Systems biology verification: the systems toxicology challenge and transparent toxicology via enhanced review platform.

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sbv IMPROVER
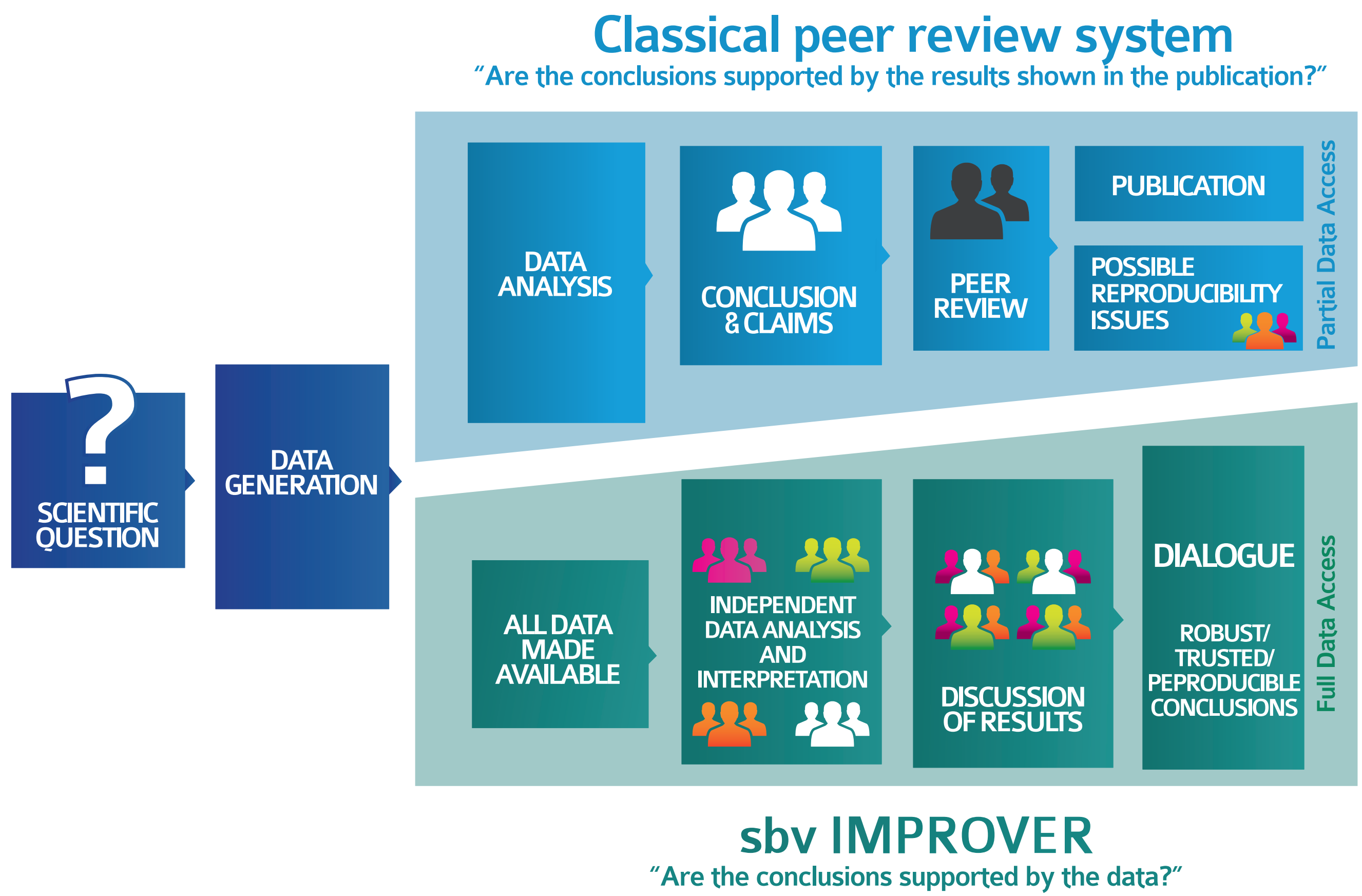
SYSTEMS BIOLOGY VERIFICATION

sbv IMPROVER

Objective: Systems toxicology relies on large numbers of data points and sophisticated methods to extract biologically meaningful signal and mechanistic understanding. The sbv IMPROVER project implements solutions to verify systems toxicology data, methods, and conclusions.
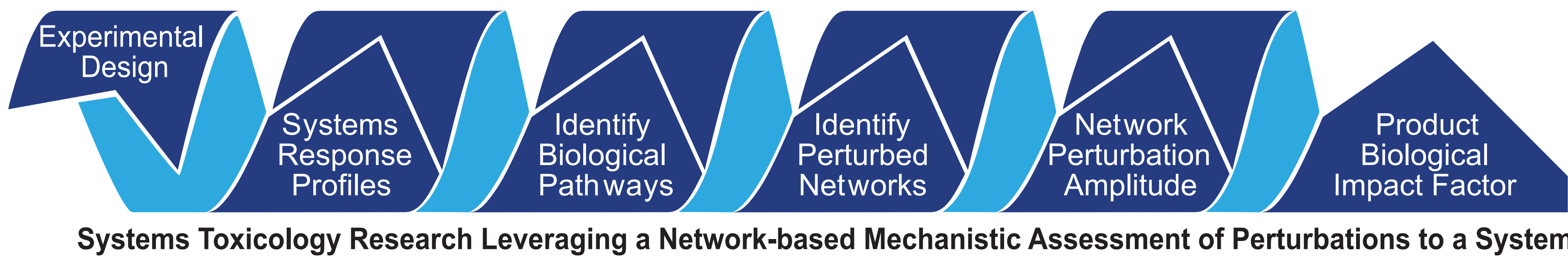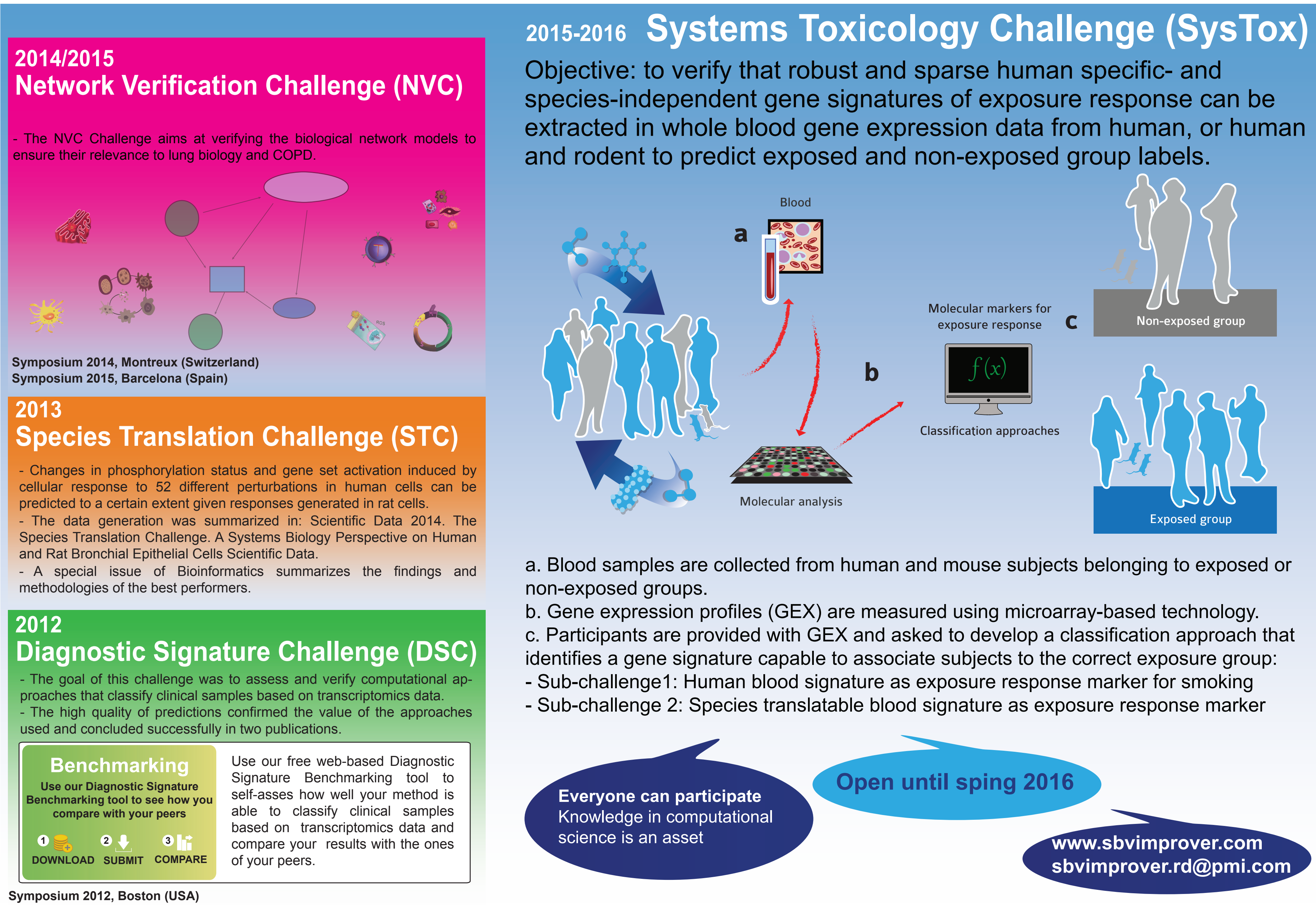
Methods: Computational challenges leveraging the wisdom of the crowd allow to benchmark methods for specific tasks, such as signature extraction or samples classification. In addition, the recruitment of expert panels allows for an independent review of the methods, data, results and conclusions drawn in large systems toxicology studies.

Results: Three challenges have already been successfully conducted and confirmed that the agglomeration of predictions often leads to better results than individual predictions and that methods perform best in specific contexts. A perennial benchmarking tool leveraging data from the diagnostic signature challenge allows for continuing performance estimation of methods classifying samples based on their transcriptional profile. A new challenge is now open following a similar concept, asking to predict the smoking status of people and mice based on their blood transcriptional profile. In parallel, a platform for the expert review of toxicology-related pre-clinical and clinical data has been built and made accessible to peer review panels that encompass diverse area of expertise relevant for systems toxicology (e.g., genomics, histopathology, and toxicology). 5 to 10 experts per panel were selected by a third party based on objective experience metrics. The experts share their evaluation by answering a list of questions about the methods, results and interpretation of findings, in an anonymous and independent fashion through an online platform, after getting access to a manuscript, the sbv platform, and the underlying data.

Conclusion: The sbv IMPROVER project supports the verification of systems toxicology through different paths leveraging the wisdom of either the crowd or expert panels.
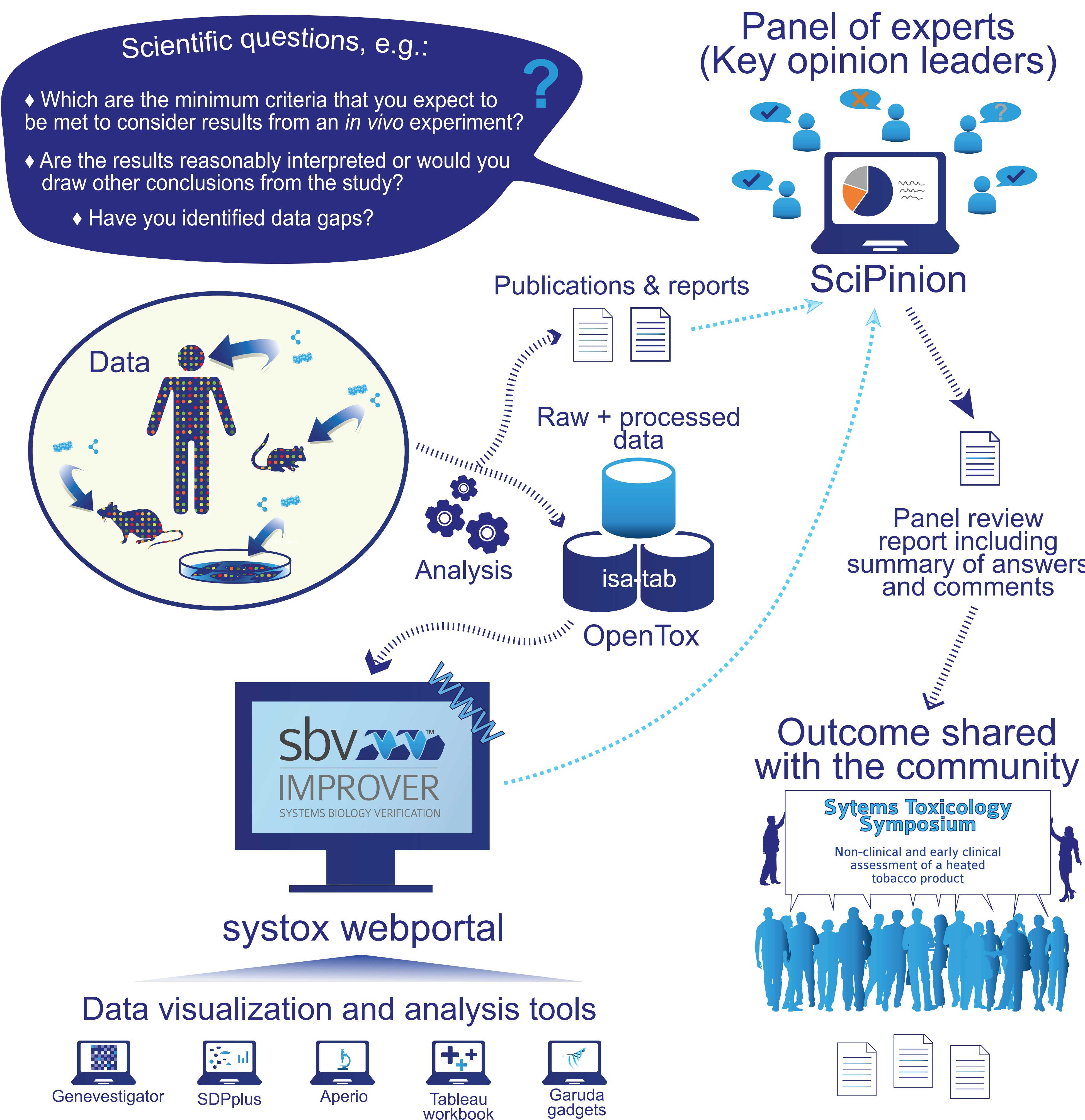
Classical peer review system
"Are the conclusions supported by the results shown in the publication?"

sbv IMPROVER
"Are the conclusions supported by the data?"

sbv IMPROVER Challenges

2015-2016 Systems Toxicology Challenge (SysTox)

Objective: to verify that robust and sparse human specific- and species-independent gene signatures of exposure response can be extracted in whole blood gene expression data from human, or human and rodent to predict exposed and non-exposed group labels.

a. Blood samples are collected from human and mouse subjects belonging to exposed or non-exposed groups.
b. Gene expression profiles (GEX) are measured using microarray-based technology.
c. Participants are provided with GEX and asked to develop a classification approach that identifies a gene signature capable to associate subjects to the correct exposure group:
- Sub-challenge1: Human blood signature as exposure response marker for smoking
- Sub-challenge 2: Species translatable blood signature as exposure response marker

Everyone can participate Knowledge in computational science is an asset

Open until sping 2016

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2014/2015 Network Verification Challenge (NVC)
- The NVC Challenge aims at verifying the biological network models to ensure their relevance to lung biology and COPD.

Symposium 2014, Montreux (Switzerland)
Symposium 2015, Barcelona (Spain)

2013 Species Translation Challenge (STC)
- Changes in phosphorylation status and gene set activation induced by cellular response to 52 different perturbations in human cells can be predicted to a certain extent given responses generated in rat cells.
- The data generation was summarized in: Scientific Data 2014. The Species Translation Challenge. A Systems Biology Perspective on Human and Rat Bronchial Epithelial Cells Scientific Data.
- A special issue of Bioinformatics summarizes the findings and methodologies of the best performers.

2012 Diagnostic Signature Challenge (DSC)
- The goal of this challenge was to assess and verify computational approaches that classify clinical samples based on transcriptomics data.
- The high quality of predictions confirmed the value of the approaches used and concluded successfully in two publications.

Benchmarking Use our Diagnostic Signature Benchmarking tool to self-assess how well your method is able to classify clinical samples based on transcriptomics data and compare your results with the ones of your peers.

Use our free web-based Diagnostic Signature Benchmarking tool to self-assess how well your method is able to classify clinical samples based on transcriptomics data and compare your results with the ones of your peers.

DOWNLOAD SUBMIT COMPARE

Symposium 2012, Boston (USA)

Systems Toxicology Research Leveraging a Network-based Mechanistic Assessment of Perturbations to a System

Experimental Design → Systems Response Profiles → Identify Biological Pathways → Identify Perturbed Networks → Network Perturbation Amplitude → Product Biological Impact Factor

How to participate in the SysTox Challenge?

SHARE / PUBLISH / LEARN / CONTRIBUTE / COLLABORATE / EXPLORE / NETWORK

VISIT: www.sbvimprover.com/comp-start

New to sbv IMPROVER?
REGISTER
ACTIVATE YOUR ACCOUNT
Didn't receive the registration email? Check your spam folder or email us sbvimprover.rd@pmi.com

LOGIN
If you already took part in any sbv IMPROVER challenge simply reuse your previous login.

1. GO TO YOUR DASHBOARD
2. JOIN THE CHALLENGE
3. CREATE/JOIN A TEAM

OPEN!
Visit the challenge pages for all details and challenge rules
Download data from your dashboard and get started!

Sub-challenge 1
Human blood gene signature as exposure response marker
- 20th Nov Data subset 1 released
- 7th Apr Predictions submission deadline
- 11th Apr Data subset 2 released
- 29th Apr Predictions submission deadline

Sub-challenge 2
Species translatable blood gene signature as exposure response marker
- 20th Nov Data subset 1 released
- 7th Apr Predictions submission deadline
- 11th Apr Data subset 2 released
- 29th Apr Predictions submission deadline
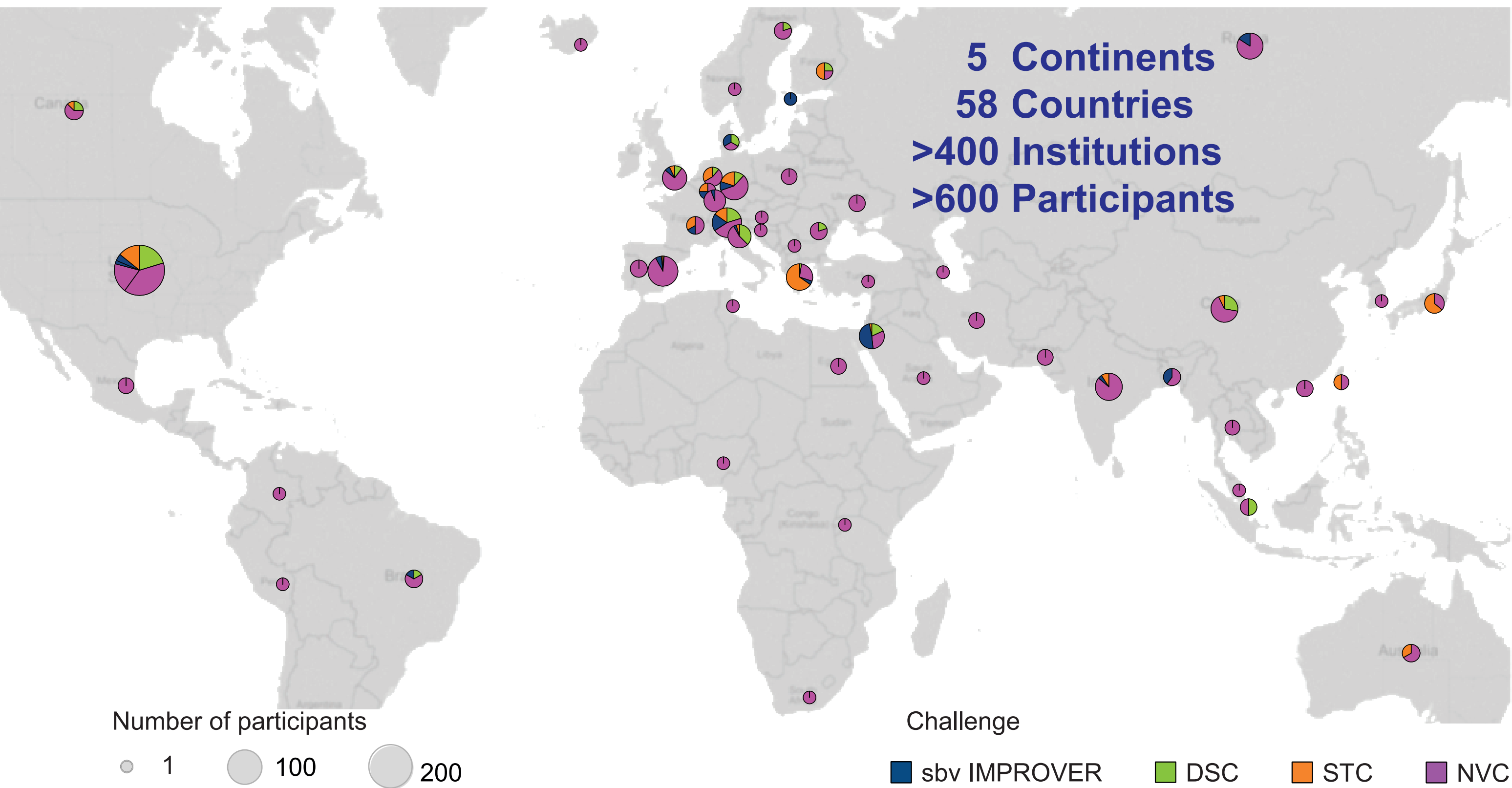
SUBMIT

Systems Toxicology Verification

Systems toxicology or 21st century toxicology, aims to create a detailed understanding of the mechanisms by which biological systems respond to toxicants, so that this understanding can be leveraged to assess the potential risk associated with chemicals, drugs, and consumer products.

In the frame of sbv IMPROVER, a platform was built to enable conducting a peer review of a Systems Toxicology-based inhalation study performed in rodents across diverse expertise fields. The intention of this review is to go beyond classical peer-review and pilots the SciPi™ (short for Scientific opinion) process (scipinion.com) as a model for a more in depth review of a complex study by an independent panel of experts.

Scientific questions, e.g.:
♦ Which are the minimum criteria that you expect to be met to consider results from an in vivo experiment?
♦ Are the results reasonably interpreted or would you draw other conclusions from the study?
♦ Have you identified data gaps?

Panel of experts (Key opinion leaders)

SciPinion

Publications & reports

Data

Analysis

Raw + processed data

isa-tab

OpenTox

Panel review report including summary of answers and comments

Outcome shared with the community

Sytems Toxicology Symposium
Non-clinical and early clinical assessment of a heated tobacco product

systox webportal

Data visualization and analysis tools

Genevestigator / SDPplus / Aperio / Tableau workbook / Garuda gadgets

Worldwide Participation in sbv IMPROVER
March 2012 - June 2015 / per Country

5 Continents
58 Countries
>400 Institutions
>600 Participants

Number of participants: 1 / 100 / 200

Challenge: sbv IMPROVER / DSC / STC / NVC

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