

Rule-based Modeling in Systems Biology

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 - Boolean/Discrete/Stochastic/ODE interpretations of reaction rules
 - Reaction models → structural influence graph (circuit analysis)
 - Consistency checks, protein functions (ontologies as types)

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 - Delete/merge molecules/reactions → subgraph epimorphisms
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- " Better than simulation: **model-checking, temporal logic constraints**
 - Formalizing experimental observations with temporal logic formulae
 - Query language for all possible behaviors in CTL
 - Continuous satisfaction degree in $[0,1]$ of LTL(R) properties
 - Parameter inference, robustness, sensitivity analyses w.r.t. LTL(R) spec

Conclusion

- " **New focus in Systems Biology:** formal methods from Computer Science
 - Beyond diagrammatic notations: formal semantics, static analyses
 - Beyond curve fitting: high-level specifications in temporal logic
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- " **Synthetic Biology**
 - Program the living with programming tools
 - Computational design and optimization tools

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