Thinking about the future of ‘toxicology’

HESI Presentation to the National Toxicology Program
February 2019

Syril D Pettit, HESI Executive Director
Health and Environmental Sciences Institute

International, non-profit leader in convening scientists from academe, government, NGOs, foundations, clinic, industry, and other scientific sectors seeking to build a safer, more sustainable world.

Science for a Safer, More Sustainable World
Demodifying RNA for Transcriptomic Analyses of Archival Formalin-Fixed Paraffin-Embedded Samples

Leah C Wehmas, Charles E Wood, Remi Gagne, Andrew Williams, Carole Yauk, Mark M Gosink, Deidre Dalmas, Ruixin Hao, Raegan O’Lone, Susan Hester


- **Diverse Science**
- **Human & Env Health & Safety**

Protease resistance of food proteins: a mixed picture for predicting allergenicity but a useful tool for assessing exposure

Jaap Akkerdaas1, Muriel Tots5, Brian Barnett8, Erin Bell1, Tom Davis1, Thomas Edington4, Kevin Glenn6, Gerson Graser6, Rod Herman1, Andre Kruist6, Gregory Ladics3, Scott McClain1, Lars K. Poulsen10, Rakesh Ranjan2, Jean-Baptiste Rascle2, Hector Serrano3, Dave Speijer1, Rong Wang2, Lucilla Pereira Mournis3, Annabelle Captop1 and Ronald van Ree1,14

Risk Assessment Methodologies and Enabling Technologies

- **Safe & Effective Medicines**
- **Food Safety**
- **Environmental Quality & Sustainability**
20,000 Citations of HESI’s 300+ Peer-Reviewed Publications, Around Globe, Across Sectors

- Global Reach
- Multi-Sector Scientific Impact
- Multi-Sector Participation
- Science for OECD & ICH
Objective
Create a broad picture of widely identified global and/or national science and health priorities and align those with priorities identified by our own diverse stakeholder base.
What is coming/growing and should be a focus for resources and effort?

National Health and/or Environment Organizations

International Health and/or Environment Organizations

SCIENSe AND HEALTH PRIORITIES AND PREDICTIONS

Global Health View
What is coming/growing and should be a focus for resources and effort?

HESI Governance & Leadership Perspective

HESI Scientific Committee Perspective

SCIENCE AND HEALTH PRIORITIES AND PREDICTIONS

HESI Stakeholder View
SCIENCE FORESIGHT
PERSPECTIVES FOR 2017-2020

http://hesiglobal.org/scienceforesight/

PLANETARY PRESSURES
- Climate change impact on human and environmental health
- Environmental exposures and human/eco health outcomes
- Chemical substitutions and sustainability

HESI VIEW
- Cell, immune, and gene therapy
- Personal monitoring data & role in health, disease, exposure
- Organ chips
- 3D printing
- Computational modeling

PRACTICE OF SCIENCE
- Epidemiology data & use
- 'Alternative' testing methods
- Data sharing and data access
- Predictive signatures & epigenetics
- Exposure in risk assessment

HESI VIEW
- New disciplines merging with biology
- Interdisciplinary science

SOCIOECONOMIC INFLUENCES
- Global regulatory standards
- Role of social media in information collection and exchange
- Public perception of risk v hazard
- Reduced research $$$

HESI VIEW
- Science in period of political, economic instability
- Public skepticism of science
- Culture of open access

TECHNOLOGY
- High density data
- Sensory technologies & tracking
- Regenerative medicine
- Genome editing
- 3D Printing
- Robotics
- Nanotech

HESI VIEW
- Increased aging population
- Microbial resistance & disease
- Rates of NCDs in population
- Novel disease pathogens

POPULATION & INDIVIDUAL SENSITIVITY
- Aging related disorders
- Neurological illness/safety
- Drug-drug interactions
- Safety of novel cancer therapies
- Impact of combined exposure
For today – not focusing on specific project concepts

Will share an over-arching theme
Moving Toxicology from Defense to Offense
Toxicity = Avoid Harms/ ‘De-Risk’
Toxicity = Avoid Harms/ ‘De-Risk’

CURRENT
Tox on Defense

FUTURE
Offense

Toxicity = Quality of Life, Public Health
Neonatal abstinence syndrome
• Retinopathy of prematurity
• Neonatal brain, GI, lung injury
• Neonatal Sepsis

Tox Role in Health PROMOTION

Nonclinical models of Neonatal Pediatric Drug Development

Survey of existing models

Establishing a research framework

Starting dose in neonates

Model application/workshop

Cardio-Oncology

Do current approaches to assessing therapy related adverse events align with the needs of long-term cancer patients and survivors?

Physiology of the neonatal gastrointestinal system relevant to the disposition of orally administered medications
Increasing Rates of Non-communicable Disease in the population
- Understanding mechanisms of toxicity to promote enhanced health.

Role of Microbiome and Microbial Health
- Opportunities to enhance drug efficacy, nutritional quality, ecological resilience and human and environmental health status

Natural Resource Limitations
- Informing new practices to preserve and extend natural or ‘engineered’ resources.

More on ‘Offense’ From the Foresight Map
Why Apply this Concept ACROSS the Traditional Toxicology Portfolio?

- Enhances and illustrates impact
- Increases efficiency through cross-purposing effort
- Enhances potential partner and resource base
- Acknowledges historical progress in managing risk...
- Adheres to collaborative and multidisciplinary mission goals
What could that look like?
Tox-Centric

- Immunotoxicology
- Ecotoxicology
- Mechanistic Tox
- Epidemiology
- Assay Driven Testing
- Risk Assessment Methods

Health Context

- Rheumatology/Immunology
- Environmental Stewardship
- Innovation Enabling Biology
- Real-world Evidence
- Decision-driven Strategies
- Public Health
HESI is moving in this direction...looking forward to watching how/if others migrate as well!
Thanks for your attention

Syril D Pettit, HESI Executive Director
www.hesiglobal.org
spettit@hesiglobal.org