

# METHODS IN MOLECULAR BIOLOGY

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# High-Throughput Screening Assays in Toxicology

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## Preface

The use of traditional animal models for chemical toxicity testing is often costly, time-consuming, low throughput, and sometimes inconsistently predictive of human toxicity. Cell-based High-Throughput Screening (HTS) assays used to measure the toxicity of environmental compounds have been widely applied as an alternative to traditional animal tests of chemical toxicity. Current HTS assays provide the environmental and toxicological scientific community with rich toxicology data that has the potential to be integrated into chemical toxicity research. While classic animal models have been standardized in most regulatory agencies, industries, and institutes, HTS protocols are still being developed, optimized, and updated in modern toxicology research. The US ToxCast and Tox21 initiatives from several government agencies including the National Toxicology Program (NTP) based at the National Institute of Environmental Health Sciences (NIEHS), the Environmental Protection Agency (EPA), the National Center for Advancing Translational Sciences (NCATS), and the Food and Drug Administration (FDA) represent a paradigm shift in compound toxicity testing from traditional animal studies to in vitro cell-based HTS assays that can be used to evaluate large amounts of environmental chemicals. This book will focus on introducing recently developed HTS assay protocols, many involved in the ToxCast and/or Tox21 initiatives, and the relevant HTS data analysis techniques. This is divided into the following three major parts:

1. In vitro HTS assays
2. In vivo HTS assays
3. Computational techniques to analyze HTS data

The book's authors have many years of experience in applying HTS assays to chemical toxicity evaluations and aim to present their HTS techniques to scientists at every level of pursuing chemical toxicology research. We hope that this book will serve as a valuable reference resource for translating new HTS techniques into standardized chemical toxicity assessment tools and will advance modern toxicology research to a new era where HTS techniques can partially replace the prevailing animal models.

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H.Z.: I would like to thank my father Dr. Keqin Zhu who guides me in my current career path, and Ning and Stella who always encourage me to keep challenging myself in my career life and to pursue science topics of interest. Without them, nothing is possible.

M.X. dedicates this to Wei, Rena, Roman, and Lily for their love and support.

*Camden, NJ, USA*  
*Bethesda, MD, USA*

*Hao Zhu*  
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