WRITTEN STATEMENT

Keith Murphy
Founder, CEO, and Chairman, Viscient Biosciences
Founder, Organovo
Board Member, California Life Sciences

Finance Committee - Bill Hearing
SB 560: Animal Testing and Research – Human–Relevant Research Funding and Animal Testing and Research Licensure

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Thank you, Chair Griffith and Vice Chair Klausmeier, for the opportunity to submit testimony on SB 560, critical legislation that would advance the use of non-animal testing methods in medical and product research and mark Maryland's commitment to developing safer and more successful drug therapies.

I and those in my field appreciate your efforts and I wanted to provide the perspective of an entrepreneur and innovator working on new non-animal testing methods. I am here to tell you that we are at the cusp of a major technological revolution. The technology exists today to dramatically improve our ability to develop drugs, improve the likelihood of success of drugs in clinical trials, and lower the costs of drug development. For patients, this can mean more new breakthrough therapies and lower priced drugs. But first, the technology needs to be taken up more broadly.

Several companies now are in the early stages of applying more modern technologies, such as 3D bioprinted tissues made from human cells from a patient, to avoid the "species gap" and overreliance on rodent and animal models in pharmaceutical research. I am the Chief Executive Officer of Viscient Biosciences in San Diego, which has a superior model for liver fibrosis made from 3D human cells. Several major big pharma drug programs in this space have failed to reduce fibrosis in patients, and two have been successful. Animal models predicted all of them would work, but our 3D human model shows exactly which two reduce fibrosis and which ones fail to do so. Our human 3D disease model, if available a decade ago, would have avoided wasting hundreds of millions of dollars on failed clinical trials, but more importantly it would have avoided thousands of patients receiving experimental drugs that were doomed to fail and led to new drugs sooner. Our own drug found using this model, unrelated to the others, should be in clinical trials by 2024, and we believe it has a much higher chance of success than the typical drug would.

These models and other technology to do better than animal models exist today and need support to be more broadly used. Our company is one of several, some of which commercially offer their models and their solutions to drug developers. Your efforts through this legislation will yield great benefit in making these models be used sooner with greater impact. The result will be not only beneficial in the sense of less use of animal models, but it will end the ethical tragedy that is using humans in experiments doomed to fail, when the technology exists to avoid such practices.

Some of the world's top 25 drug manufacturers are incorporating alternatives to animal testing in their drug development programs that demonstrate to be more predictive of drug safety, toxicity, and efficacy than traditional models. SB 560 is the right legislation at the right time to further support this field of discovery, enable better treatments for individuals and families, and establish the State as an incubator primed to change the frontier for new and existing drugs and therapeutics.

Organovo is a U.S. company dedicated to developing and utilizing highly customized, bioprinted 3D human tissues as dynamic models of healthy and diseased human biology for drug development. These advances

are enabling complex, multicellular disease models that can be used to develop clinically effective drugs for selected therapeutic areas without relying on animal models. Viscient Biosciences, a company working with Organovo and using Organovo's bioprinting technology under license, has produced a liver model of nonalcoholic steatohepatitis (NASH, commonly known as fatty liver disease) that shows high evidence of disease reproduction. When tested in this model, results for NASH drugs match results obtained in clinical trials.

As an innovator who has dedicated my career to bringing significant new technologies to market, my assessment is that these and similar case studies reflect that the biomedical community is nearing a tipping point of sufficient data that calls into twofold-question the ethics of continued animal drug testing in light of proven non-animal testing pathways. Recent scientific validation of non-animal research capabilities includes a July 2016 peer-reviewed study[1] using 3D bioengineered liver tissues modeling drug-induced liver injury (DILI) to investigate the effects of *Trovafloxin*, a drug withdrawn from the market due to acute liver failure in patients. The study provided new evidence that 3D bioengineered tissues can better model the effects of chronic drug dosing or conditions that develop over extended periods of time. Additionally, peer-reviewed data presented at the March 2016 Society of Toxicology[2] conference found that 3D human tissue models can identify drug-induced liver toxicity of compounds in a preclinical setting. These models can detect complex and induced toxic events requiring multiple human cell types which, to date, have only been captured in animal models or subsequent clinical trials.

Expanded regulatory avenues to support non-animal testing more directly, like the proposed Human-Relevant Research Fund, would accelerate the development of game-changing treatments, potentially drive down research and experimentation costs, and begin to address ethical concerns involving animal models. The goals and dedicated investments outlined in SB 560 greatly would aid researchers and stakeholders and further incentivize this essential line of medical discovery.

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[1] Nguyen DG, Funk J, Robbins JB, Crogan-Grundy C, Presnell SC, Singer T, et al. (2016) Bioprinted 3D Primary Liver Tissues Allow Assessment of Organ-Level Response to Clinical Drug Induced Toxicity *In Vitro*. PLoS ONE 11(7): e0158674. <https://doi.org/10.1371/journal.pone.0158674>

[2] Norona L, Nguyen DG, Gerber DA, et al. Modeling Drug-Induced Hepatic Fibrosis *In Vitro* Using Three-Dimensional Liver Tissue Constructs. Society of Toxicology Annual Meeting, 2016. Presentation. <https://organovo.com/wp-content/uploads/2019/01/2016-SOT-UNC-Orgnaovo-Drug-Induced-Hepatic-Fibrosis.pdf>