Biophysical Special Interest Group - A Planning Meeting

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SPECIAL INTEREST GROUP PROPOSAL
TOPIC: Biophysical System Dynamics

MEMBER REQUIRMENTS:

Leadership Commitment:

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3. Membership Commitment:
   1. Jim Rogers
   2. Ed Gallaher
   3. Louis Macovsky
   4. Geoff McDonnell
   5. Diana Fisher
   6. Wayne Wakeland
   7. Mark Paich
   8. Ozge Karanfil
   9. Craig Hocum

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Purpose:

Vision Statement: The Biophysical SIG will focus on understanding of the basic biomedical sciences (physiology, biophysics, pharmacology, biochemistry, and others), with three long-term goals in mind:

1. The development of a core set of models (and teaching materials) to serve as a foundation for the study of biological dynamics.
2. The incorporation of ST/SD into everyday practice within laboratory and clinical research environments.
3. The translation of resulting new insights into practical and effective clinical protocols.

Collaboration with the Health Policy SIG: The success of the previous goals will require careful consideration of administrative structures, current policies, individual skill sets (and attitudes), and the economics of experimental research and clinical practice. As a result, we anticipate close collaboration between the Biophysical and Health Policy SIGs.

Anticipated Initial Activities Subject to Conference Planning Meeting Results Documented Below:

Initiate a one-year series of exploratory focus groups via online web-meetings.

Monthly meetings (2 hours?) will focus on 3-4 major topics (TBD), discussed at 3- to 4-month intervals on an overlapping schedule throughout the year. Within each topic this schedule allows for the clarification of key issues, providing windows to explore and refine the issues, and to identify short-term action items and longer-term goals. Participants may choose to participate in one or more focus groups according to individual interests.

Examples include:

I. Development of an organizing framework within which to categorize classes of biophysical models.
II. Development of a set of basic structures that illustrate core concepts in biophysics, and biophysical ST/SD (similar to 'molecules' currently available in other areas of SD).
III. Development of introductory course materials (one quarter or one semester course; modified as necessary high school students, undergraduates, graduate and medical students, and post-graduate biomedical professionals).
    a. 1 week: Why study ST/SD in biology and medicine? Examples…
    b. 2 weeks: Overview of system dynamics principles (for biomedical students)
    c. 2 weeks: Overview of core biological concepts (for system dynamics students)
    d. 5 weeks: Application of ST/SD to biology and medicine. Examples of project development and case studies.
IV. Exploration and Development of Cooperative Initiatives with federal agencies (NIH, NSF, CDC, FDA, others?) and research foundations (American Cancer Society, etc.)
    a. The ST/SD community can inform funding agencies with respect to the potential benefits of ST/SD in biology and medicine, criteria for evaluating exemplary modeling practice, realistic expectations, and the limitations (or boundaries) of the ST/SD approach.
    b. Funding agencies can inform the ST/SD community with respect to emerging needs within the basic science, clinical medicine, and public health arenas. Additional

information may serve to inform (and nurture) ST/SD practitioners with respect to grant strategies

c. A joint task-force with members from both communities can develop informational materials and training sessions for the research, clinical, and funding communities.
    i. Within the funding agencies, staff members and review panels need to be informed about the potential of ST/SD. This knowledge will provide a basis for the development of RFAs (requests for applications), and the review and management of emerging research programs. (This inquiry should include critical comparisons of ST/SD with other modeling strategies such as agent-based modeling, data mining, statistical analysis, etc.)
    ii. As this infrastructure takes shape within the funding agencies, similar workshops (satellite symposia; panel discussions; etc.) can be provided at major research and clinical conferences; presentations should include speakers from both the funding agencies and the ST/SD communities, and in time, investigators who have begun incorporating these strategies within their research programs.

V. Support for cross-platform software development.
    a. Initiatives are already underway among the various developers of SD software to facilitate the transfer of models from one software package to another. These are innovative companies, but they are small companies with limited resources.
    b. Similar approaches have been identified as priorities within NIH, NLM (National Library of Medicine), and other agencies, to leverage data- and knowledge-transfer and encourage collaboration.
    c. The BPSD SIG might play a role in identifying funding support for this effort, thus mitigating the financial burden borne by the software developers.

VI. Integrating ST/SD Disciplines Within The Cultural Anthropology of Academic and Clinical Communities
    a. Teaching institutions, basic science departments, clinical departments, non-academic health-care providers, research funding agencies, and federal health-care funding agencies (e.g. Medicare) each operate within their own cultures. How can the practice of ST/SD be incorporated into these cultures to provide long-term benefits (as opposed to 'pilot studies')?
    b. For example:
        i. How does a small research lab (6-8 people) function on a day-to-day basis? How is progress evaluated on a week-to-week basis?
        ii. How are new concepts introduced, discussed, refined, and expanded?

iii. To what extent are dynamic processes evaluated in the experimental lab? Conversely, to what extent do research strategies ignore (obvious) dynamic questions due to lack of understanding, intellectual training, and tools?
iv. Could lab meetings be conducted using causal-loop and stock-and-flow diagrams?
v. To what extent might simulations guide the design of laboratory experiments? Might parameter values be examined via simulation, before running the (predictably) wrong (and expensive) experiments?
vi. To what extent might experimental results be interpreted in comparison to simulated predictions?
vii. To what extent might the conceptual framework of the research problem, experimental design, statistical analysis, and interpretation be organized within a ST/SD umbrella? Or stated differently, to what extent would the research endeavor benefit from a ST/SD 'lens', beginning with the grant proposal and review process, through the management of the laboratory, and in the presentation of the results in the professional journals?

c. Fundamental changes in the practice of biomedical research will *not* arise spontaneously due to the availability of a cohesive set of prototype models! To what extent can the Fifth Discipline (Senge, 1994) and The Dance of Change (Senge, et al., 1999) contribute to a deep-seated adoption of a dynamic mindset?

VII. Interaction with the Health Policy SIG: Biological Modeling Within the Clinical Environment

A fundamental goal of this SIG is to focus on the dynamic behavior of biological processes as opposed to issues such as resource allocation, economic viability, etc. For example, in our investigation of the basic science of anemia, we quickly learned, that applying the biological insights requires must include consideration of relevant policy and economic issues embedded within the surrounding environment. As a result, there will be relevant issues that will benefit from close collaborative between the Biophysical and Health Policy SIGs. We expect many members will choose to participate regularly in both groups.

Results of the Planning Meeting, Wednesday, July 27:

Attendees: Tom Cavin, Warren Farr, Ed Gallaher, Yrjo Tapio Grohn, Craig Hocum, Ozge Karanfil, Meyer Katzper, Peter Lacey, Thomas Moore, Nate Osgood, Jim Rogers, Karl Rogers, Nasim Sabounchi, Marek Susta, Wayne Wakeland, Robert Wears

1. Dr. Gallaher presented the vision, purpose, and objectives of the BPSD SIG (above).
2. Jim Rogers elicited summaries of the participants' areas of interest for modeling and dissemination. Following is a summary of the identified areas of application:
    a. Immunodynamics
    b. Cancers/autoimmune disorders
    c. Drug delivery systems
    d. Pain management
    e. Individual psychiatric interventions
    f. Addiction physiology
    g. Sleep disorders
    h. Stress response
    i. Weight dynamics
    j. Chronic disease progression
    k. Alternative and complimentary medicines (CAMS)
    l. Receptor dynamics
    m. Body fluid electrolytes
    n. Developing clinical applications
    o. Teaching pharmacokinetics using ST/SD
    p. Integrating BPSD in Continuing Medical Education
    q. Adverse drug events
    r. Antimicrobial resistance
    s. Food borne pathogens
3. Detailed results of the meeting were distributed to meeting participants on Wednesday, August 3.
4. The next meeting is scheduled to occur on or before Wednesday, August 31, 2011 for the respective participants' local times.