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Joint Hearing: "Exploring Alternatives to Fetal Tissue Research"

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Subcommittee on Healthcare, Benefits, and Administrative Rules
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Chairmen Meadows and Jordan, and Ranking Members Connolly and Krishnamoorthi thank you for the opportunity to testify at this hearing about the value of fetal tissue research. I am Professor of Neuroscience at the Albany Medical College and at SUNY Albany, and co-founder and Scientific Director of the Neural Stem Cell Institute, although my remarks today are not as a representative of these institutions, I am here today on behalf of the International Society for Stem Cell Research.

I offer my perspective as a scientist who has spent the last 32 years seeking to advance our understanding of human biology to improve our ability to fight human disease. My labs work has been recognized by merit awards from NIH and by a MacArthur fellowship.

Fetal cells and tissue have unique properties that cannot always be replicated by other cell types. This tissue would be discarded if not donated for crucial biomedical research. In my testimony, I would like to share with you four examples of why I believe fetal tissue research is critical and cannot be replaced or substituted with alternative types of research.

Zika Virus

Fetal tissue is particularly important for studying developmental conditions – including the birth defects associated with the Zika virus. The use of donated fetal tissue, including placental tissue,

improved our understanding of how Zika behaves in the body and crosses the placenta to infect specific types of fetal brain cells and produce malformations such as microcephaly and decreased brain tissue that can severely impact normal function and quality and length of life.

This research would not have been possible with other research models – including organoids and other stem cell-based models. While we can create many cell types using embryonic and induced pluripotent stem cells (iPSCs), we do not yet know if we can create cells and model tissues that accurately mimic normal fetal brain tissue.

Current technology for making brain organoids lack immune cells and tend to mimic early fetal development, making them inadequate for modeling immune responses to infection and the later stages of fetal development; Zika-linked developmental defects are different depending on stage of infection. The cells derived from iPSCs are too developmentally immature and the cells derived from adult tissues are too developmentally mature, only fetal cells are obtainable at the appropriate stages and variety of developing cell types for studying Zika infection.

There are cases in which diseases affecting development can be studied with cells derived from iPSCs or organoids. But even in those cases, the results must be validated using fetal tissue as a critical reference material. As a result, fetal tissue remains critically important to understand human development, the complexity of cell types present in the developing human brain at single cell and molecular levels, and to accurately and rigorously validate other models of research.

New Therapies for HIV

Fetal tissue research is essential in our fight against HIV and other infectious diseases. The development of Truvada, an antiretroviral therapy that prevents the transmission of HIV,

depended on fetal tissue. Researchers used the BLT mouse model (in which fetal bone marrow, liver, and thymic tissue is transplanted into mice to promote the formation of a human immune system) to evaluate whether Truvada could protect patients from contracting the HIV infection. They found that Truvada was effective at preventing HIV transmission, including to babies during birth. Humanized mouse models using fetal tissue are also crucial for ongoing drug discovery for Dengue, Epstein-Barr virus, influenza, Ebola, Herpes, Kaposi's Sarcoma, and Tuberculosis.

There are currently no alternatives to this fetal tissue model for evaluating and developing new therapies for infectious disease. With organoids and other iPSC-derived cells, we are still unable to form a functional human immune system or to model the complex interactions between different kinds of immune cells and supporting cells in lymphoid and other organs.

Children's Cancer Research

Fetal tissue research is crucial for understanding why and how many childhood cancers develop. Research was recently published by a lab at St Jude's hospital in Tennessee that compared the stages of retina development in fetal tissues to samples from childhood eye cancers to identify the genetic components responsible for the tumor formation and growth. This new understanding of where and when these genetic malfunctions occur opened new possibilities of drug discovery for targeting and eliminating the cancer cells. Similarly, fetal tissue research is helping scientists target the genetic mutations responsible for rhabdomyosarcoma (childhood muscle cancers).

Opponents of fetal tissue research often claim that fetal tissue can be replaced with fetal cell lines, but in fact this research would not have been possible by studying fetal cell lines. The research required study of the diverse cell types present in the fetal tissues in vivo, and to define the molecular profiles of these multiple types. Without fetal tissue research, these discoveries would have not been possible.

Cancer Immunotherapy (CAR-T therapies)

Earlier this year, the Food and Drug Administration approved the third CAR-T therapy, which would have not been possible without the basic scientific understandings acquired through decades of fetal tissue research. CAR-T immunotherapy involves genetically outfitting a patient's immune cells with new artificial genes to target cancerous cells. Car-T is a revolution in cancer therapy that can induce complete remissions of cancers such as types of lymphoma.

The development of these products would have not been possible without the ability to test them in fetal tissue humanized mice that closely model the human immune system. Testing of these products in human study participants would have been far riskier without this fetal tissue research.

After the approval of these novel anti-tumor therapies, researchers are focused on other incurable tumor types. Our ability to develop the next generation of immune therapies for other types of cancer depends on fetal tissue derived mouse models.

To close, I would like to reiterate that fetal tissue is essential to many areas of biomedical research. A significant restriction on this critical work would devastate research that is necessary

for the development of new treatments and devastate patients suffering from diseases waiting these advancements.

Thank you again for allowing me to testify, and I look forward to taking your questions.