Welcome to the SSH Forum on Modeling and Simulation. We have an outstanding program planned and look forward to a great experience of learning, networking, broadening horizons, and having fun.

Modeling and Simulation (M&S) has become a powerful, ubiquitous but often little understood tool in many aspects of healthcare. Simulation-based engineering and science involves the use of computer M&S to solve mathematical formulations of physical models of engineered and natural systems. In January 2013 SSH’s Healthcare Systems Modeling & Simulation Affinity Group (HSMSAG) was created to connect professionals who use constructive and computational M&S technology in healthcare systems and human factors engineering and modeling in biological systems.

Simulation in healthcare predominately is a training technique that provides a safe environment for healthcare practitioners to acquire valuable experience without patient harm. M&S also can be used as test-bed to study the interactions between the complex systems and sub-systems and test new process interventions before clinical application. Systems science considers different components within complex systems across multiple levels to help understand their interactions and influences. The focus on single, independent risk factors often fails to capture the complexity of interactions between diverse factors in subtle, bidirectional, or non-linear ways to strongly influence overall behaviors and health outcomes.

Simulation Modeling and Systems Science (SMSS) provides avenues for modeling relevant multiple processes, testing plausible scenarios, understanding the magnitude of intended and unintended consequences of specific interventions, and having the option to adjust and refine simulated intervention designs prior to actual implementation testing in the real world. SMSS approaches have been used to guide interventions in clinical preventive care, disaster planning, and for analyzing national health reform strategies. Many M&S applications have been applied to system biology, disease mechanisms modeling, drug/device design and development, provider workflow/process, hospital operations, and public healthcare policy at different spatial and time scales.

Today and tomorrow, you will hear from some of the world’s leading experts on simulation, healthcare, and modeling and simulation in healthcare. We begin with Professor Terry Young who will share insights on the role of modeling and simulation on healthcare systems around the world undergoing redesign and transformation with refocusing on patient centered care.

We follow this with speakers from hospital systems, academia, government agency and industry who work with modeling and simulation in and outside of healthcare. We’ll explore everything from how the use of modeling and simulation can be expanded to better address challenges of biology system, clinicians, hospital operation and policy through synthesis with various technologies (EMR, big data, AI, 3D printing, etc.) Finally, we will hear from C. Donald Combs, SSH board member, who will share insight on how themes from the Forum are percolating within SSH’s future strategic agenda.

Thank you for joining us. We appreciate your interest and involvement and look forward to many energizing discussions.

SSH Forum Planning Committee,

Bob Armstrong, MS
Yue Dong, MD
@dongyue
Gilbert Muniz, PhD
John Rice
# Schedule at a Glance

**Friday, January 12**

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<td><strong>Closing Plenary</strong> with C. Donald Combs, PhD, FSSH</td>
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**Breakout Sessions**

- **Computational and Mathematical Modeling of Biological Processes to Inform Clinical Practice and Therapeutics**
- **Drugs and Devices: From Virtual to Reality**
- **Healthcare Delivery Process, Information Systems, Hospital Operation**
- **Strategic Decision-making in Healthcare Organizations**
- **Emerging Technologies**

**M&S Forum Reception, Poster Presentation & Exhibits**
DAY ONE
JANUARY 12, 2018

7:00 AM – 6:00 PM
Registration
West Hall Lobby

9:00 AM - 9:45 AM
OPENING PLENARY
Three Reasons Why Clinicians Should Model
Room 408A
Modeling and simulation are not commonly used in designing healthcare services - yet! In this session we’ll explore three reasons why clinical staff, in particular, should model: the insights yielded by modeling provide clinicians with insights into how to obtain the goals they want in the context of the service being run, and the output from models provide clinical staff with a voice when it comes to the design or improvement of services and an ability to articulate their preferences in meaningful terms to operational managers and strategic planners. Too often, clinical staff feel the only option left open to them is to withdraw support from changes on the grounds of safety. Finally, healthcare services rely heavily on information services and modeling provides a link for clinicians into the world of IT and communications.

Speaker: Professor Terry Young, Brunel University in London, Chair of Healthcare Systems

10:00 AM – 10:30 AM
CONTENT EXPERT ONE
M&S Improving Time to Market
Room 408A
This session will discuss the advantage of M&S as a serious strategy to improve “time to market” in healthcare innovation.

Speaker: Speaker to be announced

10:30 AM – 11:00 AM
CONTENT EXPERT TWO
Getting to Know Your Digital Twin
Room 408A
This session will review the current regulatory frameworks for using computational modeling in a regulated environment along with examples of the in silico clinical trials concept, e.g. the MDIC Virtual Patient Project, statistical shape analysis of femurs to develop patient-realistic models and patient-specific modeling of AAA stent placement.

Speaker: Marc Horner, PhD

11:00 AM – 11:30 AM
CONTENT EXPERT THREE
AR, VR, AI and Similar Acronyms: What They Mean for Healthcare Simulation: A Clinician’s Perspective
Room 408A
The field of healthcare simulation has undergone tremendous growth since the founding of SSH in 2006. During this time, much emphasis has been placed on developing and using physical patient simulators to practice technical interventions, either in isolation or as a component of a more complex simulated clinical scenario involving one or more healthcare professionals. Yet the implementation of simulation in healthcare should not be limited to physical simulators alone. It’s hard to think outside of the box if we don’t realize that we are in a box. This session will focus on how new ways of modeling complex systems will change not only how we train healthcare professionals but also how those professionals will deliver patient care.

Speaker: Louis P. Halamek, MD

11:30 AM – 12:00 PM
CONTENT EXPERT FOUR
Bedside Clinical Simulation: Ubiquitous Imprecision in Need of Innovation
Room 408A
Expert clinicians are fundamentally pattern recognition “devices”. Senior clinicians are better pattern recognizers than are junior clinicians. And because patients (at least critically ill children) spew approximately 350 data streams, the patterns we recognize ignore vast tracts of data. Further, all clinicians make decisions carrying many of the at least 160 categorized cognitive biases.

Yet, every decision a clinician makes is really a simulation run with an imprecise mental model. We are imprecisely defined agents imposing actions on other poorly defined agents (the patients), variably interact with other agents (other clinicians and patient contacts) and through biased filters variably observe actions and conclude imprecisely defined outcomes (or model outputs).

Clinicians are slow to adopt simulation for two reasons:
1. We just don’t realize the role simulation and modeling play in our current daily decisions, and
2. We lack the tools to implement and then demonstrate the utility of even a simple bedside mathematical model or simulation.

Speaker: James Fackler, MD

12:00 PM – 1:00 PM
Lunch & Exhibits
Room 408B
BREAKOUT SESSION ONE
Computational and Mathematical Modeling of Biological Processes to Inform Clinical Practice and Therapeutics
Room 409A
The practice of medicine is ultimately the task of trying to maintain the state of “health” either by preventing a divergence from that state, or correcting such a divergence should it occur. Being able to do this in a rational manner requires understanding how basic biological processes function to produce these dynamics, and then using that understanding to develop control modalities. However, the current state of biological knowledge is hugely complex, and being able to parse this dense data/knowledge landscape requires the application of correspondingly sophisticated analytical tools that take advantage of our rapid advances in computational methods and capabilities. This session will introduce and discuss how computational/mathematical modeling of basic biomedical processes can inform the development of therapies and facilitate the optimization of those therapies in a more precise and personalized way.

Chair: Gary An, MD
Speakers: Mark Alber, PhD; Jonathan Ozik, PhD; William (Drew) Pruett, PhD; Russell Rockne, PhD

BREAKOUT SESSION TWO
Drugs and Devices: From Virtual to Reality
Room 409B
It takes a virtual village, including experts with diverse backgrounds, to care for patients. This breakout session explores the development of healthcare drugs and devices, addressing both conceptual and pragmatic considerations. Participatory group exercises will be interspersed between presentations tackling varied facets of drug and device development and clinical use. Experts will speak to practical considerations, goal-directed treatment, abstract and in silico device development, product packaging, and patient safety. This eclectic session will conclude with a panel discussion of future directions.

Chair: Ellen Deutsch, MD; Samsun Lampotang, PhD
Speakers: Fahad Alam, PhD; Laura Bix, PhD; Mary Kay Smith, PhD, MSN, RN, CHSE; Chris Unger, PhD

BREAKOUT SESSION THREE
Healthcare Delivery Process, Information Systems, Hospital Operations
Room 410
Modeling and simulation impact healthcare delivery and hospital operations in powerful ways. Significant strategic advantage for healthcare delivery systems is possible at a favorable cost to benefit ratio. This session explores how healthcare leaders around the world have helped to transform healthcare at their local institutions, and how their experience can translate into practical solutions for you.

Chair: Sapan Desai MD, PhD; Jingshan Li, PhD
Speakers: Abdullah Alibrahim, PhD; Evelyn Pagan, RN, MBA; Charles Pozner, MD; S. Joe Qin, PhD; James Wilkerson

BREAKOUT SESSION FOUR
Strategic Decision-making in Healthcare Organizations
Room 406A
Join us to explore the interdependence of governance, leadership, technology, policy, and economics in extracting value and improving patient safety by the application of simulation and modeling technologies, practices, and methods.

Examples will be shared from various domains of healthcare application such as pandemic disease modeling, epidemiology forecasting, diagnostic methods and practices, and computer visualization and participant immersion. The discussion will include some aspects of the social and financial considerations in adopting and expanding use of M&S in healthcare.

Chair: Geoff Miller, MS; Richard Severinghaus, CMSP
Speakers: Speakers to be announced

BREAKOUT SESSION FIVE
Emerging Technologies
Room 406B
The Emerging Technologies session will highlight a variety of innovative technologies related to clinical education and patient care including: 3D Printing, Game-Based Learning and Virtual Reality. Speakers will share their technologies with workshop attendees using a case study framework, followed by a hands-on, immersive exploration and demonstration. The session will conclude with a roundtable activity where the speakers will facilitate discussion with session participants on how the emerging technologies could be leveraged to solve real-world challenges in clinical education and patient care.

Chair: Eric Bauman, PhD, FSSH; Carla Pugh, MD
Speakers: Reid Adams; Eric Gantwerker, MD; Yu-Hui Huang; Angela Robert
DAY TWO
JANUARY 13, 2018

8:00 AM - 8:45 AM

PANEL ONE
Future Directions for Simulation in Healthcare
Room 408A
This panel will discuss future directions for simulation in healthcare: Representatives from government agencies (NIH, USUHS, AHRQ) will discuss current research challenges and opportunities for modeling and simulation; medical simulator research, development and implementation in the field.

Chair: Grace Peng, PhD
Panel Speakers: Dana Anderson, MD; Jeff Brady, MD, MPH; Joe Lopreiato, MD, MPH, CHSE; Grace Peng, PhD

8:45 AM - 9:30 AM

PANEL TWO
Knowledge Dissemination: Model Sharing and Outreach
Room 408A
This panel will discuss the nuts and bolts of model sharing and outreach, demonstrating model credibility with reproducibility and the strengths and pitfalls of model re-purposing.

Chair: Lealem Mulugeta
Panel speakers: Robert McDougal, PhD; Pras Pathmanathan, PhD; Herbert Sauro, PhD

9:30 AM - 9:45 AM

Break

9:45 AM - 10:30 AM

PANEL THREE
Creating and Enhancing Interdisciplinary Higher Education Programs; Cross Training
Room 408A
This panel will discuss education and culture change; creating and enhancing interdisciplinary higher education programs; cross training to foster partnership between medical/healthcare and engineering community to build high performance system in which participating units recognize their interdependence and the implications and repercussions of their actions on the system as a whole to serving the patients’ needs.

Chair: Michael DeVita, MD
Panel Speakers: Ziv Amitai, MD; Doug Beighle; John Schaefer III, MD

10:30 AM - 11:15 AM

PANEL FOUR
The Role of Organizations to Advance the Adoption of M&S in Their Practice to Advance Medicine and Healthcare
Room 408A
What is the role of professional societies, government agencies, non-profit organizations and companies working together to advance the adoption of M&S in their practice to advance medicine and healthcare? This panel presents the latest innovations, technologies, research and findings.

Chair: Chris Unger, PhD
Panel speakers: Marian Heller; Randy Russell; Richard Severinghaus, CMSP

11:15 AM - 11:30 AM

Break

11:30 AM - 12:00 PM

CLOSING PLENARY
So What?
Room 408A
The SSH Forum on Modeling and Simulation involved thoughtful, and sometimes provocative, presentations on different aspects of modeling and simulation in healthcare. Some common themes about current and near future applications have emerged. The big question, however, remains: So what? What difference has analysis, modeling and simulation made in the education of healthcare professionals, in improved patient safety, in the operations of healthcare organizations, and in risk management? And, what is the potential for improvement in future healthcare outcomes and what can be done to nurture that potential?

Speaker: C. Donald Combs, PhD, FSSH

Thank you to the Forum Planning Committee

John Rice (RETIRED)
Bob Armstrong, MS, Director, Sentara Center for Simulation and Immersive Learning, Eastern Virginia Medical School
Yue Dong, MD, Mayo Clinic, Anesthesiology
Gilbert Muniz, PhD, Chair, Healthcare Systems Modeling & Simulation Affinity Group, Society for Simulation in Healthcare (SSH)
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- Provider
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- Evaluate
- Test
- Train

**WHY**
Safe & quality patient care