



ILLINOISTM
RIGHT TO LIFE

The Scientific Consensus On When Life Begins

SOURCES THAT ESTABLISH
THE CONSENSUS VIEW
THAT A HUMAN'S LIFE
BEGINS AT FERTILIZATION

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I. Definitions

1. "'Fertilization' is the process of union of two gametes (i.e., ovum and sperm) whereby the somatic chromosome number is restored and the development of a new individual is initiated"
 - Definitions used by U.S. National Institute of Health, Medline Plus, and Merriam-Webster Medical Dictionary, 2013¹
2. "Embryo: The developing individual between the union of the germ cells and the completion of the organs which characterize its body when it becomes a separate organism. . . . At the moment the sperm cell of the human male meets the ovum of the female and the union results in a fertilized ovum (zygote), a new life has begun. . . . The term embryo covers the several stages of early development from conception to the ninth or tenth week of life"
 - Definition of "Embryo" in *Medical Embryology* and *Van Nostrand's Scientific Encyclopedia*²
3. "Embryo: An organism in the earliest stage of development; is a man, from the time of conception to the end of the second month in the uterus"
 - Definition of "Embryo" in the *Harper Collins Illustrated Medical Dictionary*³
4. "Zygote. This cell results from the union of an oocyte and a sperm during fertilization. A zygote is the beginning of a new human being (i.e., an embryo). . . . [The zygote] marked the beginning of each of us as a unique individual"
 - Definition of "Zygote" in *The Developing Human: Clinically Oriented Embryology*⁴
5. "Zygote. This cell, formed by the union of an ovum and a sperm (Gr. zyg tos, yoked together), represents the beginning of a human being. The common expression 'fertilized ovum' refers to the zygote"

¹ Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

² Langman, J., *Medical Embryology*, 3rd ed., Baltimore: Williams and Wilkins, 1975, p. 3; Considine, D. (Ed.), *Van Nostrand's Scientific Encyclopedia*, 5th ed., New York: Van Nostrand Reinhold, 1976, p. 943. Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

³ *Harper Collins Illustrated Medical Dictionary*, New York: Harper Perennial, 1993, p. 146. Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

⁴ Moore, K.L. & Persaud, T.V.N., *The Developing Human: Clinically Oriented Embryology*, 7th ed., Philadelphia: Saunders, 2003, pp. 2, 16. Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

- Definition of “Zygote” in *Before We Are Born: Essentials of Embryology and Birth Defects*⁵
- 6. "Embryo: The early developing fertilized egg that is growing into another individual of the species. In man the term 'embryo' is usually restricted to the period of development from fertilization until the end of the eighth week of pregnancy"
 - Definition of “Embryo” in *Test-Tube Babies*⁶
- 7. “Note on the meaning of scientific terminology for human development: "Organism" is the scientific name for a *living human being*. Only organisms undergo development. "Zygote" is the one-cell human organism produced by sperm-egg fusion. "Embryo" is a human organism during the first eight weeks of development”
 - Definitions of “Organism”, “Zygote”, and “Embryo” in *The Origin of Human Life at Fertilization: Quotes Compiled from Medical Textbooks and Peer-Reviewed Scientific Literature*⁷

II. Science Articles

- 8. “Fertilization is the union of gametes to *initiate development of a new individual*”
 - *Advances in Experimental Medicine and Biology* Journal Article⁸
- 9. “Fertilization-the fusion of gametes to *produce a new organism*-is the culmination of a multitude of intricately regulated cellular processes”
 - *Advances in Experimental Medicine and Biology* Journal Article⁹

⁵ Moore, K.L. & Persaud, T.V.N., *Before We Are Born: Essentials of Embryology and Birth Defects*, 4th ed., Philadelphia: W.B. Saunders, 1993, p. 1. Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

⁶ Walters, W. & Singer, P. [Eds.], *Test-Tube Babies*, Melbourne: Oxford University Press, 1982, p. 160. Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

⁷ Condic, M.L. *The Origin of Human Life at Fertilization: Quotes Compiled from Medical Textbooks and Peer-Reviewed Scientific Literature*, Bioethics Defense Fund, Last updated Nov. 2017, <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

⁸ Machaty, Z., Miller, A.R., & Zhang, L., *Egg Activation at Fertilization*, *Adv Exp Med Biol*, 2017, 953:1-47. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

⁹ Marcello, M.R., Singaravelu, G., & Singson, A., *Fertilization*, *Adv Exp Med Biol*, 2013, 757:321-50. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

10. "In multicellular organisms *the fusion of two gametes with a haploid set of chromosomes leads to the formation of the zygote, the first cell of the embryo*"
 - *Advances in Experimental Medicine and Biology* Journal Article¹⁰
11. "The oocyte-to-embryo transition refers to the process whereby a fully grown, relatively quiescent oocyte undergoes maturation, fertilization, and is *converted into a developmentally active, mitotically dividing embryo*, arguably one of the most dramatic transitions in biology"
 - *Advances in Experimental Medicine and Biology* Journal Article¹¹
12. "In higher animals, the *beginning of new life* and transfer of genetic material to the next generation occurs in the oviduct when two distinct gametes cells unite resulting in the formation of a zygote."
 - *Animal Reproduction Science* Journal Article¹²
13. "A crucial step of fertilization is the sperm-egg interaction that allows the *two gametes to fuse and create the zygote*"
 - *Annual Review of Physiology* Journal Article¹³
14. "At the end of oogenesis and spermatogenesis, both haploid gametes contain a single set of chromosomes *ready to form the zygote, the first cell of the newly developing individual*"
 - *Basic and Clinical Andrology* Journal Article¹⁴
15. "We have discovered that a single sperm protein, phospholipase C-zeta (PLC ζ), can stimulate intracellular Ca(2+) signalling in the unfertilized oocyte ('egg') culminating in the initiation of embryonic development. Upon fertilization by a

¹⁰ El Yakoubi, W. & Wassmann, K., *Meiotic Divisions: No Place for Gender Equality*, Adv Exp Med Biol, 2017, 1002:1-17. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

¹¹ Robertson, S. & Lin, R., *The oocyte-to-embryo transition*, Adv Exp Med Biol, 2013, 757:351-72. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

¹² Salilew-Wondim, D., Schellander, K., Hoelker, M., & Tesfaye, D., *Oviductal, endometrial and embryonic gene expression patterns as molecular clues for pregnancy establishment*, Anim Reprod Sci, 2012, 134(1-2):9-18. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

¹³ Evans, J.P., *Sperm-egg interaction*, Annu Rev Physiol. 2012, 74:477-502. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

¹⁴ Gat, I. & Orvieto, R. "*This is where it all started*" - the pivotal role of PLC ζ within the sophisticated process of mammalian reproduction: a systemic review, Basic Clin Androl, 2017, 21;27:9. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

spermatozoon, the earliest observed signalling event in the dormant egg is a large, transient increase in free Ca^{2+} concentration. The fertilized egg responds to the intracellular Ca^{2+} rise by completing meiosis“

○ *Bioessays Journal Article*¹⁵

16. "The traditional Western ethic has always placed great emphasis on the intrinsic worth and equal value of every human life regardless of its stage or condition. This ethic has had the blessing of the Judeo-Christian heritage and has been the basis for most of our laws and much of our social policy. The reverence for each and every human life has also been a keystone of Western medicine and is the ethic which has caused physicians to try to preserve, protect, repair, prolong and enhance every human life which comes under their surveillance. This traditional ethic is still clearly dominant, but there is much to suggest that it is being eroded at its core and may eventually even be abandoned. This of course will produce profound changes in Western medicine and in Western society. There are certain new facts and social realities which are becoming recognized, are widely discussed in Western society and seem certain to undermine and transform this traditional ethic... What is not yet so clearly perceived is that in order to bring this about hard choices will have to be made with respect to what is to be preserved and strengthened and what is not, and that this will of necessity violate and ultimately destroy the traditional Western ethic with all that this portends. It will become necessary and acceptable to place relative rather than absolute values on such things as human lives, the use of scarce resources and the various elements which are to make up the quality of life or of living which is to be sought... The process of eroding the old ethic and substituting the new has already begun. It may be seen most clearly in changing attitudes toward human abortion. In defiance of the long held Western ethic of intrinsic and equal value for every human life regardless of its stage, condition or status, abortion is becoming accepted by society as moral, right and even necessary. It is worth noting that this shift in public attitude has affected the churches, the laws and public policy rather than the reverse. Since the old ethic has not yet been fully displaced it has been necessary to separate the idea of abortion from the idea of killing, which continues to be socially abhorrent. The result has been a curious avoidance of the scientific fact, which everyone really knows, that human life begins at conception and is continuous whether intra- or extra-uterine until death. The very considerable semantic gymnastics which are required to rationalize

¹⁵ Nomikos, M., Swann, K., & Lai, F.A., *Starting a new life: sperm PLC-zeta mobilizes the Ca^{2+} signal that induces egg activation and embryo development: an essential phospholipase C with implications for male infertility*, *Bioessays*, 2012 Feb;34(2):126-34, doi: 10.1002/bies.201100127, Epub 2011. <https://thefetalposition.com/conception/>

abortion as anything but taking a human life would be ludicrous if they were not often put forth under socially impeccable auspices. It is suggested that this schizophrenic sort of subterfuge is necessary because while a new ethic is being accepted the old one has not yet been rejected"

- *California Medicine* (aka *Western Journal of Medicine*) 1971 Editorial¹⁶

17. "Recognition between sperm and the egg surface *marks the beginning of life* in all sexually reproducing organisms"

- *Cell* Journal Article¹⁷

18. "*Pronuclear/zygotic stage is the very first stage of life*"

- *Cellular and Molecular Life Sciences* Journal Article¹⁸

19. "The egg-to-embryo transition marks *the initiation of multicellular organismal development* and is mediated by a specialized Ca(2+) transient at fertilization"

- *Cell Calcium* Journal Article¹⁹

20. "[F]ertilization is the process by which male and female haploid gametes (sperm and egg) unite to *produce a genetically distinct individual*"

- *Cell Tissue Research* Journal Article²⁰

21. "Ca²⁺ signaling plays a crucial role in virtually all cellular processes, from the *origin of new life at fertilization* to the end of life when cells die"

¹⁶ "A New Ethic for Medicine and Society", Editorial, *California Medicine* 113, September 1970, pp. 67-68. Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

¹⁷ Raj, I., Sadat, A.I., Hosseini, H., Dioguardi, E., Nishimura, K., Han, L., Villa, A., de Sanctis, D., & Jovine, L., *Structural Basis of Egg Coat-Sperm Recognition at Fertilization*, *Cell*, 2017, 169(7):1315-1326.e17. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

¹⁸ Okada, Y. & Yamaguchi, K., *Epigenetic modifications and reprogramming in paternal pronucleus: sperm, preimplantation embryo, and beyond*, *Cell Mol Life Sci*, 2017, 74(11):1957-1967. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

¹⁹ Nader, N., Kulkarni, R.P., Dib, M., & Machaca K. *How to make a good egg!: The need for remodeling of oocyte Ca(2+) signaling to mediate the egg-to-embryo transition*, *Cell Calcium*, 2013, 53(1):41-54. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

²⁰ Signorelli, J., Diaz, E.S., & Morales, P., *Kinases, phosphatases and proteases during sperm capacitation*, *Cell Tissue Res*. 349(3):765, 2012. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

- *Cellular and Molecular Life Sciences Journal Article*²¹
- 22. “*Mammalian embryo development begins when the fertilizing sperm triggers a series of elevations in the oocyte's intracellular free Ca(2+) concentration*”
 - *Cell Tissue Research Journal Article*²²
- 23. “The fusion of sperm and egg membranes initiates the life of a sexually reproducing organism”; “Membrane fusion has an overarching influence on living organisms. The fusion of sperm and egg membranes initiates the life of a sexually reproducing organism.”
 - *Chemical Society Reviews Journal Article*²³
- 24. “It is intuitive that *fertilization-the start of life*-involves communication between a sperm cell and an egg”
 - *Communicative & Integrative Biology Journal Article*²⁴
- 25. “Mammalian life, with all its complexity *comes from a humble beginning of a single fertilized egg cell*”
 - *Current Opinion in Genetics & Development Journal Article*²⁵
- 26. “*Activation of the egg by the sperm is the first, vital stage of embryogenesis*”
 - *Development Journal Article*²⁶

²¹ Santella, L., Ercolano, E., Nusco, G.A., *The cell cycle: a new entry in the field of Ca2+ signaling*, Cell Mol Life Sci. 2005. 62(21):2405-13. Cited by:

<http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

²² Machaty, Z., *Signal transduction in mammalian oocytes during fertilization*, Cell Tissue Res. 2016. 363(1):169-83. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

²³ Marsden, H.R., Tomatsu, I., & Kros, A., *Model systems for membrane fusion*, Chem. Soc. Rev. 40(3):1572, 2011. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf> and <https://thefetalposition.com/conception/>.

²⁴ Asano, A., Nelson-Harrington, J.L., Travis, A.J., *Membrane rafts regulate phospholipase B activation in murine sperm*, Commun Integr Biol, 2013, 6(6):e27362. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

²⁵ Leung, C.Y. & Zernicka-Goetz, M. *Mapping the journey from totipotency to lineage specification in the mouse embryo*, Curr Opin Genet Dev, 2015, 34:71-6. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

²⁶ Hachem, A., Godwin, J., Ruas, M., Lee, H.C., Ferrer Buitrago, M., Ardestani, G., Bassett, A., Fox, S., Navarrete, F., de Sutter, P., Heindryckx, B., Fissore, R., & Parrington J., *PLCζ is the physiological trigger of the Ca2+ oscillations that induce embryogenesis in mammals but conception can occur in its absence*, Development,

27. “New parents anticipate their job begins at birth. Little do they know *they have been exerting control within the baby’s first cell since fertilization*”
 - *Genetics Journal Article*²⁷
28. “Since *a new individual is derived from the fusion of a single sperm and egg*, we tested...”
 - *Journal of Assisted Reproduction and Genetics Journal Article*²⁸
29. “Fertilization is a complex process comprised of numerous steps. During fertilization, two highly specialized and differentiated cells (sperm and egg) fuse and subsequently trigger the *development of an embryo* from a quiescent, arrested oocyte”
 - *Journal of Biochemistry and Molecular Biology Journal Article*²⁹
30. “Oocyte maturation is an essential cellular differentiation pathway that prepares the egg for activation at fertilization leading to the *initiation of embryogenesis*”
 - *Journal of Cellular Physiology Journal Article*³⁰
31. “In sexual organisms, *division of the zygote initiates a new life cycle*”
 - *Journal of Integrative Plant Biology Journal Article*³¹
32. “*The time of our conception is when we are most vulnerable to survival and growing as a healthy human being*”

2017, 144(16):2914-2924. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

²⁷ Chu, D., *Parental Control Begins at the Beginning*, Genetics, 2016, 204(4):1377-1378. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

²⁸ Wilding, M., Coppola, G., De Icco, F., Arenare, L., Di Matteo, L., & Dale, B., *Maternal non-Mendelian inheritance of a reduced lifespan? A hypothesis*, J Assist Reprod Genet, 2014, 31(6):637-43. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

²⁹ Marcello, M.R. & Singson, A., *Fertilization and the oocyte-to-embryo transition in C. elegans*, BMB Rep, 2010, 43(6):389-99. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

³⁰ Machaca, K., *Ca²⁺ signaling differentiation during oocyte maturation*, J Cell Physiol, 2007, 213(2):331-40. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

³¹ Yang, K.J., Guo, L., Hou, X.L., Gong, H.Q., & Liu, C.M., ZYGOTE-ARREST 3 that encodes the tRNA ligase is essential for zygote division in Arabidopsis, J Integr Plant Biol, 2017, 59(9):680-692. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

- *Journal of Obstetrics and Gynecology* Journal Article³²
- 33. “Fertilization is the process that *leads to the formation of a diploid zygote* from two haploid gametes”
 - *Mammalian Genome* Journal Article³³
- 34. “As representatives of the 60 trillion cells that make a human body, a sperm and an egg meet, recognize each other, and fuse to *create a new generation*”
 - *Methods in Molecular Biology* Journal Article³⁴
- 35. “*Mammalian life begins with a cell-cell fusion event, i.e. the fusion of the spermatozoid with the oocyte*”
 - *Methods in Molecular Biology* Journal Article³⁵
- 36. “Sperm are remarkably complex cells with a singularly important mission: to deliver paternal DNA and its associated factors to the oocyte *to start a new life*”
 - *Molecular Cell Proteomics* Journal Article³⁶
- 37. “In mammals, egg activation is initiated by multiple cytosolic Ca(2+) transients (Ca(2+) oscillations) that are triggered following delivery of a putative sperm factor from the fertilizing sperm. The identity of this 'sperm factor' thus holds much significance, *not only as a vital component in creating a new life*, but also for its potential therapeutic and diagnostic value in human infertility”

³² Norman, R.J. & Aust, N.Z., 2015 *RANZCOG Arthur Wilson Memorial Oration 'From little things, big things grow: The importance of periconception medicine'*, J Obstet Gynaecol. 2015. 55(6):535-40. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

³³ Lorenzetti, D., Poirier, C., Zhao, M., Overbeek, P.A., Harrison, W., & Bishop, C.E., *A transgenic insertion on mouse chromosome 17 inactivates a novel immunoglobulin superfamily gene potentially involved in sperm-egg fusion*, Mamm Genome, 2014, 25(3-4):141-8. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

³⁴ Inoue, N. & Okabe, M., *Sperm-egg fusion assay in mammals*, Methods Mol Biol, 2008, 475:335-45. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

³⁵ Willkomm, L. & Bloch, W. State of the art in cell-cell fusion, Methods Mol Biol. 2015, 1313:1. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

³⁶ Wu, T.F. & Chu, D.S., *Sperm chromatin: fertile grounds for proteomic discovery of clinical tools*, Mol Cell Proteomics, 2008, 7(10):1876-86. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

- *Molecular Human Reproduction* Journal Article³⁷
- 38. "Aging is a developmental process *that begins with fertilization* and ends up with death involving a lot of environmental and genetic factors"
 - *Molecular Neurobiology* Journal Article³⁸
- 39. "The seminal question in modern developmental biology is *the origins of new life* arising from the unification of sperm and egg"
 - *Molecular Reproductive Development* Journal Article³⁹
- 40. "*When sperm meets egg: the spark of new life*"
 - *Molecular Reproductive Development* Journal Article⁴⁰
- 41. "Our data suggest that activation of LINE- 1 regulates global chromatin accessibility *at the beginning of development* and indicate that retrotransposon activation is integral to the developmental program"
 - *Nature Genetics* Journal Article⁴¹
- 42. "The life cycle of mammals begins when a sperm enters an egg."
 - *Nature* Journal Article⁴²

³⁷ Kashir, J., Nomikos, M., Swann, K., & Lai, F.A., *PLCζ or PAWP: revisiting the putative mammalian sperm factor that triggers egg activation and embryogenesis*, Mol Hum Reprod, 2015, 21(5):383-8. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

³⁸ Ahmed, M.S., Ikram, S., Bibi, N., & Mir, A. *Hutchinson-Gilford Progeria Syndrome: A Premature Aging Disease*, Mol Neurobiol. 2017. doi: 10.1007/s12035-017-0610-7. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

³⁹ Evsikov, A.V. & Marín de Evsikova, C., *Gene expression during the oocyte-to-embryo transition in mammals*, Mol Reprod Dev. 2009. 76(9):805-18. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

⁴⁰ Wozniak, K.L., Luque, G.M., & Ahn, S.H., *When sperm meets egg: the spark of new life*, Mol Reprod Dev. 2017. doi: 10.1002/mrd.22857. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

⁴¹ Jachowicz, J.W., Bing, X., Pontabry, J., Bošković, A., Rando, O.J., Torres-Padilla, M.E., *LINE-1 activation after fertilization regulates global chromatin accessibility in the early mouse embryo*, Nat Genet, 2017, 49(10):1502-1510, [referring to events in the zygote]. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

⁴² Okada, Y., Yamagata, K., Hong, K., Wakayama, T. & Zhang, I., *A role for the elongator complex in zygotic paternal genome demethylation*, NATURE, 463(7280):554-8, 2010. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

43. “Representing the 60 trillion cells that build a human body, a sperm and an egg meet, recognize each other, and *fuse to form a new generation of life*”
 - *Nature Journal Article*⁴³
44. “Fertilization occurs when *sperm and egg recognize each other and fuse to form a new, genetically distinct organism*”
 - *Nature Journal Article*⁴⁴
45. “When mammalian eggs and sperm come into contact in the female oviduct, a series of steps is set in motion that can lead to fertilization and ultimately to development of *new individuals*”; “Fertilization is defined as the process of union of two gametes, eggs and sperm. When mammalian eggs and sperm come into contact in the female oviduct, a series of steps is set in motion that can lead to fertilization and ultimately to development of new individuals”
 - *Natural Cell Biology Journal Article*⁴⁵
46. “[Since I’ve been directly involved in over 60,000 abortions, I have] increasing certainty that I had in fact presided over 60,000 deaths”
 - *New England Journal of Medicine Journal Article*⁴⁶
47. “Fertilization is the culminating event in sexual reproduction and requires the recognition and *fusion of the haploid sperm and egg to form a new diploid organism*”
 - *Philosophical Transactions of the Royal Society of London B: Biological Sciences Journal Article*⁴⁷

⁴³ Inoue, N., Ikawa, M., Isotani, A., & Okabe, M., *The immunoglobulin superfamily protein Izumo is required for sperm to fuse with eggs*, *Nature*, 2005, 434(7030):234-8. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

⁴⁴ Bianchi, E., Doe, B., Goulding, D., & Wright, G.J., *Juno is the egg Izumo receptor and is essential for mammalian fertilization*, *Nature*, 2014, 508(7497):483-7. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

⁴⁵ Wassarman, P.M., Jovine, L, Litscher, E.S., *A profile of fertilization in mammals*. *Nat Cell Biol.* 2001.3(2):E59-64. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf> and <https://thefetalposition.com/conception>.

⁴⁶ Nathanson, B., *Deeper Into Abortion*, *New England Journal of Medicine* 291, 1974, 1189D90. Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

⁴⁷ Bianchi, E. & Wright, G.J., *Cross-species fertilization: the hamster egg receptor, Juno, binds the human sperm ligand, Izumo1*, *Philos Trans R Soc Lond B Biol Sci*,

48. "A proper dialogue between spermatozoa and the egg is essential for conception of a new individual in sexually reproducing animals. Ca(2+) is crucial in orchestrating this unique event *leading to a new life*"
 - *Physiological Reviews* Journal Article⁴⁸
49. "Fertilization is a process involving multiple steps that lead to the final fusion of one sperm and oocyte to *form the zygote*"
 - *Protein & Cell* Journal Article⁴⁹
50. "*Human life begins with sperm and oocyte fusion*"
 - *Reproduction* Journal Article⁵⁰
51. "The oviduct or Fallopian tube is the anatomical region where every new life begins in mammalian species. After a long journey, the spermatozoa meet the oocyte in the specific site of the oviduct named ampulla, and fertilization takes place."
 - *Reproduction* Journal Article⁵¹
52. "In sexually reproducing organisms, *embryogenesis begins with the fusion of two haploid gametes*"
 - *Reproductive Biology and Endocrinology* Journal Article⁵²

2015, 370(1661):20140101. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

⁴⁸ Darszon A., Nishigaki, T., Beltran, C., & Treviño, C.L., *Calcium channels in the development, maturation, and function of spermatozoa*, *Physiol Rev.* 2011, 91(4):1305-55. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

⁴⁹ Sun, T.T., Chung, C.M., & Chan, H.C. *Acrosome reaction in the cumulus oophorus revisited: involvement of a novel sperm-released factor NYD-SP8*, *Protein Cell*, 2011, 2(2):92-8. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

⁵⁰ Soygur, B. & Sati, L., *The role of syncytins in human reproduction and reproductive organ cancers*, *Reproduction*, 2016, 152(5):R167-78. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

⁵¹ Coy, P., Garcia-Vazquez, F.A., Visconti, P.E., & Aviles, M. *Roles of the oviduct in mammalian fertilization*, *Reproduction* 144(6):649, 2012. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

⁵² Tscherner, A., Gilchrist, G., Smith, N., Blondin, P., Gillis, D., & LaMarre, J., *MicroRNA-34 family expression in bovine gametes and preimplantation embryos*, *Reprod Biol Endocrinol*, 2014, 12:85. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

53. “Fertilization is the sum of the cellular mechanisms that pass the genome from one generation to the next and *initiate development of a new organism*”
 - *Science Journal Article*⁵³
54. “At fertilization, eggs unite with sperm to initiate developmental programs that give rise to development of the embryo. Defining the molecular mechanism of this fundamental process at *the beginning of life* has been a key question in cell and developmental biology”
 - *Seminars in Cell and Developmental Biology Journal Article*⁵⁴
55. “At the time of fertilization, an increase in the intracellular Ca(2+) concentration ([Ca(2+)](i)) underlies egg activation and *initiation of development* in all species studied to date”
 - *The Journal of Cellular Physiology Journal Article*⁵⁵
56. “*As the start of a new life cycle, activation of the first division of the zygote* is a critical event in both plants and animals”
 - *The Plant Journal Journal Article*⁵⁶
57. “*The fusion of a sperm with an oocyte to form new life* is a highly regulated event”
 - *Theriogenology Journal Article*⁵⁷
58. “*Most readers of this review originated from a sperm-egg fusion event*”

⁵³ Primakoff, P. & Myles, D.G. *Penetration, adhesion, and fusion in mammalian sperm-egg interaction*. Science. 2002. 296(5576):2183-5. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

⁵⁴ Sato, K., Fukami, Y., & Stith, B.J., *Signal transduction pathways leading to Ca2+ release in a vertebrate model system: lessons from Xenopus eggs*, Semin Cell Dev Biol, 2006. 17(2):285-92. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

⁵⁵ Wakai, T., Vanderheyden, V., Yoon, S.Y., Cheon, B., Zhang, N., Parys, J.B., & Fissore, R.A., *Regulation of inositol 1,4,5-trisphosphate receptor function during mouse oocyte maturation*, J Cell Physiol, 2012, 227(2):705-17. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

⁵⁶ Guo, L., Jiang, L., Zhang, Y., Lu, X.L., Xie, Q., Weijers, D., & Liu, C.M., *The anaphase-promoting complex initiates zygote division in Arabidopsis through degradation of cyclin B1*, Plant J, 2016, 86(2):161-74. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

⁵⁷ Gadella, B.M. & Boerke, A., *An update on post-ejaculatory remodeling of the sperm surface before mammalian fertilization*, Theriogenology, 2015, 85(1):113-24. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

- *Trends in Cell Biology* Journal Article⁵⁸

III. Articles

59. "When fertilization is complete, a unique genetic human entity exists"
- Mayo Clinic Ethicist Dr. Christopher Hook, M.D.⁵⁹
60. "Life begins with fertilization and abortion is legalized destruction of life... We tell her exactly how it is . . . when they abort, they'll be aborting a small baby"
- Abortion Doctor Dr. Arthur Morris, Jr.⁶⁰
61. "When a human being begins to exist as a single-cell organism is an essential and relevant scientific fact of life that everyone can and should know, because there is a simple, well-established answer. For 75 years the field of human embryology (the branch of biology that specializes in the beginning of human life and early development) has documented when a human life begins in the Carnegie Stages of Early Human Embryonic Development and the Carnegie Chart"
- Science Educator Brooke Stanton⁶¹

IV. Science Books

62. "[T]he evidence no longer allows a discussion as to if and when and in what month of ontogenesis a human being is formed. To be a human being is decided for an organism at the moment of fertilization of the ovum. For this reason we have to regard the intrinsic quality of the fertilized ovum as an essential prerequisite, decisive for all future ontogenesis".
- German anatomist and embryologist Dr. Erich Blechschmidt, M.D.⁶²
63. "[T]he fertilized egg (zygote) is the beginning of a new diploid individual."

⁵⁸ Oren-Suissa, M. & Podbilewicz, B., *Cell fusion during development*, Trends Cell Biol, 2007, 17(11):537-46, Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

⁵⁹ Hook, C. Mayo Clinic, as quoted by Richard Ostling in an AP news story, 9.24.99. Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

⁶⁰ *Asheville Citizen-Times*, April 4, 1976. Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

⁶¹ Stanton, B., *Science tells us when life begins. Why isn't it taught in the class room?*, Washington Examiner, 2018, <https://www.washingtonexaminer.com/science-tells-us-when-life-begins-why-isnt-it-taught-in-the-classroom>.

⁶² Blechschmidt, E. *Beginnings of Human Life*, New York, Heidelberg, and Berlin: Springer Verlag, 1977. Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

- Biology Professor Dr. Richard E. Jones, Ph.D.⁶³
64. “*Human development begins at fertilization* when an oocyte (ovum) from a female is fertilized by a sperm (spermatozoon) from a male... Embryology is concerned with the origin and development of a human being from a zygote to birth”
- Medical School Professor Dr. Keith L Moore, Ph.D., D.Sc.⁶⁴
65. “Human development begins at fertilization, when a sperm fuses with an oocyte to form a single cell, the zygote. This highly specialized, *totipotent cell* (capable of giving rise to any cell type) marks *the beginning of each of us as a unique individual*.”
- Medical School Professor Dr. Keith L Moore, Ph.D., D.Sc.⁶⁵
66. “The main results of fertilization are as follows: Restoration of the diploid number of chromosomes, half from the father half from the mother. Hence, the zygote contains a new combination of chromosomes different from both parents. Determination of the sex *of the new individual*. An X-carrying sperm produces a female (XX) embryo and a Y-carrying sperm produces a male (XY) embryo. Therefore, the chromosomal sex of the embryo is determined at fertilization”
- Embryologist Dr. T.W. Sadler, Ph.D.⁶⁶
67. “*All of us were once human embryos*, so the study of human embryology is the study of our own prenatal origins and experiences.” (p. 2); “Fertilization, the uniting of egg and sperm, takes place in the oviduct. After the oocyte finishes meiosis, the paternal and maternal chromosomes come together, resulting in the formation of a zygote containing a single diploid nucleus. *Embryonic development is considered to begin at this point*.” (p.14)

⁶³ Jones, R. E. *Human Reproductive Biology*, 4th edition. Waltham, MA. Elsevier, Academic Press, 2014, p. 169. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

⁶⁴ Moore, K.L. *Before We Are Born: Essentials of Embryology*, 9th edition. Philadelphia, PA: Saunders, 2016. p. 1. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

⁶⁵ Keith L. Moore, *The Developing Human: Clinically Oriented Embryology*, 10th edition. Philadelphia, PA: Saunders, 2016. p. 11. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

⁶⁶ Sadler, T.W. *Langman's Medical Embryology*, 13th edition. Philadelphia, PA: Lippincott Williams & Wilkins, 2015. p. 42 (*emphasis added*). Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

- Medical School Professor Dr. Gary C. Schoenwolf, Ph.D.⁶⁷

68. "[T]he evidence no longer allows a discussion as to if and when and in what month of ontogenesis a human being is formed. To be a human being is decided for an organism at the moment of fertilization of the ovum. For this reason we have to regard the intrinsic quality of the fertilized ovum as an essential prerequisite, decisive for all future ontogenesis".

- German anatomist and embryologist Dr. Erich Blechschmidt, M.D.⁶⁸

69. "Today it is known that the early stages of human development are strikingly different from the early developmental stages of all other species. . . . Ontogeny is phenogenesis. We talk of human development not because a jumble of cells, which is perhaps initially atypical, gradually turns more and more into a human, but rather because the human being develops from a uniquely human cell. There is no stage in human development prior to which one could claim that a being exists with not-yet-human individuality. On the basis of anatomical studies, we know today that no development phase exists that constitutes a transition from the not-yet-human to the human. . . . In short, a fertilized human egg (conceptus) is already a human being. . . . The following important statement is valid: that which changes during development is only the phenotype but not the essence"

- German anatomist and embryologist Dr. Erich Blechschmidt, M.D.⁶⁹

70. "Almost all higher animals start their lives from a single cell, the fertilized ovum (zygote). . . . The time of fertilization represents the starting point in the life history, or ontogeny, of the individual"

- Embryologist and Biology Professor Dr. Bruce M. Carlson, M.D., Ph.D.⁷⁰

71. "No physician can say with certainty: if this pregnancy is not terminated promptly, the mother will die or her health be seriously impaired. On the other

⁶⁷ Schoenwolf, G. C. *Larsen's Human Embryology*, 5th edition. Philadelphia, PA: Elsevier, Saunders, 2015. p. 2, 14. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

⁶⁸ Blechschmidt, E. *Beginnings of Human Life*, New York, Heidelberg, and Berlin: Springer Verlag, 1977. Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

⁶⁹ Blechschmidt, E. & Freeman, B (Ed.), *The Ontogenic Basis of Human Anatomy: A Biodynamic Approach to Development from Conception to Birth*, Berkeley, CA: North Atlantic, 2004. Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

⁷⁰ Carlson, B.M., *Patten's Foundations of Embryology*, 6th ed. (New York: McGraw-Hill, 1996, p. 3. Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

hand, he cannot say with certainty: if this pregnancy is terminated promptly by abortion, the mother will live. A physician has a clear duty to preserve human life, but by what principle can one demonstrate that he is the arbiter of life and death and can therefore decide to kill one human being in order that another may live? [All doctors (except abortionists) feel that the principles of the sanctity of human life held since the time of the ancient Jews and Hippocrates and stubbornly defended by the Catholic Church are correct, and we are pained when placed before the necessity of sacrificing it. At the present time, when rivers of blood and tears of innocent men, women and children are flowing in most parts of the world, it seems almost silly to be contending over the right to live of an unknowable atom of human flesh in the uterus of a woman. No, it is not silly. On the contrary, it is of transcendent importance that there be in this chaotic world one high spot, however small, which is safe against the deluge of immorality and savagery that is sweeping over us. That we, the medical profession, hold to the principle of the sacredness of human life and the rights of the individual, even though unborn, is proof that humanity is not yet lost and that we may ultimately attain salvation. - ed.]"

- Dr. Joseph B. DeLee, M.D. & Dr. J.P. Greenhill, M.D.⁷¹

72. "Sexual reproduction occurs when female and male gametes (oocyte and spermatozoon, respectively) *unite at fertilization*."

- Medical School Professor Dr. Ronald W. Dudek, Ph.D.⁷²

73. "Development of the embryo begins at Stage 1 when a sperm fertilizes an oocyte and together they form a zygote"

- Medical School Professor Dr. Marjorie A. England⁷³

74. "The zygote thus formed represents the beginning of a new life"

- Dr. J.P. Greenhill, M.D. & Dr. Emanuel A. Friedman, M.D., DMedSci⁷⁴

75. "The basic fact is simple: life begins not at birth, but conception"

⁷¹ DeLee, J.B. & Greenhill, J.P. (Eds.), *1940 Yearbook of Obstetrics and Gynecology*, Chicago: Yearbook, 1941, pp. 68, 69. Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

⁷² Dudek, R.W. *Embryology*, 4th edition. Philadelphia, PA. Lippincott Williams and Wilkins, 2008, p. 1. Cited by: <http://bdfund.org/wp-content/uploads/2016/05/Condic-Sources-Embryology.pdf>.

⁷³ England, M.A., in *Life Before Birth*, 2nd ed., London: Mosby-Wolfe, 1996, p. 31. Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

⁷⁴ Greenhill, J.P. & Friedman, E.A., *Biological Principles and Modern Practice of Obstetrics*, Philadelphia: W.B. Saunders, 1974, p. 17. Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

- Harvard University Geneticist Dr. Ashley Montagu, Ph.D.⁷⁵
76. "Human development begins after the union of male and female gametes or germ cells during a process known as fertilization. . . . Fertilization is a sequence of events that begins with the contact of a sperm (spermatozoon) with a secondary oocyte (ovum) and ends with the fusion of their pronuclei (the haploid nuclei of the sperm and ovum) and the mingling of their chromosomes to form a new cell. This fertilized ovum, known as a zygote, is a large diploid cell that is the beginning, or primordium, of a human being"
- Medical School Professor Dr. Keith L Moore, Ph.D., D.Sc.⁷⁶
77. "It is the penetration of the ovum by a spermatazoan and resultant mingling of the nuclear material that constitutes the culmination of the process of fertilization and marks the initiation of the life of a new individual"
- Embryologist and Medical School Professor Bradley M. Patten, Ph.D.⁷⁷
78. "Although life is a continuous process, fertilization... is a critical landmark because, under ordinary circumstances a new, genetically distinct human organism is formed when the chromosomes of the male and female pronuclei blend in the oocyte"
- Medical School Professors Dr. Ronan O'Rahilly, M.D. & Dr. Fabiola Müller, M.D.⁷⁸
79. "The development of a human begins with fertilization, a process by which the spermatozoon from the male and the oocyte from the female unite to give rise to a new organism, the zygote"
- Embryologist Dr. T.W. Sadler, Ph.D.⁷⁹
80. "[A]nimal biologists use the term embryo to describe the single cell stage, the two-cell stage, and all subsequent stages up until a time when recognizable humanlike limbs and facial features begin to appear between six to eight weeks

⁷⁵ Montagu, A. *Life Before Birth*, New York, Signet, 1977. Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

⁷⁶ Moore, K.L., *Essentials of Human Embryology*, Toronto: B.C. Decker, 1988, p. 2. Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

⁷⁷ Patten, B.M., *Human Embryology*, 3rd ed., New York: McGraw-Hill, 1968, p. 43. Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

⁷⁸ O'Rahilly, R. & Muller, F. *Human Embryology and Teratology*, 3rd ed., New York: Wiley-Liss, 2001, p. 8. Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

⁷⁹ Sadler, T.W., *Langman's Medical Embryology*, 7th ed., Baltimore: Williams & Wilkins, 1995, p. 3. Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

after fertilization..."; "[A] number of specialists working in the field of human reproduction have suggested that we stop using the word embryo to describe the developing entity that exists for the first two weeks after fertilization. In its place, they proposed the term pre-embryo..."; "I'll let you in on a secret. The term pre-embryo has been embraced wholeheartedly by IVF practitioners for reasons that are political, not scientific. The new term is used to provide the illusion that there is something profoundly different between what we nonmedical biologists still call a six-day-old embryo and what we and everyone else call a sixteen-day-old embryo"; "The term pre-embryo is useful in the political arena -- where decisions are made about whether to allow early embryo (now called pre-embryo) experimentation -- as well as in the confines of a doctor's office, where it can be used to allay moral concerns that might be expressed by IVF patients. 'Don't worry,' a doctor might say, 'it's only pre-embryos that we're manipulating or freezing. They won't turn into real human embryos until after we've put them back into your body.'"

- Princeton University Professor Dr. Lee M. Silver, Ph.D.⁸⁰

V. Books

81. "Perhaps the most straightforward relation between you and me on the one hand and every human fetus from conception onward on the other is this: All are living members of the same species, homo sapiens. A human fetus, after all, is simply a human being at a very early stage in his or her development"

- Philosophy Professor David Boonin, Ph.D.⁸¹

82. "A human fetus is not a nonhuman animal; it is a stage of human being"

- Philosophy Professor Wayne Sumner, Ph.D.⁸²

83. "Modern technologies have convinced us that beyond question the unborn child is simply another human being, another member of the human community, indistinguishable in every way from any of us"

- Abortion Doctor Dr. Bernard Nathanson, M.D.⁸³

⁸⁰ Silver, L.M., *Remaking Eden: Cloning and Beyond in a Brave New World*, New York: Avon Books, 1997, p. 39. Cited by:

<https://www.princeton.edu/~prolife/articles/embryoquotes2.html>.

⁸¹ Boonin, D. *A Defense of Abortion*, New York: Cambridge University Press, 2002, p. 20. Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

⁸² Sumner, W. *Abortion and Moral Theory*, Princeton, NJ: Princeton University Press, 1981, p. 10. Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

⁸³ Bernard Nathanson, B. *Aborting America*, Garden City, NY: Doubleday, 1979. Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

84. "I accept what is biologically manifest, that human life commences at the time of conception"
- Obstetrician-Gynecologist Dr. Landrum Shettles⁸⁴

VI. Hearings and Events

85. "Physicians, biologists, and other scientists agree that conception marks the beginning of the life of a human being—a being that is alive and is a member of the human species. There is overwhelming agreement on this point in countless medical, biological, and scientific writings."
- The Official Senate report on Senate Bill 158 (the "Human Life Bill")⁸⁵
86. "Pro-abortionists, though invited to do so, failed to produce even a single expert witness who would specifically testify that life begins at any point other than conception or implantation. Only one witness said no one can tell when life begins"
- A prominent physician pointed out at 1981 Senate hearings on the "Human Life Bill" (S-158, 97th Congress, 1st Session, 1981)⁸⁶
87. "I have learned from my earliest medical education that human life begins at the time of conception. . . . I submit that human life is present throughout this entire sequence from conception to adulthood and that any interruption at any point throughout this time constitutes a termination of human life. . . . I am no more prepared to say that these early stages [of development in the womb] represent an incomplete human being than I would be to say that the child prior to the dramatic effects of puberty . . . is not a human being. This is human life at every stage"

⁸⁴ Shettles, L. *Rites of Life*, Grand Rapids, MI: Zondervan, p. 103. Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

⁸⁵ S-158, 97th Congress, 1st Session, 1981; "Background on the Committee testifiers: A group of internationally-known biologists and geneticists appeared to speak on behalf of the scientific community on the subject of when a human being begins. They all presented the same view and there was no opposing testimony. Among those testifying: Dr. Micheline M. Mathews-Roth, Harvard medical School, Dr. Jerome Lejeune ("Father of Modern Genetics"), Dr. McCarthy de Mere, medical doctor and law professor, University of Tennessee, Dr. Alfred Bongiovanni, Professor of Pediatrics and Obstetrics, University of Pennsylvania School of Medicine, Dr. Richard V. Jaynes, Dr. Landrum Shettles, sometimes called the "Father of In Vitro Fertilization", Professor Eugene Diamond, Gordon, Hymie, M.D., F.R.C.P., Chairman of Medical Genetics, Mayo Clinic, Rochester" (https://www.facebook.com/notes/716620865136847/?__tn__=H-R).

⁸⁶ S-158, 97th Congress, 1st Session, 1981. <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

- Medical School Professor of Pediatrics and Obstetrics Dr. Alfred M. Bongiovanni, M.D.⁸⁷
88. "[A]fter fertilization has taken place a new human being has come into being . . . not a metaphysical contention, it is plain experimental evidence. . . . Each individual has a very neat beginning, at conception"; "The human nature of the human being from conception to old age is not a metaphysical contention, it is plain experimental evidence"
- Medical School Professor Dr. Jerome LeJeune, M.D.⁸⁸
89. "By all the criteria of modern molecular biology, life is present from the moment of conception"
- Mayo Clinic Medical School Professor Dr. Hymie Gordon, M.D.⁸⁹
90. "It is incorrect to say that biological data cannot be decisive... It is scientifically correct to say that an individual human life begins at conception... Our laws, one function of which is to help preserve the lives of our people, should be based on accurate scientific data"
- Harvard University Medical School Professor Micheline Matthews-Roth⁹⁰
91. "The beginning of a single human life is from a biological point of view a simple and straightforward matter, the beginning is conception. This straightforward biological fact should not be distorted to serve sociological, political, or economic goals"
- Medical School Professor Dr. Watson A. Bowes⁹¹
92. "[A]bortion terminates the life of a unique, whole, living human being"
- Conclusion of Report of The South Dakota Task Force to Study Abortion⁹²

⁸⁷ S-158, 97th Congress, 1st Session, 1981. <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

⁸⁸ S-158, 97th Congress, 1st Session, 1981. <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

⁸⁹ S-158, 97th Congress, 1st Session, 1981. <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

⁹⁰ S-158, 97th Congress, 1st Session, 1981. <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

⁹¹ S-158, 97th Congress, 1st Session, 1981. <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

⁹² Report of The South Dakota Task Force to Study Abortion, Submitted to the Governor and Legislature of South Dakota, p. 13, 2005. <https://www.dakotavoices.com/Docs/South%20>

93. "The changes occurring between implantation, a six-week embryo, a six-month fetus, a one-week-old child, or a mature adult are merely stages of development and maturation. The majority of our group could find no point in time between the union of sperm and egg, or at least the blastocyst stage, and the birth of the infant at which point we could say that this was not a human life"
 - o Conclusion from the First International Symposium on Abortion⁹³

VII. Additional Sources

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4. House Resolution No. 214, <https://leg1.state.va.us/cgi-bin/legp504.exe?151+ful+HR214+pdf>.
5. Irving, D.N. *What Human Embryo?: Funniest Mental Gymnastics from Medicine and Research*, Catholic Culture, <https://www.catholicculture.org/culture/library/view.cfm?recnum=6373>.
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Dakota%20Abortion%20Task%20Force%20Report.pdf.

⁹³ *Abortion Questions and Answers*, Cincinnati, OH: Hayes, 1988, p. 42. Cited by: <https://lis.virginia.gov/cgi-bin/legp604.exe?161+ful+HR19+pdf>.

9. *Life Begins at Fertilization*, Princeton University, <https://www.princeton.edu/~prolife/articles/embryoquotes2.html>.
10. *Life Begins at Fertilization – Peer Reviewed Scientific Sources*, The Fetal Position, May 29, 2019, <https://thefetalposition.com/conception>.
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12. *The Carnegie Stages of Human Embryonic Development*, Contend Projects, <https://contendprojects.org/the-science/carnegie-stages>
13. *The Science of the Unborn*, Pro-Life Atheists, October 20, 2015, https://www.facebook.com/notes/716620865136847/?__tn__=H-R.

VIII. 1,061 Institutions Represented in Study on When Life Begins

These are the academic institutions of the biologists who affirmed that a human's life begins at fertilization in the recent international study on when a human's life begins.

Aarhus University	Denmark
Abilene Christian University	USA
Adelphi University	USA
Agnes Scott College	USA
Aix-Marseille University	France
Alabama State University	USA
Albert Ludwigs University of Freiburg	Germany
Albion College	USA
Alcorn State University	USA
Allegheny College	USA
Alma College	USA
Alma Mater Studiorum - University of Bologna	Italy
American Museum of Natural History	USA
American University	USA
Amherst College	USA
Anderson University	USA
Angelo State University	USA
Appalachian State University	USA
Arcadia University	USA
Aristotle University of Thessaloniki	Greece
Arizona Christian University	USA
Arizona State University	USA
Arkansas State University	USA
Arkansas Tech University	USA
Armstrong State University	USA
Ashland University	USA
Assumption College	USA
Auburn University	USA
Augsburg College	USA
Augusta University	USA
Augustana College	USA
Austin College	USA
Australian National University	Australia
Ave Maria University	USA

Azusa Pacific University	USA
Babson College	USA
Baldwin Wallace University	USA
Ball State University	USA
Bangor University	USA
Bard College	USA
Barnard College	USA
Barrow Neurological Institute	USA
Barry University	USA
Barton College	USA
Bates College	USA
Bay Path College	USA
Belmont Abbey College	USA
Belmont University	USA
Beloit College	USA
Ben Gurion University of the Negev	Israel
Bennington College	USA
Berea College	USA
Bethel College	USA
Bethel University	USA
Bethune-Cookman University	USA
Biola University	USA
Birkbeck, University of London	England
Birmingham-Southern College	USA
Bismarck State College	USA
Black Hills State University	USA
Blackburn College	USA
Bloomsburg University of Pennsylvania	USA
Bluffton University	USA
Boehringer Ingelheim	Germany
Boise State University	USA
Boston College	USA
Boston College of Medicine	USA
Boston University	USA
Bowie State University	USA
Bowling Green State University	USA
Bradley University	USA
Brandeis University	USA
Brenau University	USA
Bridgewater College	USA

Bridgewater State University	USA
Brigham Young University	USA
Brigham Young University - Idaho	USA
Brooklyn College	USA
Brooklyn College	USA
Brown University	USA
Bryan College	USA
Bryn Mawr College	USA
Bucknell University	USA
Buena Vista University	USA
Buffalo State	USA
Cal Poly	USA
California Institute of Technology	USA
California Lutheran University	USA
California Maritime Academy	USA
California State University	USA
Calvin College	USA
Cameron University	USA
Campbell University	USA
Canisius College	USA
Capital University	USA
Cardiff University	USA
Carleton College	USA
Carnegie Mellon University	USA
Carson-Newman College	USA
Cary Institute of Ecosystem Studies	USA
Case Western Reserve University	USA
Catholic University	USA
Cedar Crest College	USA
Central College	USA
Central Michigan University	USA
Central South University	China
Central Washington University	USA
Centre College	USA
Chalmers University of Technology	Sweden
Chaminade University of Honolulu	USA
Champlain College	USA
Chapman University	USA
Charles University	Czech Republic
Charleston Southern University	USA

Chatham University	USA
Chestnut Hill College	USA
Chicago Botanic Garden	USA
Chicago State University	USA
Chico State University	USA
China Medical University	Taiwan
Chinese University of Hong Kong	Hong Kong
Chowan University	USA
Christian Albrechts University zu Kiel	Germany
Christian Brothers University	USA
Christopher Newport University	USA
Chulalongkorn University	Thailand
Citadel Military College	USA
City University of Hong Kong	Hong Kong
Clark University	USA
Clarkson University	USA
Clayton State University	USA
Clemson University	USA
Cleveland State University	USA
Coastal Carolina University	USA
Coe College	USA
Coker College	USA
Colby College	USA
Colgate University	USA
College at Brockport	USA
College of Charleston	USA
College of Idaho	USA
College of New Jersey	USA
College of St. Scholastica	USA
College of Staten Island	USA
College of the Atlantic	USA
College of William & Mary	USA
College of Wooster	USA
Colorado Christian University	USA
Colorado College	USA
Colorado Mesa University	USA
Colorado State University	USA
Columbia University	USA
Columbus State University	USA
Concordia College	USA

Concordia University	USA
Connecticut College	USA
Converse College	USA
Cornell College	USA
Cornell University	USA
Covenant College	USA
Creighton University	USA
CUNY	USA
CUNY - Baruch College	USA
CUNY - Brooklyn College	USA
CUNY - CCNY	USA
CUNY - Graduate Center	USA
CUNY - Hunter College	USA
CUNY - Queens College	USA
CUNY - The Graduate Center	USA
CUNY - York College	USA
Curry College	USA
D'Youville College	USA
Daemen College	USA
Dalhousie University	Canada
Dartmouth College	USA
Davidson College	USA
Davis & Elkins College	USA
Deakin University	Australia
Delaware State University	USA
Delaware Valley College	USA
Delta State University	USA
Denison University	USA
DePaul University	USA
DePauw University	USA
DeSales University	USA
Desert Botanical Garden	USA
Dickinson College	USA
Dixie State University	USA
Doane College	USA
Dominican College	USA
Dominican University	USA
Drake University	USA
Drew University	USA
Drexel University	USA

Dublin City University	Ireland
Duke University	USA
Duquesne University	USA
Durham University	England
Earlham College	USA
East Stroudsburg University	USA
East Tennessee State University	USA
East Texas Baptist University	USA
Eastern Connecticut State University	USA
Eastern Illinois University	USA
Eastern Kentucky University	USA
Eastern Mennonite University	USA
Eastern Michigan University	USA
Eastern New Mexico University	USA
Eastern University	USA
Eberhard Karls Universitat Tübingen	Germany
Eckerd College	USA
Ecole Normale Supérieure de Lyon	France
Ecole Normale Supérieure Paris	France
Ecole Polytechnique Fédérale de Lausanne	Switzerland
Edinboro University	USA
Eindhoven University of Technology	Netherlands
Elmhurst College	USA
Elmira College	USA
Elms College	USA
Emmanuel College	USA
Emory University	USA
Emporia State University	USA
Endicott College	USA
Eötvös Loránd University	Hungary
Erasmus University Rotterdam	Netherlands
Eureka College	USA
Evergreen State College	USA
Fairfield University	USA
Fairleigh Dickinson University	USA
Field Museum	USA
Flinders University	Australia
Florida A&M University	USA
Florida Atlantic University	USA
Florida Institute of Technology	USA

Florida International University	USA
Florida State University	USA
Fordham University	USA
Fort Hays State University	USA
Fort Lewis College	USA
Fort Valley State University	USA
Framingham State University	USA
Francis Marion University	USA
Franklin and Marshall College	USA
Fredonia	USA
Freie Universitaet Berlin	Germany
Fresno Pacific University	USA
Fresno State University	USA
Friedrich-Alexander-Universitat Erlangen Nurnberg	Germany
Furman University	USA
Gallaudet University	USA
Gannon University	USA
Genome Institute of Singapore	Singapore
George Fox University	USA
George Mason University	USA
George Washington University	USA
Georgetown University	USA
Georgia College	USA
Georgia Institute of Technology	USA
Georgia Southern University	USA
Georgia Southwestern State University	USA
Georgia State University	USA
Georgia Tech University	USA
Georgian Court University	USA
Gettysburg College	USA
Ghent University	Belgium
Gonzaga University	USA
Gordon College	USA
Goshen College	USA
Grace College	USA
Grambling State University	USA
Grand Valley State University	USA
Grand View University	USA
Great Basin College	USA
Green Mountain College	USA

Griffith University	Australia
Grinnell College	USA
Guilford College	USA
Gustavus Adolphus College	USA
Gwynedd Mercy University	USA
Hampden-Sydney College	USA
Hampton University	USA
Harding University	USA
Hartwick College	USA
Harvard University	USA
Harvey Mudd College	USA
Haskell Indian Nations University	USA
Haverford College	USA
Hawaii Pacific University	USA
Hebrew University of Jerusalem	Israel
Heidelberg University	Germany
Henderson State University	USA
High Point University	USA
Hiram College	USA
Hobart & William Smith Colleges	USA
Hofstra University	USA
Hokkaido University	Japan
Hollins University	USA
Holy Cross	USA
Hong Kong University of Science and Technology	USA
Hood College	USA
Hope College	USA
Houston Baptist University	USA
Howard University	USA
Humboldt State University	USA
Humboldt-Universitat zu Berlin	Germany
Huntingdon College	USA
Idaho State University	USA
Illinois College	USA
Illinois Institute of Technology	USA
Illinois State University	USA
Imperial College London	England
Indian Institute of Technology Bombay	India
Indiana State University	USA
Indiana University - Bloomington	USA

Indiana University of Pennsylvania	USA
Indiana Wesleyan University	USA
Institut Pasteur	France
Institute of Bioorganic Chemistry	Russia
Institute of Molecular Biology - Boehringer Ingelheim Foundation	Germany
Iowa State University	USA
IPFW	USA
Ithaca College	USA
IUPUI	USA
Jackson State University	USA
Jacksonville State University	USA
Jagiellonian University	Poland
James Madison University	USA
Jawaharlal Nehru University	India
Jefferson	USA
Johannes Gutenberg Universitat Mainz	Germany
John Brown University	USA
Johns Hopkins University	USA
Judson University	USA
Julius Maximillians Universitat Wurzburg	Germany
Juniata College	USA
Kansas State University	USA
Karlsruhe Institute of Technology	Germany
Karolinska Institutet	Sweden
Kean University	USA
Keene State College	USA
Kennesaw State University	USA
Kent State University	USA
Kentucky State University	USA
Kentucky Wesleyan College	USA
King Abdullah University of Science and Technology	Saudi Arabia
King University	USA
King's College London	England
Knox College	USA
Kobe University	Japan
Korea University	South Korea
KU Leuven	Belgium
Kutztown University	USA
Kyoto University	Japan

Kyushu University	Japan
La Roche College	USA
La Salle University	USA
La Trobe University	Australia
Lafayette College	USA
LaGrange College	USA
Lake Erie College	USA
Lake Superior State University	USA
Lancaster University	England
Lander University	USA
Laval University	Canada
Le Moyne College	USA
Lee University	USA
Lees-McRae College	USA
Lehigh University	USA
Lehman College	USA
Leiden University	Netherlands
Lenoir-Rhyne University	USA
Lewis & Clark College	USA
Lewis University	USA
Liberty University	USA
Lincoln Park Zoo	USA
Lincoln University	USA
Linköping University	Sweden
Loma Linda University	USA
Lomonosov Moscow State University	Russia
London School of Hygiene and Tropical Medicine	England
Long Island University	USA
Longwood University	USA
Loras College	USA
Louisiana State University	USA
Louisiana State University - Baton Rouge	USA
Louisiana Tech University	USA
Loyola Marymount University	USA
Loyola University - Chicago	USA
Loyola University Maryland	USA
Loyola University New Orleans	USA
Lubbock Christian University	USA
Ludwig-Maximilian University of Munich	Germany
Lund University	Sweden

Luther College	USA
Lynchburg College	USA
Lynn University	USA
Maastricht University	Netherlands
Macalester College	USA
Macquarie University	Australia
Mahidol University	Thailand
Malone University	USA
Manchester University	USA
Manhattan College	USA
Marist College	USA
Marlboro College	USA
Marquette University	USA
Mars Hill University	USA
Marshall University	USA
Martin Luther University of Halle-Wittenberg	Germany
Marywood University	USA
Masaryk University	Czech Republic
Massachusetts Institute of Technology	USA
Massey University	New Zealand
McDaniel College	USA
McGill University	Canada
McMaster University	Canada
McMurry University	USA
McNeese State University	USA
Medical University of Graz	Austria
Memorial University of Newfoundland	Canada
Mercer University	USA
Meredith College	USA
Messiah College	USA
Miami University	USA
Michigan State University	USA
Michigan Technological University	USA
Middle Tennessee State University	USA
Millersville University	USA
Millikin University	USA
Millsaps College	USA
Minnesota State University	USA
Minot State University	USA
Misericordia University	USA

Mississippi College	USA
Mississippi State University	USA
Mississippi University for Women	USA
Missouri Botanical Garden	USA
Missouri Southern State University	USA
Missouri State University	USA
Missouri University of Science and Technology	USA
Missouri Western State University	USA
Moffitt Cancer Center	USA
Molloy College	USA
Monash University	Australia
Montana State University	USA
Montana Tech	USA
Montclair State University	USA
Monterey Peninsula College	USA
Moravian College	USA
Morningside College	USA
Mount Holyoke College	USA
Mount Saint Mary College	USA
Mount St. Joseph University	USA
Mount St. Mary's College	USA
Mount St. Mary's University	USA
Muhlenberg College	USA
Murdoch University	Australia
Murray State University	USA
Museum fur Naturkunde Berlin	Germany
Nagoya University	Japan
Nanyang Technological University, Singapore	Singapore
National and Kapodistrian University of Athens	Greece
National Chiao Tung University	Taiwan
National Taiwan University	Taiwan
National University of Ireland Galway	Ireland
National University of Singapore	Singapore
National Yang Ming University	Taiwan
Nazareth College	USA
NC A&T	USA
Neumann University	USA
Nevada State College	USA
New College of Florida	USA
New Jersey City University	USA

New Jersey Institute of Technology	USA
New Mexico Highlands University	USA
New Mexico State University	USA
New Mexico Tech	USA
New Paltz	USA
New York University	USA
Newcastle University	England
Newman University	USA
Niagara University	USA
Nicholls State University	USA
Norfolk State University	USA
North Carolina Central University	USA
North Carolina State University	USA
North Central College	USA
North Dakota State University	USA
North Greenville University	USA
North Park University	USA
Northeastern Illinois University	USA
Northeastern State University	USA
Northeastern University	USA
Northern Arizona University	USA
Northern Illinois University	USA
Northern Kentucky University	USA
Northern Michigan University	USA
Northern New Mexico University	USA
Northwest Missouri State University	USA
Northwest Nazarene University	USA
Northwestern College	USA
Northwestern University	USA
Norwegian University of Science and Technology	Norway
Notre Dame of Maryland University	USA
Notre Dame University	USA
NYC College of Technology	USA
Oakland University	USA
Oberlin College	USA
Occidental College	USA
Ohio State University	USA
Ohio University	USA
Ohio Wesleyan University	USA
Oklahoma Christian University	USA

Oklahoma State University	USA
Old Dominion University	USA
Olivet Nazarene University	USA
Oral Roberts University	USA
Oregon State University	USA
Oregon Zoo	USA
Osaka University	Japan
Oxford Brookes University	England
Pacific Lutheran University	USA
Pacific University	USA
Peking University	China
Penn State University	USA
Pennsylvania State University - University Park	USA
Pepperdine University	USA
Philadelphia University	USA
Philander Smith College	USA
Philipps Universitat Marburg	Germany
Plymouth State University	USA
Point Loma Nazarene University	USA
Pomona College	USA
Pontificia Universidad Catolica de Chile	Chile
Portland State University	USA
POSTECH	South Korea
Princeton University	USA
Principia College	USA
Providence College	USA
Purdue University	USA
Purdue University - West Lafayette	USA
Pusan National University	South Korea
Queen Mary University of London	England
Queen's University at Kingston	Canada
Queen's University Belfast	Ireland
Queensland University of Technology	Australia
Quincy University	USA
Quinnipiac University	USA
Radboud University	Netherlands
Radford University	USA
Ramapo College of New Jersey	USA
Randolph College	USA
Randolph-Macon College	USA

Reed College	USA
Regis University	USA
Rensselaer Polytechnic Institute	USA
Rheinische Friedrich-Wilhelms-Universität Bonn	Germany
Rhodes College	USA
Rice University	USA
Rider University	USA
Ripon College	USA
Rivier College	USA
Roberts Wesleyan College	USA
Rochester Institute of Technology	USA
Rockefeller University	USA
Rockford College	USA
Rocky Mountain College	USA
Rogers State University	USA
Roosevelt University	USA
Rose-Hulman Institute of Technology	USA
Rowan College	USA
Rowan University	USA
Royal Holloway	England
Ruprecht-Karls-Universität Heidelberg	Germany
Rush University Medical Center	USA
Russell Sage College	USA
Rutgers	USA
Rutgers University	USA
Rutgers University - New Brunswick	USA
Rutgers University - Newark	USA
RWTH Aachen University	Germany
Sacramento State	USA
Saginaw Valley State University	USA
Saint Anselm College	USA
Saint Augustine's University	USA
Saint John's University	USA
Saint Joseph's College of Maine	USA
Saint Joseph's University	USA
Saint Louis University	USA
Saint Martin's University	USA
Saint Mary's College of California	USA
Saint Mary's University of Minnesota	USA
Saint Michael's College	USA

Saint Peter's College	USA
Saint Petersburg State University	Russia
Saint Xavier University	USA
Salem College	USA
Salve Regina University	USA
Samford University	USA
San Diego State University	USA
San Jose State University	USA
Sapienza University of Rome	Italy
Seattle Pacific University	USA
Seattle University	USA
Seton Hall University	USA
Seton Hill University	USA
Shanghai Jiao Tong University	China
Shemyakin-Ovchinnikov Institute	Russia
Shenandoah University	USA
Shepherd University	USA
Shippensburg University	USA
Siena College	USA
Simmons College	USA
Simon Fraser University	Canada
Simpson College	USA
Skidmore College	USA
Slippery Rock University	USA
Smith College	USA
Sonoma State University	USA
South Dakota State University	USA
Southeastern Louisiana University	USA
Southern Nazarene University	USA
Southern Oregon University	USA
Southern Utah University	USA
Southern Wesleyan University	USA
Southwestern Oklahoma State University	USA
Southwestern University	USA
Spelman College	USA
Spring Hill College	USA
Springfield College	USA
St. Ambrose University	USA
St. Andrews University	USA
St. Bonaventure University	USA

St. Catherine University	USA
St. Cloud State University	USA
St. Edward's University	USA
St. Francis College	USA
St. John Fisher College	USA
St. John's University	USA
St. Joseph's College	USA
St. Lawrence University	USA
St. Louis University	USA
St. Mary's College	USA
St. Norbert College	USA
St. Olaf College	USA
Stanford University	USA
Stellenbosch University	South Africa
Stephen F. Austin State University	USA
Stevens Institute of Technology	USA
Stevenson University	USA
Stockholm University	Sweden
Stockton University	USA
Suffolk University	USA
Sungkyunkwan University	South Korea
SUNY - Binghamton University	USA
SUNY - Cortland	USA
SUNY - Geneseo	USA
SUNY - Oneonta	USA
SUNY - Oswego	USA
SUNY - Plattsburgh	USA
SUNY - Potsdam	USA
SUNY - Purchase	USA
SUNY - Stony Brook University	USA
SUNY - University at Albany	USA
SUNY - University at Buffalo	USA
Susquehanna University	USA
Swarthmore College	USA
Sweet Briar College	USA
Syracuse University	USA
Tabor College	USA
Taipei Medical University	Taiwan
Tarleton State University	USA
Technical University of Denmark	Denmark

Technical University of Munich	Germany
Technion Israel Institute of Technology	Israel
Technische Universitat Darmstadt	Germany
Technische Universitat Dresden	Germany
Tel Aviv University	Israel
Temple University	USA
Texas A&M University - College Station	USA
Texas A&M University - Corpus Christi	USA
Texas A&M University - Kingsville	USA
Texas Christian University	USA
Texas Tech University	USA
Texas Woman's University	USA
Thomas Jefferson University	USA
Thomas More College	USA
Tiffin University	USA
Tokyo Institute of Technology	Japan
Touro College	USA
Towson University	USA
Transylvania University	USA
Trinity College	USA
Trinity College - Dublin	Ireland
Trinity University	USA
Trinity Washington University	USA
Truman State University	USA
Tsinghua University	China
Tufts University	USA
Tulane University	USA
U.S. Geological Survey	USA
UC Merced	USA
Umea University	Sweden
UMES	USA
UNC Charlotte	USA
UNC Pembroke	USA
Union College	USA
Union University	USA
UNIST - Korea	South Korea
Univerisite libre de Bruxelles	Belgium
Universidad Autonoma de Madrid	Spain
Universidad de Buenos Aires	Argentina
Universidad de Chile	Chile

Universidad de Sevilla	Spain
Universidad Nacional Autonoma de Mexico	Mexico
Universidad San Francisco de Quito	Ecuador
Universidade de Sao Paulo	Brazil
Universita degli Studi di Pavia	Italy
Universita di Padova	Italy
Universitat Autonoma de Barcelona	Spain
Universitat Bielefeld	Germany
Universitat de Barcelona	Spain
Universitat Duisburg-Essen	Germany
Universitat Frankfurt am Main	Germany
Universitat Hamburg	Germany
Universitat Jena	Germany
Universitat Leibzig	Germany
Universitat Pompeu Fabra	Spain
Universitat Potsdam	Germany
Universitat Regensburg	Germany
Universitat Stuttgart	Germany
Universite catholique de Louvain	Belgium
Universite Claude Bernard Lyon 1	France
Universite de Montpellier	France
Universite de Montreal	Canada
Universite de Sherbrooke	Canada
Universite de Strasbourg	France
Universite Grenoble-Alpes	France
Universite Laval	Canada
Universite Nice Sophia Antipolis	France
Universite Paris-Sud	France
Universite Pierre et Marie Curie	France
Universiti Malaya	Malaysia
Universiti Sains Malaysia	Malaysia
Universiti Teknologi Malaysia	Malaysia
University College Cork	Ireland
University College Dublin	Ireland
University College London	England
University Complutense Madrid	Spain
University North Carolina - Greensboro	USA
University of Aberdeen	Scotland
University of Adelaide	Scotland
University of Akron	USA

University of Alabama	USA
University of Alabama - Birmingham	USA
University of Alabama - Huntsville	USA
University of Alaska	USA
University of Alaska Fairbanks	USA
University of Alberta	Canada
University of Amsterdam	Netherlands
University of Antwerp	Belgium
University of Arizona	USA
University of Arkansas	USA
University of Arkansas - Monticello	USA
University of Auckland	New Zealand
University of Baltimore	USA
University of Bari	Italy
University of Basel	Switzerland
University of Bayreuth	Germany
University of Bergen	Norway
University of Bern	Switzerland
University of Birmingham	United Kingdom
University of Bologna	Italy
University of Bordeaux	France
University of Bristol	England
University of British Columbia	Canada
University of Calgary	Canada
University of California - Berkeley	USA
University of California - Davis	USA
University of California - Irvine	USA
University of California - Los Angeles	USA
University of California - Riverside	USA
University of California - San Diego	USA
University of California - San Francisco	USA
University of California - Santa Barbara	USA
University of California - Santa Cruz	USA
University of Cambridge	England
University of Canterbury	New Zealand
University of Cape Town	South Africa
University of Central Arkansas	USA
University of Central Florida	USA
University of Central Missouri	USA
University of Chicago	USA

University of Chinese Academy of Sciences	China
University of Cincinnati	USA
University of Cologne	Germany
University of Colorado - Boulder	USA
University of Colorado - Colorado Springs	USA
University of Colorado - Denver	USA
University of Connecticut	USA
University of Crete	Greece
University of Dallas	USA
University of Debrecen	Hungary
University of Delaware	USA
University of Denver	USA
University of Dubuque	USA
University of Dundee	Scotland
University of Dusseldorf	Germany
University of East Anglia	England
University of Edinburgh	Scotland
University of Erlangen-Nuremberg	Germany
University of Evansville	USA
University of Exeter	England
University of Findlay	USA
University of Florence	Italy
University of Florida	USA
University of Geneva	Switzerland
University of Georgia	USA
University of Glasgow	Scotland
University of Gothenburg	Sweden
University of Gottingen	Germany
University of Granada	Spain
University of Groningen	Netherlands
University of Guelph	Canada
University of Hartford	USA
University of Hawaii	USA
University of Hawaii - Hilo	USA
University of Hawaii - Manoa	USA
University of Helsinki	Finland
University of Houston	USA
University of Hyderabad	India
University of Idaho	USA
University of Illinois - Chicago	USA

University of Illinois - Springfield	USA
University of Illinois - Urbana-Champaign	USA
University of Indianapolis	USA
University of Iowa	USA
University of Jamestown	USA
University of Kansas	USA
University of Kentucky	USA
University of KwaZulu-Natal	South Africa
University of Lausanne	Switzerland
University of Leeds	England
University of Leicester	England
University of Lisbon	Portugal
University of Liverpool	England
University of Louisiana	USA
University of Louisiana - Lafayette	USA
University of Louisiana - Monroe	USA
University of Louisville	USA
University of Maine	USA
University of Maine at Augusta	USA
University of Maine at Machias	USA
University of Manchester	England
University of Manitoba	Canada
University of Marburg	Germany
University of Mary Hardin-Baylor	USA
University of Mary Washington	USA
University of Maryland	USA
University of Maryland - Baltimore County	USA
University of Maryland - College Park	USA
University of Massachusetts	USA
University of Massachusetts - Amherst	USA
University of Massachusetts - Boston	USA
University of Massachusetts - Lowell	USA
University of Melbourne	Australia
University of Memphis	USA
University of Miami	USA
University of Michigan - Ann Arbor	USA
University of Michigan - Dearborn	USA
University of Michigan - Flint	USA
University of Milan	Italy
University of Minho	Portugal

University of Minnesota - Duluth	USA
University of Minnesota - Morris	USA
University of Minnesota - Twin Cities	USA
University of Missouri	USA
University of Missouri - Kansas City	USA
University of Missouri - St. Louis	USA
University of Montana	USA
University of Montevallo	USA
University of Mount Union	USA
University of Munster	Germany
University of Naples - Federico II	Italy
University of Nebraska - Lincoln	USA
University of Nebraska - Omaha	USA
University of Nevada - Las Vegas	USA
University of Nevada - Reno	USA
University of New Hampshire	USA
University of New Haven	USA
University of New Mexico	USA
University of New Orleans	USA
University of Newcastle	England
University of North Carolina - Asheville	USA
University of North Carolina - Chapel Hill	USA
University of North Carolina - Charlotte	USA
University of North Carolina - Greensboro	USA
University of North Carolina - Wilmington	USA
University of North Dakota	USA
University of North Florida	USA
University of North Georgia	USA
University of Northern Colorado	USA
University of Northern Iowa	USA
University of Notre Dame	USA
University of Nottingham	United Kingdom
University of Oklahoma	USA
University of Oregon	USA
University of Oslo	Norway
University of Otago	New Zealand
University of Ottawa	Canada
University of Oulu	Finland
University of Oxford	England
University of Pennsylvania	USA

University of Pisa	Italy
University of Pittsburgh	USA
University of Porto	Portugal
University of Pretoria	South Africa
University of Puerto Rico	Puerto Rico
University of Puerto Rico - Rio Piedras	Puerto Rico
University of Queensland	Australia
University of Reading	England
University of Redlands	USA
University of Rhode Island	USA
University of Richmond	USA
University of San Diego	USA
University of San Francisco	USA
University of Saskatchewan	Canada
University of Scranton	USA
University of Sheffield	England
University of South Alabama	USA
University of South Australia	Australia
University of South Carolina	USA
University of South Dakota	USA
University of South Florida	USA
University of Southampton	England
University of Southern California	USA
University of Southern Denmark	Denmark
University of Southern Indiana	USA
University of Southern Maine	USA
University of Southern Mississippi	USA
University of St. Francis	USA
University of St. Thomas	USA
University of Sussex	England
University of Sydney	Australia
University of Tasmania	Australia
University of Technology Sydney	Australia
University of Temple	USA
University of Tennessee - Chattanooga	USA
University of Tennessee - Knoxville	USA
University of Tennessee - Martin	USA
University of Texas - Austin	USA
University of Texas - Dallas	USA
University of Texas - El Paso	USA

University of Texas - San Antonio	USA
University of the Pacific	USA
University of the Sciences	USA
University of the Witwatersrand	South Africa
University of Tokyo	Japan
University of Toronto	Canada
University of Tromsø	Norway
University of Tsukuba	Japan
University of Tübingen	Germany
University of Turin	Italy
University of Turku	Finland
University of Utah	USA
University of Vermont	USA
University of Vienna	Austria
University of Virginia	USA
University of Warsaw	Poland
University of Warwick	England
University of Washington	USA
University of Waterloo	Canada
University of West Alabama	USA
University of West Georgia	USA
University of Western Australia	Australia
University of Western Ontario	Canada
University of Wisconsin - Green Bay	USA
University of Wisconsin - La Crosse	USA
University of Wisconsin - Madison	USA
University of Wisconsin - Milwaukee	USA
University of Wisconsin - Oshkosh	USA
University of Wisconsin - Platteville	USA
University of Wisconsin - Stevens Point	USA
University of Wisconsin - Whitewater	USA
University of Wollongong	Australia
University of Würzburg	Germany
University of Wyoming	Germany
University of York	England
University of Zurich	Switzerland
University Ulm	Germany
Uppsala University	Sweden
UQAC	Canada
UQAM	Canada

UQAR	Canada
UQTR	Canada
Utah State University	USA
Utah Valley University	USA
Utica College	USA
Utrecht University	Netherlands
UW Bothell	USA
Valdosta State University	USA
Valparaiso University	USA
Vassar College	USA
Victoria University of Wellington	New Zealand
Villanova University	USA
Virginia Polytechnic Institute and State University	USA
Virginia Tech	USA
Virginia Wesleyan College	USA
Wagner College	USA
Wake Forest University	USA
Warner Pacific College	USA
Wartburg College	USA
Washburn University	USA
Washington & Jefferson College	USA
Washington College	USA
Washington State University	USA
Washington University in St. Louis	USA
Wayne State University	USA
Weber State University	USA
Webster University	USA
Weizmann Institute of Science	Israel
Wellcome Trust Sanger Institute	England
Wellesley College	USA
Wells College	USA
Wesleyan College	USA
Wesleyan University	USA
West Chester University	USA
West Virginia University	USA
Western Carolina University	USA
Western Illinois University	USA
Western Kentucky University	USA
Western New England University	USA
Western Oregon University	USA

Western State Colorado University	USA
Western Washington University	USA
Westfälische Wilhelms Universität Münster	Germany
Westmont College	USA
Wheaton College	USA
Wheeling Jesuit University	USA
Whitman College	USA
Wichita State University	USA
Widener University	USA
Wilkes University	USA
Willamette University	USA
William Jewell College	USA
William Paterson University	USA
Williams College	USA
Winona State University	USA
Winthrop University	USA
Wisconsin Lutheran College	USA
Worcester Polytechnic Institute	USA
Wright State University	USA
Wuhan University	China
Xavier University	USA
Xi'an Jiaotong University	China
Yale University	USA
Yavapai College	USA
York College	USA
York University	Canada
Youngstown State University	USA