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Minimizing Potential "Immune Response" to Functional Programming

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Presentation Developed with the Amgen Systems Informatics Group

Commercial Users of Functional Programming
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We Have Had Varying Success in Using Functional Programming

- **Successful**
  - Using FP for scientific applications
- **Barely Started**
  - Using FP to help validate code
- **Bi-modal Success**
  - Boosting programmer morale

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Some Mathematical Simulations That Used FP

- Economic process modeling and production planning
- Drug discovery process optimization via Petri-nets
- Pharmacokinetic/Pharmacodynamic (PKPD) modeling
- Software project portfolio management

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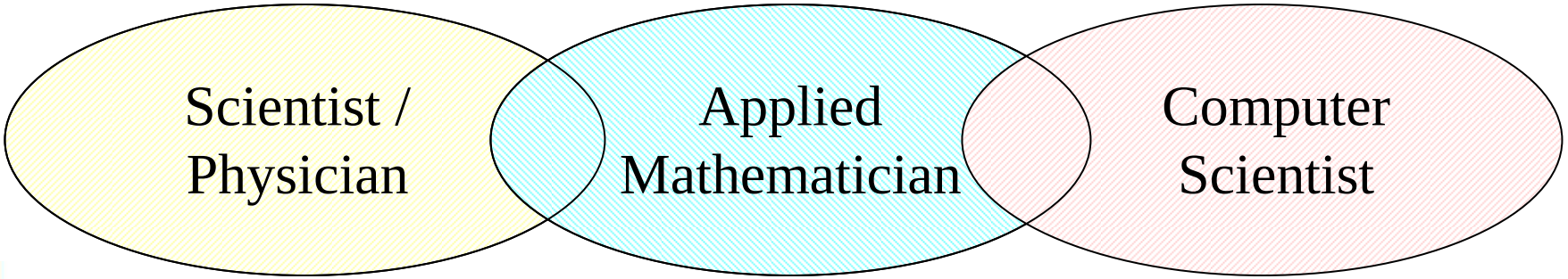
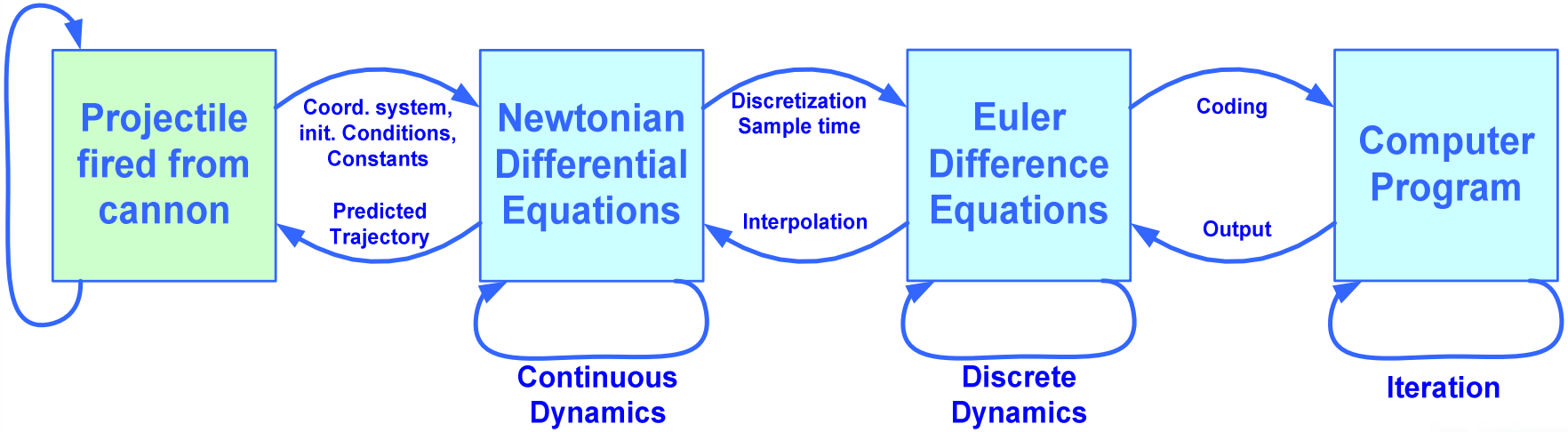
Creation of Complex Models Requires Multi-disciplinary Cooperation





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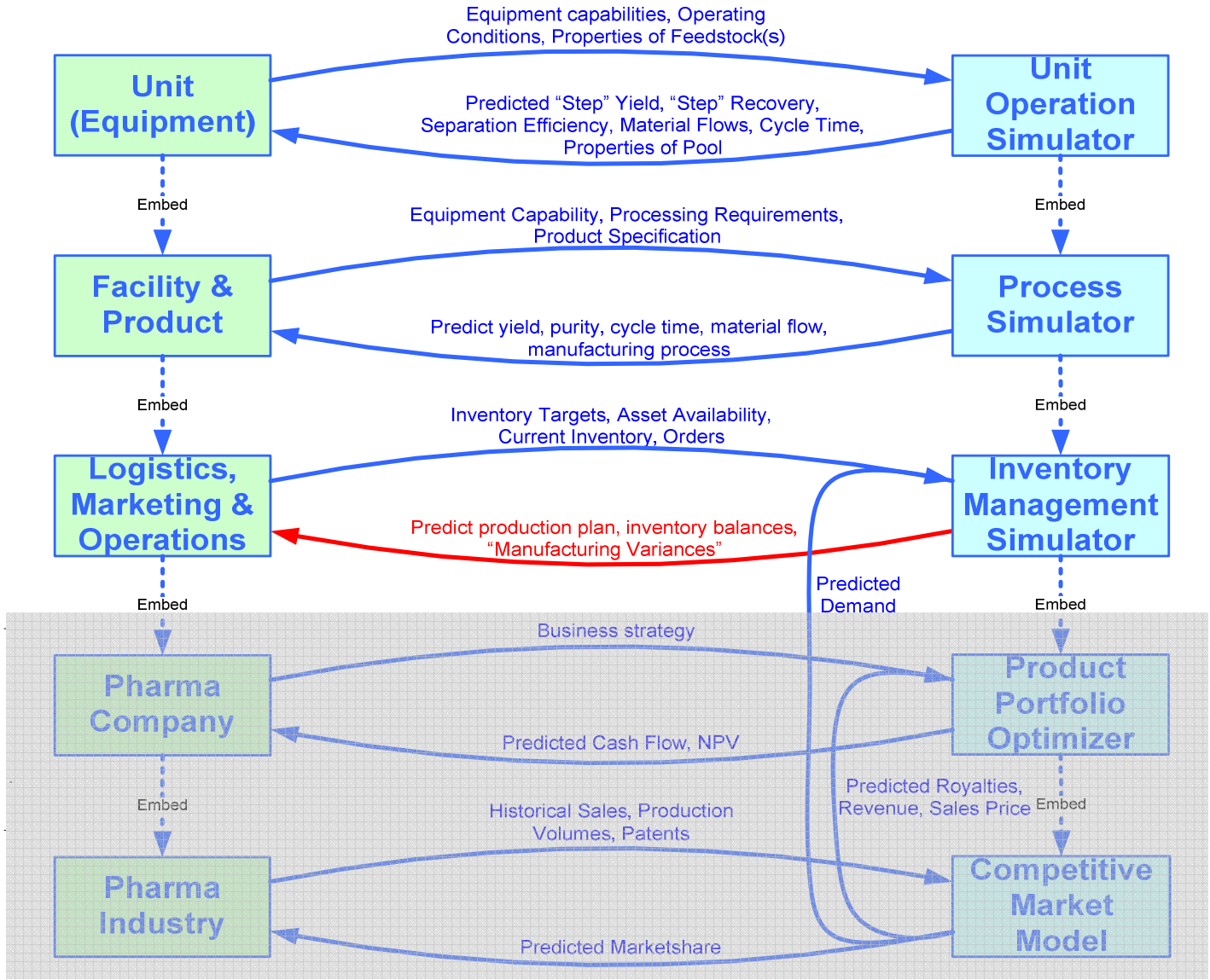
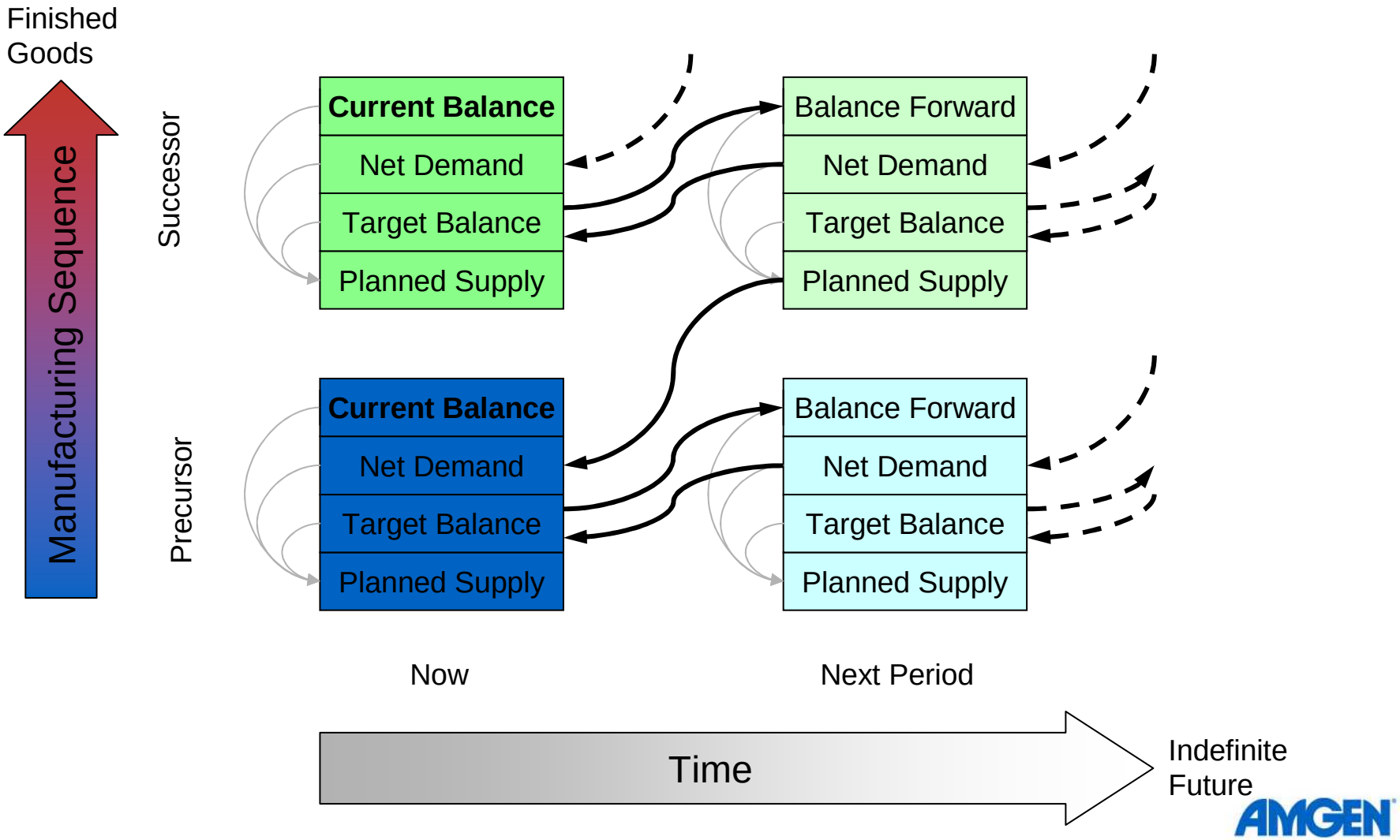
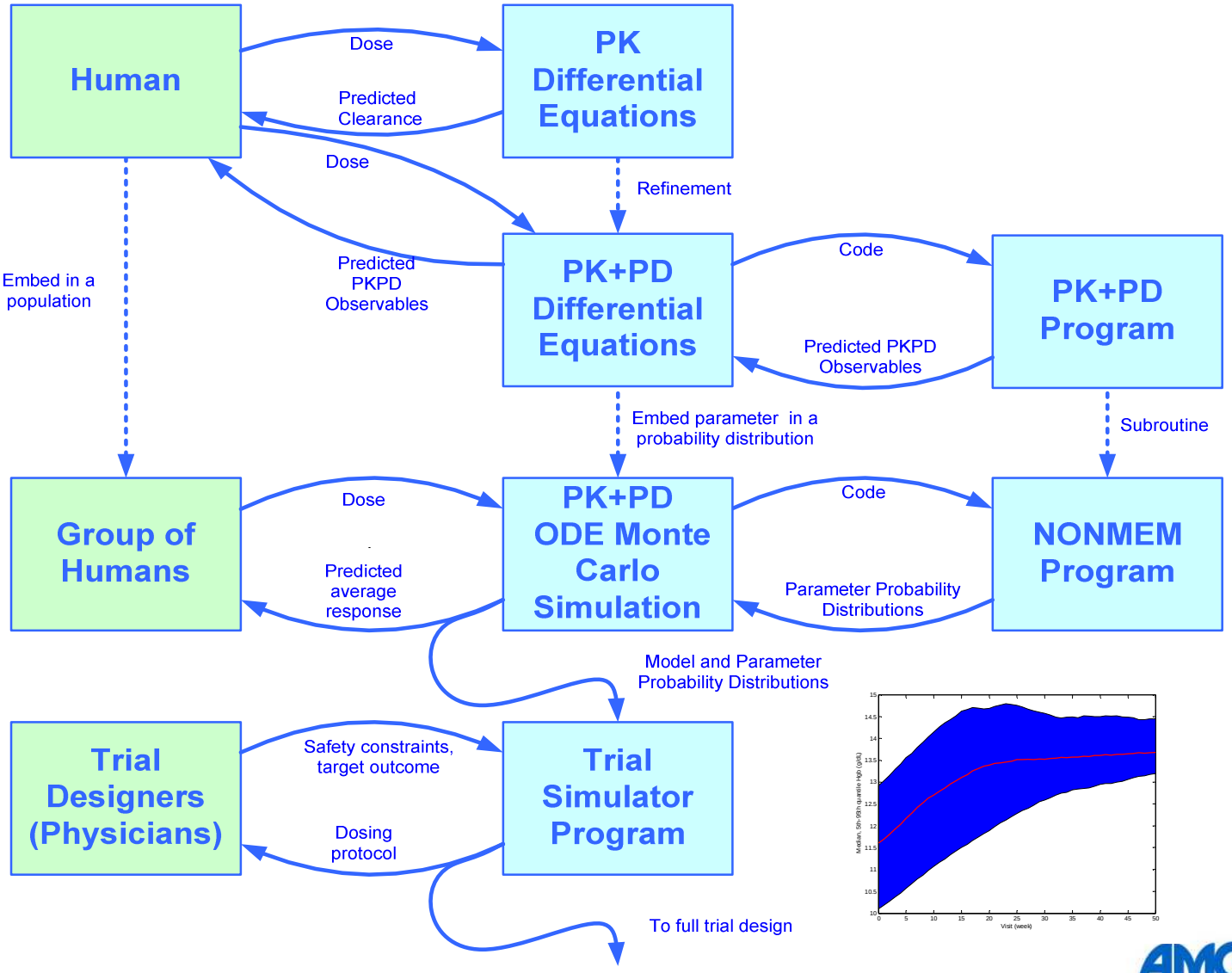
Simulating Economic Processes



Planning Functions are Mutually Recursive and Range Over both Time and Manufacturing Sequence



Simulating PK PD and Clinical Trials



Software Validation Needs

- **Scientific validation**
  - **Mathematical models**
  - **Mathematical algorithms**
- **Regulatory validation**
  - **Requirements and testing traceability**

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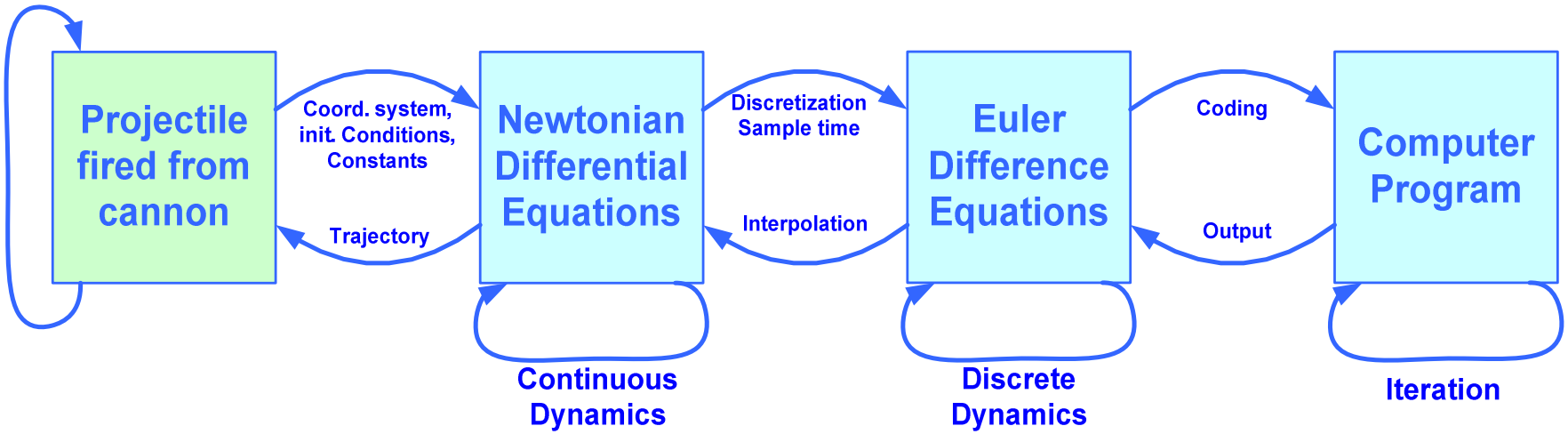
Rigorous Requirements Traceability Can Guarantee that "Good Behavior" is Preserved

Requirements are Preserved

Accuracy is Preserved

Semantics Preserved



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“Inoculation” -- Haskell Education

- Oxford Haskell course
- Haskell presentations
  - Jeremy Gibbons
  - Simon Peyton-Jones
- Scientific exchange
  - Galois
  - Various researchers

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“Immune Response” -- Adoption of FP (Or Not)

- High curiosity about FP
- Steep learning curve created attrition from courses
- Level of abstraction was a barrier
- Fear that “non-mainstream” languages may not be supportable
- Where FP has been used, it has worked well

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Next Steps for Systems Informatics

- Continue to use FP
- If possible, hire more functional programmers with science or math backgrounds
- Improve testing
  - Start using QuickCheck
- Focus more on using parallelism

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END