Proponent Testimony of SB275
For the Senate Education Committee
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Chair Erickson and Members of the Committee, thank you for the opportunity to provide proponent testimony in support of Senate Bill 275, providing for an instructional presentation of human development in school district courses that address human growth, human development or human sexuality. I am testifying on my own behalf, based on my experiences as a scientist and educator.

I am a cell, molecular and developmental biologist, and have almost 50 years experience as a scientist, researcher and professor. I am a fifth-generation Kansan, and earned my Ph.D. degree at the University of Kansas. My experience includes federally-funded laboratory research and past academic appointments at the University of Texas Medical School-Houston, Professor of Life Sciences as well as Acting Associate Dean of Arts and Sciences at Indiana State University, Adjunct Professor of Medical and Molecular Genetics at Indiana University School of Medicine, and Adjunct Professor of Molecular Genetics at the John Paul II Institute at The Catholic University of America, as well as experience as a science policy advisor.[1] For many of those years I taught embryology and developmental biology to undergraduate and graduate students, nursing and medical students, as well as to general audiences in public lectures.

I support this legislation. The dearth of understanding about prenatal human development needs to be addressed even at the earliest student ages with scientifically-accurate, age-appropriate education. To ignore this deficit in education is to shortchange students of basic knowledge that can give them a better outlook on human life and human flourishing.

Teaching biologically-accurate human embryology is essential to scientific literacy. Even for the youngest students, it provides a clear picture of how our bodies have developed, from the very earliest and simplest stages of life to the amazing complexity displayed even at just a few weeks into development, with an intricate ballet of cells forming organized tissues, organs and physiological systems. Fundamental biological processes including cell growth and differentiation and genetic expression are on full display from the earliest stages of human development.

Knowledge of developmental biology provides insight into how our body functions and becomes the complex, interactive organism we see. It also helps understanding of abnormal development, i.e., birth defects and other developmental anomalies, allowing appreciation for the complex nature of human life and growth. This in turn provides practical knowledge for prevention (e.g., why pregnant women should have adequate nutrition and prenatal vitamins, and why they should avoid

[1] Brief bio at dprentice.org/index.php/about/

certain drugs, etc.) as well as therapies and interventions such as in utero enzyme and genetic treatments and fetal surgeries less than halfway through gestation.[2]

Embryology can also provide appreciation of human variation as well as our common developmental pathway. Moreover, it illustrates how both genetics and our environment can affect us, even in the womb. For example, the eyes begin to form at 5 weeks gestational age and finish forming by 10 weeks gestational age and eye movements detected by 12 weeks gestational age, with eye form and color determined genetically.[3] Meanwhile our fingerprints, which start forming at 12 weeks gestational age and are developed by 19 weeks, are not genetically directed but rather develop based on how we are positioned in the womb.[4] Yet even with the incredible variation within the human race, the shared experience of our common embryological development, stage by stage, is perhaps second only to our DNA sequence in our common human heritage.

The respected embryologist Dr. Ronan O'Rahilly developed the Carnegie stages,[5] the accepted standard of human embryological development since 1942 and reaffirmed by all leading embryologists ever since. O'Rahilly put it bluntly: "Prenatal age begins at fertilization, postnatal age at birth."[6] The exquisite human developmental pathway needs to be a part of every student's knowledge, lest we impoverish them with ignorance of a critical part of their own lives and beginnings.

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[2] Malloy C, Wubbenhorst MC, Sander Lee T, The Perinatal Revolution, *Issues in Law & Medicine* 34(1), 15-41, 2019; https://issuesinlawandmedicine.com/articles/the-perinatal-revolution/

[3] Moore, Keith L, TVN Persaud, and Mark G. Torchia. The Developing Human, Clinically Oriented Embryology. 10th ed. Philadelphia: Elsevier, 2016;
AND Kwan KM et al., A Complex Choreography of Cell Movements Shapes the Vertebrate Eye, *Development* 139, 359–372, 2012, doi: https://doi.org/10.1242/dev.071407;
AND Horimoto N et al., Fetal Eye Movements, *Ultrasound in Obstetrics & Gynecology* 3, 362–369, 1993, doi: https://doi.org/10.1046/j.1469-0705.1993.03050362.x;
AND see "Eye Formation", *The Voyage of Life*, accessed at: https://lozierinstitute.org/dive-deeper/eye-formation/

[4] See "When and How Fingerprints Form", *Voyage of Life*, accessed at: https://lozierinstitute.org/dive-deeper/when-and-how-fingerprints-form/;
AND Kücken M, Models for fingerprint pattern formation, *Forensic Science International* 171 (2–3), 85-96, 2007, doi: https://doi.org/10.1016/j.forsciint.2007.02.025;
AND Babler WJ, Embryologic Development of Epidermal Ridges and Their Configurations, *Birth Defects Original Article Series* 27, no. 2, 95–112, 1991

[5] See, e.g., Hill, M.A. (2025, February 24) **Embryology** *Carnegie Stages*. Accessed at: https://embryology.med.unsw.edu.au/embryology/index.php/Carnegie_Stages;
AND Embryonic Ages & Stages, *The Virtual Human Embryo*, accessed at: https://www.ehd.org/virtual-human-embryo/ages.php

[6] O'Rahilly R, Müller F, Developmental Stages in Human Embryos: Revised and New Measurements, *Cells Tissues Organs* 192, 73–84, 2010; doi: 10.1159/000289817