Tackling the autism epidemic

Thomas Hartung
The autism pandemic

Autism Spectrum Disorders

1:68 diagnosed with ASD in USA

from Studies completed by the CDC on Autism Spectrum Disorder incidence
The lack of toxicological knowledge

Known neurotoxic to humans during development, N > 10

Neurotoxic to humans in lab tests

Chemical universe

(Updated from Grandjean and Landrigan, The Lancet, 2006)
Correlation of chemical use and autism

Definitive Proof that Jim Carrey Causes Autism

- Prevalence of autism per 1000 people
- Total number of Jim Carrey movies

Correlation: 0.94293

Autism prevalence source: CDC
The contribution of chemical exposure to autism is not clear - we have to test !!!

- Some chemicals produce developmental neurotoxicity
- Exposure often minor

- Other factors:
  - genetics
  - infections
  - maternal obesity and age
  - vaccines

100,000 mostly untested chemicals
Chemophobia
EU: REACH
Animal testing for developmental neurotoxicity
- 1,400 rats
- $1.4 million
- Little human predictive

- Information, Grants
- Think tank
- EU branch, policy program
- Stakeholder consensus
Four International Conferences jointly with European Center for the Validation of Alternative Methods (ECVAM)

Our mini-brain project
Summary

Human “mini-brain” developing from iPSC

- All cell types but micro-glia
- 350um diameter
- 800 per batch
- Reproducible
- Electrophysiological active
- From patient cells: gene/environment interactions
Opportunities for human mini-brain research

- Map the neurotoxic chemical universe
- Characterization of medical countermeasures
- Neurotoxic and DNTToxic side effects
- Brain trauma, infectious disease and neurodegenerative disease research
- Individual susceptibility using patient iPSC – genetic risk factors
- Long-term culture and co-culture with other organs
Diseases like autism cannot be explained by genetics or exposure alone.

Disposition to DNToxicants?

Test on a genetic background that allows DNT.
Mapping the Human Toxome by Systems Toxicology
EUToxRisk21 to start this autumn
Project aims to put mechanistic-based alternative toxicity testing in a regulatory context

17 June 2015 / Europe, Risk assessment, Test/non test methods

François Busquet: Why Europe needs the Human Toxome Project

30.05.2012 - What is the Human Toxome Project? It’s a wide-reaching programme aimed at helping us to reconsider how hazard/risk assessment has been performed over the last 50 years on marketed substances like chemicals, cosmetic products, pharmaceuticals, pesticides, biocides and feedstuffs. It’s necessary because most of the scientific community now accepts that animal models for testing the safety of these products have more limitations than advantages. In basic terms, the loose genetic homology to humans is no match for modern cell-culture technology, which promises to be much more apt to correctly predict toxic effects in humans. These cell cultures can provide not only insights into the safety of substances but also how they may disrupt the human physiology.
Toxicology for the 21\textsuperscript{st} century

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  - \textbf{Starts with 21\textsuperscript{st} century cell culture}
  - \textbf{Big data from good models}
  - \textbf{New tests fit for purpose for regulation}

Mechanistic & evidence-based toxicology