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OpenTox

OpenTox 2011

Enabling decision support for chemical liability assessment

Integrating Bioclipse and OpenTox

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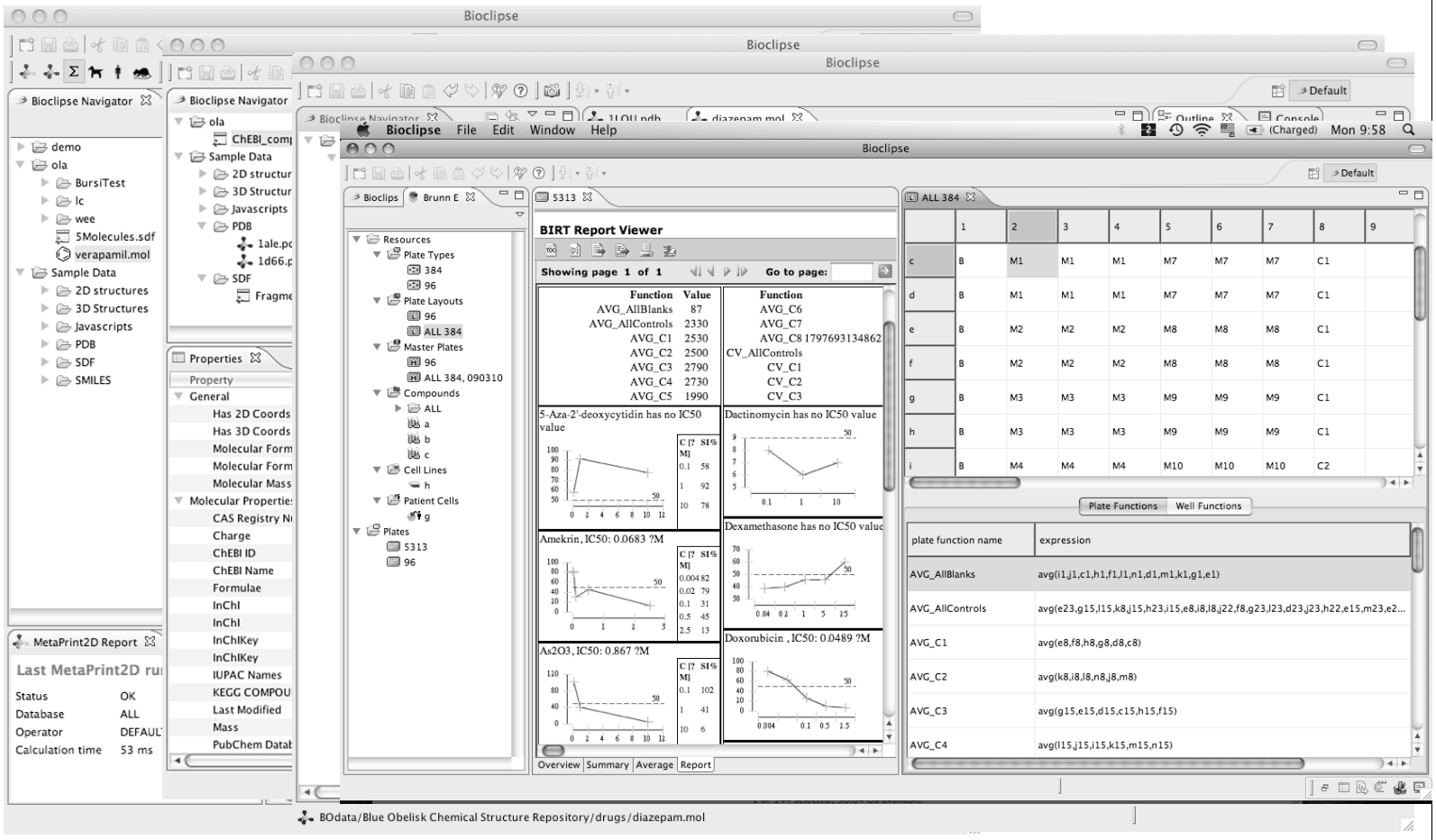
Bioclipse – an open source workbench for the life sciences



O. Spjuth, J. Alvarsson, A. Berg, M. Eklund, S. Kuhn, C. Mäsak, G. Torrance, J. Wagener, E.L. Willighagen, C. Steinbeck, and J.E.S. Wikberg. *Bioclipse 2: A scriptable integration platform for the life sciences*. BMC Bioinformatics 2009, **10**:397

Spjuth O, Helmus T, Willighagen EL, Kuhn S, Eklund M, Wagener J, Murray-Rust P, Steinbeck C, Wikberg JES: *Bioclipse: an open source workbench for chemo- and bioinformatics*. BMC Bioinformatics 2007, **8**:59.

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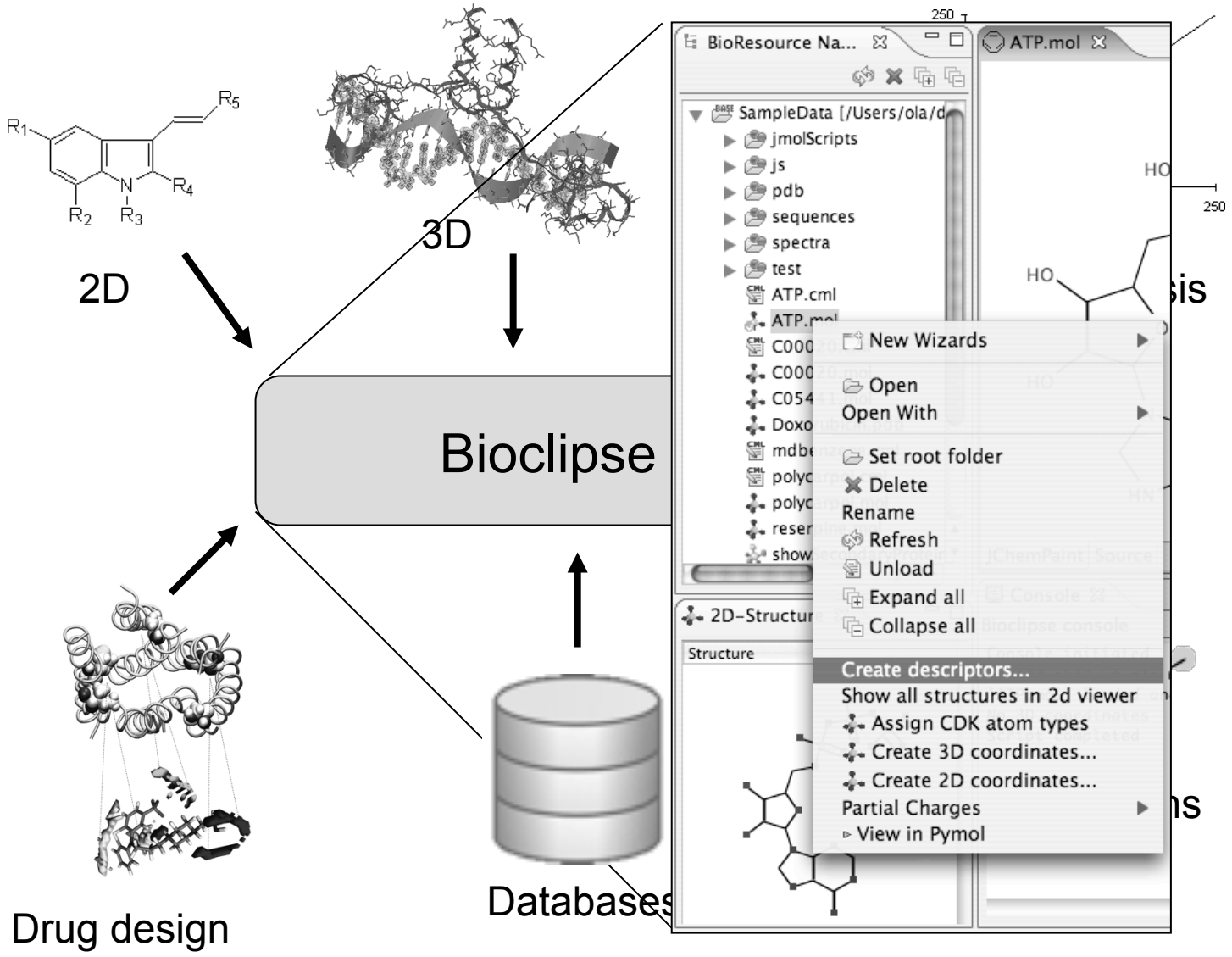
Component-based architecture



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Bioclipse Scripting Language

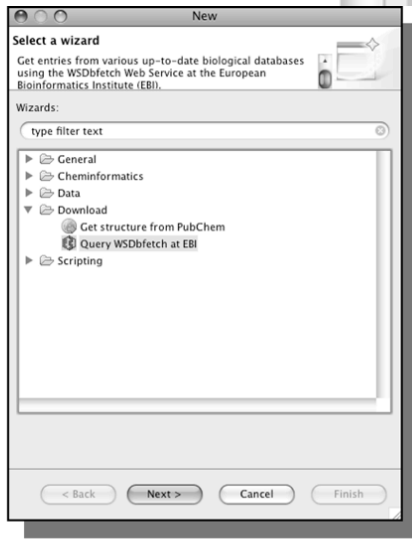
Properties | Progress | Javascript Console

```
biows.queryEMBL("X56734")
biows.queryRefseq("NM_000410")
biows.queryUniProtKB("INSR_HUMAN")
```

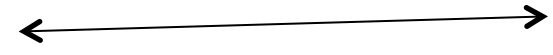
(a)

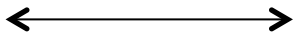
```
seqs = biows.queryEMBL("X56734,X56735");
aln = kalignws.alignDNA(seqs);
biojava.sequencesToFASTAfile(aln, "save here");
```

(b)



(c)





gist.github

my experiment

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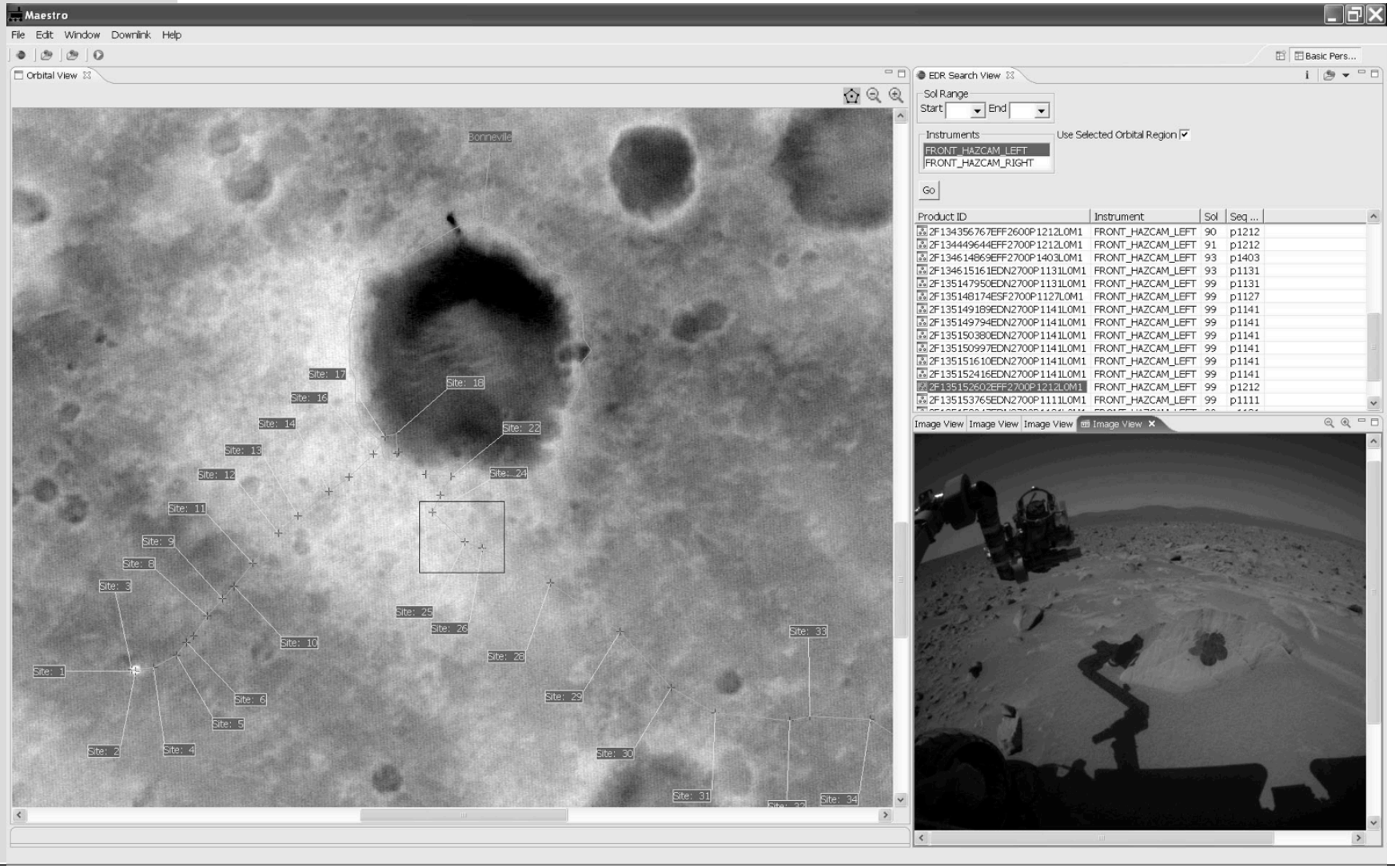
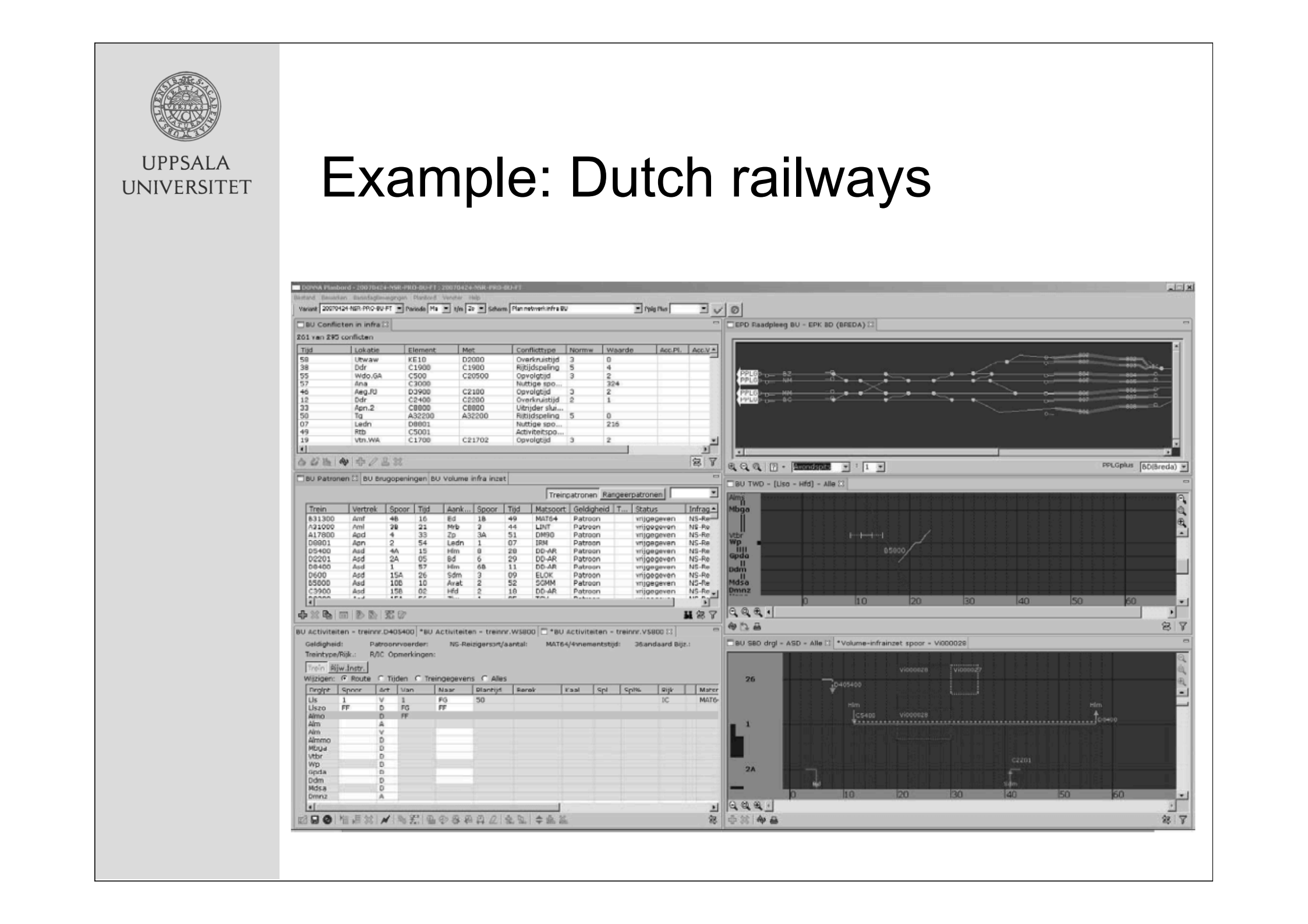
Eclipse: Proven technology





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Example: Dutch railways

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Bioclipse and OpenTox: Shared goals – predictive toxicology

- OpenTox
  - Defines an API, ontology, and services for predictive toxicology
- Bioclipse
  - Rich GUI, built for taking advantage of networked services
  - Local predictions

→ A good match!

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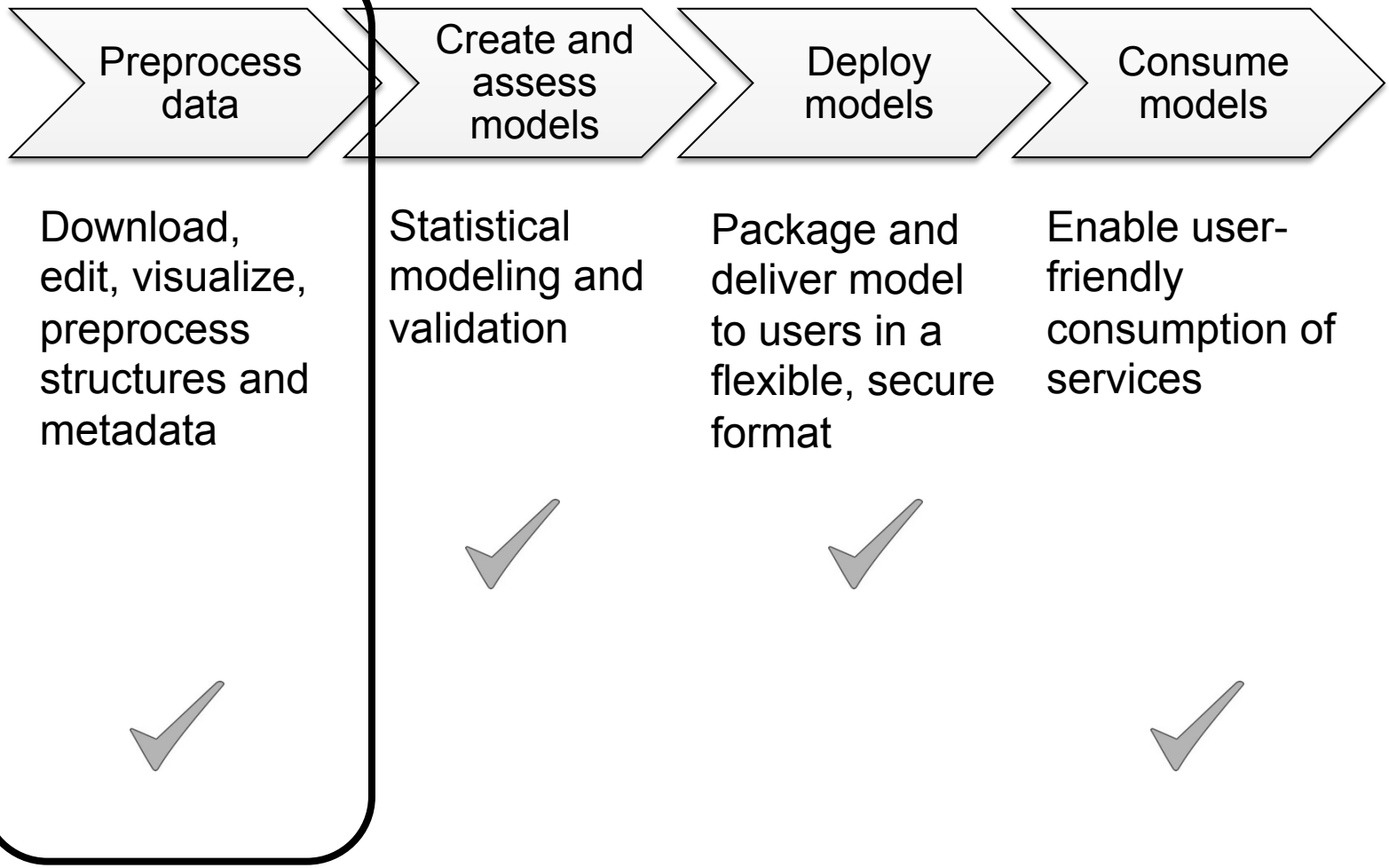
From data to predictions



OpenTox

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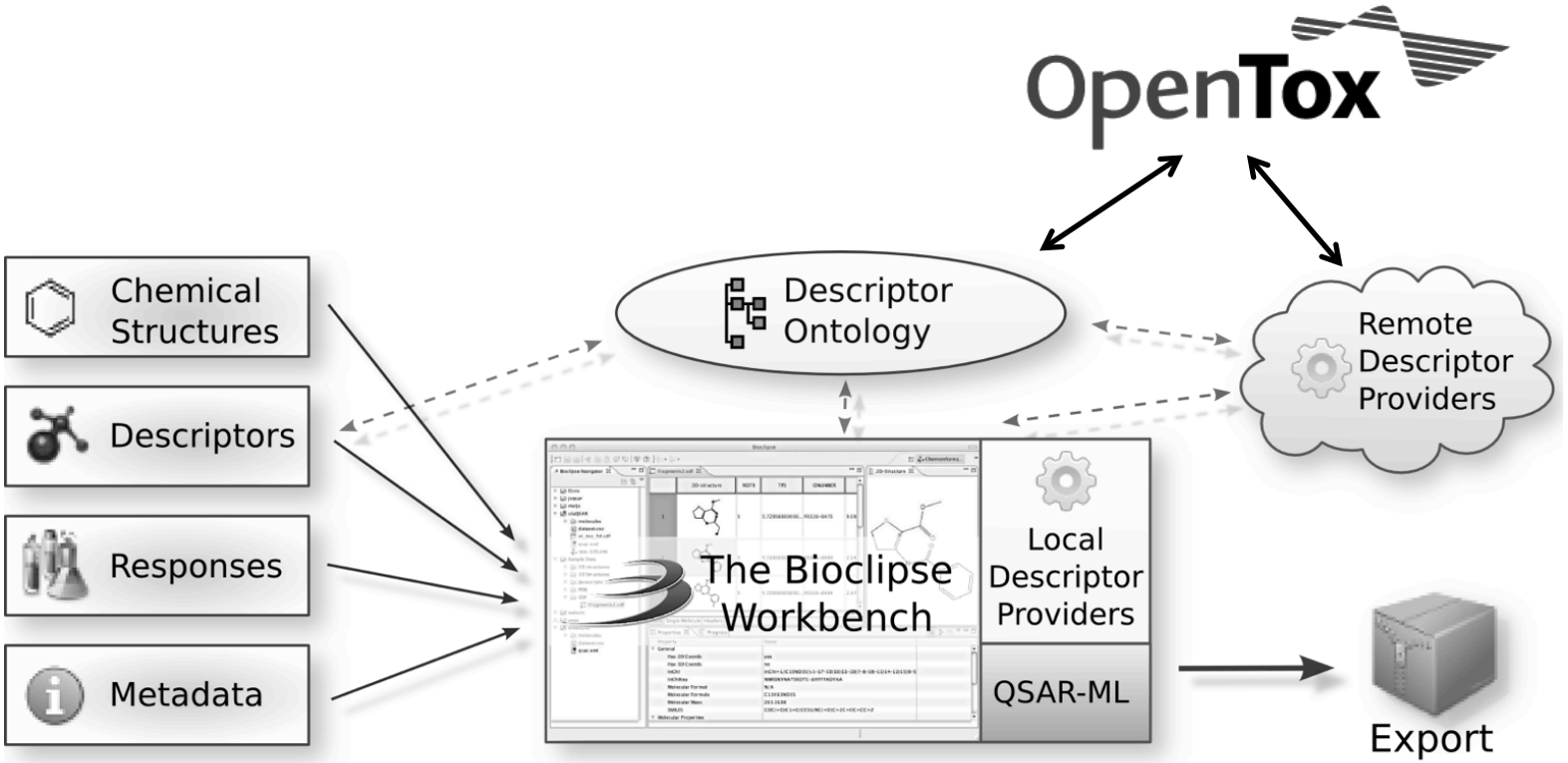
Bioclipse-QSAR: Reproducible QSAR datasets



O. Spjuth, E.L. Willighagen, R. Guha, M. Eklund, and J.E.S. Wikberg. *Towards interoperable and reproducible QSAR analyses: Exchange of data sets*. Journal of Cheminformatics 2010, **2**:5

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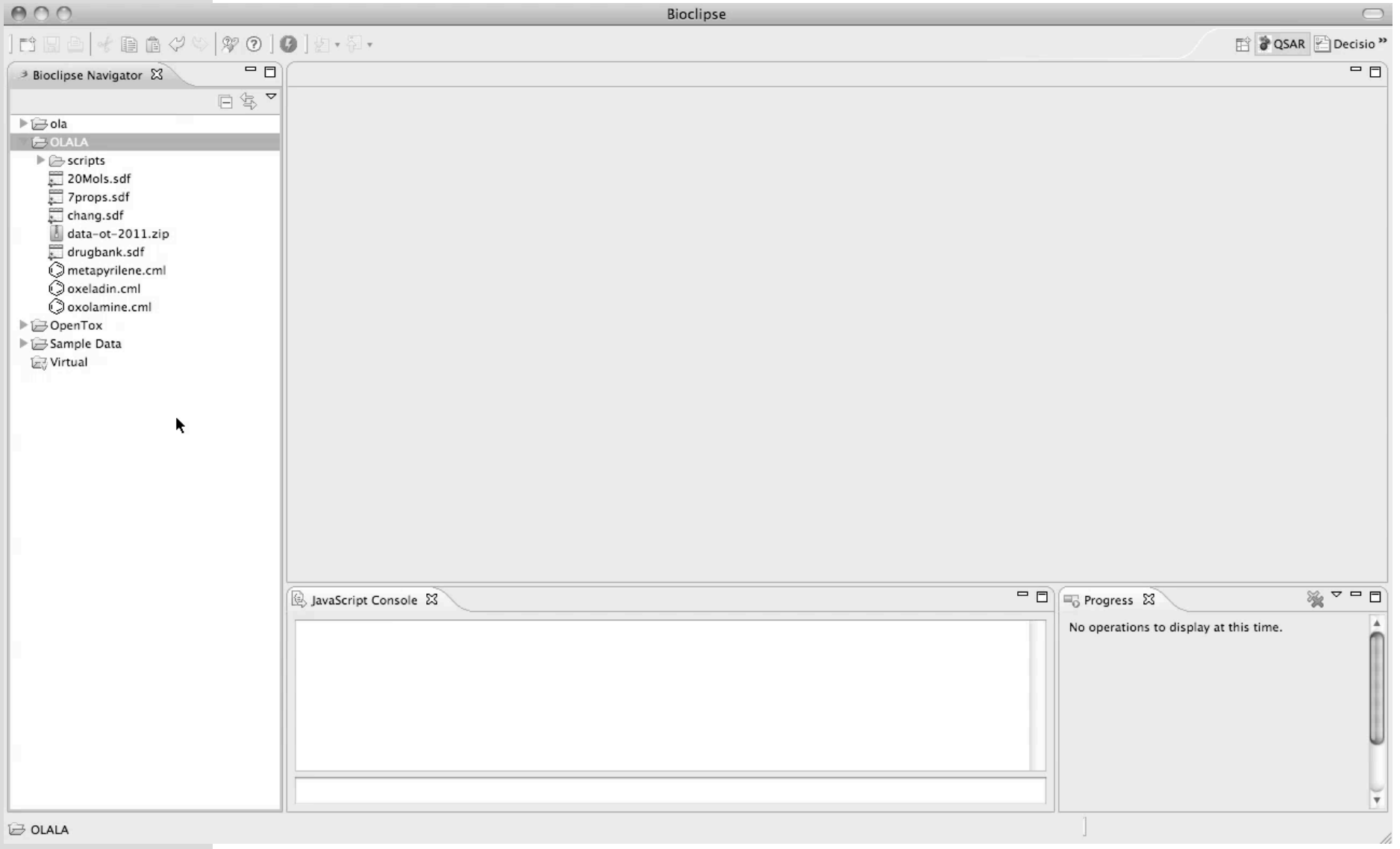
Bioclipse-QSAR with OpenTox



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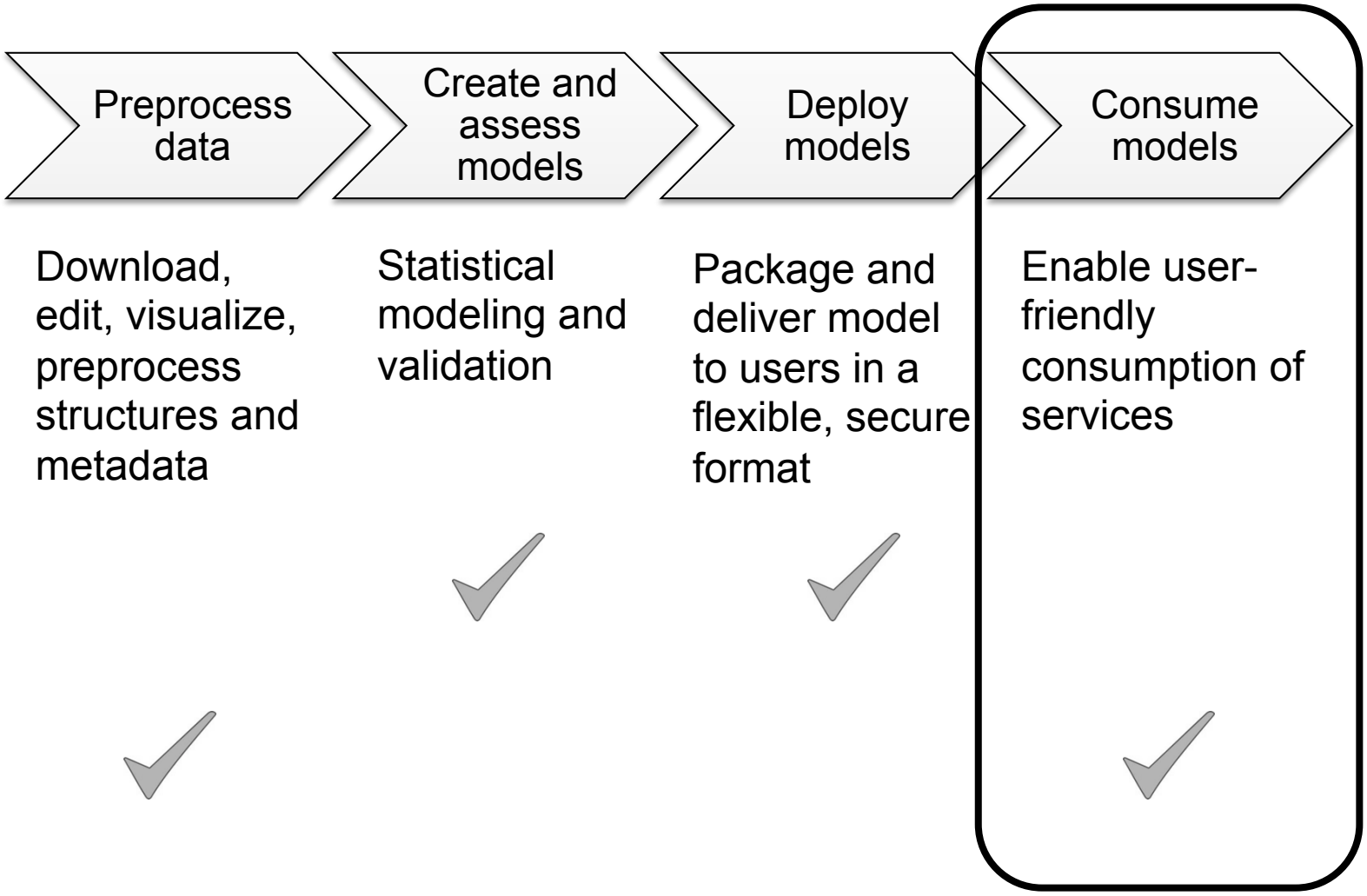
From data to predictions



OpenTox

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Bioclipse Decision Support for assessing chemical liabilities

- Original plan: Use Bioclipse workbench and provisioning system to:
  - Run models locally
    - fast execution, no need for network connection
  - Deliver a customizes prediction workbench
    - Just install the plugins you desire
- Evolution: Also take advantage of networked services (e.g. SOAP, XMPP, OpenTox)

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Bioclipse Decision Support for assessing chemical liabilities

- Integrate various predictive technologies
  - Similarity searches (InChi, signatures, fingerprints)
  - Structural alerts (SMARTS + Signature alerts)
  - QSAR models (signatures, SVM)
- Safety endpoints based on open data:
  - Mutagenicity (AMES)
  - Carcinogenicity (CPDB)
  - AHR inhibition (PubChem BioAssay 2796)

O. Spjuth, L. Carlsson, M. Eklund, E. Ahlberg Helgee, and Scott Boyer. *Integrated decision support for assessing chemical liabilities*. Accepted in J. Chem. Inf. Model.

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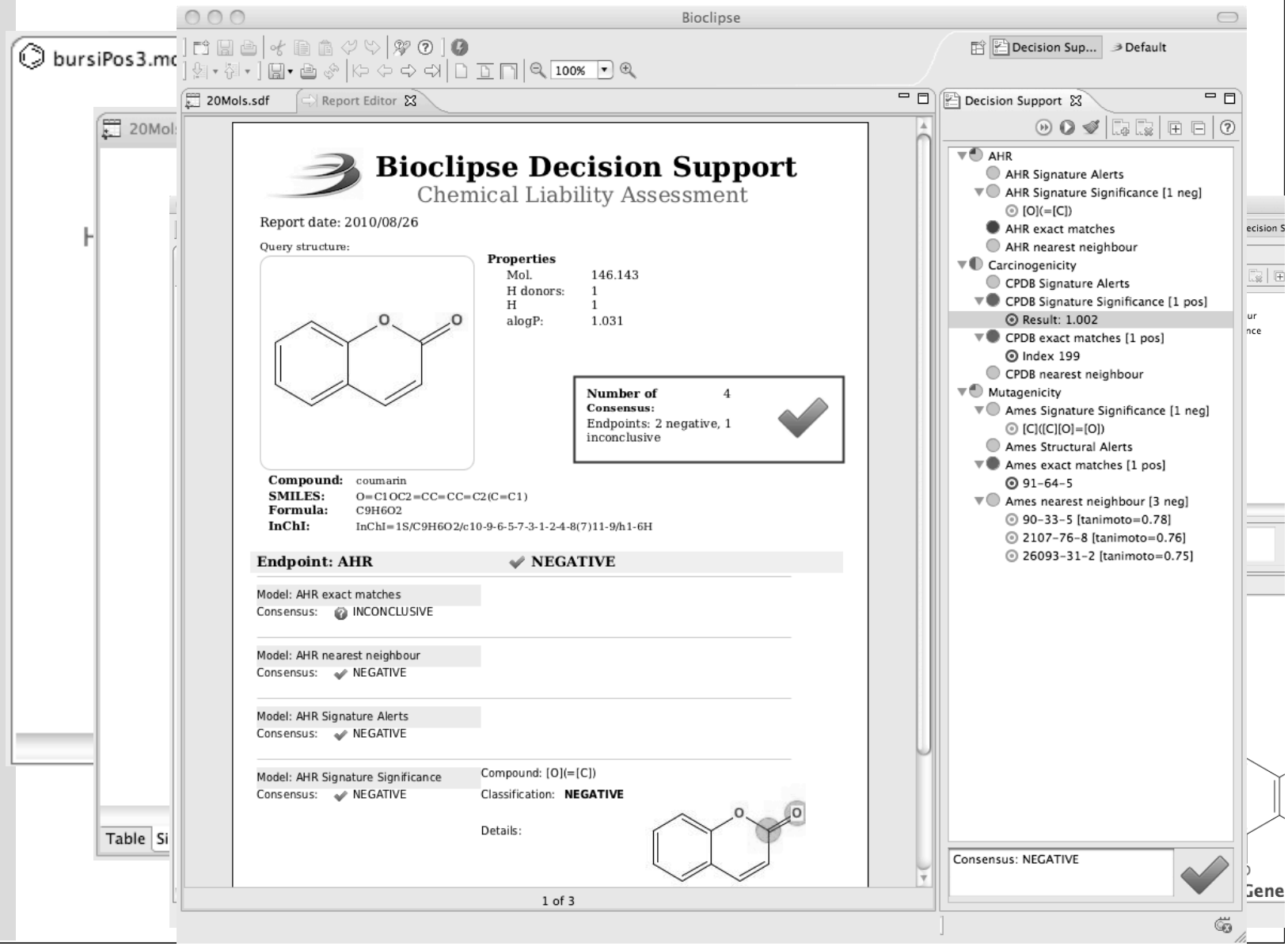
Bioclipse Decision Support



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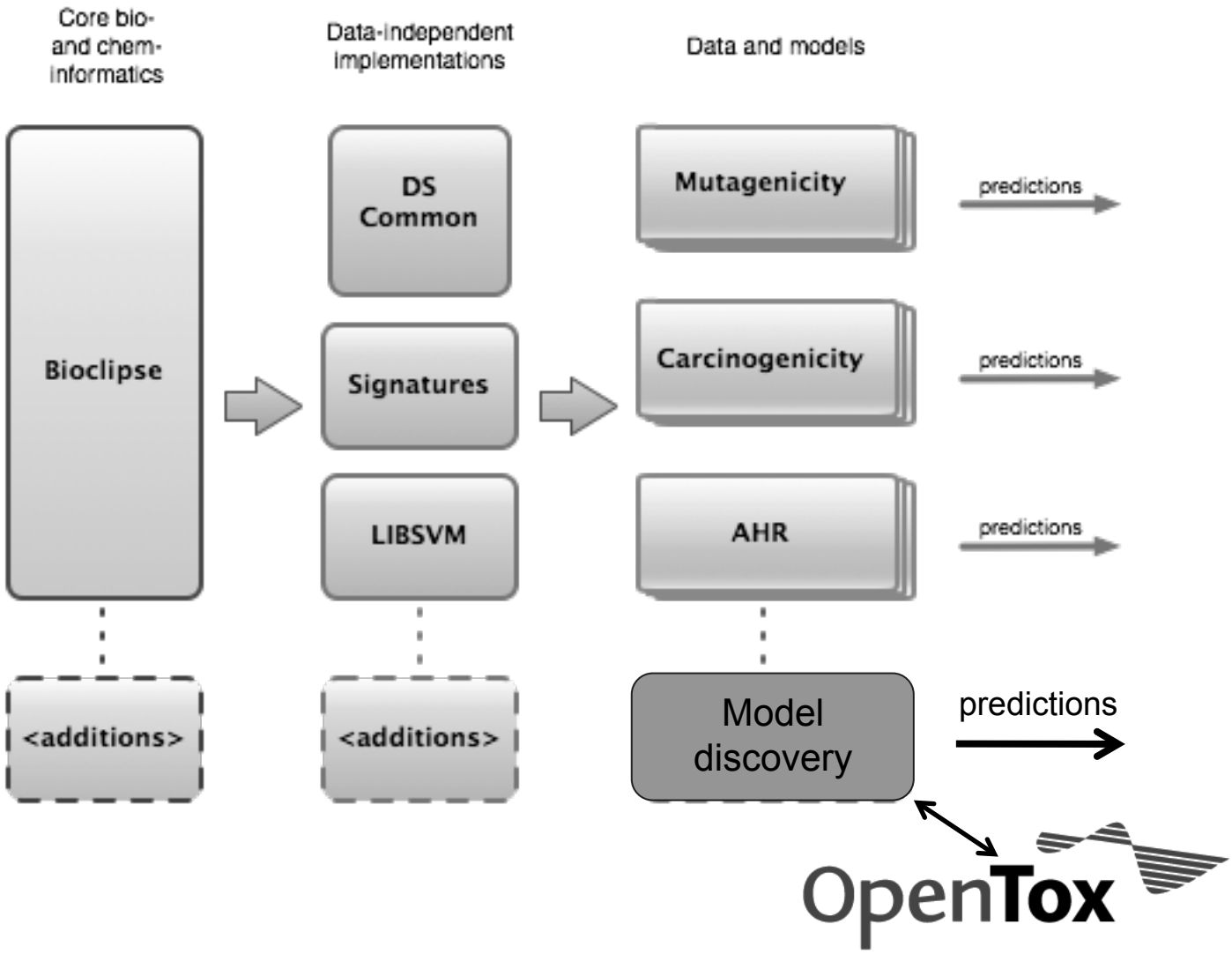
Bioclipse Decision Support



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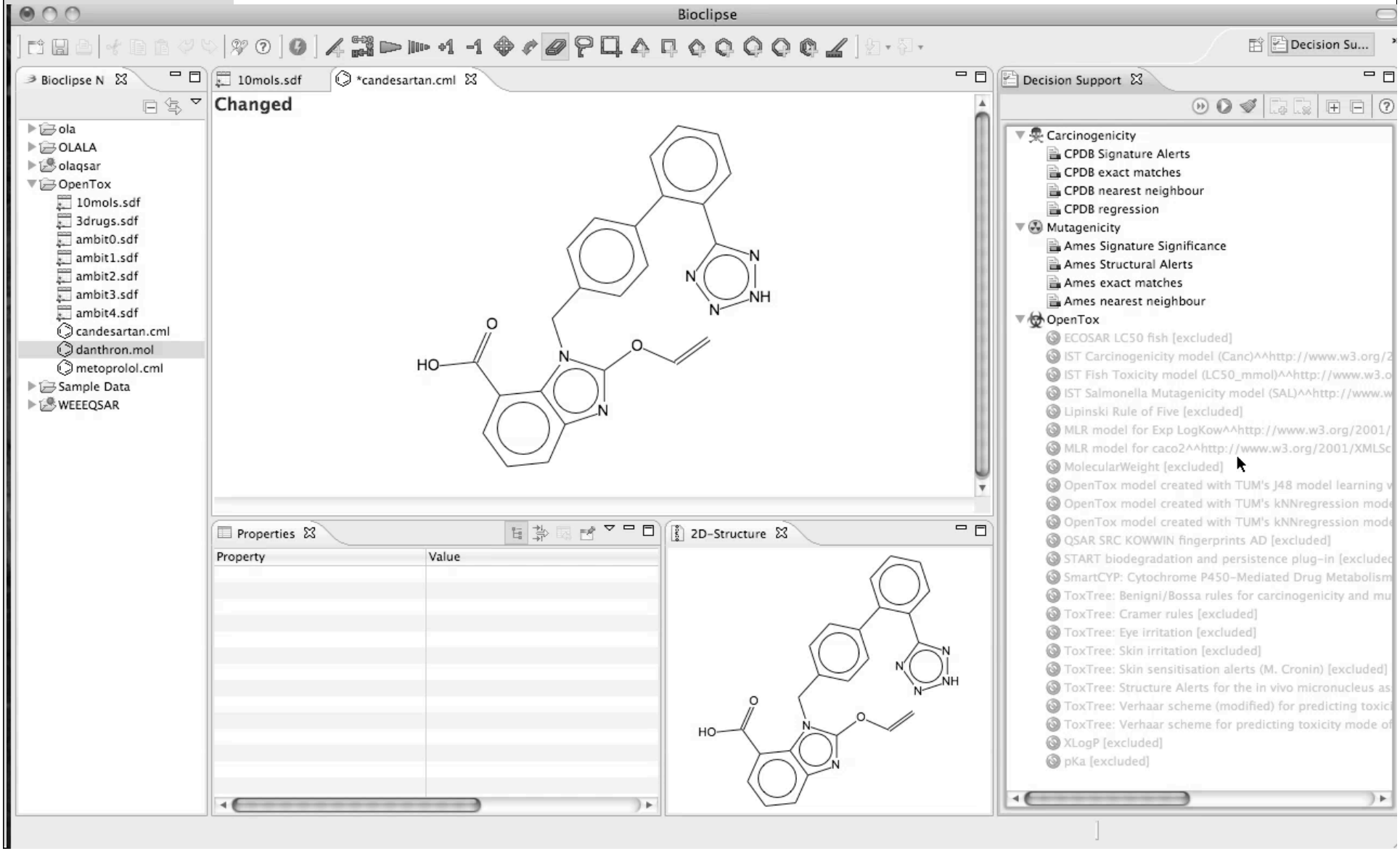
Rich GUI for predictions



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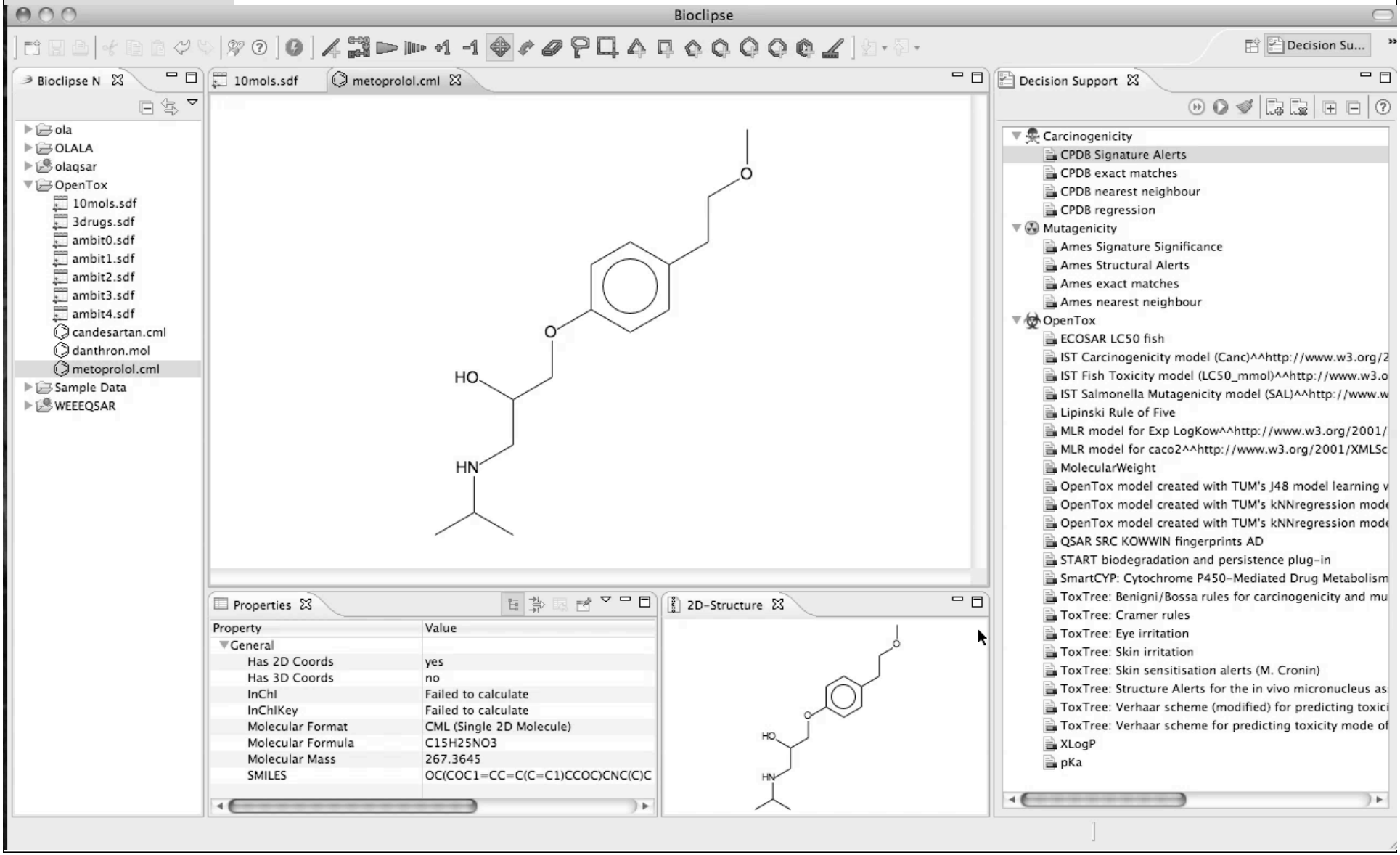
OpenTox in Bioclipse



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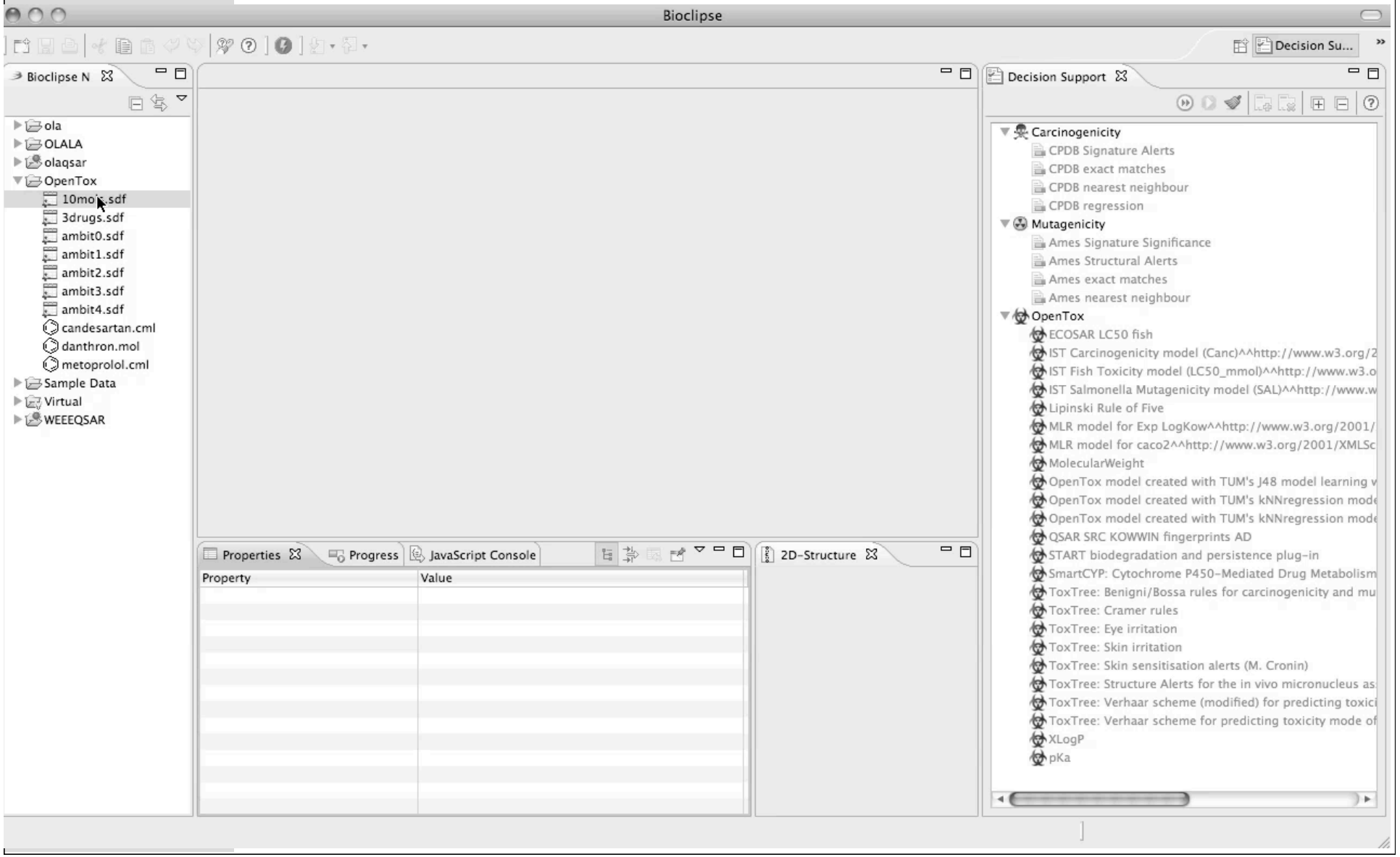
OpenTox in Bioclipse (2)



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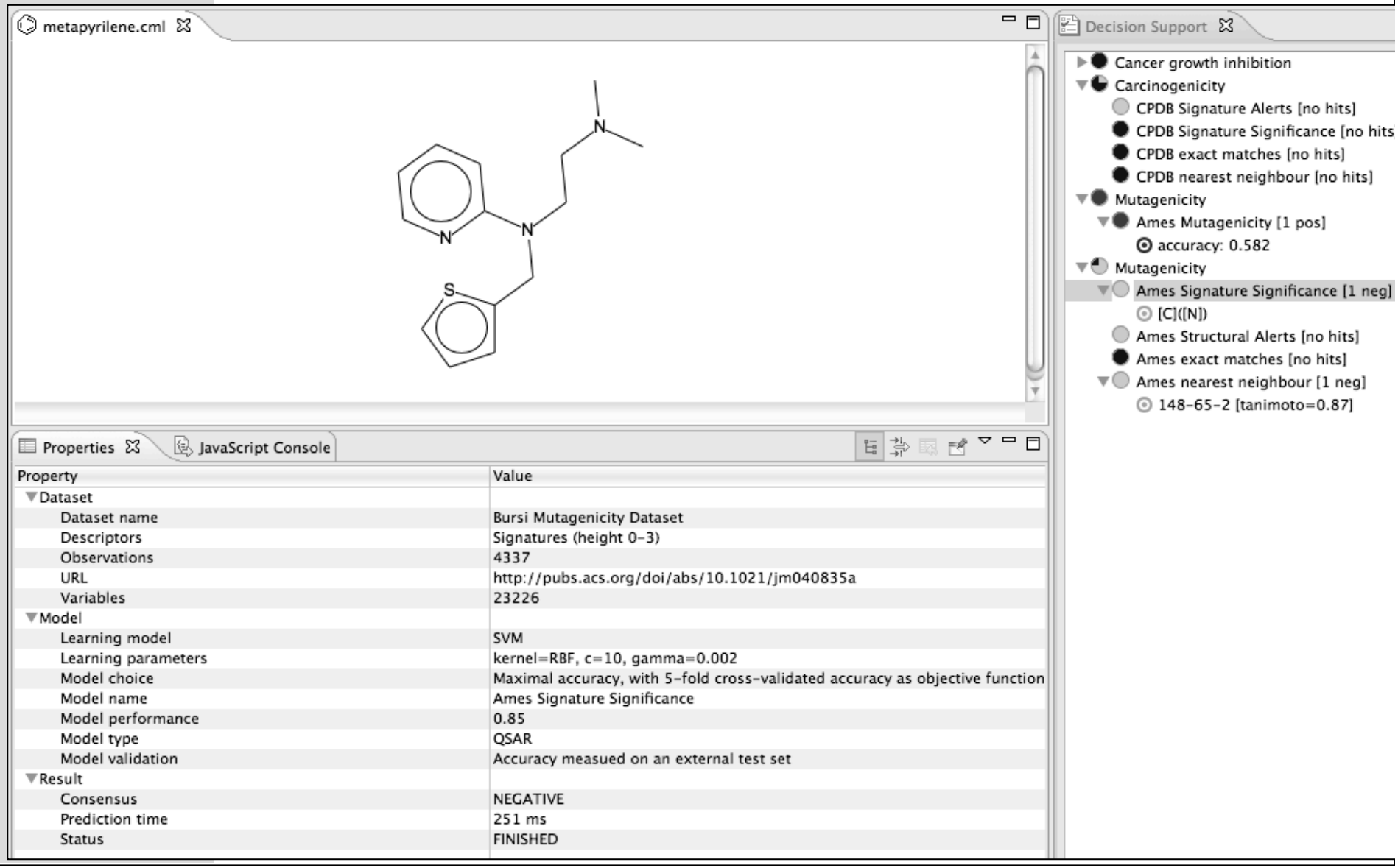
Report model validation



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From data to predictions

Proprocess data	Create and assess models	Deploy models	Consume models
Download, edit, visualize, preprocess structures and metadata	Statistical modeling and validation	Package and deliver model to users in a flexible, secure format	Enable user-friendly consumption of services

OpenTox

Remote

Local

Remote

Local

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Next steps…

- Improve UI
  - Better indication of A&A, encryption, status
  - Selection of local and remote services
  - Highlight substructure results
  - More wizards and editors for OpenTox functionality
- Report accuracy from OpenTox predictions
- Include MetaPrint2D site-of-metabolism predictions, other open models…
- Consensus modeling

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Future prospects

- Deploy Bioclipse models in OpenTox
  - Implement a bridge from OSGi services to OpenTox
- Run local server for offline OpenTox predictions
- Include OpenTox modeling in wizards (e.g. ToxCreate)

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Experiences from the Bioclipse-OpenTox integration

- Open standards and ontology/API greatly simplify integration
- Open and collaborative community
- Encouraging and constructive feedback

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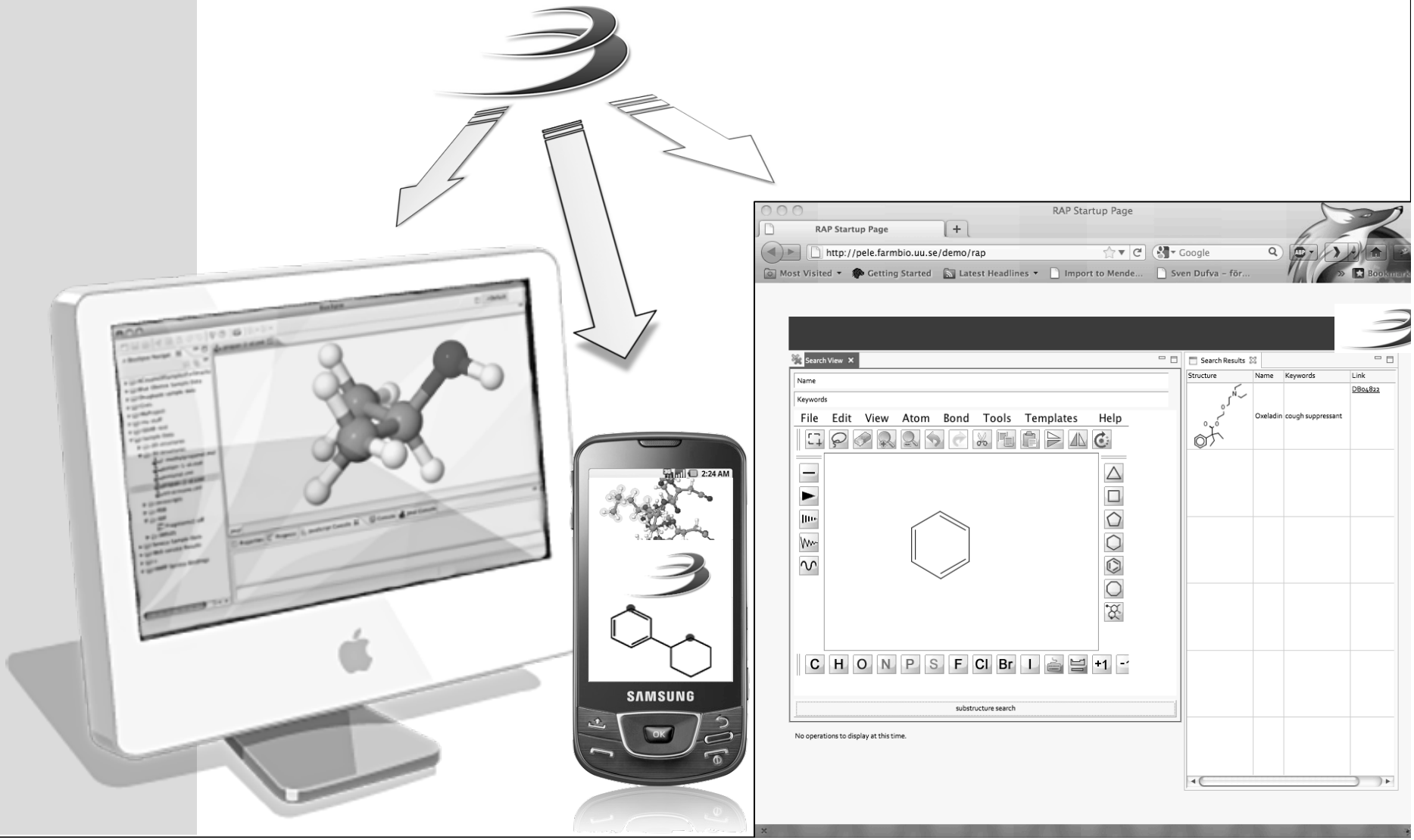
Bioclipse on desktop, web, and mobile



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Acknowledgement: The Chemistry Development Kit (CDK)

- Most prominent open source Java library for cheminformatics, 10 year anniversary!
- Coordinated from Uppsala/Stockholm (Egon Willighagen) and EBI (Christoph Steinbeck)
- ~150 citations
- Widely Used in academia and pharma industry
  - AstraZeneca, Bayer, Merck-Serono, Sanofi Aventis, Eli Lilly, Novartis

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Genetta SOFT

- Providing commercial support around the topics of Bioclipse and statistical modeling.
- Research, implementations, education, branding/deployment
- www.genettasoft.com

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- Thank you -

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