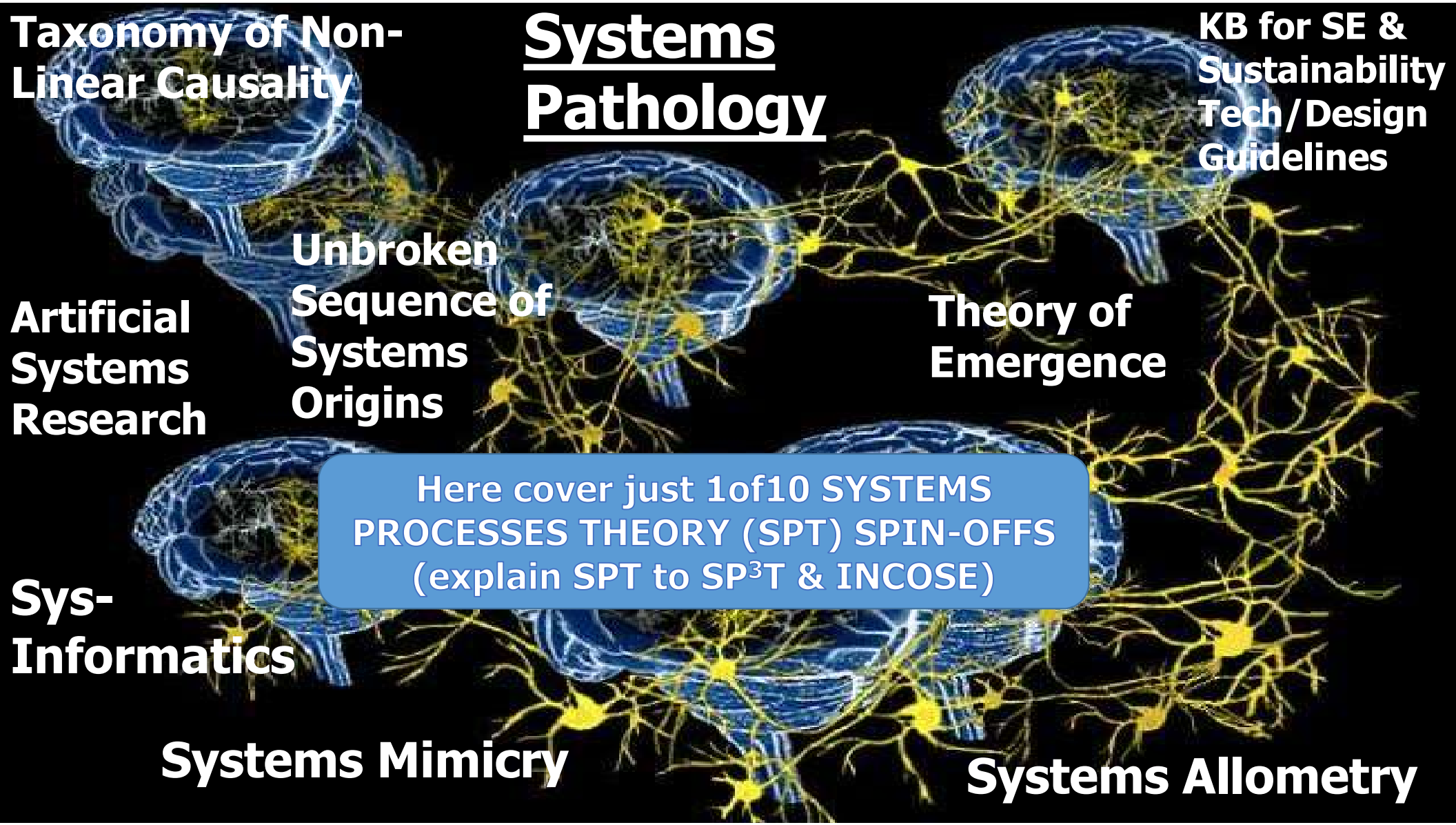
SYSPATH OVERVIEW

Len Troncale, Past President, ISSS, 1990
Prof. Emeritus & Past Chair, Biology Dept., College of Science, Lecturer, M.S. in S.E., College of Engineering, Calif. State Polytechnic Univ., Pomona
lrtroncale@cpp.edu

SPIN-OFF's of SYSTEMS PROCESSES THEORY (SPT)


Taxonomy of Non-Linear Causality
Systems Pathology
KB for SE & Sustainability Tech/Design Guidelines
Unbroken Sequence of Systems Origins
Artificial Systems Research
Theory of Emergence
Here cover just 1of10 SYSTEMS PROCESSES THEORY (SPT) SPIN-OFFS (explain SPT to SP³T & INCOSE)
Sys-Informatics
Systems Mimicry
Systems Allometry

SYSTEMS PATHOLOGY BASIC IDEA

What Is the New "top-down" Systems Pathology? I.

- ✓ **We present/advocate → need for Doctors to the SYSTEMNESS of the Universe;**
  - *Please see, read, sign up as supporter of the new SYSTEMS PATHOLOGY MANIFESTO*
- ✓ **From our working assumption: virtually everything is a system (see USSO)**
- ✓ **Advocate conscious emulation of & learning from successful 2,500 yr history of medicine; avoid its mistakes; leapfrog way ahead from its experiences**
  - **Would involve rigorous use of its concepts and methods**
    - *"recognition and naming of CAS diseases" EACH'S "etiology" "symptomology" "diagnosis" "prognosis"*
    - *BUT focused on CS dysfunctions; Experimental verification of treatments by modeling & follow-up*
    - *Incredibly long term & detailed documentation of outcomes & comparison with initial states*
    - *All of these are currently absent in SE, sustainability, solving hybrid complex-system crisis problems*
  - **Key step is conscious effort at recognizing, naming, prediction & investigation of common, repeated, RECURRING cases of systems-level dysfunctions ("top-down" = from GST level)**
  - **And education in a fundamental sys framework → ontology, or taxonomy of errors resulting in dysfunctions deriving DIRECTLY FROM the nature of complex systems**
- ✓ **Must be based on a well-established, vetted, consensus SS or GST**
  - New top-down SysPath derives from three advances: (1) Raising all studies of dysfunction & failure to level of SYSTEMNESS; (2) search for first causes; (3) emulation of medicine ……

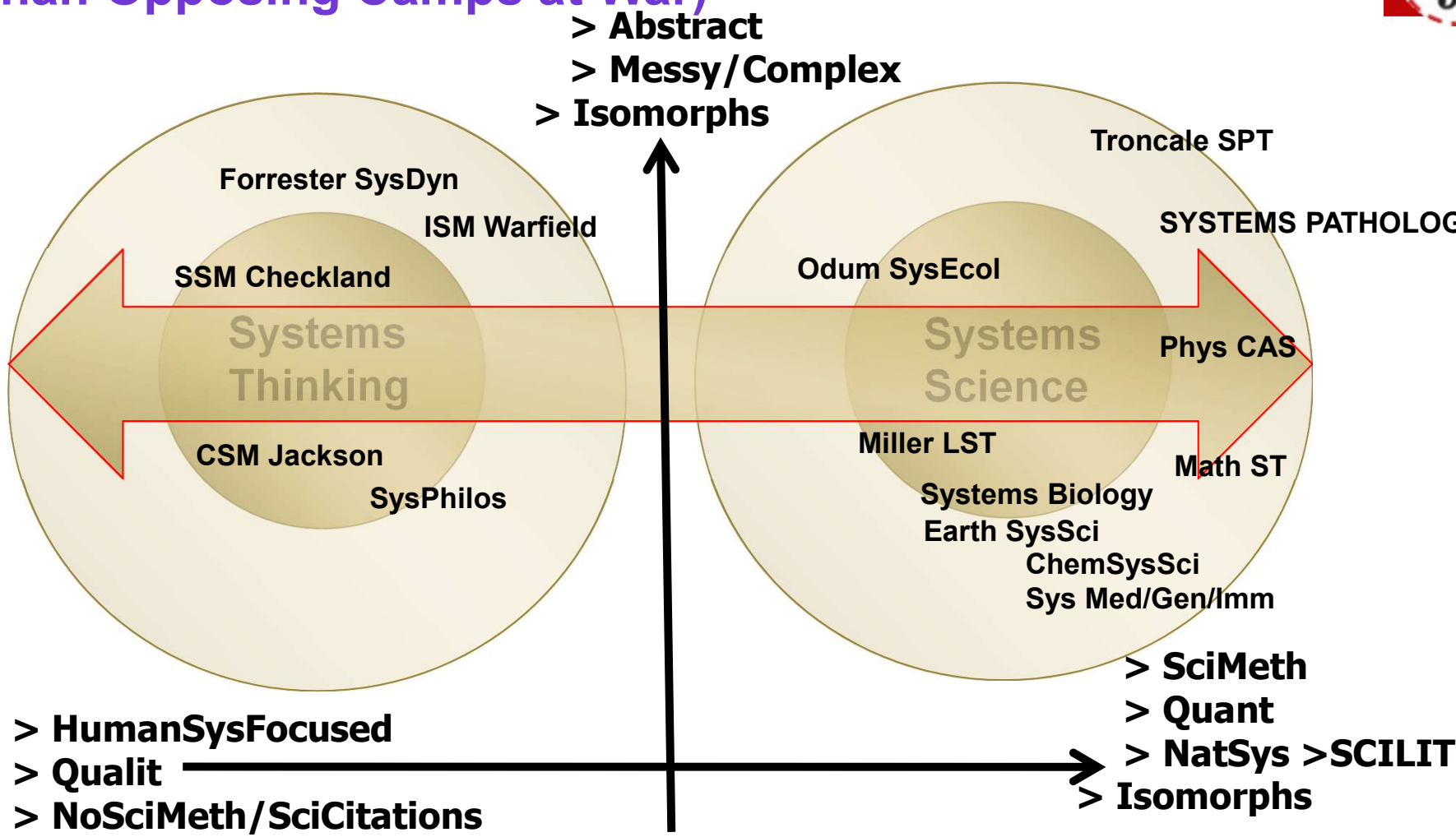
SYS PATH RELATION TO SYSSCI: +ADVANCES

Relations: Systems Pathology & SysSci/GST

- ✓ **Pathology NEGATIVE approach to understanding Systems → NO!!**
  - **Note role of Pathologies in studying complex systems like Cell Metabolism**
    - *Was a highly complex, unapproachable "black box" network; looking for needle in a haystack; have to possess a "handle" or "radiation" to find needle in complexity ….*
  - **Note role of Enzymopathies in understanding Human Disease States**
  - **Note method of inducing mutations in bacteria to get "handle"**
- ✓ **Caveat! Difficulty defining a "healthy" vs. dysfunctional system**
  - Just as difficult to do for you&I as complex human organism, but medicine did it
  - >> Arguments that identifying/disseminating awareness of recurring CAS dysfunctions of hi value
- ✓ **Even neophytes recognize there are isomorphies in ways <u>Systems Don't Work</u>**
- ✓ **Consider the need for Education Programs in this new area! SysMed schools**
  - This would increase funding, respect for systems education

SYSTEMS PATHOLOGY POSITION ON SPECTRUM OF Systems Thinking TO Systems Science

Two Axis Spectrum: SysDomain Positions:
(Better than Opposing Camps at War)



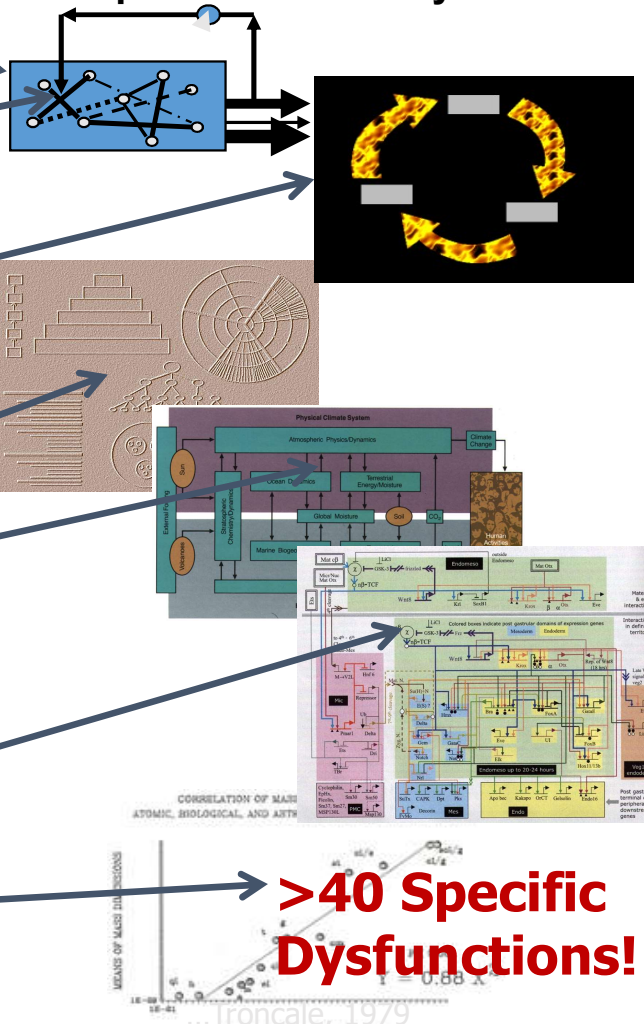
TOP-DOWN (SPT) TAXONOMIC CATEGORIES of SYSTEMS-LEVEL DYSFUNCTIONS

NAME TAXONOMIC CATEGORIES OF SYSTEMS DISEASES…….each followed by suggested specific diseases

Top-Down strategy……

…On basis of dysfunction TO a particular SPT-ISysProcess

- **Cyberpathologies: errors in Feedback ISP**
  - (missing fdbk; uncoupled; missconnect; wrong set pt; temporal delay; too weak; >>+/- in a series)
- **Rheopathologies: errors in Flows ISP**
  - (no pathway; <insulation; non-fractal; boundary/limit errors; non-laminar; chaotic turbulence; <>flowrate)
- **Cyclopathologies: errors in Cycling ISP**
  - (sequence error; missing stage; stuck at a stage; missing stage controls; imbalance +/- fdbks for oscill; phases in/out; coherence off)
- **Heteropathologies: errors in Hierarchy ISP**
  - (fdbks across levels; <> 12 parameter trends; exceed W/T limit;)
- **Nexopathologies: errors in Network str & dyn ISP**
  - (missing nodes; unconnected; missing motif's; node overload; unstable links; incompl nets; poor key nodes)
- **Teratopathologies: errors in Development ISP**
  - (missed stage; missing prereq; unassimilated variation; missing exaptation; <> stage controls)
- **Allometric Pathologies, No. Pattern's ISP's**
  - (exceeds allometric prediction; outlier of equations; growth /-> pattern; not coupled env)

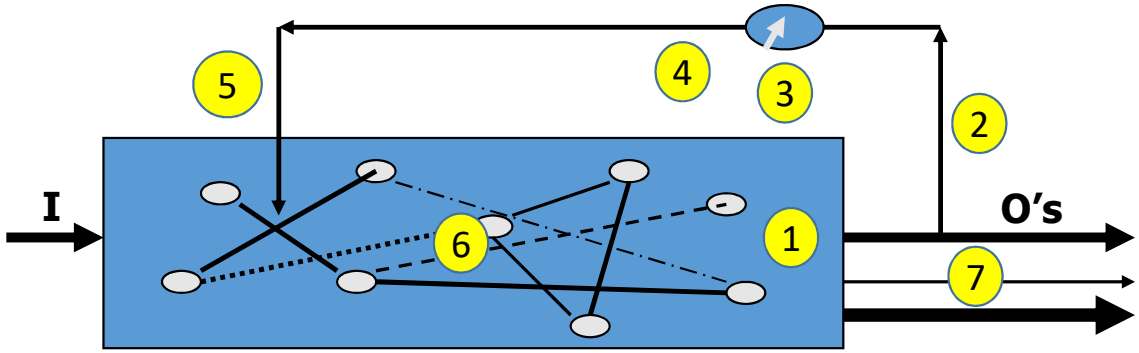


>40 Specific Dysfunctions!

FROM DEEP KNOWLEDGE of an ISOMORPHY to prediction of PATHOLOGIES

From Category to Specific Predicted Dysfunctions

Notice all this is all dependent on verified, proven, consensus Model of the Isomorphic Systems Process before hand



- ✓ **How do you go from knowing a ISP to Predicted Problems in Complex Systems?**
  - **Foreknowledge of Specifically Identifiable Design/Operation Failures (I have lists of 350 recurring)**
- ✓ **Focus on <u>Steps in Process</u>; one example FEEDBACKS**
  - *Above illustrated steps: (1) black box of net of specific interactions responsible for producing outputs ; (2) measurement of output; (3) set point; (4) comparator; (5) message to responsible parts of producer; (6) change in production; (7) change in output. THEN IMAGINEER OPPOSITE OF ISP ACTION*
- ✓ **<u>Very Important</u> to note A MAJOR difference between human & natural sys's**
  - **In regard to the "set point"**
    - *Humans often set the points, or parameters, in all levels of Human Systems;*
    - *But in natural systems there is no conscious entity setting the point;*
    - *The context /or/ environment /or/ interaction with other natural entities set the point; so it is self-selecting and self-organizing*

COMPREHENSIVE LISTS OF COMPLEX SYSTEMS DYSFUNCTIONS/ PATHOLOGIES

CONTENTS/OUTLINE

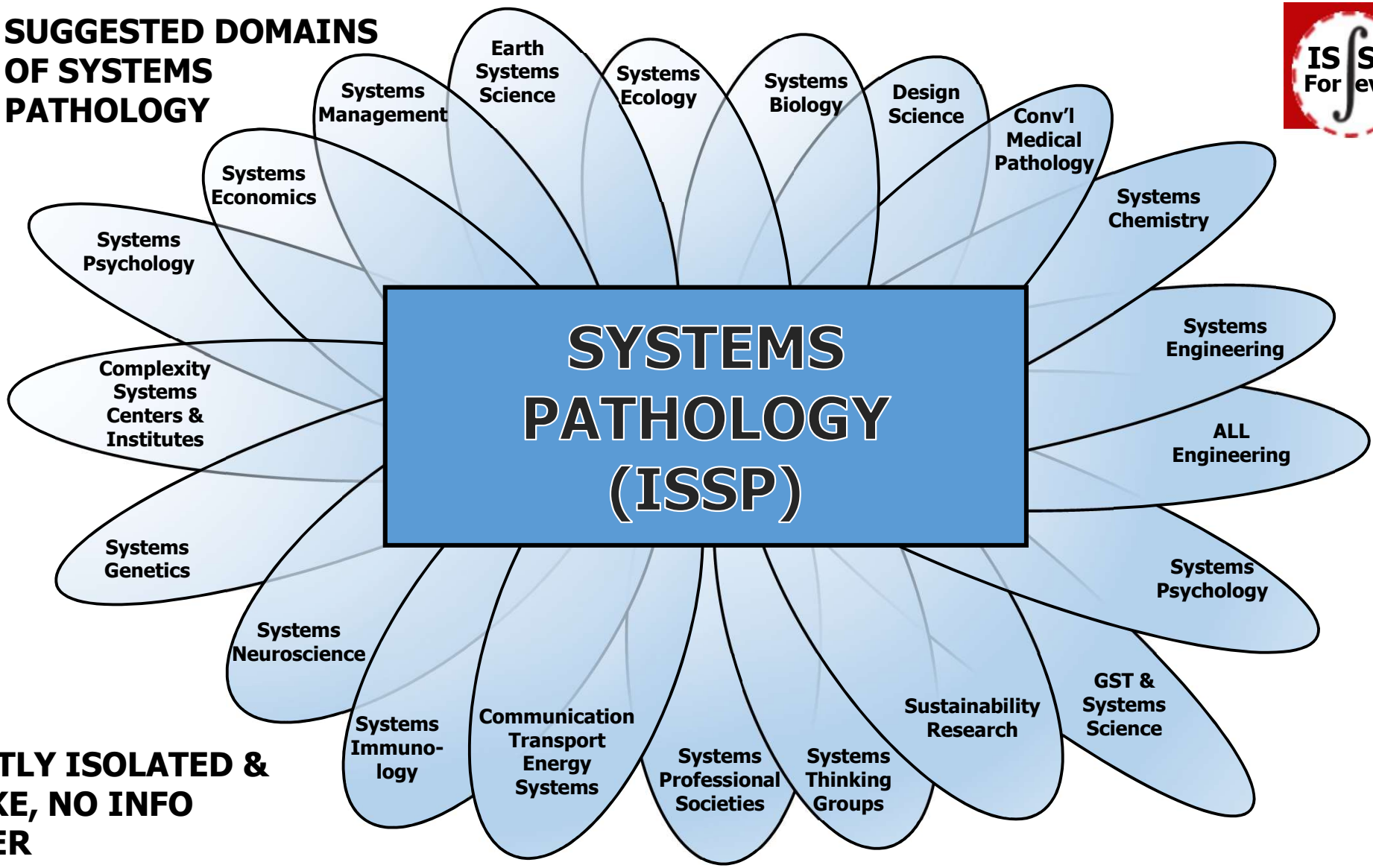
- **Recurring Complex Sys Problems/Projects 15 SE's (n=158)**
  - ✓ *Recurring Human Systems Problems from **Davidz/Jackson/Thomas** **Systems Engineering** group **(10)***
  - ✓ *Recurring Human Systems Problems from **Talbot et. al.** **Systems Engineering** group **(7)***
  - ✓ *Recurring Human Systems Problems from **Ohno/Meekings** **Systems Engineering** group **(7)***
  - ✓ *Recurring Human Systems Problems from **Pennock/Wades** **Systems Engineering** group **(10)***
  - ✓ *Recurring Human Systems Problems from **Keating** **Systems Engineering** group **(41)***
  - ✓ *Recurring Human Systems Problems from **Katina** **Systems Engineering** group **(83) note mix Praxis&Theory!!!***
- **Recurring Complex Sys Problems 4 Systems Work (ST/SS/GST) (n=45)**
  - ✓ *Recurring Human Systems Problems from **Systems Dynamics** group **(Meadows, D) (17)***
  - ✓ *Recurring Systems Imperfections from **Zwick Systems Science (14)***
  - ✓ *Recurring Systems Problems from **Gall** **Systems Bible** publications **(19)***
  - ✓ *Recurring Systems Problems from **Troncale** **SPT & Systems Pathology (now ; potentially)***
- **Initial Comparisons and Integrations: Future Work (n=83)**
  - ✓ *Comparisons Troncale -to- SE from **Schindel Systems Engineering group (21)** [also G. Smith; Tom Marzolf]*
  - ✓ *Comparisons BeerVSM-GST -to- SE from **Keating&Katina** **Systems Engineering** group **(41)***
  - ✓ *Comparisons Troncale SPT -to- LST from **DeLamarre Systems Engineering & Swanson SysSci groups (21)***

SO START new professional science society:
International Society for Systems Pathology

ISSP

PROPOSED DOMAINS

SUGGESTED DOMAINS OF SYSTEMS PATHOLOGY



CURRENTLY ISOLATED & SILO-LIKE, NO INFO TRANSFER BETWEEN.....

ISSP OBJECTIVES

Current ISSP Goals as Expressed in By-Laws:

1. To expand awareness of the more than a dozen domains of systems-level pathology;
2. To integrate & share across the knowledge bases of those multiple domains;
3. To conduct research on multiple mechanisms by which systems dysfunction at all scales;
4. To transfer SysPath concepts, theories, techniques, & tools across all disciplines;
5. To develop theoretical models of systems pathology where they are lacking;
6. To critique different taxonomic frameworks to organize mechanisms of dysfunction;
7. To find exemplar applications of SysPath as solutions for complex societal problems;
8. To identify & research causes of systems malfunction at the most fundamental levels.
9. To mimic medical & scientific traditions & documentation of systems-level dysfunctions;
10. To develop & improve tools for examination of cross-disciplinary dysfunctions;
11. To help provide easier & more effective translation between domains;
12. To design & deliver educational programs in systems pathology and application.

ISSP

ACCOMPLISHMENTS TO-DATE

ISSP Accomplishments & New Services to-date:

1. Five volunteer Officers; two offices still open
2. Ten Board of Director's members
3. Est'd International Business Office, IBO, 232 Harrison, Suite B, Claremont, CA 91711
4. Extensive IBO Archive on Systems and Systems Pathology (many 1000's of products; ten archives)
5. Recognized by California Secretary of State; Federal EIN issued and accepted.
6. Website active: Go to intsocsyspath.org
7. Research Collaboratories and reporting underway (see first Bulletin)
8. By-Laws accepted & two years of meetings of Officers and BOD's
9. New venues for publication of original research in a critically important new area.
10. A rare opportunity to help initiate an entirely new discipline & influence its future.
11. All member fees & donations are Tax Deductible with ISSP as a 501c3 organization.
12. Another professional association for your CV; one of proven ability for curing CAS
13. New, and better-targeted opportunities to form collaborations
14. New sets of Conferences and Workshops to travel to & be stimulated by

RICH SYSTEMS ARCHIVES at CLAREMONT OFFICE

GLIMPSE OF VALUABLE SYS INFO IN ISSP IBO:

1. Already attracted private foundation grants of ~$60,000 with more coming.
2. IBO financed for 2017 to 2020; possibly in perpetuity.
3. SEVEN websites up (see handout list).
4. Files organized of >5,000 reprints on Systems Isomorphies.
5. Systems Pathology reprints = 63.
6. Systems Integrated Science (SIS) reprints and position announcements = 308.
7. Combo of physical and digital ISSS Archive of 7,080 Bulletin pages; 34,900 ISSS Yearbook pages; >10,000 Proceedings pages representing research of 5,568 authors.
8. A.G. Wilson Archive of 108 Notebooks, of 10,828 pages, 909 pages on Isomorphies alone, 184 manilla envelopes, 2,578 pages of these are on science alone.
9. Troncale Archive of >531 systems-based products; dozens of posters in systems theory and systems applications.
10. About 134 texts on Isomorphies, or GST.
11. Systems Engineering & Sustainability & Biology Graduate student course-produced science isomorphy literature searches in Endnote = millions/isomorphy.
12. 336 case studies or instantiations of Isomorphies in context of the natural, symbolic, & human science fields as systems application attempts.

PRODUCT & ACTIVITY LISTS for Sys Pathology SIG

BEGINNINGS OF PRODUCT LIST I. !

- **BIBLIOGRAPHY:**
  - ✓*We are publishing in the first ISSP Bulletin a start bibliography of 45 references*
- **ACTIVITIES:**
  - ✓ *ISSS'17, Vienna; held a JOINT SESSION of the SIG on SYSTEMS BIOLOGY and the SIG on SYSTEMS PATHO LOGY*
- **RESEARCH PAPERS:**
- **REPORTS:**
- **POWERPOINTS/WEBINARS/WORKSHOPS:**
- **JOIN INTERNATIONAL SOCIETY FOR SYSTEMS PATHOLOGY (ISSP)**
- **EXPECTED FUTURE SOCIETY MOU's:**
  - ✓ *Several medical societies; ISSS; AAAS; ICCS; ISAER; IFSR*