IAS

IMPACTS OF SSP

Part X

CSU

NSF

THREE NEW DISCIPLINES ARISING FROM SSP RESEARCH

IAS

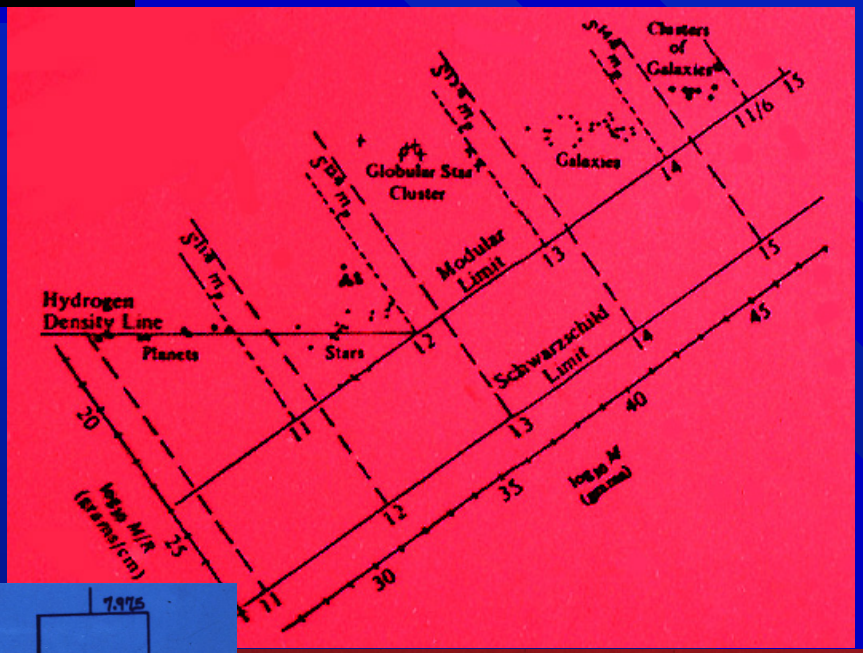
SSP IMPACTS & APPLES
Part X

CSU

The New Specialty of SYSTEMS ALLOMETRY

Dr. Len Troncale, July, 2008

Empirical Testing of Hierarchy Theory



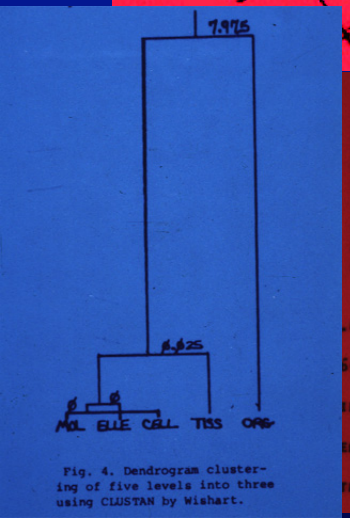
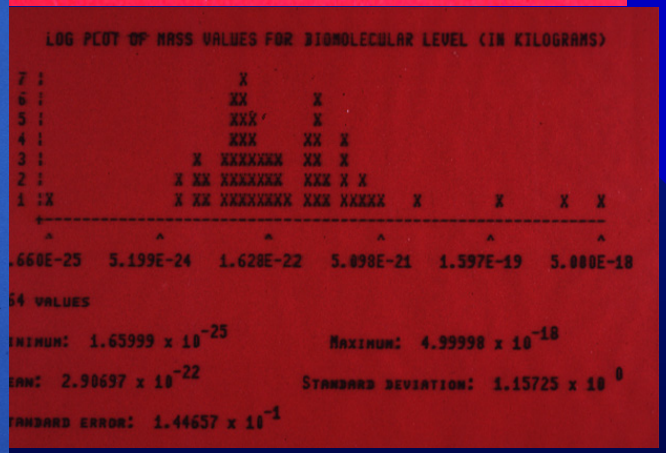


Fig. 4. Dendrogram clustering of five levels into three using CLUSTAN by Wishart.



- Recall said systems sci needs more empirical testing…..
- E.g. Hierarchies widely accepted systems pattern
- But who has ever empirically proven H-levels? Intuitive
- Wilson (IAS Fellow) dev'd chart showing astron objects obey very precise size limits
- Proves astronomical H-levels
- So at IAS we tested all major natural science levels
- Multiparametric tests at left showed some surprising insights about H-levels
- Used parameters to test for possible allometries

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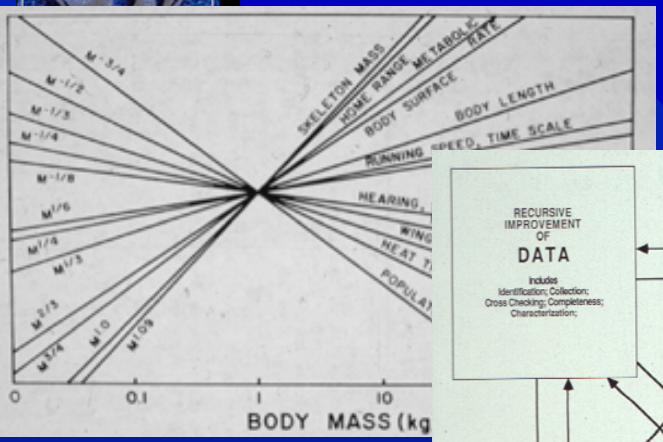
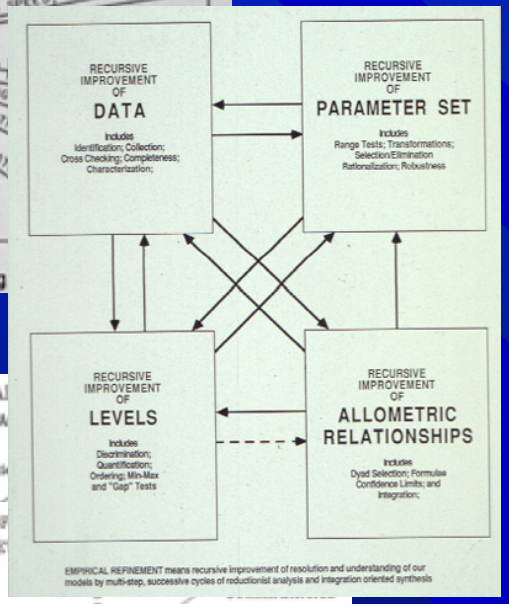
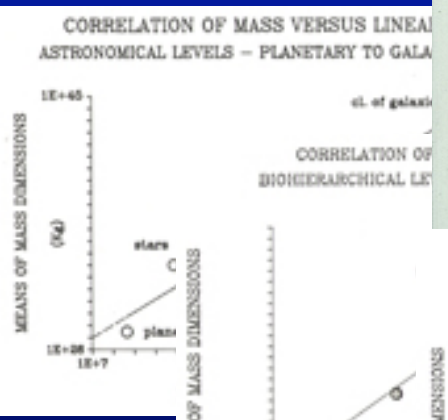
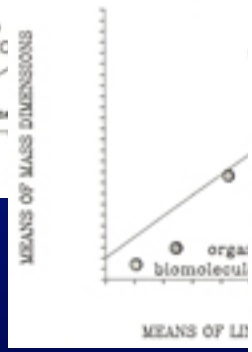
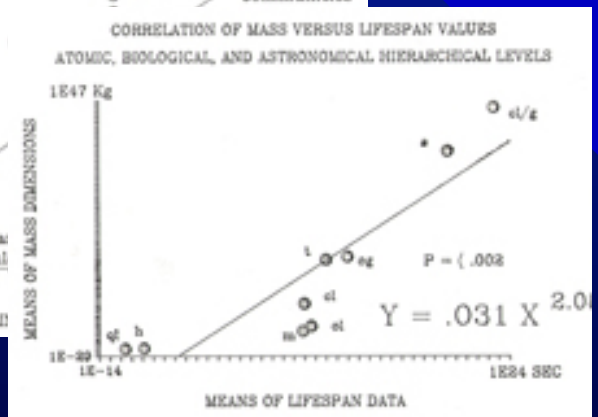
NEW FIELD OF SYSTEMS ALLOMETRY I.











- Bio-allometry = solid data in search of a theory
- Collect data 12 newtonian 5 info parameters
- Very large data sets; diff't type of bioinformatics; to systems informatics
- Treat natural science scalar levels as entities; rep's of a class of organization; check for design patterns
- Highly significant regress between parameters
- Highly

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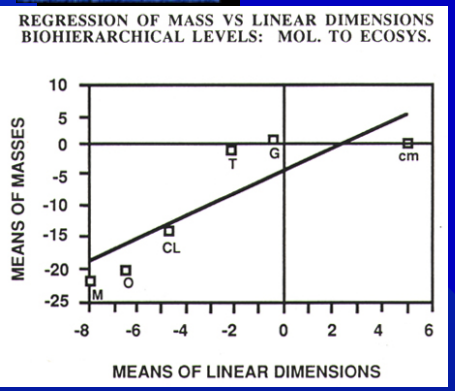
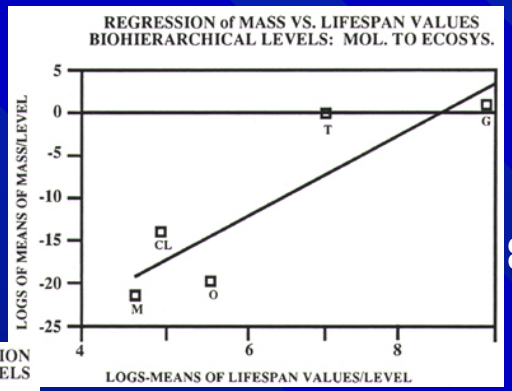
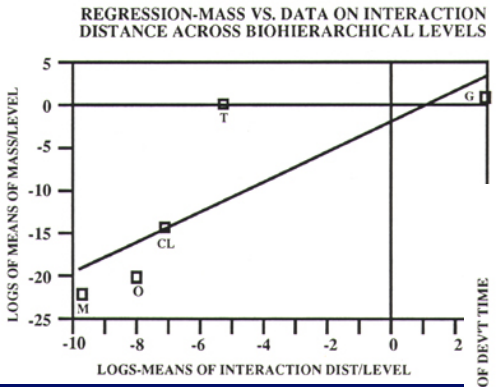
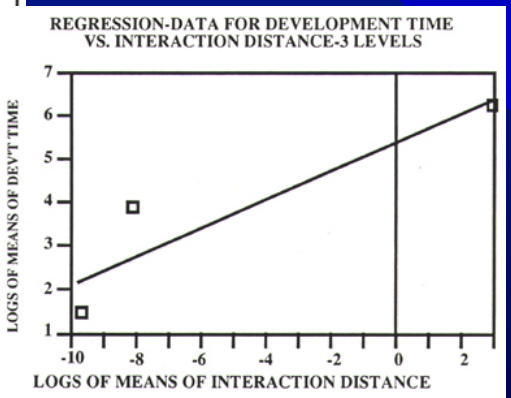
(IAS) NEW FIELD OF SYSTEMS ALLOMETRY II.









- Multiple pairings of parameter sets are tested
- Treat “levels of organiz’n” as “real” not usual entities
- Levels of organization reflect design principles; must follow universal balance among parameters
- Nature fills potential spaces with similar gen’l systems despite immense diff’s in origin times & parts

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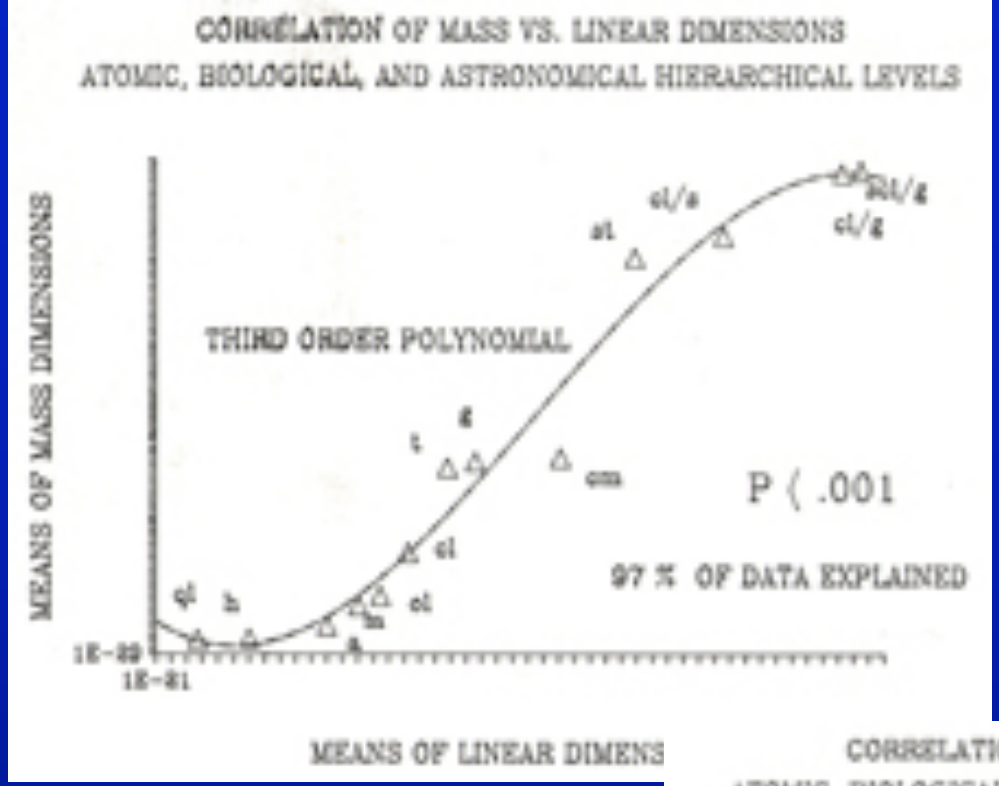
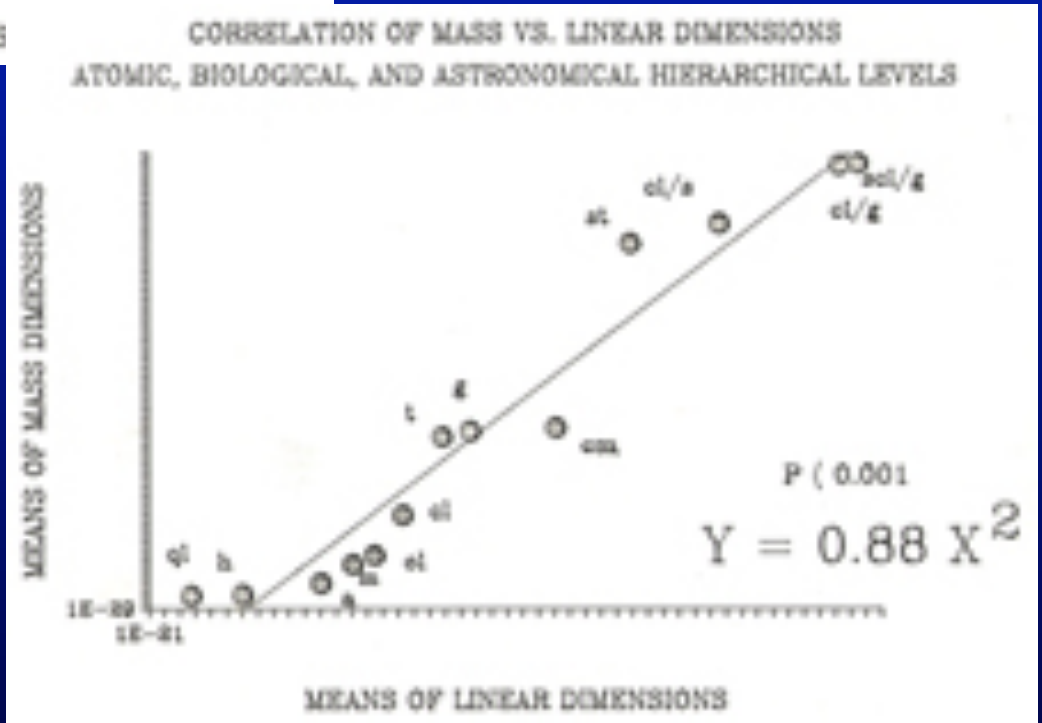
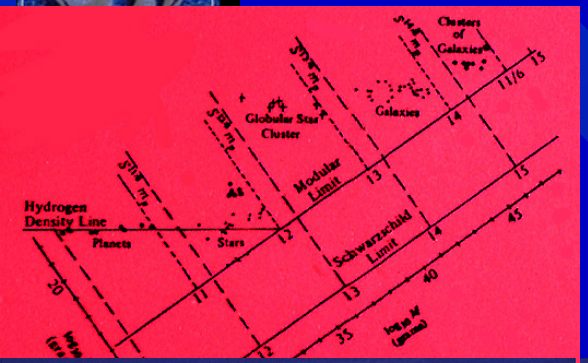

CORRELATION OF MASS VS. LINEAR DIMENSIONS
ATOMIC, BIOLOGICAL, AND ASTRONOMICAL HIERARCHICAL LEVELS
MEANS OF MASS DIMENSIONS
THIRD ORDER POLYNOMIAL
P (.001
97 % OF DATA EXPLAINED
1E-89
1E-81
MEANS OF LINEAR DIMENS


CORRELATION OF MASS VS. LINEAR DIMENSIONS
ATOMIC, BIOLOGICAL, AND ASTRONOMICAL HIERARCHICAL LEVELS
MEANS OF MASS DIMENSIONS
P (0.001
Y = 0.88 X 2
1E-89
1E-81
MEANS OF LINEAR DIMENSIONS

(IAS) EMPIRICAL THEORY OF ORIGINS & EMERGENCE



- Astronomical scalar levels by Wilson (CalTech alumnus) = regular pattern
- Gaps as predictable; why

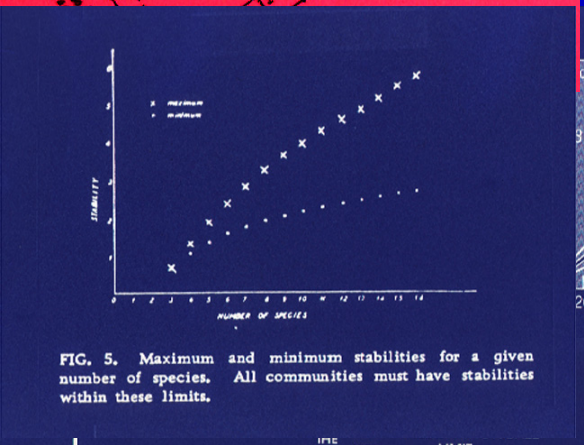
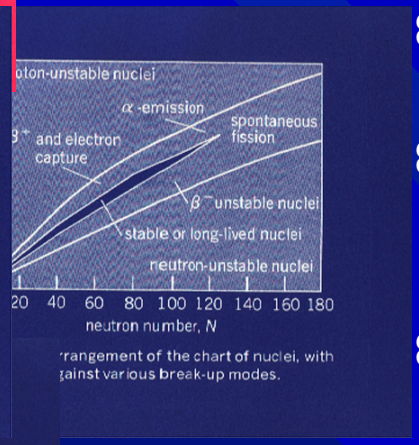
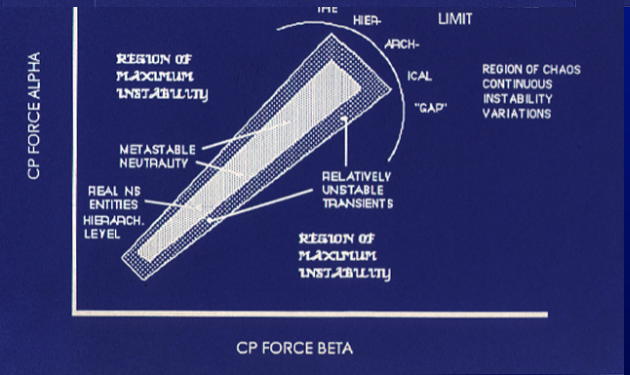


FIG. 5. Maximum and minimum stabilities for a given number of species. All communities must have stabilities within these limits.



rangement of the chart of nuclei, with gainst various break-up modes.

- Why given times of origin?
- Suggests sys design constraints at a distance
- Note natural science eg's of restricted range of stability until max size



- Do all nat sci scales show this pattern? Real emergence & origin. Enables empirical theory of emergence

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