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SERIES EDITOR

RALPH M. WYNN, M.D.

Vice President for Medical Affairs, Ravenswood Hospital Medical Center,
Chicago, Illinois



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CONTRIBUTORS

Frances R. Batzer, M.D.

Philadelphia Fertility Institute; Assistant Clinical Professor, Pennsylvania Hospital, University of Pennsylvania, School of Medicine, Philadelphia, Pennsylvania

Michael M. Baylson, Esq.

Partner, Duane, Morris, & Heckscher, Philadelphia, Pennsylvania

Stephen P. Boyers, M.D.

Assistant Professor, Department of Obstetrics and Gynecology, Harbor-U.C.L.A. Medical Center, Torrance, California

Denis Cavanagh, M.D.

American Cancer Society Ed C. Wright Professor of Clinical Oncology; Director of Gynecologic Oncology, University of South Florida, College of Medicine, Tampa, Florida

Richard B. Clark, M.D.

Professor, Departments of Anesthesiology and Obstetrics and Gynecology, University of Arkansas for Medical Sciences, Little Rock, Arkansas

Stephen L. Corson, M.D.

Philadelphia Fertility Institute; Assistant Clinical Professor, Pennsylvania Hospital, University of Pennsylvania, School of Medicine, Philadelphia, Pennsylvania

Hans-Werner Denker, M.D., Ph.D.

Professor, Abteilung Anatomie, Rheinisch-Westfälische Technische Hochschule (RWTH) Aachen, Aachen, West Germany

Sherman Elias, M.D.

Northwestern University Medical Center, Director, Medical Genetic Services, Associate Professor of Obstetrics and Gynecology, Department of Human Genetics, Prentice Women's Hospital and Maternity Center, Chicago, Illinois

Henry W. Foster, Jr., M.D.

Professor and Chairman, Department of Obstetrics and Gynecology, Meharry Medical College, Nashville, Tennessee

Douglas M. Haynes, M.D.

Professor of Obstetrics and Gynecology, University of Louisville School of Medicine, Louisville, Kentucky

Robert W. Kelly, M.D.

Associate Professor and Vice Chairman, Department of Obstetrics and Gynecology at Wesley Medical Center, University of Kansas School of Medicine-Wichita, Wichita, Kansas

Donald E. Marsden, M.D., F.R.A.C.O.G.

Assistant Professor, Department of Obstetrics and Gynecology, University of South Florida, College of Medicine, Tampa, Florida

Thomas W. McDonald, M.D.

Associate Professor of Obstetrics and Gynecology, Associate Director of Gynecologic Oncology, University of South Florida, College of Medicine, Tampa, Florida

Paul G. McDonough, M.D.

Professor, Chief Reproductive Endocrinology Division, Department of Obstetrics and Gynecology, Medical College of Georgia, Augusta, Georgia

Ewa Radwanska, M.D.

Associate Professor, Department of Obstetrics and Gynecology, Rush Medical College, Chicago, Illinois

Christopher W.G. Redman, M.A., M.B., B.Chir., M.R.C.P.

Lecturer in Obstetric Medicine, Nuffield Department of Obstetrics and Gynaecology, University of Oxford, Oxford, England

Richard H. Reindollar, M.D.

Assistant Professor, Obstetrics and Gynecology, Reproductive Endocrine Division, Medical College of Georgia, Augusta, Georgia

Daniel K. Roberts, M.D., Ph.D.

Professor and Chairman, Department of Obstetrics and Gynecology at Wesley Medical Center; Professor, Department of Pathology, University of Kansas School of Medicine-Wichita, Wichita, Kansas

Eugene H. Ruffolo, M.D.

Clinical Professor of Pathology and Clinical Professor of Obstetrics and Gynecology, University of South Florida, College of Medicine, Tampa, Florida

Astride B. Seifen, M.D.

Associate Professor, Department of Anesthesiology, University of Arkansas for Medical Sciences, Little Rock, Arkansas

Gordon M. Stirrat, M.A., M.D., F.R.C.O.G.

Professor of Obstetrics and Gynaecology, Department of Obstetrics and Gynaecology, University of Bristol, Bristol, Avon, England; formerly, Clinical Reader in Obstetrics and Gynaecology, Nuffield Department of Obstetrics and Gynaecology, University of Oxford, Oxford, England

Christopher A. Sunderland, B.A., D.Phil

Research Associate, Department of Obstetrics and Gynaecology, University of Bristol, Bristol, Avon, England; formerly, Research Assistant, Nuffield Department of Obstetrics and Gynaecology, University of Oxford, Oxford, England

Michel Thiery, M.D., Ph.D.

Professor and Chairman, Division of Obstetrics and Gynecology, Department of Obstetrics and Gynecology, State University of Ghent, Ghent, Belgium

Sandra P.T. Tho, M.D.

Assistant Clinical Professor, Obstetrics and Gynecology, Reproductive Endocrine Division, Medical College of Georgia, Augusta, Georgia

Ian H. Thorneycroft, Ph.D., M.D.

Associate Professor, Department of Obstetrics and Gynecology,
Harbor-U.C.L.A. Medical Center, Torrance, California

Mary Van Sickle, Ph.D.

Clinical Instructor, Department of Obstetrics and Gynecology at Wesley
Medical Center, University of Kansas School of Medicine-Wichita,
Wichita, Kansas

Marion S. Verp, M.S.

Northwestern University Medical Center, Associate Director, Medical Genetic
Services, Assistant Professor of Obstetrics and Gynecology, Department of
Human Genetics, Prentice Women's Hospital and Maternity Center,
Chicago, Illinois

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HISTORY OF PLACENTAL STUDIES

DOUGLAS M. HAYNES

HISTORY OF PLACENTAL STUDIES

From the earliest times, the study of the structure and function of the placenta has engaged the interest and imagination of generations of physicians, other scientists, and laymen. Of special significance is the mystique that has always surrounded this organ, to which magical and supernatural properties have often been ascribed.

The term "placenta" is of comparatively recent origin, having been first introduced as a systematic descriptive term in 1559 by Realdus Columbus in the treatise *De Re Anatomica* (Fig. 1). Columbus used the Latin phrase *placenta uterina*, or "uterine cake," derived from the Greek *πλακουζ*, "flat cake." The term *πλακουντα* was appropriated by the Renaissance anatomist Gabriele Fallopio, a pupil of Vesalius, and Garrison in his *History of Medicine* attributes the naming of both the placenta and the vagina to Fallopio. The term "placenta" was first used in English writings in 1677, while the vernacular "afterbirth" did not appear in English until 1691.

Despite the late acquisition of its standard nomenclature, knowledge of and interest in the "afterbirth" is attested to by references to it in various ancient literatures. Among the earliest specific indications of this interest is the depiction of a placenta on an ancient Egyptian royal sculpture, dating from 3400 B.C., which was found in Hierakonopolis (Fig. 2). Here the ceremonially crowned Pharaoh is seen in solemn procession preceded by attendants, one of whom represents the Pharaoh's "Soul" and is pictured as a personified placenta with its dependent umbilical cord. Special importance has been attached to the fate of the placenta among primitive peoples. This tendency persists in the attitudes of contemporary primitive peoples, especially in African tribal societies. Primitive Hindu traditions prescribe the hastening of the delivery of a sluggish placenta by using emetics, external pressure, and shaking of the parturient.

Although neither the Greeks nor the Romans had a consistent name for the placenta as a unit, retention of the placenta is discussed in the *Corpus Hippocraticum*, and some methods for promoting its expulsion are noted. One method was to seat the woman on a chair with a hole in it designed for fumigation, and place the infant on the



Fig. 1. Frontispiece of the first edition of *De Re Anatomica* by Realdus Columbus, 1559, in which the term “placenta” was first used. (From Boyd & Hamilton: *The Human Placenta*. Courtesy of Macmillan Publishers, Ltd. London.)

floor on filled water bags, which then were punctured. As the water slowly escaped the infant descended and pulled the placenta after it. This description is of interest because it is evidence that from the earliest times attendants at childbirth have been aware of the hazards associated with forcible traction on the umbilical cord.

Some of the component parts of the placenta were recognized and named in classical Greek writings. Thus, Aristotle (384–322 B.C.) first used the term “chorion,” and wrote an early description of the yolk sac of vertebrates. However, the detailed description of placental morphology had to await the extraordinary renaissance of anatomy in the early sixteenth century. The lack of structural information prior to that time did not prevent the writing of practical directions for the clinical management of delivery of the placenta.



Fig. 2. The figure reproduces part of a sculpture on an Egyptian ceremonial slate of 3400 B.C. found at Hierakonopolis. In it the Pharaoh, wearing the crown of Lower Egypt, is depicted in a ceremonial procession preceded by five attendants, four of whom are bearing standards and the last of which is thought to represent the royal placenta (the Pharaoh's secret helper) with the dependent umbilical cord. (From G. Elliot-Smith: *Human History*. Reproduced by permission of Jonathan Cape, London.)

Aetius of Amida (fl. 550) wrote 100 capitula on obstetrics and gynecology, relying mostly on Soranus, but also on Hippocrates, Galen, Philumenus, and Aspasia. Aetius noted the dangers of forceful extraction of the placenta, but external expression seems to have either been taken for granted or to have dropped out of sight, so that the only technique described was that of internal manual extraction.

Paul of Aegina (625–690) wrote:

Often, after the removal of the foetus, the placenta (which is also called the secundines) is retained in the uterus. When the mouth of the uterus is dilated and the placenta separated, and rolled into a ball in some part of the uterus, the extraction is most easy. The left hand warmed and anointed is to be introduced into its cavity, and the secundines extracted as they present. But if they adhere to the fundus uteri we must introduce the hand in like manner, and grasp them and pull them along, not straight down for fear of prolapsus, not with great violence, at first from this side to that, and afterwards somewhat more strongly, for thus they will yield and be freed from their adhesion. If the mouth of the uterus be found shut we must have recourse to the same treatment. If the strength is not sunk, sternutatories and fumigations with aromatics in a pot may be used; and if the mouth of the womb dilate, the hand is to be introduced and an attempt made to extract the placenta, as aforesaid. If even in this way it cannot be extracted, one need not be alarmed, for after a few days it will putrefy, dissolve into sanies and drop off.¹

Galen (ca 130–200), the only important contributor to embryology in the classical era (except for Aristotle), wrote a treatise, *De Formatu Foetus in Utero*, on the subject. It was his dictum that a direct communication exists between the maternal and fetal circulations, consisting of an artery and a vein originating in the uterus and extending into the placenta. The artery was said to contain “spiritual blood” which had the function of maintaining the placenta’s innate beats, and the vein provided “alimentary blood” to nourish its tissue. He drew an analogy between the vessels of the placenta and umbilical cord and the roots of a tree, and compared the hepatic branchings of the umbilical vein with its branches.

During the period of the Renaissance the most celebrated world cultural figure to interest himself in human reproduction was Leonardo da Vinci (1452–1515). In the Windsor collection of sketches attributed to the years 1510–1512 (Fig. 3), there is a drawing of the fetus *in utero* from which it is evident that Leonardo’s concept of the human placenta and membranes was derived from his observations on comparative anatomy. He depicted the human placenta as that of ungulates, a confusion shared by other sixteenth century anatomists.

The most important contribution to the understanding of the placenta to emerge during the sixteenth century was the treatise *De Humano Foetu*, published in 1564 by Arantius. He was the first to state clearly that Galen’s notion of a direct vascular connection between the mother and the fetus *in utero* is incorrect. For promulgating this doctrine, Arantius was taken to task by Fabricius ab Aquapendente (1533–1619), the “celebrated master of the still more celebrated Harvey,” who on this particular point



Fig. 3. A portion of a page from the Windsor collection of sketches by Leonardo da Vinci, attributed to the years 1510–1512, in which a drawing of a fetus *in utero* is shown. (Reproduced by gracious permission of Her Majesty Queen Elizabeth II.)

regarded the Galenical dogma as sacrosanct. In his *De Formato Foetu* of 1600, Fabricius stated that the fetal vessels are plugged into the placental maternal vessels. He followed Arantius in the mistaken notion that the arteries of the mother carry vital spirits to the fetus, and that only the veins carry blood.

Fabricius' most important contribution to placentology was his demonstration of valves in the veins, a discovery which was partly responsible for leading William Harvey on to his epochal achievement, the discovery of the circulation. Harvey's views on mammalian reproduction were strongly influenced by the opportunity provided him by Charles I to study deer specimens from the royal forest. In *De Generatione Animalium* (1651), he suggested that in the mammalian conceptus the maternal blood does not pass directly to the fetus, but requires some transforming process to become an aliment suitable for absorption by the fetal vessels. Since such a concept rules out direct vascular connections, Harvey rejected Fabricius' theory of the exact juxtaposition of the two sets of vessels. By logical deduction Harvey concluded that the two blood streams must be separate, each stream flowing in an opposite direction to the placenta through its arteries and returning by its own veins. Although Harvey's work abolished the Galenical concept of end-to-end anastomoses of the fetal and maternal vessels, he did not know what to substitute for the old concept, since he was unaware of the existence of the capillaries; as a consequence, he had no way of explaining how the blood passed from arteries to veins through the tissues.

It was Malpighi who in 1660 published his account of the capillaries and thereby provided an anatomical basis for the regional circulation. Also in this period, John Mayow (1643-1649), while studying the oxygenation of the blood, proposed the theory that the maternal blood supplies the fetus not only with food, but with oxygen (nitro-aër). Nevertheless, Johannes Müller (1801-1858), the greatest German physiologist of his time, ignored Mayow's dictum as late as 1840, holding that respiration in the fetus is effected, not by the placenta, but by a special juice or plasma secreted in the maternal blood.

The seventeenth century embryologists collectively formulated the basic idea of a "placental barrier," and had a nebulous idea of processes later to be understood as mechanisms involved in feto-maternal transfer, filtration, diffusion and osmosis.

In the history of the obstetrics of the seventeenth century, importance attaches to the work of Louise Bourgeois or Boursier (1563-1636), a pupil of Ambroise Paré and the most famous of midwives, attached to the person of Queen Marie de Médicis. Reputed for her caution and great skill, she was much sought after by the French aristocracy after the fortunate delivery of the future Louis XIII. He was born in a state of asphyxia, but is said to have been saved by the midwife, who forced into his mouth a few drops of wine. She made a number of valuable observations, especially as to detachment of the placenta. She attended the birth of six royal princes, but was fiercely attacked by her enemies, particularly after the death of the Queen's daughter-in-law, Marie de Bourbon Montpensier, who died of a puerperal peritonitis for which la Boursier was held responsible. When one reads the report of the physicians today, the accusation seems to have but little foundation. Another important French obstetrician, André Levret (1730-1780), formulated methods for the diagnosis and treatment of placenta previa.

William Smellie (1697-1763), one of the foremost English teachers and practi-

tioners in the eighteenth century, wrote as follows about the management of the delivery of the placenta:

For the most part, in ten, fifteen, or twenty minutes, more or less, the placenta will come away of itself; and though some portion of it, or of the membranes, be left in the uterus, provided no great flooding ensues, it is commonly discharged in a day or two, without any detriment to the woman; but, at any rate, if possible, all the secundines ought to be extracted at once, and before you leave your patient, in order to avoid reflections. I find that, both amongst the ancients and moderns, there have been different opinions and directions about delivering the placenta, some alleging that it should be delivered slowly, or left to come of itself; others, that the hand should be immediately introduced into the uterus, to separate and bring it away. Before we run into extremes of either side, it should be considered how nature of herself acts in these cases. We find, in the common course of labours, that not once in fifty or a hundred times is there anything more to be done than to receive the child. Some of the ancients have alleged that no danger happens on this account oftener than once in one thousand labours; and as nature is, for the most part, sufficient of itself in such cases, it is very rare, perhaps not once in twenty or thirty times, that I have occasion to separate, as it generally comes down by the common assistance of pulling gently at the funis, and the efforts of the woman. I also find that the mouth of the womb is as easily dilated some hours after delivery as at any other time; so, in my opinion, we ought to go in the middle way, never to assist but when we find it necessary; on the one hand, not to torture nature when it is self-sufficient, nor delay it too long, because it is possible that the placenta may sometimes, though seldom, be retained several days; for if the uterus should be inflamed from any accident, and the woman be lost, the operator will be blamed for leaving the after-birth behind.²

As quoted by McClintock, Smellie discussed placental separation as follows:

Placental separation proceeds from all the foregoing diseases and accidents that happen to the mother; from violent shocks, strains, over-reachings, falls, and bruises on the abdomen; as also from vehement coughs, vomitings, or straining at stool when the body is costive. The separation of the placenta is always accompanied with a discharge of blood from the vessels of the uterus, more or less, according to the term of pregnancy, or as the placenta is more or less detached. It is happy for the woman in this case when she is so near the full time that she may be sustained till labour is brought on; and this may be promoted, if the head presents, by gently stretching the mouth of the womb, which being sufficiently opened, the membranes must be broke; so that the waters being evacuated, the uterus contracts, the flooding is restrained, and the patient safely delivered. At any rate, if the hemorrhagy returns again with great violence, there is no other remedy than that of delivering with all expedition. . .

Although the great danger is from flooding when near the full time, yet, if labour can be brought on, the os uteri is easily dilated with the labour or the hand; but in the sixth or seventh month it takes longer time and is stretched with greater difficulty, which is sometimes the occasion of the danger at that period.

The edge or middle of the placenta sometimes adheres over the inside of the os internum, which frequently begins to open several weeks before the full time; and if this be the case, a flooding begins at the same time, and seldom ceases entirely until the woman is delivered; the discharge may indeed be intermitted by coagulums that stop up the passage; but when these are removed, it returns with its former violence, and demands the same treatment that is recommended above.²

During the century lapse from 1750 to 1850, the nature of the placental circulation and of the intervillous space was clarified; the histology and cytology of the placenta and membranes were described; the embryology of the human placenta was established; and there was a growth of knowledge of reproductive physiology in general and of placental