

## EMBRYOLOGY, HUMAN

Human embryology is the scientific study of the material aspect of the developing human embryo and fetus with focus on the embryonic period, from the beginning of fertilization, or “when the matter is appropriately organized,” through 8 weeks (O’Rahilly and Müller 2001, p. 7). It has been systematically documented in the *Carnegie Stages of Early Human Embryonic Development* (CSEHED) since 1942. Human embryos can be reproduced both sexually (by fertilization—both natural and artificial, such as in IVF [*in vitro* fertilization]) and other artificial reproductive technologies) and asexually (as in naturally occurring human monozygotic twinning *in vivo* as well as in many different kinds of CLONING and genetic engineering techniques *in vitro*). The immediate products of both human reproductive processes are new genetically unique individual living human beings, who immediately produce specifically *human* proteins and enzymes, and continuously form specifically *human* cells, tissues, and organs throughout development. Such objective scientific facts should be the starting point for any discussions, debates, policies, or legislation on these issues. Unfortunately, they often are not.

### HUMAN SEXUAL REPRODUCTION

Since the fine details of human embryology have been corrupted for political purposes (Biggers 1990, pp. 1–6), it is important to identify and address some of those details, especially those occurring just before and in the first few weeks after the initiation of embryonic development.

**Gametogenesis (Including Spermatogenesis and Oogenesis).** The *genome* of a SPECIES is determined by the total amount of DNA in both the nuclear and cytoplasmic chromosomes (Lewin 2000, pp. 4, 81; Strachan and Read 1999, pp. 10, 18, 139). However, the *species* to which an individual belongs is determined only by the number of nuclear chromosomes per cell and the specific kinds and sequences of base pairs of amino acids in the genes comprising them. For humans, that species number is 46 (*plus or minus*). When a cell in the human body contains 46 chromosomes, it is called *diploid*. If it contains only 23 chromosomes, it is called *haploid*. There are two basic categories of diploid cells: somatic (body) cells, and germ line cells (future sex gametes). Before fertilization can take place, the number

of chromosomes in each diploid germ-line cell must be cut in half through the process known as gametogenesis. The final effect of gametogenesis is the production of haploid sex gametes, the sperm and the oocyte, which have only 23 chromosomes in each cell. [The terms *egg* and *ovum* are rejected as unscientific (O’Rahilly and Müller 2001, p. 12).] The oocyte must first be fertilized before its chromosomes are halved (Carlson 1999, p. 2; Emery 1983, pp. 52–53, 60, 91; Larsen 1998, p. 4; Moore and Persaud 1998, p. 18; O’Rahilly and Müller 2001, pp. 12, 19, 25; Strachan and Read 1999, p. 30).

**Fertilization.** It has been known empirically for over a hundred years that fertilization is the beginning of *sexually* reproduced human beings (Wilhelm His 1880–1885). (However, it is obviously not the beginning of *asexually* reproduced human beings.) During the process of fertilization, the sperm and the oocyte fuse. [The terms *fertilized oocyte* and *fertilized egg* are rejected as unscientific (O’Rahilly and Müller 2001, p. 12).] The diploid number of chromosomes is restored, and a new single-cell genetically unique living human being is reproduced. This is also the beginning of: the human embryo, the human organism, the human individual, the genetic sex of the embryo, the embryonic period, and normal pregnancy, which begins at fertilization in the fallopian tube, or oviduct, of the mother, not at implantation in her womb (Carlson 1999, pp. 2, 23, 27, 32, 444; Larsen 1998, pp. 1, 17; Moore and Persaud 1998, pp. 2, 12, 18, 34, 37; O’Rahilly 2001, pp. 31–33). All cell constituents, including the nuclear chromosomes and chromosomes in the mitochondria that are outside the nucleus in the cytoplasm of the cell, now belong properly to the new embryo.

This single-cell embryo is *totipotent*, that is, capable of forming all the cells, tissues, and organs of the later embryo, fetus, and adult. The cells (blastomeres) of the early developing human embryo will also exhibit a range of totipotency, that is, if separated from the developing embryo, they are capable of forming new human organisms (as in natural and artificial monozygotic “twinning”). This totipotent capacity also applies to the cells of the developing embryo from 2 cells (about 1½–3 days) until the first formation of the blastocystic cavity of the free floating blastocyst (about 4 days), to the cells of the inner cell mass of the implanting blastocyst (about 5–7 days), and to the diploid primitive germ-

line cells (future haploid sex gametes) (as early as 2½ weeks) of the later blastocyst (American Medical Association 1994, pp. 1–9; American Society for Reproductive Medicine 2004, pp. S256–257; Carlson 1999, pp. 43–45, 73; German National Ethics Council 2004, p. 14; Institute of Medicine and National Research Council 1989, pp. 25, 102ff; Lewin 2000, p. 605; A. Liu 2005, pp. 369–378; O’Rahilly and Müller 2001, pp. 23, 24, 37, 39, 136–137, 139; Strachan and Read 1999, pp. 508–509; Schieve et al 2004, pp. 1154–1163). This new single-cell human being immediately directs his/her own further continuous human growth and development by producing specifically *human* proteins and enzymes (Emery 1983, p. 93; Hao et al. 2006, p. S513; Holtzer et al. 1985, pp. 3–11; Illmensee et al. 2006a, pp. 1112–1120; Kollias et al. 1987, pp. 5739–5747; H. Liu et al. 2005a, p. S368; H. Liu et al. 2005b, p. S370; Moore and Persaud 1998, p. 12) that will cascade (will be produced on demand) throughout development (Emery 1983, p. 91; Lewin 2000, pp. 63, 914, 950). This embryonic development is most accurately documented in the *Carnegie Stages of Early Human Embryonic Development* (CSEHED, available from the National Museum of Health and Medicine at [http://nmhm.washingtondc.museum/collections/hdac/Select\\_Stage\\_and\\_Lab\\_Manual.htm](http://nmhm.washingtondc.museum/collections/hdac/Select_Stage_and_Lab_Manual.htm)).

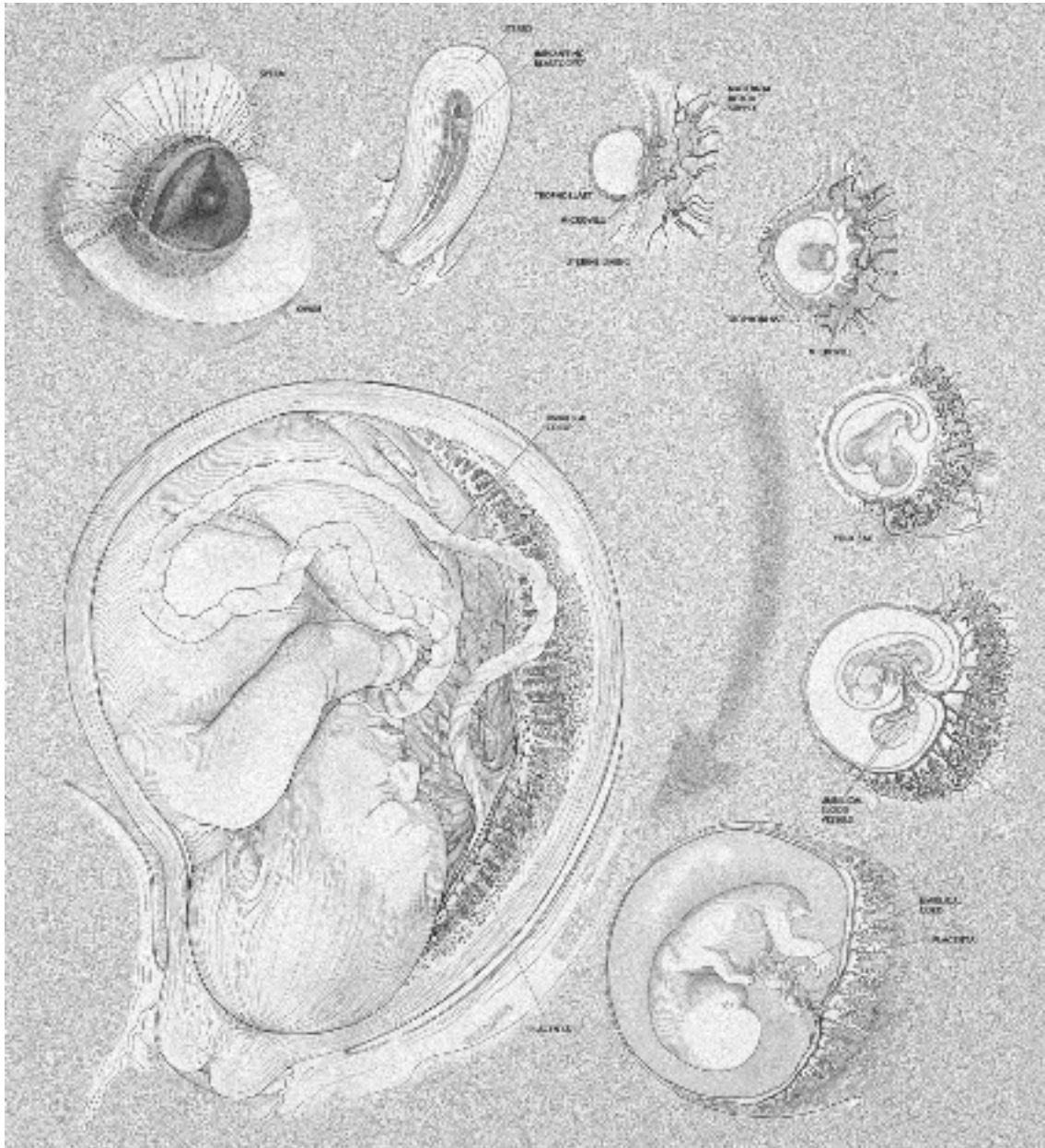
**Carnegie Stages (CSEHED).** The first to systematically study human embryos was Wilhelm His (*Anatomie Menschlicher Embryonen* 1880–1885, 3 vols.), and the first to stage them was Franklin Mall in 1914. Later George Streeter (Streeter 1942, p. 211; Streeter 1945, p. 27; Streeter 1948, p. 143) laid down the basis for the currently used Carnegie staging system, which was completed by Ronan O’Rahilly in 1973 and revised by O’Rahilly and Müller in 1987. The Carnegie Stages are often referred to as “the Bureau of Standards” of human embryology (O’Rahilly and Müller 2001, p. 3). Today they continue to be verified and documented by the international *Terminologia Embryologica* (formerly, *Nomina Embryologica*), which consists of more than twenty experts academically credentialed specifically in human embryology from around the world. After reviewing the latest research studies in human embryology, their deliberations are soon to be published in the *Terminologia Embryologica*, part of the larger *Terminologia Anatomica*.

According to the CSEHED, the embryonic period is composed of twenty-three stages (CSEHED; also Irving 2006a, pp. 1–33). Approximately 90 percent of the more than 4,500 structures of the adult body become apparent during the embryonic period. Of special note is Stage One—which begins when the sperm penetrates the oocyte and continues until just before the zygote

starts its first cleavage cell division at *syngamy*, that is, when the 23 paternally- and 23 maternally-derived chromosomes from the haploid pronuclei in the single-cell embryo mingle and line up on opposite sides of the mitotic spindle fibers that appear in the zygote just before cell division (Edwards et al. 1992, pp. 994–998; Food and Drug Administration 2002; Gasser 2003; Levron et al. 1995, pp. 653–657; Michelmann et al. 1986, pp. 243–246; O’Rahilly and Müller 2001, Table 8–1, p. 89; Riley and Merrill 2005, p. 1; Sathananthan et al. 1991, pp. 4806–4810). Much human cloning and human genetic engineering takes place during Stage One of the developing human embryo, even before the formation of the zygote, or slightly later while the cells of the very early human embryo are still totipotent.

The characteristic feature of the embryo in **Stage One** is unicellularity; it is a single-celled *organism*. As documented by the CSEHED, “Embryonic life commences with fertilization, and hence the *beginning* of that process may be taken as ‘the point de depart’ of stage 1.” Despite the small size and weight of the organism at fertilization, the embryo is “schon ein individual-spezifischer Mensch” (“already an individual and specifically human person”) (Blechs Schmidt 1963; Blechs Schmidt 1973; Blechs Schmidt 1982, pp. 171–181). Again, “It is to be remembered that at all stages the embryo is a living organism, that is, it is an on-going concern with adequate mechanisms for its maintenance as of that time” (Streeter and Heuser 1951, p. 165).

Fertilization, which normally takes place in the uterine (fallopian) tube, is the procession of events that begins when a spermatozoon (mature sperm) makes contact with an oocyte and ends with the intermingling of maternal- and paternal-derived chromosomes at metaphase of the first mitotic (cell) division of the zygote. Stage One of the embryo thus *includes*: (a) the penetrated oocyte—the term used once a haploid spermatozoon has penetrated the diploid oocyte (causing the diploid oocyte to half its number of chromosomes to 23) and, strictly, “after the individual plasma membranes of the sperm and of the oocyte have become one”; (b) the ootid, characterized by the presence of the male and female haploid pronuclei (each pronuclei containing 23 chromosomes); and (c) the zygote, which characterizes the last phase of fertilization. At syngamy, or when the chromosomes from the male and female pronuclei mingle, the first cleavage spindle (mitotic spindle) forms rapidly, the two pronuclear envelopes (outer membranes of the individual haploid male and haploid female pronuclei) break down, and the two groups of chromosomes move together (46 chromosomes in all) and assume positions on the first cleavage spindle. Thus the zygote lacks a nucleus. In the human this initial cleavage (cell division), which heralds the onset of Stage Two, normally occurs in the uterine (fallopian) tube (CSEHED at



**Human Embryonic and Fetal Development.** In sexual reproduction, the human being begins to exist at the beginning of fertilization—the process of events that begins when a male sperm makes contact with the female secondary oocyte, resulting in a highly specialized totipotent single-cell human organism or embryo (the “penetrated oocyte”). This new human being then develops as the “ootid” (when the male and female pronuclei have separately formed). The envelopes of the pronuclei of the ootid break down, followed by the arrangement of the maternal and paternal chromosomes on the first cleavage spindle (“syngamy”). Fertilization ends with the first mitotic division of the human “zygote”. Stage One of the new developing human being thus consists of the “penetrated oocyte”, the “ootid”, and the “zygote”. In Stage Two (“morula”, not pictured) the human embryo continues to grow and develop by multiplication of its totipotent cells (blastomeres) as it moves along the Fallopian tube and enters the uterus. At Stage Three the “free blastocyst” consists of an outer cell layer (trophoblast) and an inner cell mass (containing both totipotent and pluripotent cells), and the embryo begins to hatch from its outer zona pellucida. The whole blastocyst is the human embryo, not just the inner cell mass. At Stage Four (5-7 days) the “implanting blastocyst” (containing both totipotent and pluripotent cells) begins to implant into the uterus. After implantation the human embryo continues to grow and develop further in utero through 8 weeks (the “embryonic period”); from 9 weeks through birth is the “fetal period”. (See *CSHED*). © PHOTOTAKE INC./ALAMY

<http://nmhm.washingtondc.museum/collections/hdac/stage1.pdf>; also Carlson 1999, pp. 24–37; Larsen 1998, pp. 12–14; Moore and Persaud 1998, pp. 34–37; O’Rahilly and Müller 2001, pp. 31–33, 19–35). Also see Carnegie Stages online from University of Fribourg, Switzerland, “Human Embryology,” 1999.

The age at **Stage Two** is believed to be approximately 1½–3 days post ovulation. The range is probably 1–5 days (Sundström, Nilsson, and Liedholm, 1981). *In vitro*, 2 cells may be found at 1½ days (CSEHED at <http://nmhm.washingtondc.museum/collections/hdac/stage2.pdf>; Carlson 1999, fig. 3–2A; Larsen 1998, p. XI). **Stage Two** comprises embryos from two cells up to the appearance of the blastocystic cavity within the embryo. Successive cleavage divisions of the cells (blastomeres) occur asynchronously (not in perfect multiples, but alternately) (Carlson 1999, p. 38). Separation of the cells of the early embryo is believed to account for about one-third of all cases of natural human *in vivo* monozygotic twinning, a natural form of human cloning. Fraternal or dizygotic twins are reproduced by two sperm fertilizing two oocytes (Commonwealth of Australia 1986; Commonwealth of Australia 2001; Brinsden 1999, p. 421; Campbell et al. 1997, pp. 18–19; Corner 1955, pp. 933–951; Council of Europe 1998, p. 2; Geraedts et al. 2001, pp. 145–150; Irving 2005, pp. 1–36; National Institutes of Health 1998, p. a-3; Robertson 1994, p. 6; Strachen and Read 1999, pp. 508–509). The embryo proceeds along the uterine tube and enters the uterine cavity (womb) 3–4 days after ovulation, comprised of 8–12 cells or more. The primary factor for determining one of the two alternative routes of cell specialization or differentiation (specialization as the outer layer of cells of the embryo, or trophoblast, or specialization as the cells of the inner cell mass of the embryo) is probably the position that a given cell occupies (CSEHED at [http://nmhm.washingtondc.museum/collections/hdac/stage\\_2.htm](http://nmhm.washingtondc.museum/collections/hdac/stage_2.htm); also Carlson 1999, pp. 38–48; Larsen 1998, pp. 14–15; Moore and Persaud 1998, p. 41; O’Rahilly and Müller 2001, pp. 37–39).

At about 4 days **Stage Three** consists of the free-floating, unattached blastocyst, a term used as soon as a cavity in the embryo can be recognized by light microscopy. The outer membrane, or zona pellucida, may be either present or absent. *In vitro* the blastocyst emerges from the zona at about 6–7 days, commonly referred to as *hatching*. The whole blastocyst is the embryo, not just the cells of the inner cell mass, whose cells have now clearly differentiated into at least two types: trophoblastic (outer layer) and embryonic cells proper (the inner cell mass that is observable by light microscopy). The inner cell mass constitutes a germinal mass of various potentialities (totipotent and pluripotent), which continues for a time to add cells to the

outer trophoblast. The inner cell mass also gives origin to the hypoblast, and its remainder constitutes the epiblast. The epiblastic cells soon become aligned into the germ disc. Duplication of the inner cell mass (sometimes referred to as *embryo multiplication*, *blastocyst splitting*, or *embryo splitting*) accounts for most instances of natural human *in vivo* monozygotic twinning (Bulmer 1970; Corner 1955, pp. 933–951), another form of natural cloning. Note that the blastocyst has not yet tried to implant in the uterus (CSEHED at <http://nmhm.washingtondc.museum/collections/hdac/stage3.pdf>; also Carlson 1999, p. 48; Larsen 1998, p. 15; Moore and Persaud 1998, pp. 41–42; O’Rahilly and Müller 2001, pp. 39–40).

**Stage Four** is reserved for the attaching blastocyst, which is about 5–6 days old at the beginning of implantation. Implantation (Stages Four and Five) includes the dissolving of the zona pellucida (outer membrane), contact and attachment between the blastocyst and the endometrium (lining) of the uterus, and penetration and migration of the embryo through the endometrium. These early embryos may be surrounded by an intact outer membrane, which disappears so that the embryo can begin implantation. The cytotrophoblast and the syncytiotrophoblast become distinguishable, and the amniotic ectoderm develops (CSEHED at <http://nmhm.washingtondc.museum/collections/hdac/stage4.pdf>; also

Carlson 1999, p. 48; Larsen 1998, pp. 15–16; Moore and Persaud 1998, p. 42; O’Rahilly and Müller 2001, pp. 40–41).

**Stage Five** comprises embryos that are about 7–12 days old. Implantation, which began in Stage Four, is the characteristic feature of Stage Five. Both maternal and embryonic tissues are involved, and an amniotic cavity is present. The chief function of the amnion is not mechanical protection but rather “the enclosing of the embryonic body in a quantity of liquid sufficient to buoy it up and so allow it to develop symmetrically and freely in all directions” (Mossman 1937, pp. 129–246). At the caudal margin of the epiblast, the earliest differentiated cells of the later primitive streak appear, which will give rise to the extra-embryonic mesoderm of the chorion, chorionic villi, and body stalk (Luckett 1978, pp. 59–97). The embryonic disc formed is composed of the epiblast and the primary endoderm. On the ventral side of the embryonic disk, extra-embryonic endoderm grows around to enclose a cavity called the primary umbilical vesicle, or yolk sac. [The term *yolk sac* has been scientifically rejected (O’Rahilly and Müller 2001, p. 12).] The primary umbilical vesicle will provide most of the lining of the alimentary and respiratory systems. It is the site of the earliest blood vessels and blood cells as well as of the formation of fetoproteins, appears to be the place of origin of the toti-

potent future sex gametes, and will become part of the later adult gut. If duplication of the embryo occurs after the differentiation of the amnion, the resulting twins would share an umbilical cord and amniotic sac. It has been estimated that the frequency of monoamniotic twins among monozygotic twins is about 4 percent (Bulmer 1970). In about one in every 400 monozygotic twin pregnancies, the duplication is incomplete, and conjoined (Siamese) twins result, sometimes forming many weeks post-fertilization (CSEHED at <http://nmhm.washingtondc.museum/collections/hdac/stage5.pdf>; also Baron et al. 1990, pp. 9–22; Carlson 1999, pp. 48–60; Larsen 1998, pp. 15–16; Moore and Persaud 1998, pp. 41–45, 154–162; O’Rahilly and Müller 2001, pp. 43–46, 53–55; Wilder 1904, pp. 387–472).

At about 13 days the appearance of recognizable chorionic villi is used as the criterion for **Stage Six**. The secondary umbilical vesicle, the embryonic disc, and the extra-embryonic mesoblast develop. The blood vascular system first derives from extra-embryonic areas, and the amnion is well formed. With the appearance of the primitive streak during Stage Six, certain cells of the epiblast enter the streak, and the remaining cells on the dorsal aspect of the embryo will become the embryonic ectoderm. Some of the cells of the endoderm may be primordial germ cells (future sex gametes). The primitive streak is a proliferation of cells lying in the median plane in the caudal region (toward the posterior end of the embryo) of the embryonic disc. Its essential features are the pluripotential nature of the cells that compose it and the continued segregation of more specialized cells that migrate, or delaminate, from the less specialized remainder. The primitive streak enables cells from the outer layer of the embryo to pass inside and become mesodermal endoderm. The primitive streak is believed to be an entrance where cells of the epiblast move toward the streak, folding in takes place at the streak, and subsequently cells migrate to both homolateral (same side) and heterolateral (opposite side) mesoderm. Zones have been established for future ectoderm, mesoderm, endoderm, and notochord. With the establishment of bilateral symmetry, the embryonic disc, in addition to its back and belly surfaces, now has rostral (top) and posterior (bottom) ends and right and left sides. Although the main bulk of the embryonic mesoblast is believed to come by way of the primitive streak, other sources are not excluded. The prechordal plate, the cloacal membrane, and the connecting stalk (the later umbilical cord) also form. At about 18 days, the primitive streak begins to recede (CSEHED at <http://nmhm.washingtondc.museum/collections/hdac/stage6.pdf>; also Carlson 1999, pp. 60–64; Larsen 1998, 21–34; Moore and Persaud 1998, pp. 48–51; O’Rahilly and Müller 2001, pp. 46–50).

At **Stage Seven**, about 19 days, the notochordal process (primitive axis of the body below the primitive groove) becomes visible, and the formation of blood begins. The allantoic diverticulum (a tubular formation in the posterior part of the hind gut of the embryo initially derived from the outer layer of the blastocyst, or trophoblast layer) becomes definite; this persists in the adult as the median umbilical ligament (a band of tissue that connects bones or supports organs), blood cells, and urinary bladder (CSEHED at <http://nmhm.washingtondc.museum/collections/hdac/stage7.pdf>; also Carlson 1999, p. 64–73; Larsen 1998, pp. 34–40; Moore and Persaud 1998, pp. 68–80; O’Rahilly and Müller 2001, p. 57).

At this point it is clear that the scientific bases of philosophical and theological arguments for delayed personhood, especially those in BIOETHICS, a new quasi-ethics created by the U.S. Congress in 1978 (Irving 1999c, pp. 1–11; Irving 2002b, pp. 1–84; Jonsen 1998, pp. 90–122; Neuhaus 2002, pp. 71–72; Rothman 1991, pp. 168–189; Saletan 2001), are erroneous and completely without scientific merit. The SCIENCE used has been formally rejected as unscientific and misleading by the international nomenclature committee on human embryology for years. This includes such arguments containing the various “pre-embryo” and “individuality” claims (Grobstein 1985, pp. 213–236; Grobstein 1988, p. 33; McCormick 1975, pp. 34–35; McCormick 1991, pp. 1–15), “pre-zygote” claims (Condic 2008, pp. 1–18; but see Irving 2008c, pp. 1–14), the biogenetic law or *ontogeny recapitulates phylogeny* (see Irving 2001a, pp. 1–24), and seeds or beings-on-the-way (Wallace 1989, pp. 23–53). Similarly, assertions that the early human embryo is not an organism but just a cell or a ball of cells (National Academy of Sciences 2002a, b; Varmus 1999; Weissman 2003; West 2001 and 2007) are erroneous and without scientific merit (Biggers 1990, pp. 1–6; de Beer 1958; Irving 1991, pp. 1–400; Irving 1993a, pp. 18–46; Irving 1999a, pp. 22–47; Irving 2001a, pp. 1–24; Irving 2001b, pp. 1–12; Irving 2001c, pp. 1–17; Irving 2001d, pp. 1–32; Irving 2003, pp. 1–42; Irving 2004a, pp. 1–31; Kischer and Irving 1997, pp. 4–13, 129–184, 224–247, 248–257, 267–282; O’Rahilly and Müller 2001, pp. 16, 88). It should be pointed out that a host of scientists, organizations, and countries now routinely use the false scientific term *pre-embryo*, or its various substitutes (i.e., the term *pre-embryo* is not used but other erroneous scientific terms, or omissions, achieve the same purposes), as justification for doing embryonic research (American Fertility Society 1986; American Medical Association 1994; American Society for Reproductive Medicine 2007, pp. S52–S58; British House of Lords 2001; California Advisory Committee 2002; Gerontology Research Group 2001; McLaren 1984; National Institutes of Health 1994;

National Academy of Sciences 2002a, b; National Bioethics Advisory Commission 1997; New Zealand 2004; Parliamentary Assembly of the Council of Europe 1986 and 1989; Pia Saldeen and Per Sundström 2005, pp. 584–589; The Twins Foundation 1994; Varmus 1999; Warnock Report 1984; Weissman 2003; West 2001 and 2007; Zaninovic et al. 2005, p. S476). It would seem that PROFESSIONAL ETHICS across the academy has suffered (Irving 1993a, 18–46; Irving 1993b, pp. 243–247; Irving 1993c, pp. 77–100; Irving 1995, pp. 193–215; Irving 2004b, pp. 1–65).

The remaining Carnegie Stages are summarized more briefly as follows. **Stage Eight**, about 23 days: the embryonic disc is piriform, or oval-shaped; the primitive pit (primitive digestive cavity) appears; the neural folds may begin to form; and the notochordal and neurenteric canals are generally detectable. **Stage Nine**, about 25 days: the embryo has the shape of the sole of a shoe as seen from the back; the mesencephalic (midbrain) flexure begins and the otic, or ear, disc forms; the embryo begins to be *lordotic* (the curvature of the primitive spine becomes concave); the neural groove (caused by the folding in of the neural plate) is evident; the three major divisions of the brain are distinguishable; and the heart begins to develop. **Stage Ten**, about 28 days: fusion of neural folds begins; the otic pit develops; pharyngeal arches 1 and 2 are visible on the surface; optic, thyroid and respiratory primordia begin to develop; the cardiac loop begins to appear; and the intermediate mesoderm becomes visible. **Stage Eleven**, about 29 days: the rostral neuropore (open end of the neural tube near the head of the embryo) closes; the otic (eye) pit is still open; the optic vesicles develop; sinus venosus (common receptacle of veins) begins; and the mesonephric (excretory) duct and tubules appear. **Stage Twelve**, about 30 days: the caudal neuropore closes; four pharyngeal arches are visible; upper limb buds are appearing; secondary neurulation commences; the lung bud appears; and the cystic primordium (urinary and gall bladder) and dorsal pancreas become distinguishable. **Stage Thirteen**, about 32 days: the otic vesicle is closed; the lens disc is usually not yet indented; four limb buds are usually visible; retinal and lens discs develop; the septum primum and foramen primum are distinct in the heart; and the right and left lung buds are recognizable. **Stage Fourteen**, about 33 days: the lens pit appears; the endolymphatic (pertaining to the ear) appendage becomes defined; the upper limb buds are elongated and tapering; the optic cup develops; the adeno-hypophysial (glandular portion of the future pituitary gland) pouch is defined; and the ureteric bud appears. **Stage Fifteen**, about 36 days: the lens pit is closed; the nasal pit is appearing; the hand plate is forming; the future cerebral hemispheres become defined; retinal pigment becomes visible; and lobe buds appear in the bronchial tree (primitive lung). **Stage**

**Sixteen**, about 39 days: retinal pigment is visible in the intact embryo; nasal sacs face ventrally; the foot plate appears; the epiphysis cerebri, or pineal gland, develops; neurohypophysial evagination is visible; and the lobar bronchi are evident. **Stage Seventeen**, about 41 days: the head is relatively larger and the trunk is straighter; the nasofrontal groove (origin of nose and facial bones) and the auricular hillocks (part of future ear) are distinct; finger rays become visible; chondrification (formation of cartilage) begins in bones such as the humerus, radius, and some vertebral centra; segmental bronchial buds develop; and the vermiform (worm-shaped) appendix becomes visible. **Stage Eighteen**, about 44 days: the body is more cuboidal, or cube-shaped; the digital plate of the hand is notched; toe rays begin to appear; the oronasal (mouth and nose) membrane develops; one to three semicircular ducts are present in the internal ear; and the septum secundum (a temporary dividing wall in the right side of the primitive heart) and the foramen ovale (natural openings) are distinct in the heart. **Stage Nineteen**, about 46 days: the trunk is elongated and straightening; limbs extend nearly directly forward; toe rays are prominent, but interdigital notches have not yet appeared; the olfactory bulb develops; the cartilaginous otic capsule is visible; and the posterior epithelium (covering) of the cornea begins to develop. **Stage Twenty**, about 49 days: the upper limbs are longer and bent at the elbows; nerve fibers reach optic chiasma (crossing over); and s-shaped renal vesicles are visible in metanephros, or future kidneys. **Stage Twenty-One**, about 51 days: hands approach each other; fingers are longer; feet approach each other; the cortical plate becomes visible in the brain; the substantia propria (fibrous, tough, transparent main part) of the cornea develops; and glomerular capsules develop in metanephros. **Stage Twenty-Two**, about 53 days: the eyelids and the external ears are better developed; the adeno-hypophysial (pertaining to the pituitary gland) stalk is now incomplete; scleral (white part of the eyeball) condensation is visible; and some large glomeruli are present in metanephros. **Stage Twenty-Three**, about 56 days: the head is more rounded; the limbs are longer and better developed; humerus (bone that extends from the shoulder to the elbow) presents all cartilaginous phases; the bone collar of humerus has not yet been eroded through completely; secretory tubules of metanephros (permanent embryonic kidney) become convoluted; and numerous large glomeruli are present (CSEHED at [http://nmhm.washingtondc.museum/collections/hdac/Select\\_Stage\\_and\\_Lab\\_Manual.htm](http://nmhm.washingtondc.museum/collections/hdac/Select_Stage_and_Lab_Manual.htm); also Carlson 1999, pp. 60ff; Larsen 1998, pp. 45ff; Moore and Persaud 1998, pp. 85ff; O'Rahilly and Müller 2001, pp. 57–111 and ff).

After the embryonic period, the fetal period comprises the development of the human fetus from nine weeks until birth (Carlson 1999, p. 447; Larsen

1998, p. 317; Moore and Persaud 1998, p. 107; O’Rahilly and Müller 2001, p. 103).

### HUMAN ASEQUAL REPRODUCTION

Understanding human sexual reproduction can aid in understanding human asexual reproduction, especially in terms of the natural biological processes of methylation and regulation (Irving 2003a, pp. 1–42).

**Methylation and Regulation.** Following fertilization (sexual reproduction) the early human embryo grows and develops by means of multiplying its cells, and by means of various biochemical processes, including *methylation* and *demethylation* the DNA in each of those cells—part of the critical natural process called *regulation*. That is, the DNA in each cell of the organism is “allowed to speak” or is “silenced” by adding or removing these methylation bars—depending on what products, tissues, or organs the embryo or fetus needs to grow and develop at any point in time. These products then cascade throughout growth and development. The more specialized (or differentiated) a cell, the more methylated or silenced its DNA becomes. This is one way that the programming of the DNA of a cell is naturally accomplished. By adulthood the DNA in many of the cells of the human being have been almost completely silenced by the insertion of methylation bars—such as in human skin cells (Carlson 1999, p. 49; Lewin 2000, pp. 678, 914, 950; Strachan and Read 1999, pp. 193ff; O’Rahilly and Müller 2001, p. 39).

In human asexual reproduction many of these processes operate in reverse to reprogram, or de-differentiate, the DNA in a cell. For example, in cloning by somatic cell nuclear transfer, one can begin with a highly specialized or differentiated human cell (such as a skin cell—in which some or even most of the DNA in that cell’s nucleus has been silenced). The nucleus of the skin cell is removed and injected into an enucleated oocyte, then elements in the cytoplasm of the enucleated oocyte incrementally remove the methylation bars on that DNA to allow it to speak until the DNA in that cell is in the same state of differentiation as the single-cell zygote—resulting in a new, single-cell human organism, a single-cell embryo, or human being (Commonwealth of Australia 2001; Brinsden 1999, p. 421; Campbell et al. 1997, pp. 18–19; Council of Europe 1998, p. 2; Geraedts et al. 2001, pp. 145–150; German National Ethics Council 2004, pp. 18, 19, 41; Irving 2005, pp. 1–36; National Institutes of Health 1998a; National Institutes of Health 1998b, p. a-3; Robertson 1994, p. 6; Strachan and Read 1999, pp. 508–509). That is, one begins with just a human cell, but ends up with a new single-cell organism, a human being.

This is roughly what happened with the reproduction of Dolly the sheep (Wilmut 1997, pp 810–813;

Wilmut 1988, p. 138). Quoting human molecular geneticists Strachan and Read: “For the first time an adult nucleus had been reprogrammed to be totipotent once more, just like the genetic material in the fertilized oocyte from which the donor cell had ultimately developed” (1999, pp. 508–509). And as documented above, a fertilized oocyte is a single-cell human being—a human embryo—a single-cell human organism at Stage One of embryonic development.

Despite certain claims to the contrary (NAS 2002a, b; Weissman 2003; West 2001 and 2007), the technique referred to as *nuclear transfer* just described is always cloning—regardless of why it is performed, (Commonwealth of Australia 1986; Commonwealth of Australia 2001; Brinsden 1999, p. 421; Campbell et al. 1997, pp. 18–19; Council of Europe 1998, p. 2; Geraedts et al. 2001, pp. 145–150; Irving 2005, pp. 1–36; National Institutes of Health 1998a; National Institutes of Health 1998b, p. a-3; Robertson 1994, p. 6; Strachan and Read 1999, pp. 508–509). Furthermore, the cloned human embryo reproduced would not be “virtually genetically identical to the donor cell” because it would have a different genome due to the presence of foreign DNA from the extra-nuclear mitochondrial chromosomes left over from the enucleated oocyte used and due as well to the lack of original mitochondrial chromosomes from the donor cell used (Council of Research, Technology, and Innovation 1997, p. 5; German National Ethics Council 2004, p. 18; Irving 2001c, pp. 1–17; Irving 2006b, pp. 1–3; President’s Council on Bioethics 2002; Strachan and Read 1999, pp. 508–509). Thus using stem cells from such cloned human embryos in therapies could cause serious immune rejection reactions, even in human donor recipients, as acknowledged by anti-cloning and pro-cloning policy makers alike (Brownback 2003; Kass 2001; Weldon 2005).

In addition to cloning by means of nuclear transfer, one may also clone by means of *twinning* (blastomere separation, blastocyst splitting, embryo splitting, embryo multiplication), for example, as happens in naturally occurring monozygotic twinning *in vivo* and artificially *in vitro*. Twinning can also take place with the separated cells of the early embryo (through the blastocyst stages) because such cells still exhibit a range of totipotency (American Medical Association 1994, pp. 1–9; American Society for Reproductive Medicine 2004, pp. S256–257; Carlson 1999, pp. 43–45, 73; Illmensee et al. 2006a, pp. 1112–1120; Institute of Medicine and National Research Council 1989, pp. 25, 102ff; Lewin 2000, p. 605; A. Liu 2005, pp. 369–378; O’Rahilly and Müller, pp. 23, 24, 37, 39, 136–137, 139; Schieve et al. 2004, pp. 1154–1163; Strachan and Read 1999, pp. 508–509). Twinning is also a common, and the most exact, form of cloning because the chromosomal DNA in the mitochondria in cells of twins are the same (Com-

monwealth of Australia 2001; Brinsden 1999, p. 421; Campbell et al. 1997, pp. 18–19; Council of Europe 1998, p. 2; Council of Research, Technology, and Innovation 1997, p. 5; Geraedts et al. 2001, pp. 145–150; German National Ethics Council 2004, p. 18; Irving 2006b, pp. 1–3; National Institutes of Health 1998a; National Institutes of Health 1998b, p. a-3; Robertson 1994, p. 6; Strachen and Read 1999, pp. 508–509).

Regulation not only helps one understand asexual reproduction; it is also involved in repairing an injury that has occurred to an organism, sometimes even repairing early genetic mutations, or even rejecting foreign genes artificially inserted by genetic engineering. Regulation is the ability to heal a normal structure if parts have been removed or added (Carlson 1999, pp. 44–49). Thus, if successful, regulation could heal a damaged embryo whose totipotent cells have separated from it as well as revert the separated totipotent embryonic cells back to new human embryos, that is, new living human beings.

The question can arise as to when each of the twins begins to exist as an individual. Considering twinning from the standpoint of regulation, a human embryo is normally first produced sexually via fertilization (*in vivo* or *in vitro*). Scientifically it is known that this embryo has already been determined as a unique individual—both genetically and developmentally. He or she is a new human being. The developing embryo is also composed initially of totipotent cells and grows developmentally in total continuity with itself. If these totipotent cells of the embryo are damaged, the embryo could die, or regulation could set in to heal the damaged embryo and restore it to wholeness. However, if these totipotent cells of the embryo are actually separated from the intact embryo, then these separated cells too could die, or regulation could set in and possibly revert these totipotent cells to new human embryos. Thus the first twin would be the original human embryo produced sexually (*in vivo* or *in vitro*) and would begin to exist as an individual at the beginning of fertilization (penetration of the oocyte by the sperm). As the embryo begins to develop it could be healed (if damaged) by regulation, which reverses the degree of methylation of the DNA in each remaining cell of the damaged embryo back to that required by the number of cells that remain in the intact embryo. The second twin is the new human embryo produced asexually (*in vivo* or *in vitro*) from totipotent cells that have separated from the original embryo, and this twin begins to exist as an individual when regulation is successfully completed and the DNA of the separated cells has been reprogrammed back to that of a new single- or multiple-cell embryo (Irving 2003a, pp. 1–42).

The same considerations of regulation can be applied to questions about the fusion of two early human

embryos to form a single human/human chimera. In this case the original sources of the cells, or sometimes pronuclei, are from two or more human embryos. If two human embryos fuse to make one organism, that organism is not a human being. It would have 92 nuclear chromosomes per cell. Both original embryos have died. If this chimeric organism undergoes regulation, ejects all excess chromosomes, and reduces the number and proper mixture (male and female) of nuclear chromosomes to 46, then it could theoretically result in the formation of a new human embryo. But that embryo would not be the same individual as either of the original embryos that fused. Or one can form a new human—human chimeric embryo using the male and female pronuclei from different already-existing human embryos reproduced either sexually or asexually. The same basic mechanisms would operate in the formation of human/non-human chimeras, e.g., human/mouse (Chang et al. 2004, pp. 960–962; Hutton 2007; Illmensee et al. 2006b, pp. 1248–1260; Weissman et al. 1988, pp. 1632–1639; Weissman 2003; Weissman 2005).

There are many different kinds of cloning techniques that can be used to clone human beings: twinning (blastomere separation and blastocyst/embryo splitting); somatic cell nuclear transfer, or SCNT; germ line cell nuclear transfer, or GLCNT; “hemi-cloning”; pronuclei transfer; parthenogenesis; mitochondria transfer; the use of artificially constructed sperm, oocytes, and embryos; nano-cloning; and many other reproductive genetic engineering techniques. Many of these cloning techniques are being considered or have already been used in IVF as infertility treatments (American Fertility Society 1986, p. 275; American Medical Association 1994, pp. 1–9; American Society of Reproductive Medicine 2000, pp. 873–876; American Society for Reproductive Medicine 2004, pp. S256–257; Commonwealth of Australia 1986; Commonwealth of Australia 2001; Barr 2003; Escriba et al. pp. 149–161; German National Ethics Council 2004, pp. 18, 19, 41; Gordon and Ruddle 1981, pp. 1244–1246; Hao et al. 2006, p. S513; Parens and Knowles 2003; Illmensee et al. 2006a, pp. 1112–1120; Illmensee et al. 2006b, pp. 1248–1260; Institute of Medicine and National Research Council 1989, pp. 25, 102ff; Irving 2004a, pp. 1–31; Irving 2008b, pp. 1–10; Katagiri et al. 2004, p. S10; Yoko Kato et al. 1999, p. 1823; A. Liu 2005, pp. 369–378; H.C.C. Liu et al. 2004, p. S308; H. Liu et al. 2005a, p. S368; H. Liu et al. 2005b, p. S370; National Science Foundation and U.S. Dept. of Commerce 2002; Neri et al. 2004, p. S281; Neri et al. 2005a, pp. S400–S401; Neri et al. 2005b, p. S384; New Zealand 2003; Schieve et al. 2004, pp. 1154–1163; Tesarik et al. 2003, pp. 677–681; The Twins Foundation 1994; Valiotis et al. 1993, p. 48; Wolfson 2003, pp. 376–396).



In sum, the immediate product of both sexual and asexual human reproduction is a new, living, genetically unique, single-cell human being, human embryo, human organism, human individual, who immediately directs his/her own specifically human functions, activities, and development. Thus, there is a great deal at stake in debates involving the human embryo; for example, ABORTION, the use of abortifacients (drugs and devices that kill the new embryo before implantation), IVF and other artificial technologies, prenatal genetic diagnosis, human embryo research, human cloning, human embryonic stem cell research, human genetic engineering, unethical production of vaccines, and drug and biological/chemical testing and development. Further, arguments for *delayed personhood* have been reversed and then transferred to end-of-life issues, such as EUTHANASIA, physician-assisted suicide, organ transplantation, withholding/withdrawing food and hydration (Irving 1995). Consequently, the Church has addressed these related issues quite seriously in her teachings.

#### CHURCH TEACHINGS

The Church has always taught that the intentional direct killing of innocent human beings is morally EVIL and that “no one can claim for himself the right directly to destroy an innocent human being” (Sacred Congregation for the Doctrine of the Faith, *Donum vitae* 1987; *Dignitas personae* 2008). As VATICAN COUNCIL II notes, “Divine law and natural reason ... exclude all right to the direct killing of an innocent man” (Pope Paul VI, *Professio fidei* 1968, p. 436; *Gaudium et spes*, in O’Rourke and Boyle 1989, p. 38).

**Anthropology.** The Church’s teachings with respect to the inherent dignity of all human beings, including human embryos, is grounded in the anthropology upon which those teachings rest: “Teachers, catechists and theologians have the task of emphasizing the anthropological reasons upon which respect for every human life is based” (Pope John Paul II, *Evangelium vitae* 1995, par. 82).

According to the NATURAL LAW, known through the light of reason, a human being is a “unified totality.” A human nature is “at the same time corporal and spiritual.” By virtue of its substantial union with a spiritual SOUL, “the human body cannot be considered as a mere complex of tissues, organs and functions, nor can it be evaluated in the same way as the body of animals; rather it is a constitutive part of the *person* who manifests and expresses himself through it” (*Donum vitae* 1987, Introduction 3).

Consequently, the natural moral law expresses and lays down the purposes, rights, and duties that are based

on the bodily and spiritual nature of the human person. This is why “an intervention on the human body affects not only the tissues, the organs, and their functions, but also involves the person himself on different levels.” In the body and through the body, “one touches the person himself in his concrete reality.” To respect the dignity of man consequently amounts to “safeguarding this identity of the man ‘*corpore et anima unus*,’” as the Second Vatican Council says (*Gaudium et spes* 1965, p. 14, par. 1; Sacred Congregation for the Doctrine of the Faith 1987, Introduction 3).

Through revelation the Magisterium of the Church also confirms the concurrent theological anthropology of the unified nature of the human being. That is, “from the moment of conception, the life of every human being is to be respected in an absolute way because man is the only creature on earth that God has wished for himself” (*Gaudium et spes* 1965, p. 24). The spiritual soul of each person is “immediately created by God” (Pope Paul VI, *Professio fidei* 1968, p. 436; Pope Pius XII, *Humani generis* 195, p. 575), and his whole being bears the image of the Creator. Human life is sacred because from its beginning it involves “the creative action of God” (Pope John XXIII, *Mater et magistra*: 1961, p. 447; Pope John Paul II, *Responsible Procreation* 1983, p. 562). Thus no person comes into existence by chance; he or she is always the result of the creative love of God, “and remains forever in a special relationship with the Creator, who is its sole end” (*Gaudium et spes* 1965, p. 24). God alone is the LORD of life from its beginning until its end: “no one can, in any circumstance, claim for himself the right to destroy directly an innocent human being” (Pope Pius XII, *Discourse to the Saint Luke Medical-Biological Union* 1944: *Discorsi e Radiomessaggi* VI 1944–1945, pp.191–192). Further, human procreation requires on the part of the spouses “responsible collaboration with the fruitful love of God” (*Gaudium et spes* 1965, p. 50). The gift of human life must be actualized in marriage through the specific and exclusive acts of husband and wife “in accordance with the laws inscribed in their persons and in their union” (*Gaudium et spes* 1965, p. 51; Sacred Congregation for the Doctrine of the Faith 1987, Introduction, par. 5).

Thus violations of the inherent dignity of human beings are immoral. In formally rejecting teleological theological moral theories such as PROPORTIONALISM, utilitarianism, secular bioethics, communitarianism (a mini-form of secular bioethics), and such, the Church explains that, “There exist acts which *per se* and in themselves, independent of circumstances, are always seriously wrong by reason of their object.” Examples of such acts include “whatever is hostile to life itself, such as any kind of homicide, genocide, abortion, euthanasia and voluntary suicide.” Additional examples are “whatever violates the integrity of the human person”;

for example, “mutilation, physical and mental torture and attempts to coerce the spirit; whatever is offensive to human dignity, such as subhuman living conditions, arbitrary imprisonment, deportation, slavery, prostitution and trafficking in women and children; degrading conditions of work which treat laborers as mere instruments of profit, and not as free responsible persons.” All of these and similar acts are a disgrace, and “so long as they infect human civilization they contaminate those who inflict them more than those who suffer injustice” (Pope John Paul II, *Veritatis splendor* 1993, pars. 75–78, 90, 96, 97).

Likewise, CONTRACEPTION (Pope Paul VI, *Humanae vitae* 1968, par. 14); the use of abortifacients (Pope John Paul II, *Evangelium vitae* 1995, par. 61), including the “morning-after” pill (Pontifical Academy for Life 2000b); *in vitro* fertilization and the use of other artificial reproductive techniques (Pope Pius XII, “Fertility and Sterility” in O’Rourke and Boyle 1989, pp. 164–165; Sacred Congregation for the Doctrine of the Faith 1987, Parts A and B); the freezing of spare IVF embryos (Pope Pius XII, “Fertility and Sterility” in O’Rourke and Boyle 1989, pp. 164–165); germ-line cell genetic engineering (Sacred Congregation for the Doctrine of the Faith 1987, I6); surrogate motherhood (Sacred Congregation for the Doctrine of the Faith 1987, IIA, par. 3); and prenatal diagnosis (Pope John Paul II, *Evangelium vitae* 1995, par. 14) are inherently immoral. The same anthropological considerations bear on the immorality of the use of human embryos in destructive research.

**Abortion.** The intentional and direct killing of all innocent human beings by means of abortion (Irving 2000a, pp. 45–55) has always been formally condemned by the Church. This teaching has never changed: “The tradition of the Church has always held that human life must be protected and favored from the beginning, just as at the various stages of its development....The same Paul VI, speaking on this subject on many occasions, has not been afraid to declare that this teaching of the Church ‘has not changed and is unchangeable’” (Sacred Congregation for the Doctrine of the Faith 1974, II, par. 6). Regardless of laws to the contrary, “human law can abstain from punishment, but it cannot declare to be right what would be opposed to the natural law, for this opposition suffices to give the assurance that a law is not a law at all” (Sacred Congregation for the Doctrine of the Faith 1974, V, par. 21). And, as so clearly stated by Pope PIUS XI, “Whether inflicted upon the mother or upon the child, [direct abortion] is against the precept of God and the law of nature: ‘Thou shalt not kill.’ The life of each is equally sacred, and no one has the power, not even the public authority, to destroy it.” Those who hold the reins of government must remember that “it is

the duty of public authority by appropriate laws and sanctions to defend the lives of the innocent,” especially those whose lives are endangered and assailed and cannot defend themselves, “among whom we must mention in the first place infants hidden in the mother’s womb” (Pope Pius XI, “Encyclical Letter on Christian Marriage,” in O’Rourke and Boyle 1989, pp. 35–36). Thus even appeals to choice are not morally valid: “It is true that it is not the task of the law to choose between points of view or to impose one rather than another. But the life of the child takes precedence over all opinions. One cannot invoke freedom of thought to destroy this life” (Sacred Congregation for the Doctrine of the Faith 1974, V).

More people have become aware of these truths, particularly as science has uncovered the accurate facts of human embryology and human genetics over the centuries. Even considering genuine burdens as well as misperceptions of the quality of the new life, direct abortion remains inherently immoral:

We do not deny these very great difficulties. It may be a serious question of health, sometimes of life or death, for the mother; it may be the burden represented by an additional child, especially if there are good reasons to fear that the child will be abnormal or retarded; it may be the importance attributed in different classes of society to considerations of honor or dishonor, of loss of social standing, and so forth. We proclaim only that none of these reasons can ever objectively confer the right to dispose of another’s life, even when that life is only beginning. (Sacred Congregation for the Doctrine of the Faith 1974, V)

What is clear in the Church teachings is that the fact of being a human being is sufficient reason to proscribe abortion: “‘Human life is sacred,’ Pope John XXIII recalled; ‘from its very inception it reveals the creating hand of God’” (Pope Paul VI, *Humanae vitae* 1968). “From the moment of conception, the life of every human being is to be respected in an absolute way because man is the only creature on earth that God has ‘wished for himself’ and the spiritual soul of each man is ‘immediately created’ by God; ... no one can, in any circumstance, claim for himself the right directly to destroy an innocent human being” (Sacred Congregation for the Doctrine of the Faith 1987, Introduction 5). As will be noted below, the precious term *conception* has now been so deconstructed to mean “implantation,” especially in the law, that it is now very problematic to use, as is the term *fertilization* and the phrase “natural death” (Irving 2007, pp. 1–4; 2008c, pp. 1–6; 2008d, pp. 1–6; 2008e, pp. 1–7; 2008f, pp. 1–2).

**Ensoulement.** The issue of when the immaterial human soul (and thus personhood) is initially present in the early human being has been a source of some disagreement in the tradition, leading to different conclusions and impacting several related bioethics issues, especially abortion and human embryo research. Some argue for immediate personhood, others for delayed personhood. But the Church has consistently held that the critical criterion remains the fact that there is a human being present, based on teachings of the human being's unitary nature.

Some people try to justify abortion by claiming that the result of conception, at least up to a certain number of days, cannot yet be considered a personal human life. But in fact, 'from the time that the ovum is fertilized, a life is begun which is neither that of the father nor the mother; it is rather the life of a new human being with his own growth. It would never be made human if it were not human already...'

Even if the presence of a spiritual soul cannot be ascertained by science, the Church insists, the results of scientific research on the human embryo provide 'a valuable indication for discerning by the use of reason a personal presence at the moment of the first appearance of a human life: how could a human individual not be a human person?' Furthermore, the mere probability that a human person is involved would suffice to justify a prohibition of any intervention aimed at killing a human embryo.

Precisely for this reason, over and above all scientific debates and those philosophical affirmations to which the Magisterium has not expressly committed itself, the Church has always taught and continues to teach that the result of human procreation, from the first moment of its existence, must be guaranteed that unconditional respect which is morally due to the human being in his or her totality and unity as body and spirit. (Pope John Paul II, *Evangelium vitae* 1995, par. 60; Sacred Congregation for the Doctrine of the Faith, 1987, I, 1)

The Pontifical Academy for Life has also agreed to the possibility of reasoning to an immediate personal presence in the human embryo: "Judgment—as an act of the human mind—on the personal nature of the human embryo springs necessarily from the evidence of the biological datum which implies the recognition of the presence of a human being with an intrinsic active capacity for development, and not a mere possibility of life." Affirming once more the unitary conception of a human being, the Academy states: "The ethical exigency of

respect and care for the life and integrity of the embryo, demanded by the presence of a human being, is motivated by a unitary conception of man (*Corpore et anima unus*), whose personal dignity must be recognized from the beginning of his physical existence." Therefore the duty of respecting the human embryo as a human person "derives from the reality of the matter and from the force of rational argumentation, and not exclusively from a position of faith." Still, the mere presence of a human being is the critical criterion: "From the juridical point of view, the core of the debate on the protection of the human embryo does not involve identifying earlier or later indices of 'humanity' which appear after insemination, but consists rather in the recognition of fundamental human rights by virtue of the presence of a human being. Above all, the right to life and to physical integrity from the first moment of existence, in keeping with the principle of equality, must be respected" (Pontifical Academy for Life 1997a).

Those in the tradition who argue for immediate personhood also point to the advances in science and to the Church's anthropological teachings on the unitary nature of a human being, or HYLOMORPHISM. That is, a human being is not composed of two different substances (DUALISM), but rather is a single individual composite substance of a rational nature. Thus the rational soul is not a thing itself separate from the human body or vice versa, and the soul always contains virtually all three powers of the soul—the vegetative, sensitive, and rational. The soul does not rest in any one place in the body, but rather is present throughout it and is why "an intervention on the human body affects not only the tissues, the organs, and their functions, but also involves the person himself on different levels" (Sacred Congregation for the Doctrine of the Faith 1987, Introduction, 3). The material body and immaterial soul of a human being must always exist coextensively from the beginning of a human being's existence. Thus, as THOMAS AQUINAS states, the word *person* does not refer just to the rational part of the soul, nor to the whole soul alone, but to the entire composite human substance. This is why, for Thomas Aquinas, the formal definition of "a human being" must be inclusive of all these aspects of the composite human being, including "undesignated matter" (Aristotle, *Physica* 2.1.193b 3–5; 2.2.194b 12–14; 2.2.193b 33–37; *De anima* 1.5.411b 14–18; 1.5.411b 24–28; *Metaphysica* 3.2.997b 18–998a10; 11.1.1059a 34–1059b14; Boethius 1973, pp. 84, 85, 101, 103; Klubertanz 1953, p. 312; Klubertanz 1963, pp. 98–100, 116; Thomas Aquinas, *Summa theologiae* 1a, q. 45, a. 4 ad 2; 1a, q. 29, a.1 ans. ad 2, 3, 5; 1a, q. 29, a. 2 ans; *Summa theologiae* 3a, q. 19, a.1, ad 4; *Summa theologiae* 1a, q. 75, a. 4, ans; *On Being and Essence* Chap. 2; *The Division and Method of the Sciences*, pp. 14, 29, 39, 40; *Commentary on Aristotle's Metaphysics*

Bk. VIII, lect.1, *Cathala*, nos. 1688–1689; Wilhelmssen 1956, pp. 78–79 and 103–105).

It is worth noting that there are some who still attempt to appeal to the authority of Thomas Aquinas and Aristotle to support an argument for “delayed personhood.” However, a thorough read of the major works of these philosophers indicates that, had the required epistemological starting point for their philosophical analyses been the accurate objective facts of human embryology and human molecular genetics as known today, as realist philosophers they would have necessarily had to argue for “immediate personhood” themselves. Indeed, as Aristotle himself noted, “... the least deviation from the truth is multiplied later a thousandfold” (Aristotle, in *De coelo*, 1.5.271b, 9–10), often paraphrased by Thomas Aquinas as “a small error in the beginning leads to a multitude of errors in the end.” It is hardly a new academic insight that the Aristotle of the *De Anima* is and has been for centuries highly problematic and contradictory to his own mainstream systematic metaphysical doctrines on substance and anthropology (Mary Louise Gill 1989, esp. p. 173; Marjorie Grene 1963, esp. p. 175; Charlotte Witt 1989). In Aristotle’s main theory, material substance is a composite of two principles—form and matter—the pre-dominant theory in his *Categories*, *Physics*, the first half of the *Metaphysics*, and even in many parts of his *De Anima*. Aristotle’s odd theory of substance as form alone, or even as only the “rational” part of the form, and the succession of souls, is found only in the second half of his *Metaphysics* and in parts of the *De Anima*—which contradicts his former theory. (See extensive 150–page philosophical analysis in Appendix A, “Aristotle: A question of substance,” in Irving doctoral diss., *Philosophical and Scientific Analysis of the Nature of the Early Human Embryo*, 1991, pp. 296–381). There is also some degree of contradiction in Thomas Aquinas, whose major theory held that material substances are composed of three principles—form, matter and *esse* (act of existing). Yet Thomas (who was not a scientist) sometimes “unblushingly” followed Aristotle’s odd theory of separate form (see, for example, the differences between the definition of a human being and that of a human soul in the *De Ente et Essentia*, Chapter Two and Chapter Four). It is important to reiterate that for both of them the state of knowledge about human embryology and human genetics when they wrote was still rather primitive (e.g., both still held for only 4 physical elements total in the material world—air, earth, fire and water) (Irving 1993, pp. 2–19).

In arguing for immediate personhood today, if the human being begins to exist when the sperm penetrates the oocyte at fertilization in sexual reproduction as documented for many decades in the *Carnegie Stages* and for over a hundred years since the work of Wilhelm

His, then so too must the human soul (Klubertanz 1953, p. 312). The same would be true for asexual human reproduction (as in twinning). There is, so to say, no early non-human being or non-human person, no “pre-embryo” or “pre-zygote,” no intermediate human being or intermediate human person, no seed, or no being-on-the-way, no vegetable, nor non-human animal (Aristotle, *Metaphysics*, 3.2.997b 18–998a10; 11.1.1059a34–1059b 14; Thomas Aquinas, *Summa theologiae*, 1a, q. 45, a. 4 ad 2). Indeed, this is an empirical fact of human embryology and human genetics. Further, if there is a human body whose cells possess 46 chromosomes and specifically human cells, tissues, and organs continuously unfold, then there must also simultaneously be a human soul that is directing those specifically human biological functions and activities. Thus from the beginning of his/her existence the human embryo is a person, whose rights and protections may not be violated for any greater good (Bracken 2001, pp. 62, 66; Cottier 2006, p. 32; Doran 1989, p. 39; Heaney 1992, p. 36; Hersh-enov and Koch 2005, pp. 753–754; Irving 1993a, pp. 7–8; Johnson 1995, p. 743; Nelson 2007, pp. 299–301; Regan 1992, p. 122; Rossini 2006, p. 820; Schmitz 1978, p. 3).

Still, the Pontifical Academy for Life notes that such philosophical knowledge of when personhood begins is not definite: “[S]ince this is a philosophical interpretation, the answer to this question cannot be of a ‘definite kind,’ but must remain open, in any case, to further considerations” (Pontifical Academy for Life 2006, p. 6). However, the same could be said for the philosophical presuppositions of those in the tradition who argue for delayed personhood. Further, is not it a question, rather, of which philosophical system can withstand serious scrutiny and which cannot, and of which philosophical system actually matches reality? Some philosophical systems do stand the test; many do not.

In general, advocates for delayed personhood claim that either there is no human being immediately present or, if there is, it is not a human person yet. Examples of these claims include those that ground their arguments on the pre-embryo and its various substitutes, the “pre-zygote,” the biogenetic law (ontogeny recapitulates phylogeny), and the insistence that the early embryo is not an organism but a ball of cells, a seed or being-on-the-way (Condic 2008, pp. 1–18; see Irving 2008c, pp. 1–14); Bedate and Cefalo 1989, p. 641; Bole 1989, p. 647; Bole 1990, p. 637; Curran 1978, pp. 17–26; Cefalo 1991, p. 41; Cahill 1988, pp. 85–98; Donceel 1988, pp. 48–53; Engelhardt 1974, p. 226; Engelhardt 1985, p. 111; Ford 1988, p. 298; Grobstein 1985, pp. 213–236; Grobstein 1988, p. 33; Guenin 2004a, p. 805; Guenin 2004b, p. 1215; Hare 1988, p. 214; Hellegers 1970, p. 9; Hellegers 1978; Jones and Schroder 1987, p.

192; Kinsley 2000, p. A17; Kuhse and Singer 1985, p. 138; Kuhse and Singer 1986, pp. 149–153; Lockwood 1985, p. 10; Lockwood 1988, pp. 187–213; McCormick 1975, pp. 34–35; McCormick 1991, pp. 1–15; McLaren 1984, pp. 101–120; McLaren 1986, p. 49; Moussa and Shannon 1992, pp. 30–37; Ramsey 1970, p. 75; Ramsey 1975, pp. 35–36; Robertson 1986, pp. 53–70; Robertson 1991, p. 301; Robertson 1995a, pp. 37–38; Robertson 1995b, pp. 13–24; Sass 1989, pp. 45–59; Shannon and Wolter 1990, p. 615; Singer 1981, p. 118; Singer and Kuhse 1987, pp. 13–14; Singer et al. 1990, pp. 3–4, 6–12, 14–24, 43–50, 59–60, 66–72, 96–106, esp. 252; Suarez 1990, pp. 627–635; Tauer diss. 1982; Tauer 1988, pp. 54–84; Tooley 1974, pp. 59, 64; Varmus 1999; Wallace 1989, pp. 23–53; Warnock Report 1984, pp. 27, 63; Weissman 2003; West 2001 and 2007; Wildes 2001, pp. 3–33; British House of Lords 2001; Commonwealth of Australia 1986; U.S. Dept. of Health, Education and Welfare 1979, p. 101; American Fertility Society 1986, 46: 27S; National Academy of Sciences 2002a,b; National Institutes of Health 1994, February 2 meeting, pp. 27, 31, 50–80, 85–87, 104–106, February 3 meeting, pp. 6–55, February 51 meeting, pp. 9–41; New Zealand 2003; Parliamentary Assembly of the Council of Europe 1986 and 1989).

In response it is argued that the scientific claims used to ground these delayed-personhood arguments have been variously rejected by the international nomenclature committee in human embryology for decades, as well as by other individual scientific fields themselves. For example, it is known empirically that the immediate product of both sexual and asexual human reproduction is already a whole individual human being, a human organism, a human embryo. Consequently, it is argued, the empirical scientific starting points for delayed personhood are scientifically inaccurate and erroneous, and therefore philosophical conclusions based on them are automatically invalid. Another problem plaguing these claims is that any delay in personhood (or dualism) inherently contains a philosophical mind/body split that has proven theoretically and practically indefensible for centuries—especially since there can be no communication or interaction between the two independent and separate substances. Further, if only those human beings who actively express rational attributes or sentience are persons (Engelhardt 1984 and 1985; Kinsley 2000; Kuhse and Singer 1985, 1986; Robertson 1986, 1991, 1994, 1995; Singer 1981; Singer and Kuhse 1987; Singer et al. 1990), then the following list of human beings are not persons and thus have no ethical or legal rights and protections: the mentally ill and retarded, drug addicts, alcoholics, the frail elderly, the physically disabled, the comatose, and

those with brain or nerve damage—or even adult humans when asleep.

Although the Church has made it clear that the abuse of early human beings is not permissible regardless of the ensoulment debates, there is still some ambiguity expressed about whether the term *personhood* applies only to sexually reproduced human embryos (i.e., the union of sperm and oocyte) or if it applies to asexually reproduced human embryos as well (as in naturally occurring human monozygotic twins *in vivo* or *in vitro* as well as human embryos cloned or genetically engineered *in vitro*). For example, in the various citations from the Church above, sometimes the phrase “from the first moment of its existence” is used; sometimes the phrase “from the moment of conception” is used. However, one phrase is not coextensive with the other. The former phrase would embrace both sexually and asexually reproduced human embryos; the latter, only sexually reproduced embryos, since conception refers only to fertilization (sexual reproduction). Indeed, the term *conception* is often mis-defined, even in major professional reports and literature, government regulations, and state, national, and international law as meaning *implantation*, 5–7 days post-fertilization based on the erroneous term “pre-embryo” or its various “substitutes” (*Miller-Keane Encyclopedia & Dictionary of Medicine, Nursing & Allied Health* 2003, p. 406; O’Rahilly and Müller 1994, p. 19; *Oxford Companion to Medicine* 1986, p. 254; Peters 2006, pp. 199–228; *Sloane-Dorland Annotated Medical-Legal Dictionary* 1992, p. 131; Spahn and Andrade 1998, pp. 261, 295; see also those authors noted in bibliography with “\*” under “Organizations and Institutions”).

Aside from the obvious confusion that the use of such erroneous science can cause in the correct formation of conscience, it may not be widely understood that specific terms and phrases used in *legal* documents are usually “exclusionary,” that is, the bill, law, or regulation applies only to what is specifically articulated in the formal definitions. All other things not included in such definitions (or not articulated at all) are not covered, and thus by default are legally allowed. If today the term *fertilization* does not in fact include those human beings who are asexually reproduced, and if the term *conception* now often legally means “implantation,” then it would seem unwise to use such dubious phrases as “from the moment of conception” or “from the moment of fertilization” in any legal documents. The same legal exclusionary concerns apply to the use of the phrase “until natural death,” since especially if used in legislation it would not cover those human beings who die “unnatural” deaths, for example, suicide, murder, accidents, removal of food and hydration, as so on. The term *natural* properly applies to *rights*—that is, all human beings have the *right to* a natural death. Using the exclusionary phrase “natural death” without reference to

“rights” leaves the door open for legal loopholes permitting euthanasia, and so on (Irving 2007, pp. 1–4; Irving 2008c, pp. 1–6; Irving 2008d, pp. 1–6; Irving 2008e, pp. 1–7; Irving 2008f, pp. 1–2).

Since asexually reproduced human embryos are now being used in experimental infertility treatments and implanted for reproductive purposes (see references above) as well as being used for research purposes, it would seem that the issues of abortion and research have merged and need to be addressed inclusive of each other as well as inclusive of both sexually and asexually reproduced human embryos. Otherwise, some church teachings on sexually reproduced human beings will not apply to asexually reproduced human beings.

**Human Embryo/Stem Cell Research.** The use of living human embryos (through 8 weeks post-inception) and fetuses in destructive research is hardly new. However, especially as human embryos became available through *in vitro* fertilization and other techniques, their exploitation has dramatically increased. As noted by the Pontifical Council for the Family: “This evaluation of the morality of abortion is to be applied also to the recent forms of intervention on human embryos which, although carried out for purposes legitimate in themselves, inevitably involve the killing of those embryos.” This is the case with experimentation on embryos, increasingly widespread in the field of biomedical research and legally permitted in some countries. Regardless of legality, the Church states that “the use of human embryos or fetuses as an object of experimentation constitutes a crime against their dignity as human beings who have a right to the same respect owed to a child once born, just as to every person.” This moral condemnation “also regards procedures that exploit living human embryos and fetuses—sometimes specifically ‘produced’ for this purpose by *in vitro* fertilization” either to be used as biological material or to provide organs or tissue for transplants in the treatment of diseases. “The killing of innocent human creatures, even if carried out to help others, constitutes an absolutely unacceptable act” (Pope John Paul II, *Evangelium vitae* 1995, par. 63). Thus, intentional violations of the life and dignity of human embryos in such exploitive research is not morally permissible: “Respect for the dignity of the human being excludes all experimental manipulation or exploitation of the human embryo” (*Pontifical Council for the Family* 1983, art. 4).

The same is true for the use of human embryos for the production of embryonic stem cells. As explained by the Pontifical Academy for Life on the basis of a biological analysis, the living human embryo is “from the moment of the union of the gametes—a human subject with a well defined identity, which from that point begins its own coordinated, continuous and gradual

development, such that at no later stage can it be considered as a simple mass of cells.” Thus, the removal of the inner cell mass of the embryo at the blastocyst stage “is a gravely immoral act and consequently is gravely illicit,” adding that “a good end does not make right an action which in itself is wrong.” For the same reasons the academy specifically states that “this prohibition applies equally to the removal of stem cells from cloned human embryos.” Further, the tradition of *probabilism* cannot be appealed to because “moral theology has always taught that in the case of ‘*jus certum tertii*’ the system of probabilism does not apply.” Nor is it morally licit to use embryonic stem cells or their progeny supplied by others, as this would constitute formal or material cooperation in evil. Instead, already clinically proven adult and cord blood stem cells could probably ethically be used (Pontifical Academy for Life 2000a).

The Pontifical Academy for Life also sees that halting the human cloning project is a moral duty that must be translated into cultural, social, and legislative terms. “In a democratic, pluralistic system, the first guarantee of each individual’s freedom is established by unconditionally respecting human dignity at every phase of life, regardless of the intellectual or physical abilities one possesses or lacks.” In human cloning the necessary condition for any society—“that of treating man always and everywhere as an end, as a value, and never as a mere means or simple object”—begins to collapse. At the level of human rights, the possibility of human cloning represents a violation of the two fundamental principles on which all human rights are based: the principle of equality among human beings and the principle of non-discrimination. “Contrary to what may appear at first sight, the principle of parity and equality among human beings is violated by this possible form of man’s domination over man, and the discrimination that comes about through the whole selective–eugenic dimension inherent in the logic of cloning” (Pontifical Academy for Life 1997a).

Several other Church documents similarly address the institutions and laws that foster the use of asexually reproduced human embryos. In an appeal to the United Nations to ban human cloning based on human rights, the Vatican Mission noted, “If human rights are to mean anything, at any time, anywhere in the world, then surely no one can have the right to do such a thing. Human rights flow from the recognition that human beings have an intrinsic dignity that is based on the fact that they are human. Human embryos are human, even if they are cloned.” If the rest of us want to have the rights that flow from the recognition of this dignity, “then we must act to ban cloning in all its forms” (Vatican Mission to the United Nations 2003b).

The Vatican Mission points out that not only does human cloning violate the inherent dignity and human

rights of the cloned embryo; it also “objectifies human sexuality and turns the bodies of women into commodities.” Women are also deprived of their innate dignity “by becoming suppliers of eggs and wombs.” Furthermore, other persons and technological powers “could easily exercise undisputed dominion over the duration of this person’s life or his or her unique identity.” As fellow human beings we are “called to further the common good for the present and future generations across the globe. We do this to protect all who share and participate in the human condition.” But if some human beings are destined to serve interests that do not take into account these fundamental principles of human nature that are at the center of the UN’s concern, “they are reduced to a servile status that denies them the fundamental claim to life and self-determination guaranteed to all.” Noting the false distinction between therapeutic and reproductive cloning, supposedly based on the purpose or goal of the research, the Vatican Mission insists that to clone a human being, regardless of the goal, “is to deny this person’s basic ontological claim that unites him or her to the rest of the human family.” This human being has no HOPE of a self-determining future “because his or her individuality will be destroyed to further some research purpose or to enhance the narcissism of a person who has already existed.” In either case, the document continues, “the cloned human being is reduced to enslavement that contravenes the fundamental nature of human existence—to be free and to live as a unique individual capable of contributing to the development of the self and society” (Vatican Mission to the United Nations February 2003a).

The Church’s envoys again directly confront the false distinction made between so-called therapeutic and reproductive human cloning, rejecting both as inherently immoral, reiterating the stand that a human embryo’s humanity *per se* is sufficient. Thus the HOLY SEE rejects the false distinction between reproductive and therapeutic human cloning “as devoid of any ethical and legal ground.” It might also be stated that it is devoid of any scientific ground. The Church’s envoy continues by pointing out that reproductive cloning of human beings contravenes the law of nature, as does the cloning of the human embryo that is slated for research purposes. For the same reasons, all forms of human cloning are morally illicit: “The early but unavoidable result of both embryo splitting and nuclear transfer cloning is the reproduction of a human being at its embryonic stage of development.” Even if there is no destruction of the cloned human embryo and it is allowed to mature to adulthood, “this activity is still an affront to the dignity of the human person.” As a form of unnatural asexual reproduction, “it represents a radical manipulation of the constitutive relationship and

complementarity that are at the origin of human procreation as a biological act and an exercise of human love” (Vatican Mission to the United Nations 2003c).

The Vatican Mission also points to the United Nation’s own precepts, which should prohibit all human cloning, noting that the *Universal Declaration of Human Rights* reiterates the sanctity of all human life and the need to protect it from harm. “In this regard, Article 3 of the Declaration asserts that everyone has the right to life.” The Universal Declaration confirms that “each human being is an entity who is guaranteed a future filled with the hope of self-determination.” Therefore, conditions, such as cloning, that degrade any human being with servitude and deny the fundamental rights to life and self-determination are reprehensible (Vatican Mission to the United Nations 2003a).

The Vatican Mission also points out that such research would also violate international law: “Various international instruments acknowledge that the dignity of the human person is at the center of international law. Regardless of the objective for which it was done, human cloning conflicts with the international legal norms that protect human dignity.” International law guarantees the right to life to all, not just some, human beings and adds that involuntary medical and biological experimentation on human beings is morally wrong. Human cloning also “poses great threats to the rule of law” by enabling those responsible for cloning to select and propagate certain characteristics such as gender or race and eliminate others. This, the Vatican Mission notes, would be akin to the practice of EUGENICS leading to the institution of a “super race.” Inevitable discrimination against those born through the natural process would follow. Human cloning also denies international rights to due process and equal protection of the law for human subjects who come into being for research purposes (Vatican Mission to the United Nations 2003a).

Similarly, in an address to the United Nations Educational, Scientific, and Cultural Organization (UNESCO), the Pontifical Academy for Life also rejects the false distinction between therapeutic and reproductive cloning, a distinction supposedly based on the goal or purpose of the research, reminding them that any type of cloning is illicit “which implies the creation or splitting of embryos, no matter what techniques are used or what aims are pursued because it is not licit to do evil even to bring about good.” Thus the Academy astutely observes that the prohibition of reproductive cloning only in Article 11 is not sufficient. “Regrettably, this formulation does not exclude human cloning, equally unacceptable, for other purposes, e.g. research or therapy” (Pontifical Academy for Life 1997b). Simply put, “No circumstance, no purpose, no law whatsoever can ever make licit an act which is intrinsically illicit,

since it is contrary to the Law of God which is written in every human heart, knowable by reason itself, and proclaimed by the Church” (Pope John Paul II, *Evangelium vitae* 1995, par. 62).

The Church has formally made herself quite clear on the abuse of both sexually and asexually reproduced human embryos for any purposes. The debate is still out, however, on attempts to “ethically” create human embryonic stem cells for research and patient “therapies” (e.g., various recent cell de-differentiation methods or genetic engineering methods used in research involving Oocyte Assisted Reprogramming (OAR), Altered Nuclear Transfer (ANT), Induced Pluripotent Stem Cells (iPS), etc.). Is such research accomplished without involving the deaths of human embryos or human fetuses whose cells and tissues may be used in the materials and methods of the research protocols, or without involving new human embryos who inadvertently might be asexually reproduced in the process, or without causing serious, even deadly, immune responses to “foreign genes” in patients in clinical trials? Are these new scientific studies really either ethical or scientifically successful (Wollert and Drexler 2005, pp. 151–163; Cyranoski 2008, pp. 406–408; Irving 2008a, pp. 1–9)?

**Correct Formation of Conscience.** As Aristotle so wisely noted over two millennia ago, if we are to be able to think straight, our empirically derived concepts of the material world should correspond with it. If they do not then we are precluded from thinking critically—we will have lost the Categories (Aristotle, *Analytical Posteriora* 2.19, 100a 3–9, quoted in McKeon 1941). Similarly, if people cannot even accurately know the empirical reality involving the human embryo addressed above, how then can they think critically about issues involving the human embryo, or reliably form their consciences correctly regarding it? Their consciences are truly darkened, leading not only to immoral personal decisions (Irving 1994a, pp. 42–62; Irving 1999a, pp. 22–47; Irving 1999b, pp. 203–223), but to immoral professional, political, and legal decisions as well (Irving 1993b, pp. 243–272; Irving 1993c, pp. 77–100; Irving 1994b, pp. 82–89; Irving 1999a, pp. 22–47; Irving 2000a, pp. 44–55; Irving 2001a, pp. 1–24; Irving 2001b, pp. 1–12; Irving 2001c, pp. 1–17; Irving 2001d, pp. 1–32; Irving 2002a, pp. 1–22; Irving 2004, pp. 1–31).

As extensively noted, violations of the dignity of these early human beings are usually accompanied by the use of erroneous science and deceptive linguistic jargon in the attempt to justify these immoral actions. This use of contrived RHETORIC to refer to the newly created human embryo or fetus is now extensive; for example: a pre-embryo vs. an embryo; a pre-zygote vs. an embryo; a being on the way vs. an already existing one; a seed vs. an organism; a phase sortal vs. a substance

sortal; information content there vs. information capacity there; a biological individual vs. an ontological individual; a transient nature vs. a stable human nature; a biologically integrated whole vs. a psychologically integrated whole; a biological life only vs. a personal life; an unconscious biological life vs. a conscious personal life; a lower-brain life vs. a cortical-brain life; no one home vs. some one home; a zoe vs. a bios; a possible or potential human being vs. an actual human being; a possible or potential person vs. an actual human person; an object vs. a subject; an evolving member of the human species vs. an actual member of the human species; no rational attributes or sentience there vs. rational attributes or sentience there; no human cognition vs. human cognition, a ball of cells vs. an organism. Politicized terms such as spare or left-over embryos or products of conception are often used. Further rhetoric includes the false distinction between therapeutic and reproductive cloning, the deconstruction of therapeutic cloning to mean stem cell research, and the deconstruction of totipotent to mean pluripotent (Biggers 1990, pp. 1–6; Irving 1991, pp. 1–400; Irving 1993a, pp. 18–46; Irving 1994a, pp. 42–62; Irving 2003a, pp. 1–42; Irving 2004a, pp. 1–31; Irving 2005, pp. 1–36; Kischer and Irving 1995, pp. 4–13, 129–184, 224–247, 248–257, 267–282). As noted above, the term *conception* itself has now been erroneously redefined as beginning at implantation rather than at fertilization, even in the law.

Fortunately, the international nomenclature committee on human embryology has formally rejected the false term pre-embryo. To quote O’Rahilly and Müller (2001, p. 88), the term:

- (1) is ill-defined because it is said to end with the appearance of the primitive streak [about 15 days] or to include neurulation [formation in the early embryo of the neural plate (Stage 8, about 23 days) followed by its closure with the development of the neural tube (beginning at Stage 10 through Stage 12, about 32 days)];
- (2) is inaccurate because purely embryonic cells can already be distinguished after a few days, as can also the embryonic (not pre-embryonic!) disc;
- (3) is unjustified because the accepted meaning of the word embryo includes all of the first 8 weeks;
- (4) is equivocal because it may convey the erroneous idea that a new human organism is formed at only some considerable time after fertilization; and
- (5) was introduced in 1986 “largely for public policy reasons.”

The term was also eventually clarified in a statement by the Pontifical Academy for Life (although the term remains in the “Foreword” of *Donum vitae*):

From a biological standpoint, the formation and the development of the human embryo ap-



pears as a continuous, coordinated, and gradual process from the time of fertilization, at which time a new human organism is constituted, endowed with the intrinsic capacity to develop by himself into a human adult. The most recent contributions of the biomedical sciences offer further valuable empirical evidence for substantiating the individuality and developmental continuity of the embryo. To speak of a *pre-embryo* thus is an incorrect interpretation of the biological data. (Pontifical Academy for Life 1997a)

Yet new and ever erroneous scientific claims and linguistic rhetoric continue to confuse and darken consciences. In 1992 Josef Pieper, a contemporary Catholic philosopher and theologian, published an amazing small book concerning the advertising and communications industries, *Abuse of Language, Abuse of Power*; that is astonishingly applicable to the rhetoric found in these related debates about the human embryo today. Such rhetoric, he notes, is not new. Plato attributed it to the sophists whom he described as “highly paid and popularly applauded experts in the art of twisting words; able to sweet-talk something bad into something good and to turn white into black.” The truth itself cannot in all honesty be the decisive concern of those who aim at verbal artistry, he notes. Rather, as Plato forces Gorgias to admit, “such sophisticated language, disconnected from the roots of truth, in fact pursues some ulterior motives.” Language is thus invariably turned into an instrument of power. “The place of authentic reality is taken over by a fictitious reality; my perception is indeed still directed toward an object, but now it is a *pseudo-reality*, deceptively appearing as being real, so much so that it becomes almost impossible any more to discern the truth.” This is precisely what bothered Plato with his own contemporary Sophists. What makes the Sophists so dangerous, said Plato, is that they “fabricate a fictitious reality.” That the real world in which we all live can be taken over by pseudo-realities *whose fictitious nature threatens to become unnoticed* is truly a depressing thought. And yet this platonic nightmare possesses an alarming contemporary relevance, for the general public is being reduced to a state where “people not only are unable *to find out* about the truth but also become unable even *to search for it*” (Pieper 1992, pp. 7, 18–20, 34–35).

This darkening of the CONSCIENCE on these various, but related, issues concerning the early human being is of considerable concern to the Church:

The end result of this is tragic: not only is the fact of the destruction of so many human lives still to be born or in their final stage extremely grave and disturbing, but no less grave and

disturbing is the fact that conscience itself, darkened as it were by such widespread conditioning, is finding it increasingly difficult to distinguish between good and evil in what concerns the basic value of human life.... [W]e need now more than ever to have the courage to look the truth in the eye and to call things by their proper name, without yielding to convenient compromises or to the temptation of self-deception.... Perhaps this linguistic phenomenon is itself a symptom of an uneasiness of conscience. But no word has the power to change the reality of things: procured abortion is the deliberate and direct killing, by whatever means it is carried out, of a human being in the initial phase of his or her existence. (Pope John Paul II, *Evangelium vitae* 1995, pars. 4 and 58)

What is needed, the Church recognizes, is a cultural transformation: “The first and fundamental step towards this cultural transformation consists in forming consciences with regard to the incomparable and inviolable worth of every human life.” It is especially important to “re-establish the essential connection between life and freedom” and “between freedom and truth,” because when freedom is detached from objective TRUTH “it becomes impossible to establish personal rights on a firm rational basis.” In turn, this lays the ground for society “to be at the mercy of the unrestrained will of individuals or the oppressive totalitarianism of public authority.” In particular, “there is a need for education about the value of life from its very origins” (Pope John Paul II, *Evangelium vitae* 1995, par 96).

**SEE ALSO** ANTHROPOLOGY, THEOLOGICAL; ARTIFICIAL INSEMINATION; DOCTRINE OF THE FAITH, CONGREGATION FOR THE; EVANGELIUM VITAE; EXPERIMENTATION, MEDICAL; HUMAN GENOME; HUMAN RESPECT; IMAGE OF GOD; IMMATERIALITY; IN VITRO FERTILIZATION; LIFE, CONCEPT OF (IN THEOLOGY); NATURAL FAMILY PLANNING; NATURAL LAW; PERSON (IN PHILOSOPHY); PERSON (IN THEOLOGY); PONTIFICAL ACADEMIES; REASON, USE OF; REPRODUCTIVE TECHNOLOGY; SOUL, HUMAN; SOUL, HUMAN, ORIGIN OF; SOUL-BODY RELATIONSHIP; SUFFICIENT REASON, PRINCIPLE OF; TEACHING AUTHORITY OF THE CHURCH (MAGISTERIUM); TECHNOLOGY, PHILOSOPHY OF; TECHNOLOGY, SOCIAL EFFECTS OF; TELEOLOGICAL ETHICS; UNITED NATIONS AND THE PAPACY; VERITATIS SPENDOR.

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*Dianne Nutwell Irving*

Former Career-Appointed Bench Research Biochemist, National Institutes of Health/National Cancer Institute, Bethesda, Maryland  
Retired Professor of Philosophy and Medical Ethics, The Catholic University of America, Washington, D.C. (2009)