries and veins supposed to be locked together in each other's embraces! No wonder that the author calls this mode of communication by the name of "commercium." How the arteries and veins, deriving their origin from such distant points as the hearts of the mother and fœtus, contrive to find out one another's mouths "in the dark chamber," he does not attempt to explain. The illustrious Boerhaave, in his work "Œconomia Animalis," gives a sort of equivocal assent to this doctrine, although, at the same time, it is apparent that he did not feel at all satisfied with it, for he admits that appearances

Some of his statements and opinions are very inaccurate, and in that respect form a strong contrast to those contained in the writings of the physiologists of the 17th century. For example, he holds that in the Ruminants the *placentulæ* are produced on the chorion by contact with the *glandulæ*, and denies that in extra-uterine conceptions any placenta can exist, vol. iv. p. 93. I need scarcely remark that the existence of a placenta in extra-uterine pregnancies is a fact which cannot now be contraverted. See Turnbull's case, and many others, published of late years.

* Edin. Med. and Sur. Jour., No. 118.

† The case of the child without heart and lungs to which Haller here alludes, is no doubt the one related by Mery, *Mem de l' Acad. des Sciences*, 1720. It is noticed by Munro in his essay referred to above. The case, however, is not at all in point; for Mery himself states that this monster was twin to a perfect child, whose *funis umbilicalis* sent off the small navel string of the monster, which was thus supplied with blood from its perfect brother. The injections "lately performed by distinguished men," to which he alludes, were probably those of Cowper and Drake, which Munro shows to be utterly inconclusive.

are certainly in so far against it, since no mouths of vessels can be detected on the lining membrane of the uterus, *nor on the uterine surface of the placenta, which he describes as being smooth, and covered by the chorion* (§ 678, 679). The theory of Haller is the one which is adopted by Fleming in his *Introduction to Physiology* —a work which it is well-known was long used as a text-book on the subject it treats of by the students of medicine in this country. He says —" I stick not to believe that red blood as such is brought from the mother to the fœtus, and transmitted from the fœtus to the mother, as it were, in a circle."

Such, then, was the state of established opinions about the middle of the 18th century; some with Haller, contending for a singular sort of vascular connection between the mother and fœtus; and others, with Munro, still adhering to the theory of Harvey, and denying all such connection. It was not long after this time that the HUNTERS rose to so great celebrity that their opinions became, as it were, laws, which no one was at liberty to dispute. Now it is to be borne in mind that the Hunters acquired a mighty reputation by finally establishing (as was supposed) what had been often maintained and denied before—that the lymphatic vessels perform exclusively the function of absorption in the organism and that these all terminate *by open mouths* on the free surfaces of membranes. This doctrine regarding the absorbents it was long considered their greatest glory to have established beyond all possibility of controversy, by injected preparations contained in their museums. In particular (as has been stated by Professor Goodsir), Dr. W. Hunter, and his colleague Mr. Cruickshank, had in their collection two preparations which were considered to exhibit most distinctly the openings of the lacteals in the intestinal canal. But, as the tale is highly interesting and instructive, I must give it in Mr. Goodsir's own words :—" Mr. Cruickshank, in treating of the orifices of the lacteals and lymphatics, states that he and Dr. Wm. Hunter observed the openings by which the lacteals communicated with the cavity of the gut in portions of the intestine of a woman who died after eating a hearty supper. The two preparations of the intestine on which these anatomists made their observations came into the possession of the College of Surgeons in Edinburgh, as part of the Collection of the late Sir Charles Bell. * * Repeated examinations satisfied me that Dr. W. Hunter and Mr. Cruickshank were quite correct in describing and figuring radiating lacteals within the villi, but that they were led into error in describing those vessels as opening on the free surface of the gut, partly by imperfect instruments and methods of observations,—partly by general prejudice of the period in favour of absorbent orifices."—*Anatomical and Pathological Observations*, No. 2). It thus appears that Hunter's preparations, which were supposed to prove the truth of his doctrines respecting the absorbents, as far at least as regards their terminations by *open mouths*, prove nothing of the kind, and that the Hunters were led into the mistake of *fancying they saw what it is clear they did not actually see*,—"partly by imperfect instruments and methods of observation, partly by the general prejudices of the period in favour of absorbent orifices" —but also, I would add, in a very considerable measure by their inordinate ambition to raise themselves a name above all other names in the profession,

and to construct an original system, both of physiology and medicine,

—quod nec Joris ira neque ignis,
Nec poterit ferrum nec edax abolere vetustas.

In such a frame of mind, and with these prejudices, the two brothers, in 1780, took up the subject of the placenta; and a most unfortunate undertaking it must have proved to both, as regards their happiness, seeing the rivalry engendered by the simultaneous publication of their supposed discovery created a breach in that brotherly affection which had so long subsisted between them.

In the first place I would call attention to the remark, that the doctrines of the Hunters, regarding the absorbents, and Harvey's Theory of the Placenta, are evidently incompatible with one another, since the latter exhibits an instance of absorption through membrane and performed without the aid of lymphatics. Now I do not mean to insinuate that this consideration led the Hunters to palm deliberately on the scientific world a false statement of facts, to conceal the weak points of their own hypothesis, but I do not hesitate to say that I believe prejudices in favour of their own doctrines on absorption made them see the phenomena connected with the placenta through a distorting medium, and in such a light as suited their peculiar views and prepossessions.*

I find it difficult to convey to any reader who is not familiar with the subject, a distinct view of the description of the placenta given by the Hunters; more especially restricted, as I necessarily am, within very narrow limits. It must be apparent to every one who is at all conversant with the literature of the fœtal structures, that the Hunters mystified it in a remarkable degree by combining hypothesis with their descriptions of those "soft and gelatinous pellicles" formerly described by Malpighi, to which W. Hunter gave the very incongruous name of "*deciduæ*," from a mistaken idea that they consist of the inner membrane of the uterus, which he fancied to be cast off like "the slough" of a serpent. I need not say how much the perplexity has been increased by the preposterous ingenuity of their followers, so that it has now become a perfect puzzle to comprehend the *decidua vera*, *decidua reflexa*, *decidua parietina*, *decidua serotina*, *&c.* To me it appears that the importance of the *deciduæ*, in connection with the literature of embryology, has been absurdly exaggerated, and that they are merely flocculent films or pellicles, formed by the concretion of a gelatinous exudation from the vessels of the uterus; for they are all evidently devoid of structure and vascularity, and have none of that firmness by which the true membranes of the organ are characterised.† And now, with regard to J. Hunter's celebrated description of the dissection of an injected uterus, contained in his "Animal Economy,"

* The classical scholar will here recollect the old adage, "credunt quia credere cordi est," or, as it is otherwise expressed, "quod volunt, id credunt homines."

† It will be understood, I trust, that I apply this character merely to the films formed by exudations from the mother. I of course except what has latterly been called the *decidua vera*, by which is meant the lining membrane of the uterus, thickened and expanded like all the other structures of the organ, by the stimulus of conception. I need scarcely remark what a gross misnomer *decidua vera* is when thus applied. *Decidua falsa* would be a more appropriate term! It would be most desirabl ethat microscopical physiologists should pay some attention to logic, as much, at least, as to teach them the importance of using properly defined terms. See Appendix B.

suffice it to say, that he describes arteries "*about the size of a crow-quill,*" passing from the surface of the uterus into the placenta, and terminating there "in a very fine spongy substance; and that the veins originating from this same spongy substance pass obliquely through the decidua, and communicate with the proper veins of the uterus." The following is his description of the appearances remarked by him on recently expelled placentæ:—"Soon after this time, Dr. Hunter and I procured several placentæ, to discover if, after delivery, the termination of the veins and the curling arteries could be observed; *they were discernible almost in every one;* and by pushing a pipe into the placenta, we could fill, not only its whole substance, but also the vessels on that surface which were attached to the uterus, with injection." The views of W. Hunter are quite similar, and from these two originals, all the descriptions of the placenta which occur in our treatises of anatomy, and works on midwifery, during the next fifty years, are, with very slight modifications, entirely borrowed. In order to place the subject in a more distinct point of view, I shall here quote the description of the placenta and the fœtal circulation, given in a Treatise on Anatomy, which was a common text book in the schools of medicine at the time when I was engaged in my professional studies, and from which I formed my first conceptions of the structure and functional office of the organ:—"In the placenta are to be observed, on the side next the child, vessels, forming the principal part of its substance; on the side next the mother, the ramifications of the umbilical *branches of the uterine arteries, almost of the size of crow-quills,* passing in a convoluted manner between the uterus and placenta, and terminating in the latter. Veins corresponding with these arteries, but flat, and of a good size, running obliquely from the placenta to the uterus; and, in the substance of the placenta, an appearance, which has been supposed by many authors to be the common cellular tissue, and easily ruptured by injection, but which is considered by late authors *as a regular spongy substance similar to that in the body of the penis.*" "The placenta receives blood from the uterus, and, according to the opinion of modern anatomists, *purifies the blood, as the lungs do in the adult,* for the nourishment of the fœtus."* The blood is sent by the

* That the placenta is a respiratory organ, was no new doctrine; indeed, as hinted above, it is as old as Hippocrates, but still, in my opinion, it is quite untenable. Needham properly remarks that it is only by a play upon the term that the functions of the placenta can be assimulated to respiration, since it evidently is so situated as to want the requisites of a respiratory organ. That it is, to a certain extent, a depuratory organ, may be readily admitted, but so, in fact, are the vessels on the inner surface of the intestinal tube, and even the spongioles of trees, for both these excrete recrementitious matters from the organisms to which they also absorb alimentary matters. But this is evidently a very different process from respiration, the primary end of which would appear to be the preservation of the innate heat of animals. We may venture then, I think, to state it as an universal law, that no animal in the state of embryo stands in need of respiration, seeing that in viviparous animals the fœtus derives heat from the vitals of its mother, and in the oviparous it is supplied with the same from without. It has, therefore, always appeared to me an extremely improbable hypothesis, that in incubation the allantoid is for the purpose of respiration; indeed, the fact that urinary deposits are often found in the allantoid, towards the end of incubation, seems to me to prove the contrary, most decidedly, and that in oviparous animals, as well as in the ruminantia and bisulca, it is rather an appendage of the urinary organs. See Wagner's Physiology, English Ed., p. 196; and Mr. Town's experiments, which are very similar to those reported to have been performed by the father of Dr. A. Munro *primus*, and appear to me to have never been fairly met. I observed, indeed, a very interesting paper on the other side of the question, in the Microscopical Journal, for

arteries of the uterus to the substance of the placenta, from which, according to the opinion of many of the ancient anatomists, it passes to the umbilical vein by a direct communication of branches,—or, according to that of the greater part of modern authors, by absorption. From the iliac arteries it is conveyed by the umbilical branches to the substance of the placenta, where one portion of it returns by corresponding veins to the fœtus, *the rest going to the uterus in the manner it was discharged from the uterine arteries to the branches of the umbilical veins.*"—*Fyfe's Compendium of Anatomy*, vol. ii. pp. 295, 296, 307, 308. Edin. 1812.

From the above descriptions it would appear that, according to the Hunters and their followers, the placenta is constructed in the following way:—The great mass of it next to the fœtus is formed from the umbilical vessels, and the more external layer, next its uterine surface, from the curling arteries of the size of crow-quills and corresponding veins of great size; while its uterine and fœtal portions are connected together by means of a spongy substance, namely the placental cells. Where the cells are situated I am not aware that any one has accurately defined, but I think it probable from the descriptions both of J. Hunter and his copyist Fyfe, as given above, that they were supposed to be much nearer the uterine than the fœtal surface of the organ.*

From what we have stated, it will be remarked that the views of Harvey, Haller, and Hunter, differ in the following respects. Harvey and his followers held that the placenta consists entirely of ramifications of umbilical vessels, with a peculiar substance to support them, enclosed in a fold of the chorion, so that the placenta is completely separated from the uterus, and all connexion between the maternal and fœtal parts is through their investing membranes. Haller held the same views with Harvey as to the vessels which compose the placenta, but he supposed the arteries and veins of the fœtus to terminate on the uterine surface of the placenta by blunt extremities, and there to inosculate with the veins and arteries of the mother. The Hunters and their followers held that the placenta consists mainly of fœtal vessels, but partly also of maternal, united together by means of certain cavities called placental cells, through which an interchange of blood takes place between the mother and fœtus. It is to be further remarked, that the peculiar views of the Hunters rest entirely, 1st, *upon a single dissection of an injected uterus* made by J. Hunter; 2d, upon certain anatomical preparations preserved in their museums; and 3dly, upon the appearances remarked on the uterine surface of fresh placentæ. It is not my intention at present to enter upon the consideration of the merits of the case thus made out by the Hunters in favour of this hypothesis, further than to remark, that I believe it will turn out, as we shall see by and by, that injections of so tender an organ as the placenta are extremely fallacious;

Feb. 1846, by Mr. J. Dalrymple, but I cannot admit that his injections, however carefully devised and executed, fairly counterbalance Mr. Town's experiments, and the fact I have alluded to of urinary deposits being found in the allentoid.

* See further Burns' *Principles of Midwifery*, 1832, p. 200. This author certainly appears to understand the construction of the placenta to be as I have represented above. He distinctly describes the placenta as consisting of two portions, which can be separated from one another during the first three months, and which can at all times be injected, separately,—the one from the fœtal and the other from the uterine side, the space called the placental cells being left between them.

and that the appearances described by the Hunters as being seen on the uterine surface of the placenta, are very different from those which Malpighi, Munro, and Boerhave had described, and *from those which I myself have observed.*

The doctrine of the Hunters, however, under the authority of their great name, soon superseded all others, and for more than half a century it may be pronounced to have been the established creed of the profession. Indeed, before Dr. R. Lee, who published his objections to the Hunterian hypothesis in the *Philosophical Transactions* for the year 1832, I am not aware that a single individual had ventured to call it in question. Of his remarkable paper "On the Construction of the Placenta," I have now to give a very brief abstract. He states that his observations are the result "of the examination of *six gravid uteri and many placentæ*, expelled in natural labour, which seem to demonstrate that a cellular structure does *not* exist in the placenta, and that *there is no connection between this organ and the uterus by great arteries and veins.*" He declares that, on detaching the placenta carefully from the uterus, "there is no vestige of the passage of any great blood-vessel, either artery or vein, through the intervening decidua from the uterus to the placenta, *nor has the appearance of the orifice of a vessel been discovered even with the help of a magnifier, on the uterine surface of the placenta*"; and further, "*that no cells are discernible in its structure by the minutest examination.*" He argues against a vascular connection between the uterus and placenta, from the surface of the latter appearing "uniformly smooth, and covered with the deciduous membrane, which could not be the case did any large vessels connect it with the uterus; and from the circumstance that in the majority of cases it is separated with the least possible force, and without hæmorrhage." He further gives an analysis of all the preparations in the Hunterian Museum at Glasgow, which were supposed to demonstrate a connection between the uterus and placenta, and shows on the testimony of two intelligent friends, who had examined them for this purpose at his request, that none of them warrant the inference which the Hunters and others had drawn from them. He therefore holds that "the facts stated warrant the conclusion *that the human placenta does not consist of two parts, maternal and fœtal; that no cells exist in its substance; and that there is no communication between the uterus and placenta by large arteries and veins.*"

Such were the conclusions respecting the structure of the placenta which Dr. Lee had arrived at in 1832. But in 1842, he declares that "the discovery of the circulation of the maternal blood in the placenta, made by the Hunters, which throws so much light upon the whole economy of the fœtus, especially the processes of respiration and nutrition, will be regarded in all future ages as one of the greatest that has ever been made in human anatomy, and as second only to the discovery of the circulation of the blood by Harvey" (MED. GAZ. vol xxxi.) From the following extract it will be apparent that he could then, that is to say, in 1842, see, as he thought, the extremities of ruptured blood-vessels on the uterine surface of a fresh placenta, and could satisfy himself of the existence of the placental cells. "If you keep this (uterine) surface of the placenta convex, you can see numerous small tortuous arteries in the decidua filled with maternal blood.

Their open mouths are visible at the surface of the membrane, and they soon disappear, after making, as John Hunter describes, 'a twist or spiral turn upon themselves.' These decidual arteries soon terminate in the cavernous structure of the placenta, &c." (Ibid.)

I cannot help thinking that when Dr. Lee published this recantation, it was incumbent upon him to explain how, in his six dissections of the bodies of pregnant women performed ten years before, he had missed seeing "the curling arteries, of the size of crow-quills," passing between the uterus and placenta,—how he then failed to detect the ruptured extremities of the same on the uterine surface of fresh placentæ, and also the placental cells; and by what process he arrived at the discovery of all these parts at the latter period. To me it would have been peculiarly gratifying and instructive if he had done so, for I must say that in 1847 I can perceive no openings of blood-vessels on the uterine surface of the placenta, nor can I discover those cavities which have been called placental cells.

I cannot leave this part of my subject without mentioning that Dr. Lee's paper quoted above contains a letter to him from Mr. Owen, giving a description of dissections made by him confirmatory of the views then held by Dr. Lee. He, too, has since explained all this away, and professed himself satisfied that Mr. Hunter's general views are correct in the main. Contrary even to what, as we shall presently see, is the established opinion of the microscopists, he seems to admit the existence of placental cells.

"Can such things be,
And overcome us like a summer cloud
Without our special wonder!"

PERIOD IV.—*Opinions advanced by Dutrochet, Velpeau, and others.*

We ought to entertain a stronger feeling of gratitude than I suspect we generally do towards our Gallic neighbours for *compelling* us to see and acknowledge the errors into which the Hunters had led us respecting the absorbents, and for explaining to us the nature of imbibition and transudation through membranes, at a time when we had fairly lost all knowladge of the true nature of these processes. I agree, indeed, with Liebig (*Animal Chemistry*, 3d edit. p. 165,) that *endosmose* and *exosmose* are little else than different names for *filtration*; but undoubtedly Dutrochet has great merit for having recalled attention to these phenomena in the animal frame, and for having investigated their laws at a time when complete forgetfulness of them had led physiologists into errors of the most serious description. Light having been thus generally diffused over physiological subjects, Dutrochet, Breschet, and Velpeau naturally thought of reconsidering the prevalent doctrines regarding the construction of the placenta, and the mode of communication between the mother and fœtus. Velpeau's "Embryologie" is one of the most important works ever published on this subject, and therefore I have to regret that I cannot give a proper exposition of his peculiar views without the plates, which constitute its greatest value. I am confident that no one can rise from an examination of these plates without coming to the conclusion that if they are carefully and faithfully executed, as there is every reason to suppose they are, it is impossible to resist the conclusion that the placenta is formed by the extension of the villi of the chorion, and consequently that this organ must belong exclusively to the fœtal apparatus. I would refer the reader particularly to

plate vii. fig. 1; plate ix. fig. 3; plate xi. fig. 2; and plate xii. fig. 1.

The principal arguments by which Velpeau combats the doctrines of the Hunters, that the placenta is supplied with blood-vessels from the mother for the purpose of conveying blood to the fœtus, are the following:—1st. In extra-uterine pregnancies such an arrangement is impossible. 2d. The placenta at first does not exist, and even until the third month it consists of agglomerated filaments only, and consequently no sinuses can exist between its lobules. 3d. A regular-formed placenta has been found in connexion with a fibrous polypus and hardened portion of the womb. 4th. Velpeau has seen the uterine surface of a recently delivered female, hard, leathery, and without orifices. (See further, Edinburgh Med. and Surg. Journ. No. 118, p 174.) Velpeau gives two figures from the great work of W. Hunter, in illustration of the peculiar views of the latter, with some interesting observations of his own. (See Embryol. plate ix. fig. 5, 6.) Of these the one, as he says, "is formed entirely from the imagination;" and in the other, what Hunter gives as the natural orifices of vessels on the surface of the decidua lining the placenta, he holds to be mere lacerations, —"sont de simples lacerations, au lieu de constituer des orifices naturels comme le croit l'auteur."

To this head may be referred the description of the placenta given by Mr. John Dalrymple, of London, which is highly deserving of notice, as being perhaps the most lucid, precise, and accurate description of the organ, as usually presented to us at the full period of gestation, which is to be found in the whole compass of medical literature. The following extracts will enable the reader to comprehend his general views:—"The umbilical arteries, after dividing and passing on in a convoluted and serpentine form over the fœtal surface of the placenta, dip at various intervals into its substance, there dividing and subdividing infinitely. The trunks are covered on the surface of the organ by the fœtal membranes, and each branch, as it dips into the thickness of the tissue, *carries before it a fold of the chorion.*" "The whole mass of the placenta is made up of the innumerable ramifications of the arteries terminating in beautiful coiled and convoluted capillaries, which form tufts or bouquets at various intervals; these finally become continuous with the minute origins of the umbilical vein, which returns to the fœtus in the same direction that the arteries left, viz., coiled and twisted in the umbilical cord." "The chorion constitutes by division into processes true villi, and each villus contains a tortuous capillary, which, entering from the arterial side, leaves by the venous." "The uterine surface of the placenta is covered by decidua." "*There are no distinct or defined cells constituting a maternal portion of the placenta.* * * The interstices between the villi have been usually but improperly called the cells of the placenta." "In the placenta must go on a double interchange of fluids, for the blood returned to this organ by the arteries is unfitted for a second circulation through the embryo,—at least, this is true in part, if not entirely. Hence, when the blood, or nutrient material of the blood, brought by the uterine arteries, and previously aërated by the mother, enters by *endosmose* the absorbent capillaries of the fœtal villi, that portion of the fœtal blood which requires the action of oxygen escapes by *exosmose*, and

returns by the uterine sinuses and veins to the maternal part."*

This description is so remarkably clear, so devoid of mystification, and, I may be allowed to add, is so much in accordance with my own observations made with the microscope, as to satisfy me that the placenta consists entirely of a congeries of the umbilical vessels, strengthened by some fibrous matter, and enveloped in a fold of the chorion, and having nothing maternal in its structure further than a thin pellicle called the decidua, formed no doubt from a gelatinous exudation poured out by the vessels of the uterus. It agrees so well, moreover, with the above-mentioned descriptions given by Malpighi and Munro, the one two hundred, and the other at least one hundred years ago, that no one can avoid the conclusion that this coincidence cannot be otherwise accounted for but upon the supposition that each of these eminent anatomists described appearances as he had remarked them, and, unlike too many others who have handled the same subject, did not allow his mental vision to be perverted by the mists of prejudice and hypothesis.

And now we find that our investigations have brought us back again at the end of this, the fourth stage of our progress, to exactly the same conclusions as those we had arrived at, at the end of the second stage, namely, that the placenta is altogether a fœtal organ, and that there is no vascular connexion between it and the uterus.

PERIOD V.—*Opinions held by the advocates of the cell-theory at the present time.*

There never occurred, I am inclined to think, within so brief a period, such a revolution in any physical science as has been produced in physiology lately by the celebrated hypothesis of Schwann and Sleiden regarding the functional office of the cell in the formation of all organic substances. A scholar who is conversant with the old atomic theory of Democritus and Epicurus,† who taught that all things are originally formed of atoms, might fancy he saw it revived when he finds the microscope actually shows that all organic substances are composed of molecules surrounded by thin films, namely, *nucleated cells*. Few persons who have any pretensions to an acquaintance with natural science can require to be told that all the structures of the animal and vegetable world are now held to be originally formed from these cells.

* I would also beg to call attention to the following observations contained in the same paper:—"It has been observed by some anatomists that the uterine veins are filled by injections thrown in by the umbilical arteries. The explanation of this phenomenon is sufficiently easy; the tufted villi are very delicate, and it not unfrequently happens that the injection bursts the covering of the chorion, and so escapes into the interstices between the villi, which have been usually but most improperly called the cells of the placenta. If the injection so escapes, it will easily find its way, after distending the spongy mass, into the uterine sinuses, and thus fill the uterine veins. On the other hand, coloured fluid thrown into either of the uterine arteries or veins will distend the placenta or spongy interspaces, and if the fœtal tufts be lacerated by the distension or force of the manipulation, some of it will enter the broken extremities of the fœtal vessels," &c. There is an interesting paper in No. 86 of the Edinburgh Medical and Surgical Journal, on the Maternal Fœtal Circulation, by Dr. Williams, from which it appears how very fallacious all attempts to ascertain the minute structure of the placenta by means of injections have generally proved. Dr Munro's Essay, referred to above, likewise contains many statements and remarks all leading to the same conclusion.

† See in particular Diogenes Laertius, *in Vita Democriti*; and Lucretius, *De Rerum Natura*.

It is also well known with what enthusiasm this doctrine was received, and with what eagerness all subjects connected with animal and vegetable physiology have been re-explored, with the hopes of deriving additional illustration to them from the lights generally diffused by this brilliant discovery.* It was not to be supposed that the placenta would be overlooked in the general survey, and accordingly it will be found that the Teutonic microscopists were not slow in announcing to the scientific world the new discoveries which they had made in this interesting field of investigation. The foremost to distinguish themselves in this way were Weber, Wagner, and Baer, whose descriptions of the placenta certainly form a most extraordinary contrast to those which we have just been considering. I must now endeavour to convey to the reader, with as much brevity as I can, a distinct notion of the views lately promulgated by Weber with regard to the construction of the human placenta. (See Wagner's Physiology, by Dr. R. Willis, Note, p. 200—206.

He illustrates his idea of the placenta by the following comparison of it to a sponge: "The fibrous tissue of the sponge corresponds with and represents the branching subdivisions of the chorion, and their uniting medium derived from the decidua; the cavities and interspaces of the sponge, however, represent the passages in which the blood of the mother flows. * * The arteries and veins of the uterus open at once into the spongy substance of the placenta." He says elsewhere (p. 201), "that the arteries and veins of the uterus, the channels of the mother's blood, *penetrate in great numbers into the placenta*, and are distributed through its substance in such wise, that every one of its minutest lobules has a canal carrying the blood of the mother, and so comes in contact with the vessels in which the blood of the embryo is flowing. The umbilical vessels of the embryo divide in the manner of a tree, into very numerous and minute branches, which finally turn round, forming loops and anastomoses, and again collect into larger and fewer branches, which at length unite into a single trunk, and form the umbilical vein. *The whole placenta, and therefore every individual lobule, consists of two distinct parts, the one a continuation of the chorion and vessels of the embryo, and the other a continuation of the membrana decidua, and vessels of the uterus.*"† Baer's description is to the same effect: he says "by the growth of the vessels of the uterus into the *decidua serotina* this is transformed into the placenta. *That vessels pass from the walls of the uterus into the placenta has been long known and admitted;* but in regard to the form and mode of this passage or transference, opinions still vary. *It was long believed with Hunter that they passed into cavities.* In more recent times there appeared a growing disposition *to regard these spaces as enlarged veins with extremely thin walls, a structure which is assigned*

* After an acquaintance with the cell Theory of Schwan and Sleiden, now extending to upwards of twelve years, I will venture to say of it that it is *un grand peut-etre*,—a splendid speculation—but that it has no pretensions to the rank of a Scientific Theory. If science be correctly defined by Aristotle to be "an immutable opinion," (Topic. vi. 8), surely an hypothesis which has been and is constantly undergoing changes does not deserve to be regarded in this light.—A.D. 1858.

† Wagner's own account of the origin of the placenta is much the same. He clearly derives the origin of it from the *decidua*, that is to say from the uterus (p. 199.)

*to them by many others, and particularly by E. Weber.** He professes himself inclined to agree with Weber, but owns that since he had become acquainted with Dr. R. Lee's views "he had no opportunity of appealing to nature for a solution of the question." Weber, in like manner, although he delivers his extraordinary account of the placenta in a strain of the greatest self-confidence, artlessly lets out that, "*Seiler believed himself authorised to conclude that no vessels from the mother penetrate the placenta but that the maternal vessels only come into contact with the surface of the placenta where it is bounded by the uterus.*" Since, then, it would appear that one portion of the German physiologists hold that the placenta is mainly formed from the vessels of the mother, while others maintain that the uterine vessels do not enter into the structure of it at all, it must surely be admitted that professional opinions in Germany, on this important subject are altogether speculative.! We shall turn our attention, then, to the examination of what has been doing in this department, of late years, by the microscopists of our own country.

Dr. J. Reid has the merit of being one of the first in this country to describe the placenta with the aid of the microscope, after the use of this instrument in physiological investigations had been revived, His views amount to this,—that the placenta consists of a congeries of umbilical vessels, *which terminate in blunt extremities on its surface*, and that it is divided on its uterine surface into a multitude of "tufts," which enter into the sinuses of the mother, these tufts being covered externally by a thin membrane derived from the mother, "consisting of a reflection of the inner coat of the venous system of the mother, or, *at least, of a membrane continuous with it.*" He seems to hold that, at delivery, these tufts are often broken off, and portions of them left behind upon the surface of the womb. Some parts of his description I am not sure that I fully understand, and it will now be generally admitted that he was mistaken in supposing that the umbilical arteries and veins terminate by "blunt extremities." Mr. Dalrymple and Professor Goodsir point out the mistake into which he has fallen in this matter. He further speaks of having satisfied himself, "but not without considerable difficulty, of the existence of the utero-placental vessels described by the Hunters." Now I am at a loss to comprehend how so excellent an anatomist as Dr. Reid could have experienced any difficulty in satisfying himself whether or not "vessels of the size of a crow-quill" pass from the uterus into the placenta, as represented by the Hunters. From some parts of his description one would be led to suppose that he considers the placenta to be formed altogether from fœtal vessels, but in other parts he seems to suppose the existence of maternal vessels in it. The functional office and structure of the placenta he clearly holds to

‡ The following experiment is the only positive proof stated by Weber in support of his hypothesis: "If the uterine surface of a very fresh placenta, that has not been put into water, be moistened with a strong solution of corrosive sublimate, in alcohol, in order to coagulate and prevent the escape of the blood still contained in it, and the whole placenta be then soaked in a weaker solution of the same kind, the whole of the maternal blood that remained in the spaces between the divisions of the chorion will be found coagulated; even in the larger lacerated veins which have just passed from the uterus into the placenta, coagulated blood will be found; and the manner in which these veins open into the interspaces mentioned, will be seen, and the course of the maternal blood during life be found indicated." I have repeated this experiment with the utmost possible care, but have failed to detect the appearances described by Weber.

be analogous to that of the branchia or gills of certain aquatic animals. He says "the placenta is therefore not analogous in its structure to the lungs, but to the branchial apparatus of certain aquatic animals."* According to this hypothesis, then, the fœtus in utero is in a state analogous to the tadpole or young frog. It must be obvious therefore, that, if the structure and functional office of the placenta be as Dr. Reid represents, it is not formed in the human subject upon the type of structure which prevails generally throughout the class of mammals. No person, for example, who examines the fœtal apparatus in the cow, the ewe, or the sow, would say that in them it bears the least analogy to branchia or gills. And besides it is clearly an organ of nutrition, and not of respiration which the fœtus stands in need of.

The description of the placenta given by Dr. Knox† is held to be confirmatory of Weber's views, but I must say that to me it is by no means so clear as that given by his original. On one important point, however, he is decided—namely, that there are no cells or cavities in the placenta, and consequently he rejects *in toto*, the Hunterian theory, which is utterly untenable, provided it be shown that the supposed cells have no existence. He speaks of the decidua being interposed between the placenta and uterus, but admits "that it is obscure in its real nature." He further speaks of the placental vessels penetrating through this decidua until they reached the surface of the uterus, where they floated in one of the venous sinuses of the uterus. This would appear to me to be much at variance with Weber's views as stated above. Altogether, however, I must use the liberty of saying that I desiderate clearness of ideas in Dr. K's exposition of his views.

The elaborate description of the placenta lately given by Professor Goodsir, of Edinburgh, must be regarded as the one which at present gives the tone to professional opinion in this country, and therefore it now demands our serious attention. I must express my regret, however, at the outset, that my prescribed limits preclude me from giving so full an exposition of it as would be necessary to render the views therein advanced intelligible to any one who is wholly unacquainted with them. But as the work is now widely circulated, it is to be presumed that few readers of this communication can be entire strangers to it. I must here, then, refer the reader to Figg. 19 and 20 in Professor Goodsir's Essays, as I find difficulty in getting them correctly copied. I shall only remark beforehand that these figures may be conceived as representing "a tuft" or a single point of the placenta where it comes into immediate contact with the uterus. *Ex uno disce omnes.*

"Fig. 19.—The extremity of a placental villus. *a* The external membrane of the villus, the lining membrane of the vascular system of the mother. *b* The external cells of the villus, cells of the central portion of the placental decidua. *c c* Germinal centres of the external cells. *d* The space between the maternal and fœtal portions of the villus. *e* The internal membrane of the villus, the external membrane of the chorion. *f* The internal cells of the villus, the cells of the chorion. *g* The loop of umbilical vessels."

* Edinburgh Med. and Surg. Journal, 1841, p. 1—12.
† Medical Gazette, Oct. 30, 1840, p. 209,

"FIG. 20.—This drawing illustrates the same structures as the last, and has been introduced to show the large space which occasionally intervenes between the internal membrane and the external cells. It would appear that into this space the matter separated from the maternal blood by the external cells of the villus is cast before being absorbed through the internal membrane by the internal cells. This space, therefore, is the cavity of a secreting follicle, the external cells being the secreting epithelia, and the maternal blood-vessel system the capillaries of supply. This maternal portion of the villus and its cavity correspond to the glandular cotyledons of the ruminants, and the matter thrown into the cavity, to the milky secretion of these organs."

It will here be perceived at a glance that the fœtal parts are represented as being enclosed within the internal membrane of the villus, *and that this membrane is held to be the external membrane of the chorion.* On this most important point, then, in the anatomy of the placenta, Mr. Goodsir, is completely in accordance with De Graaf, Malpighi, Munro, Boerhave, Velpeau, and Dalrymple. It will also be seen that the fœtal and maternal parts are represented as perfectly separate, and involved each in its own proper membrane, as further held by the physiologists of the 17th century; that, as also maintained by them, the fœtus is held to be nourished by means of an alimentary fluid secreted by the maternal portion, and absorbed by the fœtal; and, as likewise held by them, that the fœtal parts correspond to the *placentulæ*, and the maternal to the *glandulæ* of the ruminants. And moreover it will be seen that, like these physiologists, Professor Goodsir compares the function of the placental villi to that of the villi of the intestines, and to the spongioles of plants. In so far, then, one might, at first sight, be disposed to think that Mr. Goodsir's object was to revive the theory of Harvey and De Graaf, and to show it to be in unison with his own favourite cell theory. But on looking more narrowly into his "Essay on the Construction of the Placenta," one meets with opinions which it is difficult to reconcile with what I have stated to be the general bearing of it. It is impossible not to recognise in it a marked disposition to keep on terms with the followers of the Hunters. Accordingly he frequently speaks of the "maternal portion of the placenta,', although it must be obvious that if, as he himself holds, this maternal portion be analogous to the *glandulæ* of the ruminants, it is no portion of the placenta at all. Another of his conclusions wherein the same *animus* is manifest, is this: "The placenta, therefore, not only performs, *as has been always admitted*, the function of a lung, but also the function of an intestinal tube." Now Mr. Goodsir, upon reflection, must be aware that it has by no means been always admitted that the placenta performs the function of a lung—nay, more, there is nothing in his own paper to show that there is the least analogy between a placenta and a lung, for he himself makes out an exclusive case in favour of its analogy to an intestine. His drift however, would appear to have been, to reconcile in so far the conflicting theories of Harvey and Hunter. To prejudices in favour of the Hunterian doctrines may be also ascribed his comparison of "the uterine cotyledons of the ruminant and other mammalia to a permanent decidua vera, and the milky juice interposed between them and the fœtal cotyledons to a decidua reflexa in its primitive and simplest form." Now, the former of these

comparisons is, no doubt, in so far appropriate; only I cannot see how the uterine cotyledons of the ruminants can be called *permanent*, since, as any person may see upon examining the carcase of a cow two or three months after calving, the *glandulæ* or *uterine cotyledons* disappear in the same manner that the decidua vera, or internal membrane of the uterus abnormally developed, does in women. And the milky juice of the ruminants is evidently analogous to the alimentary juice or liquor imbibed by the placenta, and not to the decidua reflexa, to which it can bear no analogy. I also find it a defect in Mr. Goodsir's description of the placenta, that he does not point out the place where, according to his views, the natural separation takes place between the maternal and fœtal parts. It might be supposed that he represents it to be at the union of what he calls the internal and external membranes, since these two membranes are represented as being separated from one another by the alimentary fluid (more especially in fig. 20), and there is no vascular connection between them. The latter, at all events, is merely what is called in the nomenclature of the microscopists a basement membrane, that is to say, "a pellicle of such extreme delicacy that its thickness scarcely admits of being measured," (*Carpenter's Physiology*, 206.) Whether this very fine film is to be usually found on the uterine surface of a newly-expelled placenta, although I have made attempts to satisfy myself as to the fact with the aid of a powerful microscope, I am neither competent to affirm nor deny, and, as Mr. Goodsir has not spoken out decidedly, I am at a loss to say what his views expressly are on this point. At all events, it is evidently an insignificant affair, being, as he himself represents it, wholly devoid of all structure. That this is the outer membrane which envelopes the maternal parts must be conceded, I suppose, to so great an authority, although, I must confess, it appears to me hard to believe how such an immense sinus comes to be formed external to the lining membraneof the uterus. In the ruminants, with the fœtal anatomy, of which I am most familiar, the latter membrane—that is, the lining membrane of the uterus—is the envelope of the maternal parts or *glandulæ*, and all the sinuses are within it. One cannot help thinking that this would have been the most natural construction in the case of the human subject, but I readily admit that I am not competent to dispute this point with so eminent an authority, in microscopical anatomy, as Professor Goodsir, in whose opinions on all these matters I would place the most unbounded reliance, were it not that he evidently betrays throughout the whole of this paper a strong disposition to find all the phenomena connected with the placenta in accordance with the principles of the cell-theory. This bias has led him to adopt certain opinions regarding the placenta which I venture to predict he will find it necessary to modify at no very distant day. For example he holds that "the nucleated cells" are the sole instruments of absorption, both in the intestinal villi, and in those of the placenta; thus refusing to admit to simple imbibition, or *endosmose* and *exosmose*, any operation at all in this case. I perceive that Professor Matteucci has already pointed out this part of Mr. Goodsir's theory as being overstrained. (See *British and Foreign Medical Review*, No. 46, p. 378.)

Dr. Carpenter, in his "Manual of Physiology," professes to borrow a considerable part of his description of the placenta from Mr. Goodsir, but, upon the whole, he would seem to incline rather to the theory of Weber than

of Harvey. Thus, treating of the nature of the fœtal and maternal portions of the placenta, he says, that in the human subject "the two elements are mingled together through its whole substance;" and he further speaks of the blood being "conveyed into the *cavity of the placenta* by the curling arteries," a description which I am not sure that I understand aright; indeed, I must freely confess that in the course of my numerous dissections of the placenta, I have never been able to detect either "the cells" of Hunter, or "the cavity" of Carpenter.

I am aware that I may subject myself to the charge of presumption for thus venturing to criticise the opinions of two contemporaries so distinguished for their contributions to physiology as Professor Goodsir and Dr. Carpenter. But whoever undertakes the investigation of a subject like our present one, will find that at every stage of his progress he will have to encounter such discordant views and conflicting statements, advanced under the sanction of GREAT NAMES, as must soon compel him either to abandon the pursuit altogether in despair, or exercise his own judgment manfully in discriminating between truth and error. With much respect, therefore, for the two individuals I have just named, and fully sensible how much physiology owes to the one as an original inquirer, and to the other as a diligent expounder of the discoveries of others, I must still be permitted to state, that I too feel conscious of having cultivated this department of physicial science with so much diligence, that I am not afraid to claim for myself the privilege of exercising an independent judgment in every case; I must venture to say with Correggio, when rousing himself to contend with the great Masters in his art, "*ed io anche sono pittore.*"

RETROSPECT.—Having thus finished my historical sketch of all the opinions which have been entertained on the subject in question, I will now briefly recapitulate the results, and state the conclusions which I hold may be legitimately drawn from the same.

I. It would appear that all the opinions which have ever been held regarding the construction and functional office of the placenta, may be referred to the following heads:—1st. Physiologists in ancient times, and down to the days of Harvey, holding that the male semen is the original of the embryo, believed that the uterine vessels penetrate into it, and thus directly furnish blood to the fœtus. 2nd. Harvey, and all the physiologists of the 17th century after him, held that there is no vascular connection between the mother and fœtus, and that in the human subject, as in all the other orders of mammals, the fœtus and its appendages are inclosed in a proper membrane of their own, through which they imbibe an alimentary juice, which constitutes the pabulum out of which the blood of the fœtus is formed. This theory likewise accords in the main with the views entertained by Monro *primus*, in the middle of the 18th century, by Dutrochet and Velpeau, by Seiler, Dalrymple, and other authorities of the present day. 3rd. Certain physiologists in the 18th century, including the illustrious Haller, held that a mutual inosculation of the foetal and maternal vessels takes place upon the uterine surface of the placenta, and that in this way the uterine arteries supply pure blood to the placenta, while the uterine veins remove impure blood from it. 4th. The Hunters and their followers held that the placenta is formed partly from the ramifications of the uterine vessels, and partly from those of the umbilical, and that these two distinct

portions are united together near its uterine side, and interchange blood by means of certain cavities named the placental cells. 5th. Weber, Baer, Wagner, and other advocates of the cell-theory in Germany, have lately propounded the doctrine that the whole mass of the placenta is composed of a double set of vessels, the maternal and umbilical; that these run along, side by side, through the whole structure of the placenta, the latter corresponding to the fibrous tissue of a sponge, and the former to the cavities or interstices of the same; that the maternal vessels are far larger than the foetal, the latter being mere capillaries, whereas the former are represented to be "far too large to be spoken of as capillaries." 6th. We have shown above that all the views lately propounded by British microscopists, are modifications of the theories of Harvey, Hunter, and Weber.

II. It will be readily admitted that the first of these theories, being based on an erroneous assumption as to the original of the embryo, and also being formed in ignorance of the true functional office of the blood-vessels, must be entirely rejected; and that the third is, if possible, still less deserving of any serious consideration, being founded on an erroneous hypothesis as to the termination of the absorbent vessels, and in ignorance of the difference which it is now well known there is between the globules of the maternal and fœtal blood.

III. With regard to tho second, I hold that the following conclusions, may be legitimately drawn from the facts and arguments stated in the preceding sketch. 1st. It is a *priori* highly probable as assumed by the physiologists of the 17th century, that the human placenta should be formed upon the same type of structure that prevails through the other orders of the class *Mammalia;* and these physiologists have shown, most satisfactorily that in all the inferior orders, the maternal and fœtal parts connected with gestation are entirely distinct, and that the fœtus is nourished by means of an alimentary liquor, secreted from the maternal blood and imbibed by the fœtal secundines through their outer membrane, the chorion, which envelopes the whole secundines, including the placenta when this organ exists. 2d. The analogy between the apparatus for the support of the fœtus in the ruminants and the human subject is so striking as to have been pointed out by physiologists in all ages. Now it is clearly shown by the physiologists of the 17th century—and as to the fact I cannot entertain the slightest doubt—that in the cow the maternal and fœtal cotlyledons otherwise called the *glandulæ* and *placentulæ*, are quite distinct, and consequently there can be no vascular connection between the mother and the fœtus. The analogy of the ruminants, therefore, leads strongly to the probable conclusion that in the human subject the maternal and fœtal parts must be entirely separate. 3. The analogy of oviparous animals in like manner leads to the conclusion that it is an universal law in nature that animals in the embryonic state have no vascular connection with their parent. 4. The analogy of the placental tufts to the intestinal villi and the spongioles of trees is so striking as to have been particularly adverted to by physiologists in all ages, and it also leads to the same inference. 5. The appearances presented when separating the placenta from the womb after death, as given by Malpighi, Munro, Dr. Lee in 1832, and others, are so striking, as to preclude the supposition of there being any vascular connection between the uterus and placenta,

(See Appendix B.) John Hunter's assertion that he detected "arteries of the size of crow-quills, and veins of a large size," passing between the mother and the placenta, has not been confirmed by the observations of any trustworthy inquirer since his time. 6. As is remarked by De Graaf, Dr. Lee, and others, if the placenta were connected to the uterus by blood-vessels of considerable size, it is impossible that the separation of the placenta could ever take place without hæmorrhage. 7. The last remark is still more striking in the case of inversion of the womb. 8. The appearances on the uterine surface of the placenta as described by Malpighi, Munro, Boerhaave, Dr. Lee in 1832, J. Dalrymple, and others, have been confirmed by repeated observations made by myself, and, as far as I can see, they entirely preclude the supposition of any vessels from the mother entering the placenta:—*The uterine surface is covered with a fold of the chorion, and no vestige of any blood-vessel can be detected on it even with the aid of a microscope*. 9. As remarked by De Graaf, Velpeau, and others, if the placenta did not belong exclusively to the fœtal apparatus, this organ could not possibly be formed in extra-uterine pregnancies. 10. The figures of the ovum given by Velpeau in his *Embryologie*, if correct, put it beyond a doubt that the placenta is an appendage of the chorion, and that no maternal vessels enter into its structure.

IV. With regard to the Hunterian hypothesis, the following are the results of our preceding investigation, and the conclusions which I think must necessarily follow from them:—1. That the Hunters took up the consideration of this subject with very erroneous impressions in regard to the absorbent system, and looked upon the phenomena connected with the placenta under a strong bias in favour of their preconceived views. 2. That they allowed themselves to be imposed upon by fallacious appearances in certain injected preparations contained in their museums, as Professor Goodsir has shown that in like manner they were deceived by similar preparations illustrative of the mode by which the absorbents terminate in the intestinal canal. 3. That certain of the figures in W. Hunter's work on the Gravid Uterus are drawn from the imagination, and exhibit appearances purely ideal. 4. That when J. Hunter described "vessels of the size of crow-quills" running between the uterus and the placenta, he most probably committed the mistake which Monro shows Noortwyk to have fallen into—namely, that of confounding the portion of the maternal apparatus which is analogous to the *glandulæ* of the ruminants with the placenta itself; the fact of the matter being, that this fungous substance in the human subject is as entirely separate from the placenta as it is in the ruminants. 5. That, as we have shown to have often happened to other inquirers of equal eminence, the Hunters most probably allowed themselves to be imposed upon by preconceived notions when they described the openings of arterial vessels said to be seen by them on the uterine surface of the placenta, no such openings being actually visible. 6. That it seems to be now pretty generally conceded that there is no such structure of the placenta as the cavities described by the Hunters under the name of placental cells. 7. That, according to the Hunterian hypothesis the formation of the placenta in extra-uterine conceptions is utterly inconceivable. 8. That the human placenta, if constructed on the plan represented by the

Hunters, would be a perfect anomaly in nature, as it cannot be shown that the same organ is formed upon the same type in any other animal whatever. 9. That, in particular, the human placenta, as described by the Hunters, is analogous to the lungs in the adult, whereas in all other animals its corresponding part is analogous to the intestinal tube : in other words, the placenta is evidently an organ of nutrition, and not of respiration as held by the Hunters.

V. Respecting Weber's hypothesis, I hold,—1st, That most of the objections stated above to the Hunterian theory of the placenta apply also to that of Weber, as far, at least, as concerns a vascular connexion between the uterus and placenta. 2. That no competent proof is offered of the placenta being formed on the ideal plan he describes. 3. That the German physiologists are utterly at variance as to the facts upon which this hypothesis is founded ; thus, for example, Escricht, of Copenhagen, agrees with Weber on many points, while on others he proclaims his dissent, whereas Seiler entirely denies all vascular connexion between the placenta and the uterus,—all this implying that the hypothesis has been hastily concocted from assumed facts of a very questionable stamp, and not from original observation. 4. That this hypothesis is irreconcileable with a prominent fact than which there is no fact connected with the subject established upon a greater concurrence of high authority, namely, that the uterine surface of the placenta is covered by a smooth and firm reflection of the chorion. 5. That if tried by the acknowledged tests of evidence, the conflicting statements of alleged facts in support of the hypotheses of Hunter and of Weber nullify one another. According to the one the utero-placental vessels are few in number, and of considerable size,—according to the other, they are numerous, and of small size ; according to the one these vessels immediately after entering the placenta are lost in the cavities called the placental cells,—according to the other the placental cells have no existence, and these vessels retain their vascular form throughout the whole structure of the placenta.

Finally.—Seeing, then, that there are so many formidable objections to the other hypotheses, it seems impossible not to recognise the second as being the only true theory of the structure and functional office of the placenta, inasmuch as we have seen that observation, analogy, and reasoning from the undoubted facts of the case, all lead to the same conclusion,—namely, that the human placenta is formed upon the same type as its analogues in all the genera and orders of the class of mammals ;—that it is a portion of the fœtal appendages, having no connection with the maternal parts but by imbibition through its investing membrane ; and that its functional office is analogous to absorption by the intestinal tube and bears no analogy whatever to the process of respiration in adult animals.

APPENDIX A.

EXAMINATION OF THE PREPARATIONS OF THE GRAVID UTERUS IN THE HUNTERIAN MUSEUM AT GLASGOW

I FIND myself called upon to resume this subject, in consequence of having been obliged to leave one portion of my argument incomplete at the time I composed my papers on the Construction of the Placenta, which appeared in the MEDICAL GAZETTE during the months of July, August, and September, 1847. At that time, having never had an opportunity of inspecting the anatomical preparations in the Hunterian Museum at Glasgow, I was under the necessity of passing judgment upon those which relate to the construction of the placenta entirely at second hand, and principally upon the report of the authorities quoted by Dr. Lee, in his paper contained in the Philosophical Transactions for the year 1832. I have since had it in my power to inspect them carefully for myself, and consequently it becomes my duty to state publicly the results of my examination, as far as they bear upon the opinions advanced by me in my former communications. I think the present, moreover, a most fitting occasion to re-direct the attention of the profession to this question, as I find that a zealous advocate of the Hunterian hypothesis, in a late number of the MEDICAL GAZETTE, rests his defence of it on the appearances presented by these preparations: his words are—"Many years ago the Hunters demonstrated that vessels passed (pass?) from the uterus into the placenta, and the beautiful injections left behind them still remain to certify to this fact. Since then several attempts have been made to repeat these injections, *but without success*, and thus incontrovertible evidence seemed to be afforded in favour of the opinion that the placenta was (is?) entirely fœtal. The injections, and the doctrines founded upon them, were considered to be equally fallacious, &c." It thus appears that the evidence in support of the Hunterian hypothesis is now made to rest entirely upon the anatomical preparations contained in the Hunterian Museum. Whether or not the gentleman whose words I have just quoted has ever actually inspected these preparations, I have no means of knowing; but if he has, I must say that either he or I have been looking at the same objects through a coloured medium, and have drawn very different conclusions from the same data. Indeed, I may mention, that when I entered the Hunterian Museum, for the purpose I have stated,—although I must admit that I did so under the impression that the Hunterian hypothesis is at variance with a great law of the animal economy,—I did expect to meet with appearances by which I should be staggered, and fancied to myself that my mind for a time would be in such a state of suspense, as the Roman poet professes to have been, when called upon to pronounce judgment on the justice of a cause, which had the Gods on the one side, and Cato on the other!

"Victrix causa Diis placuit sed victa Catoni."

I was not a little surprised then,—I may almost say disappointed,—to find that, notwithstanding the imposing titles which certain of the preparations on the gravid uterus bear in the catalogue, there is not a single one of them which, when impartially examined, would warrant the inference drawn from them by the Hunters—namely, that arteries "of the size of

crow-quills, and veins of a considerable size," pass between the uterus and the placenta.

I now proceed to give literally the remarks which I wrote on these preparations at the time I made my examination of them. It would serve no good purpose, however, to detail my observations on all the preparations of the gravid uterus which I examined, as a very large proportion of them do not at all bear upon the question at issue ; and therefore I shall be content with selecting what I consider to be a sufficent number for forming a general judgment on the whole :—

No. 31, s.—A portion of the uterus at the place where the placenta adhered : the orifices of the torn veins full of plugs of coagulated blood : very remarkable. [*Very unsatisfactory : no certainty that what are here represented as vessels are vessels. The substance on the inner surface of the uterus evidently a portion of the maternal cotyledon much torn.*]

33, s.—A portion of the uterus in which the arteries had been injected red, the veins yellow : shows inside surface and the torn orifices of the veins filled with the yellow injection. [*Pieces of red wax, certainly having some resemblance to vessels, are to be seen, but they prove nothing as to the construction of the placenta.*]

34.—Ditto, shows ditto. [*Nothing certain can be made of this preparation ; very unsatisfactory.*]

96, s.—A portion of the placenta and its membranes : on the surface which adhered to the uterus may be seen some very small curling arteries injected red, and veins injected black, which are going to the cells of the placenta. [*I cannot make anything of this preparation. Substance of the placenta a mass of red wax.*]

100, s.—A small section of placenta with part of the membranes : the cells of the placenta have been filled from the veins of the uterus, and vice versa ; the cells are not very bare ; on the side which adhered to the uterus the veins may be seen very distinctly. [*Difficult to say what is meant here by the cells of the placenta. Quite an indistinct preparation.*]

106.—A section of uterus with membranes turned partly down, and showing a double layer of decidua. [*A beautiful preparation. What is called decidua, a mere film, seemingly devoid of regular structure.*]

118, s.—A section of uterus with placenta partly adhering and partly detached : showing in the angle the mode of adhesion. [*Very interesting, but no appearance of vessels at the angle. Quite at variance with the Hunterian hypothesis, as not exhibiting the utero-placental vessels.*]

124, s.—A small portion of the placenta and uterus, where the cells of the placenta have been iejected from the veins of the uterus ; the veins are seen very large, entering into the substance of the uterus : injection green. [*The green pieces of wax here taken for veins passing between the placenta and uterus, are as large as the femoral vein of an adult. Quite out of the question that this can be a correct preparation : evidently the result of laceration.*]

145, s.—A portion of the uterus with placenta adhering injected red : the cells of the placenta injected from the uterus. [*Difficult to make out what it meant by the cells : altogether the placenta is a confused mass.*]

147, s.—A portion of placenta with the cells apparently filled with fine injection of a red colour ; less distinct than when coarse injection is em-

ployed; the vessels of the navel-string are quite empty, although the vessels of the cells had been very minute, proving no communication. [*The entire mass of the placenta is here seen injected, except the cord; consequently the injection must have burst the vessels, even according to the Hunterian hypothesis.*]

149, t.—A portion of uterus and placenta; the arteries injected of a dark colour, and veins green: both vessels are seen entering into the substance of the placenta. [*Pieces of wax to be seen on the uterine surface of the placenta, but no reason to suppose that they are vessels.*]

158, t.—A portion of uterus and placenta; the placenta being partly detached, shewing veins injected green from the uterus, going into the posterior surface of placenta; the placenta itself injected with a different injection. [*Certainly no inference as to the construction of the placenta can be drawn from this preparation. The green substances are taken for vessels, but in all probability they are lacerations; the wax has burst the vessels.*]

160, s.—A placenta injected from the navel-string red, to great minuteness, most entirely unravelled, showing a most beautiful shag of vessels: it has been hardened by spirits of wine probably, and put into oil of turpentine. [*A curious preparation, but shows nothing in regard to the construction of placenta. Indeed, it seems at variance with the Hunterian hypothesis, for the whole mass of the placenta is injected from the umbilical cord.*]

(?) s. t.—A portion of uterus with placenta adhering; the vessels of the uterus injected red and black: the cells of the placenta are filled with a different injection, and therefore not from the vessels of the uterus, but must have been previously filled from the spongy surface of the placenta itself. [*What is here said about the cells is quite imaginary: here the mass of the placenta would seem to be injected from the uterine vessels. Preparation quite unsatisfactory.*]

176, s.—Section of uterus with placenta adhering: the cells of the placenta are injected from the vessels of the uterus. [*The centre is filled with a red injection from the uterus, but no appearance of vessels passing between the uterus and placenta.*]

178, s.—A small section of the uterus, with the veins injected green, and broken off where they are entering the placenta. [*Green pieces of wax are to be seen on the surface of the uterus, but no reason to suppose them truncated vessels.*]

From what I have now stated, it will be readily understood that, in my opinion, the preparations in the Hunterian Museum at Glasgow do not at all warrant the inference that there is any connection by arteries and veins between the uterus and placenta, and that the appearances of connection which they exhibit may all be reasonably supposed to be the result of laceration. At all events, as the collection exhibits the most contradictory appearances, it is indisputable that one is not warranted in founding any theory upon them. For example, No. 147 exhibits a placenta wholly injected from the uterus, while No. 160 is a placenta entirely injected from the umbilical vessels. Now most assuredly it will be admitted that one or other of these preparations must be incorrect, seeing they lead to incompatible and contradictory inferences. Then, again, who for a moment can

believe that vessels of the size of a femoral vein pass between the uterus and placenta, as exhibited in No. 124.? And, to give another example, when masses held to be vessels are exhibited in No. 124, how does it happen that the said vessels do not appear in No. 118, which exhibits an uterus with a piece of placenta partially detached from it?

I repeat, then, after a careful, and I conscientiously believe, an impartial inspection of the preparations of the gravid uterus contained in the Hunterian Museum, I do not fear to declare it as my decided opinion, that they do not at all warrant the inferences which the Hunters drew from them of a vascular connection between the uterus and placenta.

How the Hunters came to entertain these erroneous notions regarding the placenta I have partly explained in a former part of my communication; namely, that it was owing to their minds having been occupied by strong prepossessions in favour of the termination of the absorbent vessels in patulous mouths, and their prejudices against the doctrine of imbibition through membranes. It is a melancholy instance how a superior mind may be blinded by prejudices, that Dr. W. Hunter professed to have actually seen distinctly the terminations of the lacteals in an intestinal villus, and that the Museum of the Hunters contained preparations which were held to show decidedly the patulous orifices of these vessels.* With such unfounded prejudices and mistaken views, it was morally impossible that the Hunters could have solved the problem as to the mode of communication between the mother and fœtus in utero. How the opinions of the Hunters on this subject should still command authority in this country, can also admit of a ready explanation, when we advert to the extraordinary veneration in which their names have been held for the last sixty or seventy years; this is so much the case, that Mr. Samuel Lane, in his excellent paper on the Lymphatic and Lacteal System, in the Cyclopædia of Anatomy, complains that he found the minds of professional men had not yet freed themselves from the influence of the Hunterian views with respect to the parts performed by the lympathic vessels, and that we are still allowing ourselves to be misled by these impressions. It is now at least thirty years since our Gallic brethren overturned the doctrines of the Hunters regarding the Lymphatics, and yet we stuck to them down almost to the present date. We were long behind our neighbours, also, in admitting the possibility of absorption by veins and through membranes; but now, all must allow that on these points the Hunters were greatly in error. To allow, then, that they had also deceived us on the subject of the placenta appears altogether monstrous in the eyes of these ardent worshippers who are not yet prepared to cast off the Hunters as their professional Indigetes. What adds much to the tenacity with which their hypothesis on the placenta is still defended, is the circumstance that it is intimately connected with the art of midwifery, and that many of our standard authorities in this line, are already strongly committed on this subject, and naturally feel reluctant to believe and to confess that they have long been propagating erroneous doctrines on points of the most vital importance, as regards the lives of their fellow-creatures.

> Vel quia nil rectum, nisi quid placuit sibi, ducunt,
> Vel quia turpe putant parere minoribus, et quæ
> Imberbes didicere, senes perdenda fateri.

* See Mr. Lane's paper on the Lymphatic and Lacteal System, in the Cyclopædia of Anatomy, and Goodsir's Anatomical Essays.

This feeling, then, so well expressed by the poet in the verses just quoted, has operated powerfully in all ages, and for the reason which I stated it weighs very strongly with the obstetrical authorities at the present time. Hence some of them obstinately cling to the Hunterian hypothesis, while at the same time they admit facts bearing upon the question, which, to any unprejudiced mind, must appear quite decisive against their own opinions on the question as to the supposed vascular connection between the uterus and placenta. For example one of them lately made the following candid statement of facts: "The uterine surface of the placenta is covered by a delicate membrane, and seems to be so applied to the walls of the uterus as to close the venous openings on its surface without any direct connection with them. *The placenta may be peeled from the uterus more easily than the rind from an orange: no vessels seem to be broken.* The natural inference from these facts would be, that the placenta belongs altogether to the fœtus; that no maternal blood passes into it; and that any interchange between the blood of the child and the mother takes place only at the surface of the uterus, to which the placenta is applied like a cake of unbaked dough."—MED. GAZ., No. 1094, p. 826. On this remarkable passage I shall only remark, that the two facts here distinctly admitted appear to me quite decisive of the question at issue; for if the placenta can be peeled from the surface of the uterus more easily than the rind from an orange, without any vessels being seen to be broken, and if no vessels can be detected on the membrane which lines the uterine surface of a separated placenta, we may rest assured that the so-called utero-placental vessels are altogether ideal.

In the course of my examination of the preparations in the Hunterian Museum, I was much struck with one of them, and with the title it bears in the catalogue:—"No. 320, s.—A portion of gravid uterus from the cow, showing the oval fungus of the maternal part of the placenta, resembling in its surface pretty much a cauliflower. This and the foregoing preparation show that in many quadrupeds the maternal and fœtal parts of the placenta are quite distinct in structure from each other, and may throw light on the human placenta, where there is a more intimate connection between the fœtal and maternal portions."

Here then it would appear that W. Hunter had before his eyes a specimen of a placenta constructed upon a totally different type from what he conceived the human placenta to be—namely, with a complete separation between the maternal and placental portions, and where of course nutrition must take place by absorption through membrane. Strange! that it should not have occured to his acute mind, that if absorption through membrane can take place in one of the mammalia, there is every reason from analogy to suppose that the same vital process must operate in its congeners, and more especially in the highest genus of the class; and that if the secundines be entirely separated from the uterus in one of the genera, that there is every reason from analogy to infer the same of the others. But whatever their blind worshippers may say to the contrary, the minds of the Hunters, and especially of John Hunter, were not of a logical cast nor capable of entertaining any very enlarged general views on professional or scientific subjects. Had they been well trained in tracing the structural analogies in the animal kingdom, and in drawing legitimate inferences from them,

they could not have failed to arrive at the conclusion, that every other organ in the bodies of man and the ox are constructed on similar types—as, for example, the lungs, the heart, the liver, the kidneys, the bladder, the womb; nay, if even with regard to the contents of the cranium itself, which is as it were "the dome of thought and palace of the soul," every particular part in the brains of the two animals is formed on the same fundamental type;* it is contrary to all analogy to suppose that such crude structures as the secundines should be constructed on entirely different types, and that their functional office should be essentially different

And here I cannot deny myself the pleasure of introducing a quotation in which this train of thought appears to me very conclusive on the argument which I am now enforcing. "In all the principles of his internal structure, in the composition and function of his parts, man is but an animal. The lord of the earth, who contemplates the eternal order of the universe, and aspires to communion with his invisible Maker, is a being composed of the same materials, and framed on the same principles, as the creatures which he has tamed to be the servile instruments of his will, or slays for his daily food. The points of resemblance are innumerable; they extend to the most recondite arrangements of that mechanism which maintains instrumentally the physical life of the body,—which brings forward its early development, and admits, after a given period, its decay,—and by means of which is prepared a succession of similar beings, destined to perpetuate the race."—(Pritchard's Natural History of Man, p. 2.

From what has been here stated, I trust that it will be now generally admitted that I am warranted in drawing the following inferences:—

1. That a careful inspection of the preparations of the gravid uterus, in the Hunterian Museum at Glasgow, gives no support to the hypothesis advanced by the Hunters and their followers regarding the construction of the placenta, and the mode of communication between the mother and fœtus in utero.

2. That these preparations, by appearing to prove too much in regard to a vascular connection between the mother and fœtus, lose all claim to be held as competent evidence on the question at issue: since, for example, some of them exhibit vessels of the size of the femoral vein, passing between the uterus and placenta; and in others the whole substance of the placenta is injected from the uterus. *Qui probat nimium probat nihil.*

3. That considering how close an analogy subsists between the respective organs in the bodies of the ruminants and the human subject, it is highly improbable that their secundines should be composed upon totally different types.

4. That since no one pretends to say that there is an utero-placental circulation in any other animal, it is contrary to all analogy to suppose that such a process takes place in the human subject.

5. That the human placenta, if constructed in the manner represented by the followers of the Hunters, that is to say, if composed partly of fœtal and partly of maternal vessels, all blended together into one compact structure, would be an absolute monstrosity, without a parallel in the whole works of Nature.

* See Teidemann on the Fœtal Brain, *passim*.

6. That the shape of the fœtal globules indicates that they have not been derived direct from the blood of the mother.

7. That it being now universally admitted that the placenta can be peeled from the surface of the womb more easily than the rind from an orange, without any vessels seeming to be broken, and that there is no appearance of vessels on the uterine surface of an expelled placenta, it is impossible any longer to contend that the so called utero-placental vessels have any existence.

Lastly. That in the human subject, as in all other animals, the secundines are altogether a fœtal structure, and that no maternal vessels can possibly be lacerated at the separation of the placenta in natural labour.

APPENDIX B.

ON HUNTER'S PLATES OF THE GRAVID UTERUS.

BEFORE concluding I think myself obliged to notice the attempt lately made to bolster up the Hunterian Hypothesis by an appeal to the elegant Plates of the GRAVID UTERUS, published by Dr. W. Hunter, and of which a reprint was issued a few years ago by the Council of the Sydenham Society.

In the first place let me state decidedly, that I have no great faith in knowledge of anatomy acquired from plates, having seen many proofs of the fallaciousness of such delineations even when executed under the directions of the highest authorities. I request the reader's particular attention to the following confirmation of this statement taken from Mr. Guthrie's admirable work on Hernia. Mr. Guthrie gives four distinct engravings of the inguinal ring by the highest authorities in this line, along with the anatomical descriptions of these parts by Sir Astley Cooper, Cloquet, Blandin, and Velpeau, and then makes the following striking remarks :—

"The reader cannot fail to be surprised at the great difference which exists between these different versions of the same thing, and that a plain matter of fact and not of imagination; and a student in anatomy and surgery, on trying to reconcile them by an actual examination of the parts will find considerable difficulty in making his dissection correspond with any one of the descriptions which have been quoted. * * No student can look at the four engravings appended to this paper, and believe that they are intended to represent the same parts in the same stage of dissection, without drawing much on his imagination; yet they are really intended for that purpose. * * I dare hardly venture to give the reason which, in my mind, has led to the great apparent discrepancy of opinion which exists between so many able men on so plain a matter of fact. *It is possible that it may have arisen from the great minuteness with which it has been attempted to describe parts which scarcely deserve it, especially the fascia transversalis.*" p. 10. He adds, "If the student is taught to consider the fascia transversalis as a sheet of condensed cellular membrane divisible in some parts into two layers he will readily understand it." p. 11.

Now, I will here venture to affirm, that if the student of Fœtal Anatomy will compare the Hunterian engravings with one another, and with the preparations in the Hunterian Museum, and further will compare both with

the appearances which he will discover on actual dissection, he will find himself extremely puzzled, and come at last to the same conclusion respecting the *deciduæ*, as Mr. Guthrie does regarding the Fascia Transversalis, namely, "that this great discrepancy of opinion may have arisen from the minuteness with which it has been attempted to describe parts that scarcely deserve it":—for that, after all, these *membranæ deciduæ* are neither more nor less than concretions formed from the glutinous cement or mucous tractus by which the *chorion* is glued, as it were, to the inner membrane of the uterus I am fully persuaded. This has been my decided opinion for a good many years, and it is a great satisfaction to find all my opinions amply confirmed by the following descriptions of dissections lately made by Dr. Meigs, of Philadelphia, under so favourable circumstances as seemingly to preclude all suspicion of mistake.

"In a necroscopy made in the presence of Dr. Yardley and Dr. Wallace, I detached the whole of the placenta from the womb, after the careful injection made of the aorta by Dr. Wallace. Neither I, nor those gentlemen, upon the most minute and careful search, aided by good lenses, could verify the existence of even a single vessel passing from the womb to the placenta. We arose from the dissection equally and unanimously convinced that we had not seen a single vessel broken off, or pulled out in the slow, gentle, and most careful divulsion of the two utero-placental surfaces.

"During the epidemic of cholera here, I examined a womb within a very few hours after the death of the woman, in company with the late Dr. J. Hopkinson, then prosector at the University of Pennsylvania. He though an able anatomist, was unable, as I was, to detect anything broken, *save mucous tractus*, though the light and the glasses were good, and the most scrupulous care was used. A similar opportunity was enjoyed a few years since, in the Pennsylvanian Hospital, in a womb gravid with twins. *Here also I detected nothing but mucous tractus.* Another very fine specimen, at the seventh month, was afforded me by Professor Pancoast, at the Jefferson College. In this case many medical students observed the devulsion of the surfaces without detecting any vessels."—Treatise on Obstetrics, p. 178.

He thus states his conclusions:—"As I must confide in my own, rather than in other men's senses, I find it impossible, under my own observations, to adopt the views of the Hunters, and I prefer the opinions of Seiler and of Velpeau."

It thus appears that Historical research and the most recent observation lead to the same conclusion, namely:—

THAT THE HUMAN PLACENTA IS ALTOGETHER A FŒTAL STRUCTURE HAVING NO VASCULAR CONNECTION WITH THE MOTHER.

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