Automated Scientific Knowledge Extraction with AMIDOL
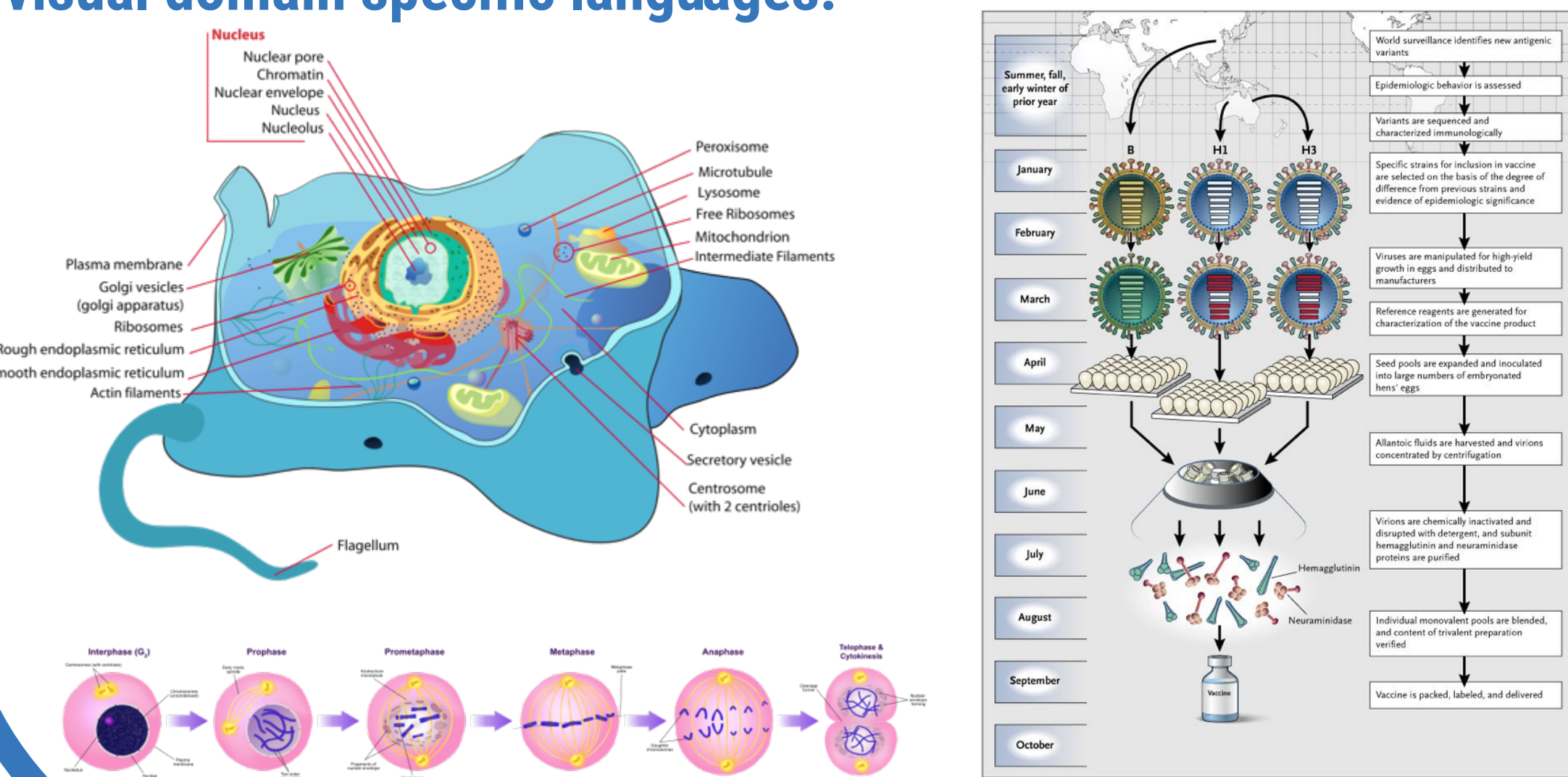
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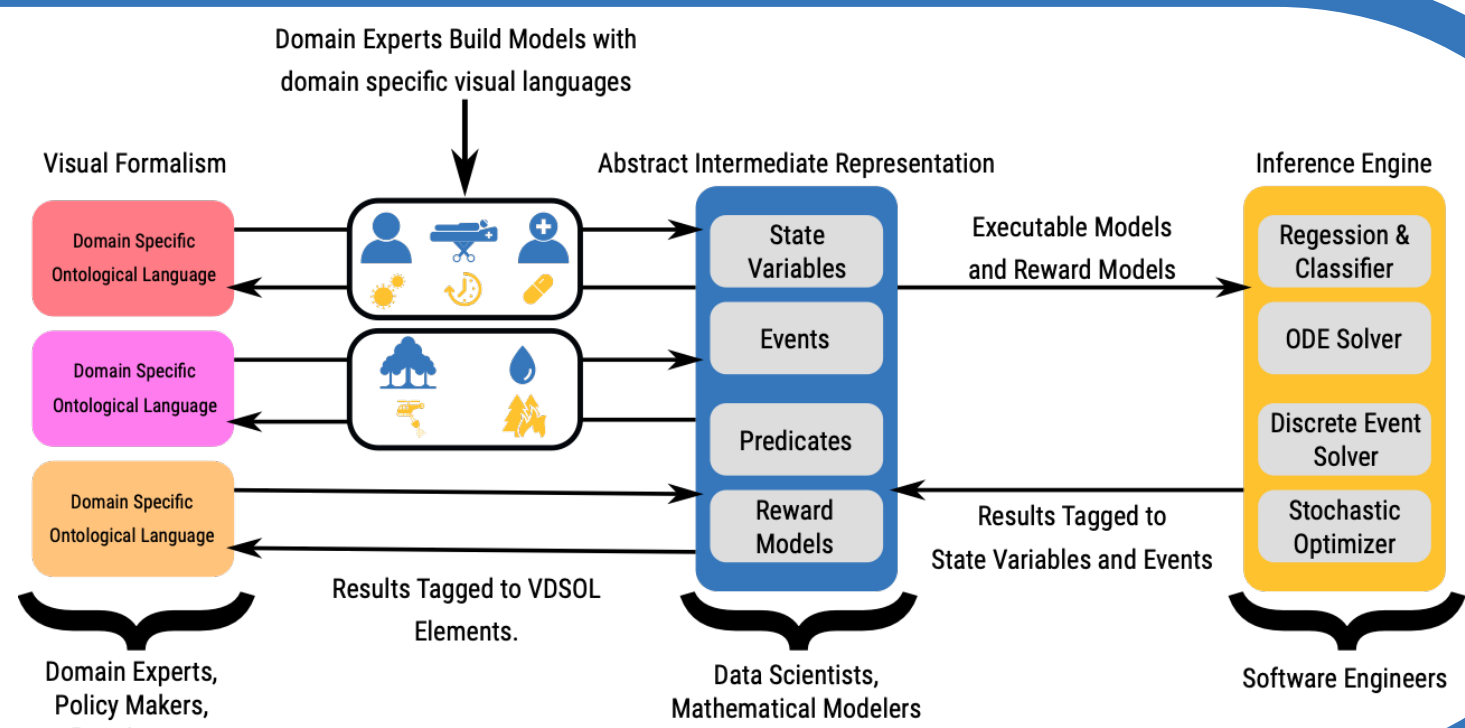Program Manager: Joshua Elliott

|galois|

In order to build, maintain, and execute multi-level models domain experts must currently also be trained as:
- Mathematicians
- Software Engineers
- Data Scientists

AMIDOL seeks to lower this barrier to entry with composable, visual domain specific languages.
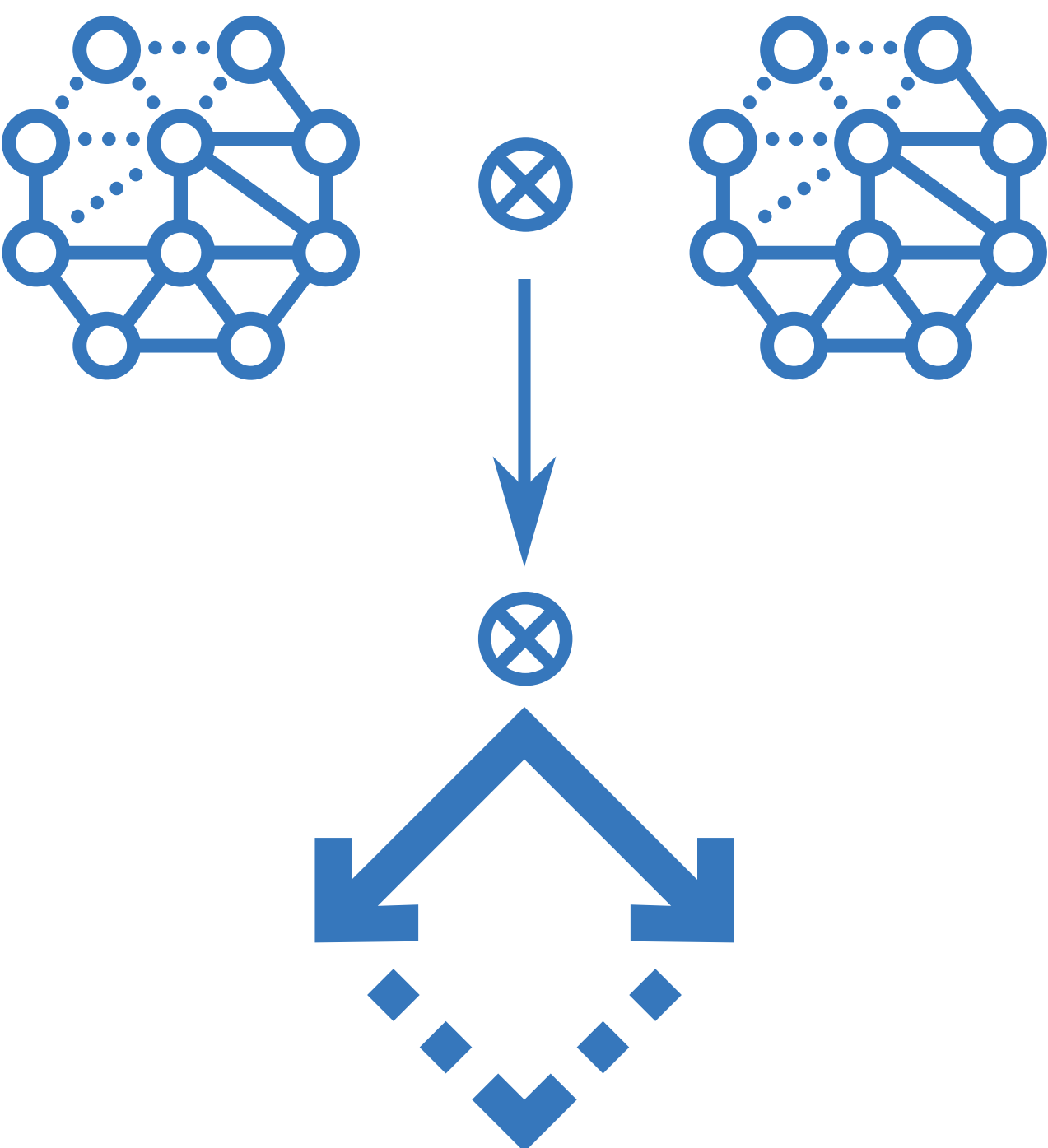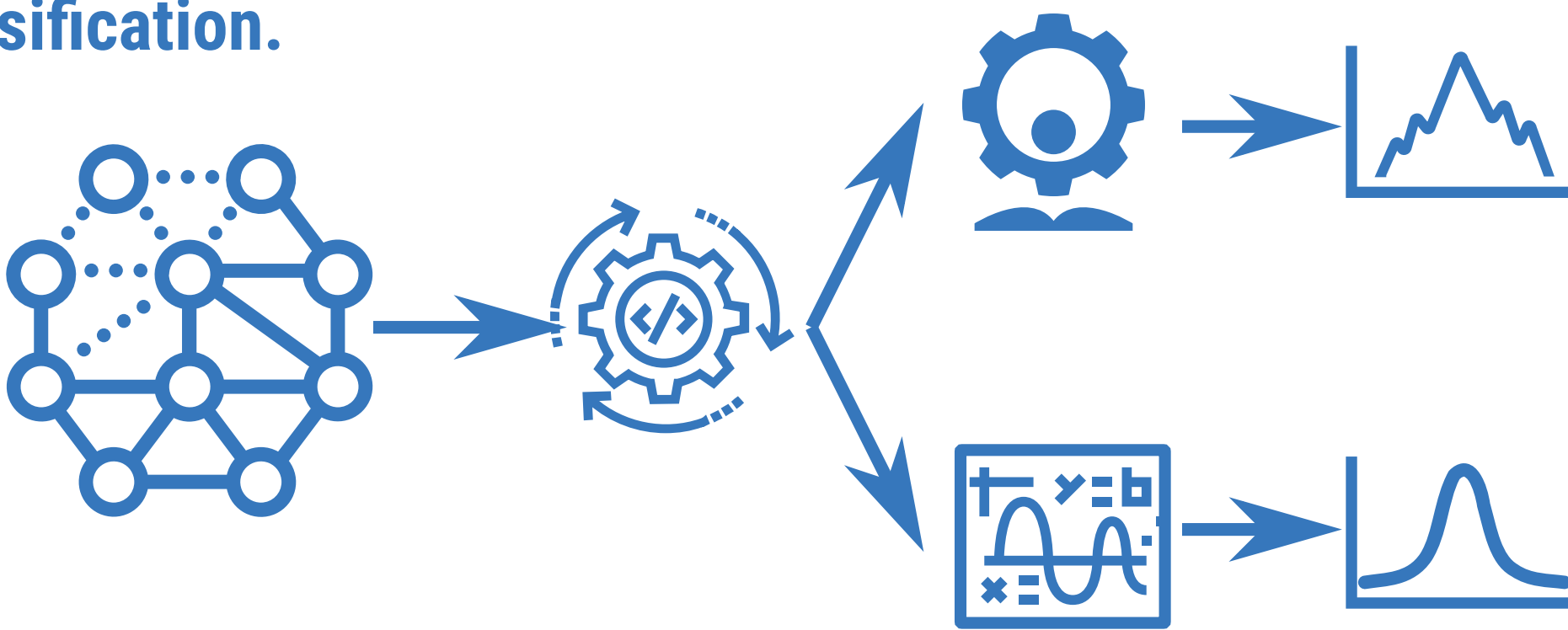

AMIDOL uses VDSLs to define models in the language natural to their domain.
AMIDOL allows models to be composed across domains and scales, using a universal intermediate representation in the form of a process algebra.
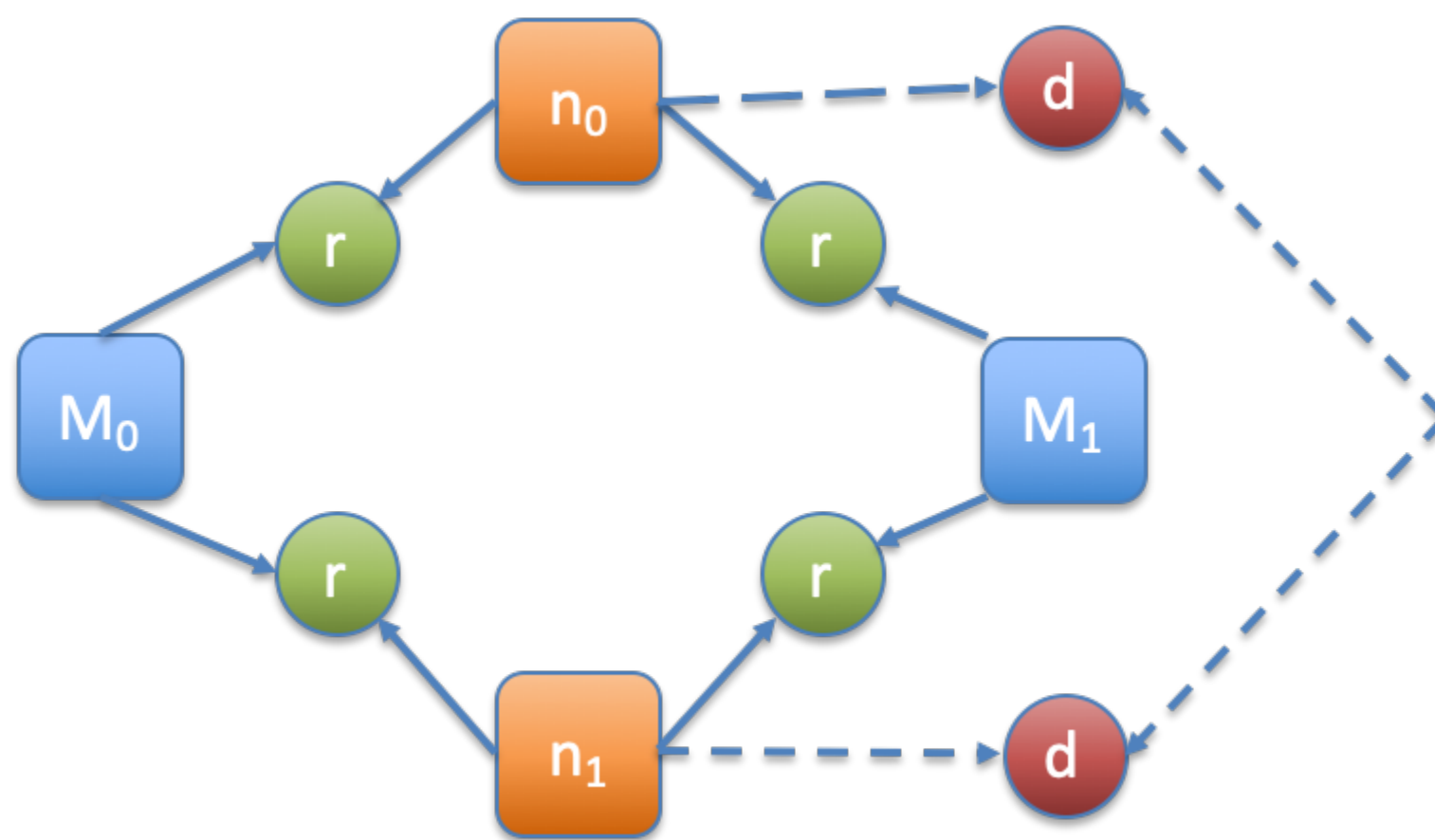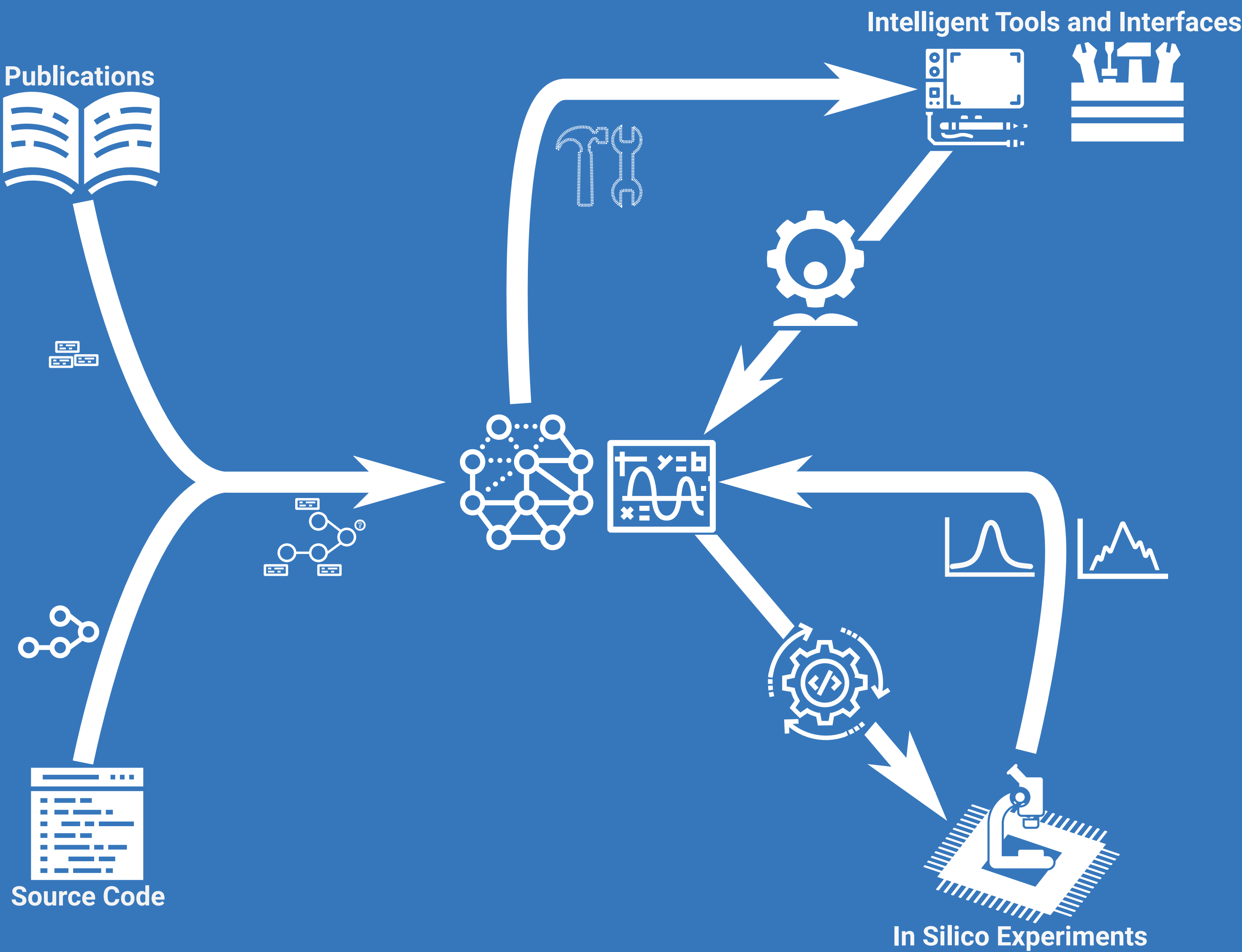

AMIDOL removes the burden of implementation and algorithm selection from the domain scientist. AMIDOL automatically synthesizes code in a target language of choice, based on the requirements of the composed models, and measures.

Models can be quickly reimplemented in other languages, with other algorithms or libraries, and for different architectures by recompiling the model.

AMIDOL automatically reasons about incompatibility, and synthesizes code that is correct by instruction, whether solving ODEs, ABMs, or using machine learning to fit models, or perform classification.

AMIDOL provides automatic methods to compose models across domains and scales.
The results of composition are also models, and can be composed themselves.
AMIDOL represents measures in the same fashion, allowing the design and reuse of generalized models, which can be composed with measures, to solve specific problems.

Publications

Source Code

Intelligent Tools and Interfaces

In Silico Experiments

AMIDOL automatically synthesizes appropriate code to solve a model, composed with a given measure.

The results of solution is stored in a graph database for later model comparison, or comparison to data collected in the field.

Interrogatability

Regression, Time Series Analysis
- Prediction
  - How will the system evolve in the near future?
- Risk assessment:
  - What is the risk of X?

Model Comparison, Design of Experiments
- Conditional forecasting
  - How will the system respond if X changes?
- Counterfactual analysis
  - What would have happened if X had been Y?
- Comparative impact
  - What is the difference in utility between strategy X and strategy Y?

- Optimal planning:
  - What is the optimal amount of X to introduce to maximize utility Y?

Stochastic Optimization, Bayesian Inference
- Risk assessment:
  - What is the risk of X?
- Outcome avoidance:
  - What is the optimal action or intervention to reduce the risk of X decreasing more than Y?

DARPA