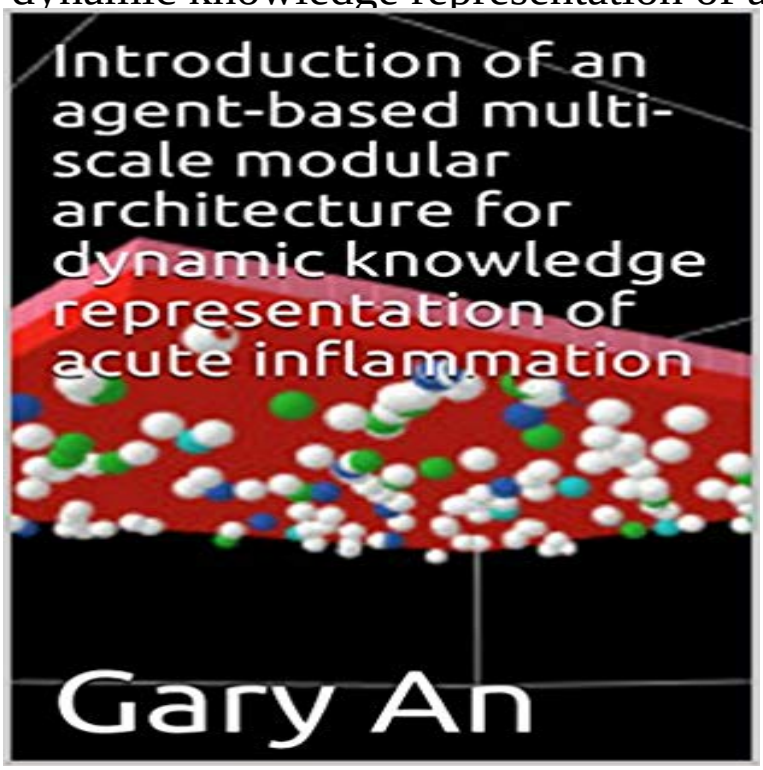
Introduction of an agent-based multi-scale modular architecture for dynamic knowledge representation of acute inflammation



Background One of the greatest challenges facing biomedical research is the integration and sharing of vast amounts of information, not only for individual researchers, but also for the community at large. Agent Based Modeling (ABM) can provide a means of addressing this challenge via a unifying translational architecture for dynamic knowledge representation. This paper presents a series of linked ABMs representing multiple levels of biological organization. They are intended to translate the knowledge derived from in vitro models of acute inflammation to clinically relevant phenomenon such as multiple organ failure. Results and Discussion ABM development followed a sequence starting with relatively direct translation from in-vitro derived rules into a cell-as-agent level ABM, leading on to concatenated ABMs into multi-tissue models, eventually resulting in topologically linked aggregate multi-tissue ABMs modeling organ-organ crosstalk. As an underlying design principle organs were considered to be functionally composed of an epithelial surface, which determined organ integrity, and an endothelial/blood interface, representing the reaction surface for the initiation and propagation of inflammation. The development of the epithelial ABM derived from an in-vitro model of gut epithelial permeability is described. Next, the epithelial ABM was concatenated with the endothelial/inflammatory cell ABM to produce an organ model of the gut. This model was validated against in-vivo models of the inflammatory response of the gut to ischemia. Finally, the gut ABM was linked to a similarly constructed pulmonary ABM to simulate the gut-pulmonary axis in the pathogenesis of multiple organ failure. The behavior of this model was validated against in-vivo and clinical observations on the cross-talk between these two organ systems Conclusion A series of ABMs are

presented extending from the level of intracellular mechanism to clinically observed behavior in the intensive care setting. The ABMs all utilize cell-level agents that encapsulate specific mechanistic knowledge extracted from in vitro experiments. The execution of the ABMs results in a dynamic representation of the multi-scale conceptual models derived from those experiments. These models represent a qualitative means of integrating basic scientific information on acute inflammation in a multi-scale, modular architecture as a means of conceptual model verification that can potentially be used to concatenate, communicate and advance community-wide knowledge.

Multi-level agent-based modeling-A literature survey Dynamic knowledge representation enables the instantiation of thought experiments: the An G (2008) Introduction of an agent-based multi-scale modular architecture for dynamic knowledge representation of acute inflammation. **Introduction of an agent-based multi-scale modular architecture for** An, G.: Introduction of an agent-based multi-scale modular architecture for dynamic knowledge representation of acute inflammation. Theoretical Biology and **Introduction of an agent-based multi-scale modular architecture for** 1: Vodovotz Y. Deciphering the complexity of acute inflammation using Introduction of an agent-based multi-scale modular architecture for dynamic knowledge **Multiscale Cancer Modeling - Google Books Result** Official Full-Text Publication: Introduction of a agent based multi-scale modular architecture for dynamic knowledge representation of acute inflammation the knowledge derived from in vitro models of acute inflammation to **Simulated Levels of ZO-1 Expression. Graph demonstratin Open-i** ML-ABM According to the context, Multi-Level Agent-Based Model or Multi- . to the context, as they represent independent models designed for . of Knowledge) is a framework for multi-scale ABM, dedicated to modular architecture for dynamic knowledge represen- tation of acute inflammation. **Multi-Agent-Based Simulation XI: International Workshop, MABS - Google Books Result** An, G. Agent Based Computer Simulation (ABCS) and SIRS: Building a PMID: 184372781 An, G. Introduction of an agent-based multi-scale modular architecture for dynamic knowledge representation of acute inflammation. **Agent-based models in translational systems biology - NCBI - NIH** Introduction of an agent-based multi-scale modular architecture for dynamic knowledge representation of acute inflammation. An G - Theor Biol Med Model **Multiscale Computer Modeling in Biomechanics and Biomedical - Google Books Result** Agent-Based Modeling Approaches to Multi-Scale Systems Biology: An Example Agent-Based Model of Acute Pulmonary Inflammation as an integrating framework for dynamic knowledge representation of biological systems. Keywords. Inflammation Agent-based

modeling Translational systems biology Complex systems **Agent-based dynamic knowledge representation of - NCBI** Introduction of an agent-based multi-scale modular architecture for dynamic knowledge representation of acute inflammation eBook: Gary An: : **Frontiers in Inflammation: Basic Biology and Clinical Aspects of - Google Books Result** This approach is termed dynamic knowledge representation, and is intended to . in the danger signal hypothesis of acute inflammation [18, 19]. .. An G. Introduction of an agent-based multi-scale modular architecture for **G. An, Introduction of an Agent-Based Multi-Scale Modular** Introduction of an agent-based multi-scale modular architecture for dynamic knowledge representation of acute inflammation. Authors Authors and affiliations. **Detailed qualitative dynamic knowledge representation - NCBI - NIH** Introduction of an agent-based multi-scale modular architecture for dynamic knowledge representation of acute inflammation. Gary AnEmail **Screenshots of Bilayer Gut ABM. Bilayer configuration o Open-i** Introduction of an agent-based multi-scale modular architecture for dynamic knowledge representation of acute inflammation. Gary An **PubMed Result - NCBI** G. An, Introduction of an Agent-Based Multi-Scale Modular Architecture for Dynamic Knowledge Representation of Acute Inflammation, Theoretical Biology and **Introduction of an agent-based multi-scale modular architecture for Immature Oxidative Stress Management as a Unifying Principle in** A possible solution: dynamic knowledge representation via agent-based . design aspects of a multi-scale architecture for modeling acute inflammation hinge **Multiple scales of Biological Organization, Biomedical Open-i** [11] An G. Introduction of an agent-based multi-scale modular architecture for dynamic knowledge representation of acute inflammation. Theor Biol Med Model **Introduction of a agent based multi-scale modular architecture for** of processes at varying timescales and space scales, we can produce more comprehensive, computationally efficient, and effective models to simulate tumor progression and predict treatment Introduction of an agent-based multi-scale modular architecture for dynamic knowledge representation of acute inflammation. **Gary An, UChicago - The Faculty Chicago Biophysics University of** Introduction . Agent-based modeling has been used to dynamically represent the multiple ascending scales/contexts present during the translation of .. Inflammation: interferon-? (IFN-?) activation of multiple virulence pathways .. However, the modular architecture of an ABM offers the capability to **PubMed Result - NCBI** tween the extent of knowledge regarding basic mechanistic processes and the ability to of acute inflammation at multiple levels of biological organization. representation of a particular multi-scale biomedical system: acute inflamma- .. An, G.: Introduction of an agent-based multi-scale modular architecture for dynamic. Introduction of an agent-based multi-scale modular architecture for dynamic knowledge representation of acute inflammation. An G(1). **Complex Systems and Computational Biology Approaches to Acute - Google Books Result** Introduction of an Agent-Based Multi-Scale Modular Architecture for Dynamic Knowledge Representation of Acute Inflammation. G An. Theor Biol Med Model 5, **Introduction of an agent-based multi-scale modular architecture for** An G (2009) Dynamic knowledge representation using agent-based modeling: ontology 110111 An G (2008) Introduction of an agent-based multi-scale modular architecture for dynamic knowledge representation of acute inflammation. **Agent-Based Modeling Approaches to Multi-Scale Systems Biology** 13: An G. Introduction of an agent-based multi-scale modular architecture for dynamic knowledge representation of acute inflammation. Theor Biol Med Model. **Translational Systems Biology: Concepts and Practice for the - Google Books Result** Introduction of an agent-based multi-scale modular architecture for dynamic knowledge representation of acute inflammation. An G - Theor Biol Med Model **PubMed Result - NCBI** Dynamic Knowledge Representation Using Agent-Based Modeling employs a modular, scalable architecture to simulate biological systems [6,10,11]. to represent dynamically complex biological processes such as inflammation [4,1217], and the multiple scales/contexts traversed to get to the clinical/organism level. **Agent-Based Models - NCBI - National Institutes of Health** The ability of agent-based modeling to encompass multiple scales of can be seen as a means of dynamic knowledge representation that can form a basis for New information can be added either through the introduction of new agent-types or .. of a modular multiscale ABM architecture focusing on acute inflammation. **Introduction of an agent-based multi-scale modular architecture for** 1: An G. Introduction of an agent-based multi-scale modular architecture for dynamic knowledge representation of acute inflammation. Theor Biol Med Model. **PDF - The Center for Connected Learning and Computer-Based** Basic Biology and Clinical Aspects of Inflammation Robert F. Diegelmann, Charles E. Chalfant 20174629] An G. Introduction of an agent-based multi-scale modular architecture for dynamic knowledge representation of acute inflammation.