The unscientific nature of the concept that "human life begins at fertilization," and why it matters

We live in a time of unprecedented scientific progress. This is not a remarkable statement, as it could easily have been made anytime during the preceding millennia of cultural evolution. Information grows exponentially, and each era not only has access to more information than the preceding era, but also adds more new discoveries and data. Additionally, the present time has given us unprecedented access to information and rapid communication. Unfortunately, one unintended consequence of our near instantaneous communication is the rapid proliferation and dissemination of misinformation and outright disinformation. Indeed, topics such as false or "fake" news are a common topic of the news media.

Trying to decide whether information is accurate may be challenging. Those of us who live in the world of science and who use scientific journals to obtain information enjoy some protection from disinformation, which is afforded us by peer review and explicit scrutiny of the scientific data presented. Unfortunately, the subsequent dissemination of scientific studies by the lay media has no such protection. And thus, on an almost daily basis, we hear of results of "scientific studies" that seem hard to believe, which are then quickly contradicted by reports of other "scientific studies." The consequence of such apparent scientific contradictions is that the lay listener develops skepticism about the scientific method, and concludes that science, like the news media, is not a reliable source of information. When we scientists do not speak up to correct the unscientific conclusions attributed to science, we are complicit in the spread of such disinformation, leading to the undermining of science credibility in general.

One observation that has been attributed to scientific consensus—one that is highly relevant to our field—is the concept that "human life begins at fertilization." This statement is commonly offered by religious organizations and is often cited as the basis for so-called personhood amendments, but the assertion that it is scientifically sound is incorrect. And although it is often offered in the context of abortion, it has profound ramifications for the treatment of infertility, particularly for in vitro fertilization (IVF). We fertility doctors take extreme care to protect and nurture the preimplantation embryos in our incubators and cryotanks. We realize that in almost all cases these aggregates of cells represent the best chance for our infertile couples to realize their dream of building their families. However, handling an embryo with the potential to produce a pregnancy is not the same as handling a human life. If harm to a preimplantation embryo were to be considered the same as harm to a human being, then the demise of a preimplantation embryo—a not infrequent event in vivo, as well as in the IVF laboratory—might well be treated as a human death, perhaps with manslaughter charges brought against the embryologists.

What is scientifically incorrect about saying that human life begins at fertilization? First, it is a categorical designation in conflict with the scientific observation that life is a continuum. The egg cell is alive, and it has the potential to become a zygote (a single-celled embryo) if it is appropriately fertilized and activated by a live sperm. If fertilization is successful and the genetic complement of the sperm is added to that of the egg, the resulting zygote is also alive. The zygote has the same size as the egg; other than for its new genotype, the cell (comprising the cytoplasm and the rest) is nearly identical to the egg cell. From a biological perspective, no new life has been created.

Second, "human life" implies individuality, which is also not consistent with scientific observations. In the clinical practice of IVF, we often speak of preimplantation embryos as individual entities, with distinct qualities like a specific genotype (mosaicism notwithstanding), and morphologic and developmental characteristics. But at the same time we realize that each of the totipotent cells that comprise these embryos is, at least theoretically, capable of producing a complete new individual. Indeed, multiple individuals can arise from the implantation of a single embryo, as in the case of identical twins. Therefore, we know that the preimplantation embryo is not actually an individual. The preimplantation embryo is essentially an aggregate of stem cells, which has the potential to produce a pregnancy, including placental and fetal tissues, assuming that it successfully implants in a receptive endometrium. It is only after implantation that the early embryo can further differentiate into the organized cell groups that enable the developing conceptus to progress further in embryonic and eventually fetal development.

"Life begins at fertilization" may certainly be considered a religious concept; because religious ideas are based on faith, no further proof is necessary. It is pointless to use science as an argument against faith-based dictums. For example, it is also not in the realm of science to investigate the nature of life after death or the validity of holy books. The beginning of human life likewise occupies the legal realm, where line drawing can be essential to the application of civil and criminal law. But laws are created by legislators, not scientists. Many attempts already have been made to legally define life as beginning at fertilization. Although the impetus for this type of legislation is likely religious, a supporting argument is often made that this is a scientific fact as well, which is in contradiction to the arguments presented here.

In these interesting times of nearly instantaneous communication and unlimited information, scientific conclusions are easily drowned out by other opinions. It matters to our patients and to us how information about our field is presented in the lay media. We should not quietly ignore the multiple Web sites, lay publications, and other sources of information that claim there is scientific proof that life begins at fertilization. If we do not object, our silence will be interpreted as scientific validation of this wholly religious, entirely unscientific conclusion. We should not be complicit in the

dissemination of this type of disinformation and, more specifically, we should not acquiesce to the claim that the concept of "life begins at fertilization" has a scientific basis.

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