

Braggarts unborn a consideration of life before birth

by

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When a man is born he is already nine months old. The Chinese used to recognise this and to regard themselves a year older than did a European born at the same moment. Sir Thomas Browne, physician, poet and subtle blender of the Latin and the Saxon tongue, speaks of this when he says: "Some divines count Adam thirty years old at his creation because they suppose him created in the perfect age and stature of man, and surely we are all out of the computation of our age and every man is some months older than he bethinks him."

The idea has long been popular with poets and more recently with psychiatrists also, that the uterus or womb where we spend the prenatal period of our lives is a place of peace and a haven of safety "where the green swell is in the haven dumb and out of the swing of the sea"; that our birth is but a sleep and a forgetting, an individual paradise lost whence we come trailing clouds of glory too soon to be dispelled.

But surely Sir Thomas was nearer the truth when he declares that "we live, move, have our being and are subject to the actions of the elements and the malice of diseases in that older world the truest microcosm, the womb of our mother." Just how contrary the elements there may be and how deadly the diseases, can be seen if we consider the age distribution of mortality from conception till old age, when it is clear that if we survive birth, we are not again exposed to such mortal risks until we fall prey to the diseases of old age.

It is difficult for us in this country and in these modern days of widespread education to appreciate the mystery and awe that surrounded the reproductive processes in earlier times and

among primitive peoples. Speculations of a mystical and religious nature at first universal, were replaced in the writings of Aristotle by a predilection for direct observation, but progress was long retarded by the absence of adequate means of investigation and little advance could be made until after the invention of the microscope towards the end of the seventeenth century. Although the relatively large ovarian follicle which contains the mammalian egg was recognized in 1672 about thirty years after Sir Thomas Browne had written the words that I have quoted, the tiny egg itself was not seen until over a hundred and fifty years later, and the significance of sperm and ovum was not at first appreciated.

In the absence of accurate knowledge speculation thrives and so it was here; two main types of theory arose both postulating that the new individual was contained or encased in the germ cell of one of the parents. One school taught that the female germ cell, the egg or ovum, contained the new individual who was stimulated to grow by the seminal fluid. The protagonists of the other theory held that the new individual was contained as a minute man or homunculus about one two hundredths of a millimetre long, in the head portion of the male germ cell or spermatozoon. Their views were caricatured by Laurence Sterne in *Tristram Shandy*—"the Homunculus," says that hero "in however low and ludicrous a light he may appear to the eye of folly and prejudice;—to the eye of reason in scientific research, he stands confessed—a BEING guarded and circumscribed with rights—consists, as we do, of skin, hair, fat, flesh, veins, arteries, ligaments, nerves, cartilages, bones, marrow, brains, glands,

genitals, humours and articulations;—is as much and as truly our fellow creature as My Lord Chancellor of England.” This absurd controversy dragged on until the early part of the eighteenth century, when a new and active school of embryologists ushered in original and stimulating ideas of progressive growth and differentiation that soon ousted the old encasement theories. We now know, as the result of much detailed observation and experiment by several generations of embryologists and biologists all over the world that the individual begins from two cells, one derived from the male parent, the other from the female, which fusing at the moment of conception subsequently divide continuously eventually supplying all the cells of the new individual. After the conceptus has established itself in the uterine cavity growth proceeds rapidly,—during the second month at a rate of about one millimetre a day, then for the remainder of intrauterine life at an average rate of about one and a half millimetres a day. This at first sight may seem slow enough, but if it were continued unabated after birth, at ten years of age the individual would be twenty feet tall! If we consider the increase in weight the results are even more impressive for before birth the growing conceptus increases in weight by some six billion times and it has been computed that if this rate were maintained thereafter the adult would weigh two billion times the weight of the earth!

The appearance of the conceptus also changes markedly during the early weeks of intrauterine life. The original shape of the embryo is quite unlike the adult; at first a spherical mass of cells like a mulberry,—hence the embryological term ‘morula’,—it soon becomes a flattened ovoid disc and then a cylindrical body without any indication of arms or legs. Throughout these early stages we speak of the growing individual as an embryo and later, some time towards the end of the second or the beginning of the third month of development when it begins to look more or less human, we drop the term embryo and speak of the product of conception as a foetus.

Long before embryologists were able to study in detail the early stages of human development philosophers had for centuries thought and argued about a related but much more

difficult problem—the time of entry of the human soul into the developing body. Aristotle in his *De Animalibus* had propounded the theory that as the conceptus develops it is endowed first with a vegetative, then with a sensitive, and finally with a rational soul, each of which successively possesses the gradually developing body. Ancient Jewish law had distinguished between a ‘formed’ and a ‘non-formed’ foetus, thus if a pregnant woman were injured so that she miscarried, the penalty imposed upon her assailant depended upon the stage of development of the foetus. If it were ‘formed’ that is recognisably human in shape, its destruction was deemed equivalent to murder and carried the death penalty “then thou shalt give life for life.” If however the foetus were unformed and the mother survived, payment of a sum demanded by the woman’s husband, and agreed by the judges, was all that the law required. This notion still persists to-day and was recently given by a woman abortionist as a justification for her behaviour. “After all,” she is reported as saying when interviewed in Holloway prison, “there is no life before three months, only a little thing in a jelly bag. Abortion—that’s once a child is formed; I would never touch a child.” Although the importance of the human soul in Christian theology gave new urgency to the problem and exercised the minds of the greatest thinkers of early and mediaeval Christendom, there was little agreement amongst authorities until the seventeenth century on how and when the *anima rationalis* entered the developing conceptus. Some believed with Gregory of Nyssa that body and soul come simultaneously into existence. Others influenced no doubt by Aristotelian thinking held with Gennadius of Marseilles that the foetus “feeds, moves and grows and receives a human form in the womb before it receives a rational soul.” Amongst the adherents of this doctrine there was no unanimity as to the exact time when the soul entered the body. Many took the view derived indirectly from a passage in Leviticus relating to the purification of women after childbirth, that the soul entered the male foetus on the fortieth, and the female on the eightieth day. Others influenced by Hippocrates favoured the thirtieth day for males and the fortieth for females. But it seems that all these authors were merely indicating a likely date and not attempting to

fix rigorously an exact moment in time. In the absence of any help from embryologists, who as we have seen are unable accurately to divide the life of the foetus into pre-human and human stages, it seemed most logical to accept with Origen, that most distinguished and influential theologian of the ancient church, either conception or birth as the critical moment when the soul becomes incarnate in human flesh. If the latter had been accepted the foetus would more often have been exposed to serious risk throughout intrauterine life at the hands of the desperate or the unscrupulous. It is not astonishing therefore that during the seventeenth century there was a marked and sustained swing of official theological opinion in favour of immediate animation at the moment of conception, based one suspects, more upon the practical considerations of what would best serve the interests of the foetus than upon any profound conviction, logical thought, or scientific observation. Our present laws relating to abortion and foeticide stem from this doctrine, and while they may be unsatisfactory in some ways they undoubtedly play an important part in protecting human life at the most vulnerable stage.

Although it is not possible to define the precise time when an embryo becomes a foetus the terminology is nevertheless useful since the most dangerous period as far as the production of foetal abnormalities is concerned is during the earlier embryonic phases of development, when body structures and organs are being laid down. It is therefore during these early weeks of development that the foetus must be protected if possible against adverse influences such as drugs, chemicals, infections and X-rays. During the later foetal stages the very marked changes that occur are mainly due to growth in parts already laid down during the embryonic phase and the foetus which is becoming increasingly human in appearance is now much less susceptible to adverse influences.

One of the oldest beliefs of mankind and one of the most productive of apprehension and unhappiness in expectant mothers, is the superstition, still unfortunately extant, that if a woman be "discontented or disquieted, or if by any casualty she be affrighted or terrified by some fearful object heard or seen, she endangers her child" who may then be born

"Full of unpleasant blots and sightless stains. Lame, foolish, crooked, swart, prodigious. Patched with foul moles and eye offending marks."

Numerous references to the effects of such maternal impressions are to be found in the literature of many different cultures at all periods of their history. Perhaps the earliest recorded is that in Genesis 30 where we read how the crafty Jacob enriched himself at the expense of his father-in-law by exposing the ewes in his flocks to the unexpected mottled effect of rows of saplings peeled in strips, and so influencing the markings of the newborn kids and lambs.

Although happily such auditory and visual influences cannot have any direct effect on the foetus since there is no anatomical connection by nerves or other tissues between the mother and her unborn child, it is now well known that in its early formative stages the embryo is susceptible to injury as a result of exposure to certain substances which may be present in the maternal bloodstream. Two such toxic materials become notorious of recent years are the virus of Rubella or German Measles and the drug Thalidomide.

There is now no doubt that a woman who develops Rubella during the early weeks of pregnancy is at a considerably increased risk of bearing an abnormal child because of the ill effects of the virus on the embryonic tissues. This is not however to say that all such children will be abnormal, nor that all such abnormalities will be severe; and while some take the view that pregnancy should always be terminated in these cases, this is, I believe, much too dogmatic and extreme an attitude and each case must rather be carefully considered on its own merits. Certainly to say as some have done, that there is in these circumstances an indication for termination on behalf of the foetus is quite illogical, for it can be held with great pertinence that "melius est essi quam non essi—it is always better to be than not to be," and certainly none would suggest euthanasia as a cure in the adult for blindness, deafness or heart disease, which are after all the most serious afflictions that may result from maternal Rubella.

The tragedy of the thalidomide babies is still fresh in our minds. Fortunately the danger

was recognized at an early stage and no longer exists as far as this particular drug is concerned. This does not mean however that no more babies will be born with deformed or absent limbs in future, for such deformities were known for hundreds of years before thalidomide, and can be genetic in origin or due to other unknown causes. It is of interest in this regard that among the drawings by Goya known as the "black border" series, executed in 1810 to 1820, there is one in the Louvre in Paris of "A Mother revealing her deformed Child" where the abnormality appears to be identical with that caused in some instances by thalidomide. Much more research and experimental work remains to be done before we can even begin thoroughly to understand, and so to prevent, congenital abnormalities in the human.

Although the heart of the embryo first begins to beat shortly after the beginning of the fourth week of intrauterine life it cannot be heard with the stethoscope much earlier than the end of the fourth month, when also the mother becomes aware for the first time of the stirring of the foetus within her. This foetal movement or quickening has served throughout the ages as a reliable sign of a progressing pregnancy. It is astonishing that so little use has been made of such a dramatic incident by novelists and playwrights, but little reference is made to quickening in literature generally. In Holy Writ, for example, only the evangelist of St. Luke's gospel describes how the foetus that was to become St. John the Baptist leaped in the womb when his mother was visited by Our Lady. Perhaps it is significant that traditionally St. Luke is believed to have been a physician, and if so would doubtless have been well versed and interested in the signs of pregnancy. Shakespeare makes only passing reference in *Love's Labour's Lost* to the phenomenon—and incidentally gave me the title for this lecture—"the poor wench is cast away" says Costard to Armande in Act V Scene II, "she's quick; the child brags in her belly already." George Moore in "*Esther Waters*" describes how his unfortunate heroine, absent-mindedly brooding over her desertion by her worthless lover, suddenly became aware that "something awoke within her, something that seemed to her like a flutter of wings; the truth"—that she was pregnant—"was borne in upon her." In modern literature

despite its preoccupation with psychology and sex, I can find only one reference to quickening—in Miss Lynne Reid Bank's recent novel "*The L-Shaped Room*." The heroine Jane, then about six months pregnant, when asked if the baby had started to move yet replies "I think so—there've been little movements for a month or more—not real kicks though. Some babies are more peaceable than others."

In order to give the foetus room to move and grow and to protect it from compression by the uterine walls and other forms of physical injury, it is enclosed within the womb in a double layer of membranes, the amnion and chorion, forming a sac which towards the end of pregnancy contains some two litres of a cloudy fluid—the liquor amnii. The foetus is thus suspended weightless in a warm pool at a constant temperature, cut off altogether from stimulation by light, and to a considerable extent by touch, sound or change in temperature also. Such an arrangement is found only in the embryos of non water-living forms and it is permissible, if somewhat fanciful, to think of the embryos of air-living forms swimming to-day in their amniotic pools much as did their remote ancestors in the warm archaean oceans of primeval times. The terms amnion and chorion are taken directly from the Greek, amnion being a derivative of *amnos*, a lamb, and one can imagine the word first used by some ancient shepherd on the hills of Greece at lambing time. Amnion also means the caul, or king's hood, the little cap of membranes occasionally present on the head of a newborn baby which is credited to this day with the power, if carefully dried and preserved, of protecting its owner from drowning. The great eighteenth century obstetrician William Smellie, whom we revere as the father of British midwifery, was contemptuous of such fancies, and remarks with some asperity "I never tell the good women whether or not the membrane remains upon the child's head, that they may not have an opportunity of indulging an idle superstition." If this seems unduly severe to our modern ears we must remember that midwifery in the eighteenth century was riddled with superstitious practices which only too often resulted in disaster. Smellie was attempting against very considerable odds to apply scientific methods to the obstetric art, and reckoned I suppose that he

cannot afford to sanction any superstition, however picturesque.

At the moment of birth the infant finds himself suddenly exposed to a bewildering variety of new stimuli as a result of exposure for the first time to light, to marked variations in noise, temperature, touch and to the effect of gravity. Although there is little experimental evidence available it is difficult to doubt that such external stimulation plays an important part in the onset of breathing and crying in the newborn.

Occasionally the foetus cries before it is born. This is the remarkable but well documented phenomenon of the *vagitus uterinus*—the intrauterine cry—which on rare occasions follows artificial or spontaneous rupture of the membranes, when the liquor amnii can escape and air enter the uterus, thus allowing the foetus to breathe and cry. This was first reported in Europe by Jubus Vincelius in 1546, but is said to have been known to the ancient physicians of Bayblon and Assyria. It is described by some of the older European writers as “a cry or joyous exclamation” heard from the abdomen of a pregnant woman sometimes audible from quite a distance. Tradition has it that Zarathustra, famous in antiquity as the founder of the wisdom of the Magi, and Mahomet, prophet of the one true God, both called out in the womb. In Christian hagiology we read that St. Bartholomew also cried out before his birth, perhaps in protest against his imminent expulsion into a world where he would be flayed alive.

Although the foetus is isolated in the amniotic sac from strong stimulation, nevertheless it is exposed to certain tactile and auditory impressions. The tactile stimuli are set up by the mother's movements as she breathes and walks about; and the auditory arise from her heartbeat conducted through the uterine wall and the liquor amnii to the auditory system of the foetus. As a result the foetus is in a very favourable situation for the phenomenon known as imprinting to occur. Imprinting may be defined as the process whereby an organism develops a tendency to remain in proximity to the first stimuli it receives. It is irreversible, unlike associative learning, and its effects continue beyond early life. It has been observed that

when imprinting has taken place the organism tends to remain free from anxiety while in the neighbourhood of the stimulus. It is a matter of common experience by those who have to look after infants that they appear to have a feeling of contentment and security when they are picked up and carried about—especially in the early hours of the morning—and it has been suggested that this is evidence of tactile imprinting during foetal life. Investigations conducted in newborn babies and young children also indicate that the sound of the maternal heartbeat, either real or simulated, also has a relaxing effect, so that if they are exposed in the nursery to the sound of a normal heart beating at seventy-two beats per minute, they cry less, eat more and grow faster than do a control group not exposed to heartbeat sounds or exposed to other sounds. It has also been shown that the foetal heart rate can be significantly increased by pure tones applied to it through the maternal abdominal wall, even when the mother herself is prevented from hearing the sounds. Both rhesus monkey and human mothers usually hold their babies on the left side, close to the heart, and among several hundred works of art depicting a child in the arms of an adult, in eighty per cent the infant was held in this way. It is of interest also that the word heart has a marked emotional connotation, and is often used in association with feelings of grief or affection. All these observations may be explained by the assumption that imprinting of the maternal heart sounds occur during the prenatal period and continues to influence behaviour even in adult life.

That the foetal heart beats audibly in utero was known long before Laennec invented the stethoscope in 1319. The first literary reference to the phenomenon is in an ode written in Limousin in his native dialect by Phillipe Le Goust, describing how his physician friend Marsac, also a poet, had noted that the foetus “jumps, turns, whirls, moves about freely and is able to change its position frequently,” and that its heart beats “comm' un traquet” like a millclapper. It was a century and a half later—Le Goust's poem was published in 1650—that Francois Maior, a Swiss surgeon interested in forensic medicine, rediscovered the foetal heart sounds, and affirmed that he could “recognize with certainty if a foetus near term is living or

not, by applying his ear to the mother's abdomen." Auscultation of the foetal heart with a stethoscope was first described three years later in 1821 by Jacques Alexandre Lejumeau De Kergaradec, Laennec's friend and pupil. A Breton nobleman of ancient line, Kergaradec had as a child of seven narrowly escaped the vengeance of the revolutionaries. He and his four young brothers were thrown into prison as the children of an emigre aristocrat father—Paul Olivier Comte De Kergaradec had fled from France the previous year in 1792. The children would certainly have died by the guillotine had not Robespierre just then fallen from power and suffered that fate himself, so bringing the Terror to an end. Kergaradec was impressed by the value of Laennec's recently invented stethoscope in the diagnosis of diseases of the chest. It occurred to him that it might be possible to detect the waves set up in the liquor amnii by foetal movements after rupture of the membranes, and it was while attempting to do this that he heard the typical double note of the foetal heart; thereafter he showed that the phenomenon was demonstrable as early as the fifth month of pregnancy. It is interesting to note that most obstetricians in this country still favour the Laennec or monaural type of stethoscope for auscultation of the foetal heart even to-day.

The rate and rhythm of the foetal heart as detected by the ear of the observer has for many years served as an indication that all is, or is not, well in the intrauterine environment. For a number of years attempts have been made to improve on this rather primitive method of diagnosis by recording the foetal heart sounds and subsequently analysing them in greater detail. This can be achieved by electronic methods for either the actual sounds of the foetal heart, or the electrical impulses associated with each heart beat, which are the basis of the well known electrocardiogram of the adult. In this way it should be possible to note over as long a period of time as necessary, the rate and rhythm of the foetal heartbeat and most important its response to stimuli, such as the contraction of the uterus or the general condition of the mother. Unfortunately numerous difficulties arose and are only gradually being overcome. The foetus, remote from the observer, and surrounded by the liquor amnii, the

foetal membranes and the tissues of the mother, is much more difficult to study than is the adult to whom instruments can be directly applied. At present most recordings of foetal phenomena must be made through the maternal tissues, for example by applying electrodes to the mother's abdomen directly over the foetus. It is easy to understand that signals from the foetus are likely to be confused or jammed by the often much stronger signals arising in the body of the mother. Techniques originally developed for monitoring space probes are now being adapted for the study of the foetus who, although much closer to us than any Sputnik, yet paradoxically is so much farther away, as far as monitoring is concerned.

The benefits of the recent advances in the science and practice of medicine have been shared by the foetus in utero. Since 1927 the number of babies born dead in this country each year has been more than halved. This has been due partly to advances in nutrition, anaesthesia, blood transfusion techniques, and the control of sepsis by antibiotics and sulphadiazine drugs, and partly by the improved care of pregnant women, the result of inspired and arduous work by individuals all over the world.

However, the fall in the stillbirth rate has greatly slowed since 1948. This is apparently because the full effects of the factors we have mentioned have now been obtained and if we are to lower the stillbirth rate still further, and there is no doubt that this can be done, we must attack those conditions that are the major cause of stillbirth to-day, namely, foetal lack of oxygen and congenital malformations, which are responsible for more than one-half of all stillbirths to-day. This requires prolonged and carefully planned observation of human pregnancy and its complications as well as experimental work on laboratory animals, especially the primate monkeys that are closest to man on the evolutionary scale. Obviously this cannot be done by obstetricians, however dedicated, in their all too scanty leisure hours. It requires the uninterrupted work of teams of expert biophysicists, biochemists, physiologists and endocrinologists working in close co-operation with obstetricians, paediatricians, psychologists and sociologists in suitably equipped laboratories and hospitals, for despite a great deal of

experimental work on other animals we possess to-day remarkably little detailed knowledge of the biochemical environment of the human foetus and its effects on subsequent development physical and mental. Obstetricians as well as civil servants are too prone to gauge success in childbearing by the percentage of babies that survive birth but even if we can reduce the stillbirth rate to half its present level, serious problems will still confront us. Surely the health and intelligence of our adult population would be a surer guide. We know that adverse intrauterine conditions not severe enough to kill, can result in permanent physical damage in the form of various nerve disorders of which cerebral palsy is a notorious example. Even where there is no obvious physical damage, there is evidence that mental power and balance may be affected so that mental deficiency, epilepsy, behaviour defects and inability to learn can result. It is likely that our ignorance of the cause and prevention of abnormal intrauterine conditions is resulting daily in the birth of second-class instead of first-class citizens. Less than ten per cent of babies die or are obviously defective at birth, but only ten per cent attain university entrance standards of education. What of the eighty per cent in between? Can we by better care throughout pregnancy and in labour, derived from increased knowledge, improve the quality of our children mentally as well as physically? The fact is that we do not really know, and I am afraid we are not trying hard enough to find out. Only a fraction of the sums currently expended in space projects and in technological

advances of dubious value—such as the development of the Concord supersonic aircraft—are available for medical research and only a disproportionately small part of this is being spent on the study of the human foetus and newborn baby. It is a deplorable fact that to-day there are so few establishments the world over wholly concerned with such studies, largely because the necessary money cannot be raised.

If this is so in wealthy countries with large national incomes how much more difficult it must inevitably be for those where it is a struggle to provide even essential medical services, to contribute to basic medical knowledge. And yet these countries may be in a specially favourable position to do so. For example, the clinical facilities for research into chorion carcinoma and hydatid mole are particularly good here in Singapore and are being exploited in the Kangdang Kerbau Hospital by Dr. Tow and his colleagues to the greatest possible extent. Unfortunately lack of funds curtails this important activity. It is to be hoped that very soon money will become available to facilitate and extend this most important work.

If this and other aspects of foetal and maternal physiology can be studied adequately we will be speeding the advent of the day when the newborn babe need no longer cry that he “is come to this great stage of fools” but the foetus confident of his birthright of mental and physical health, and looking forward to growth in wisdom as well as stature, may well “brag in the womb” in joyful anticipation of a brave new world.