

ncats.nih.gov/tox21.html



Toxicology in the 21st Century

Program Overview

During the course of a lifetime, most people are exposed to many different environmental chemicals. These substances can be found in food, water, household cleaning products and elsewhere. In some cases, these chemicals can be toxic, and in others, researchers lack sufficient data about safety.

Medicines also contain chemicals, and in fact, more than 30 percent of promising pharmaceuticals have failed in human clinical trials because they are found to be toxic, despite promising pre-clinical studies in animal and other models.

Creating alternative methods for assessing chemical toxicity that are less expensive and time-consuming than traditional approaches will improve how scientists evaluate environmental chemicals and develop new medicines to benefit public health. That is the purpose of the Toxicology in the 21st Century (Tox21) program, a federal collaboration among researchers from NIH, including NCATS and the National Toxicology Program (NTP) at the National Institute of Environmental Health Sciences (NIEHS), the Environmental Protection Agency (EPA), and the Food and Drug Administration (FDA).

Testing and Prioritizing a 10,000 Chemical Library

The Tox21 program is structured in a way that leverages partner resources and researcher expertise to more effectively predict how a collection of 10,000 compounds (Tox21 10K) may affect human health and the environment. Goals include collecting a list of all biochemical and cellular pathways in humans and designing corresponding biochemical and cell-based biological assays (tests) that can measure chemical responses.

NCATS scientists first test the compounds in a high-throughput robotic screening system, which is much less expensive and faster than traditional toxicology models. Tox21 scientists from NIH and EPA then work together to analyze the screening data generated at NCATS.

High-throughput testing helps prioritize which compounds need further evaluation for toxicity by EPA and NTP scientists, who are experts in animal and computational toxicology. Working together, they use the screening data to prioritize the thousands of chemicals that require thorough follow-up toxicity testing. FDA then provides expertise and safety information on those chemicals that are pharmaceutical drugs and food substance. As data are generated, Tox21 scientists seek to use those data to make better predictions of human toxicity.



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Data generated by the Tox21 program are submitted to the National Library of Medicine's [PubChem](#) website, making information available for the public and other scientists to access free of charge. The results enable the Tox21 team — as well as other scientists — to prioritize chemicals for further in-depth studies to define their effects on human health.

A Tox21 Research Advance

A research advance occurred when the scientific team developed an assay to test the effects of the Tox21 10K on estrogen receptors, which are activated by the hormone estrogen and convey signals to the body that regulate reproductive functions. Bisphenol A (BPA), an industrial chemical used to make plastics and found in water bottles, has been linked to birth defects in infants. Animal studies suggest that BPA could cause these effects by mimicking estrogen. The Tox21 10K screens helped identify chemical classes that were known to interact with estrogen receptors as well as some not previously known to scientists.

About NCATS and Translational Science

NCATS is one of 27 Institutes and Centers at the National Institutes of Health. The Center was established to transform the translational process so that new treatments and cures for disease can be delivered to patients faster.

Translation is the process of turning observations in the laboratory, clinic and community into interventions that improve the health of individuals and the public — from diagnostics and therapeutics to medical procedures and behavioral changes.

Translational science is the field of investigation focused on understanding the scientific and operational principles underlying each step of the translational process. NCATS studies translation on a system-wide level as a scientific and operational problem.

NCATS focuses not on specific diseases, but on what is common among them. The Center serves as an adaptor to enable other parts of the research system to work more effectively.

Through its cross-cutting programs in rare diseases, translational technologies, strategic alliances and other areas, NCATS is:

- Developing new approaches, technologies, resources and models;
- Demonstrating their usefulness; and
- Disseminating the data, analysis and methodologies to the community.

For More Information

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About Tox21

NCATS
<http://ncats.nih.gov/tox21.html>

EPA
<http://epa.gov/ncct/Tox21>

NTP/NIEHS
<http://ntp.niehs.nih.gov>