

Informationsbionik

Fahr- & Dingene Technologien

Wirtschaft & Tourismus

Medien & Design

Design & Grafik

Fachhochschule Salzburg

die.sprech.stunde



Organisationsbionik – Die Natur als der bessere Unternehmer!

Wann:

Do, 07. Dezember 06
18:45 Uhr

Wo:

Campus Urstein – HS 056

Podiumsgast: Mag. Pierre Madl - Universität Salzburg

Moderation: Manfred Brandstätter

Intro (1/4)

•Today's MENU:

- brief intro to the subject & myself
- a bit of System theory
- examples from Nature
- m-E-I Triad
- take home message

About myself:

- electronics engineer
- MSc in ecology
- PhD student
- part time service technician

Intro (2/4)

- ECOLOGY was coined by *Ernst Haeckel* (1866)
greek: *Oikos* "house" and *logia* "discourse": stands for the science of the household.

Thus, ECOLOGY has a double meaning:

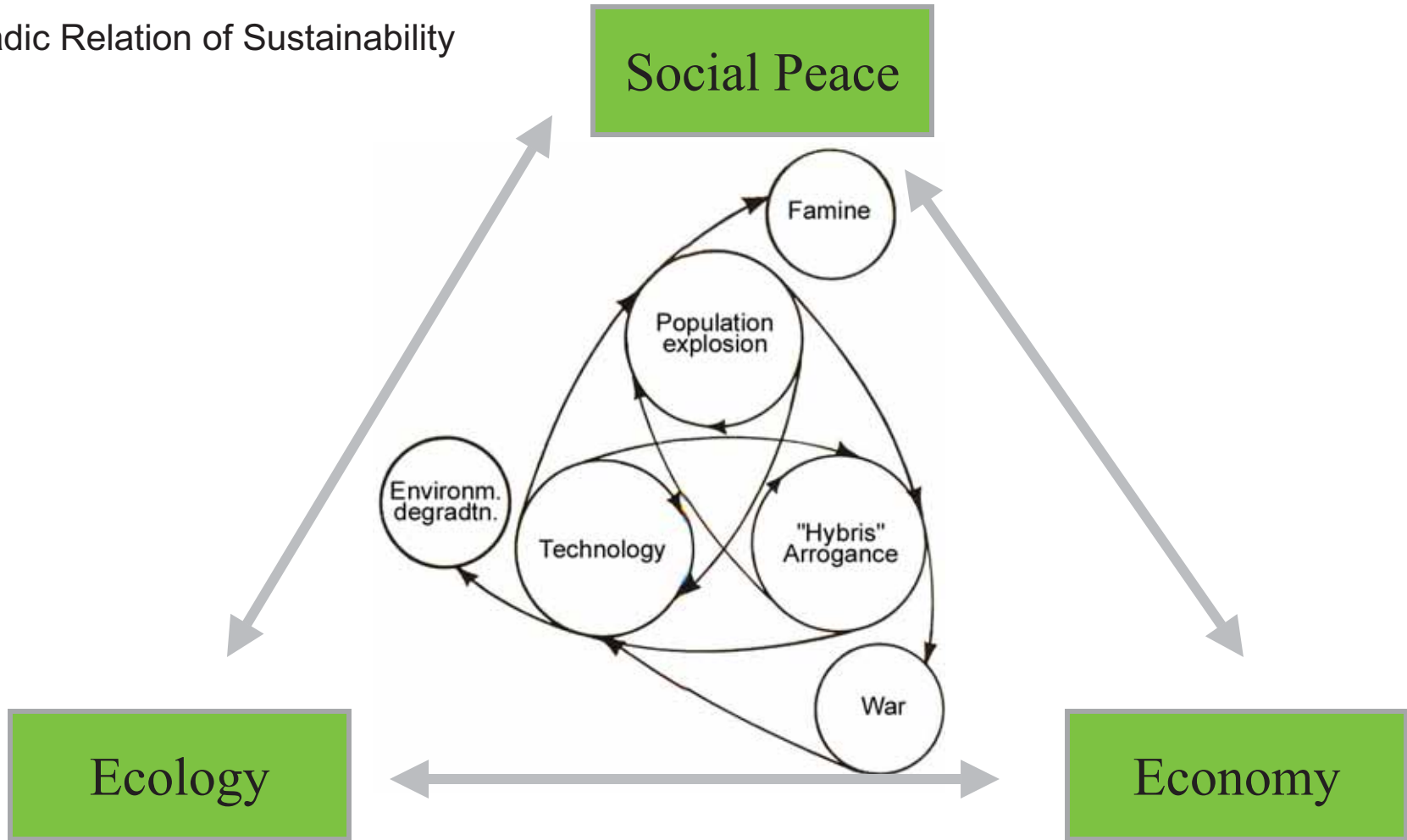
logos of *oikos* (the logical system of the universe) and

oikos of *logos* (the house that embraces human logic, or the intellectual system).

- ECONOMY, *oikos* "house" and *nemein* "to manage".

Intro (3/4)

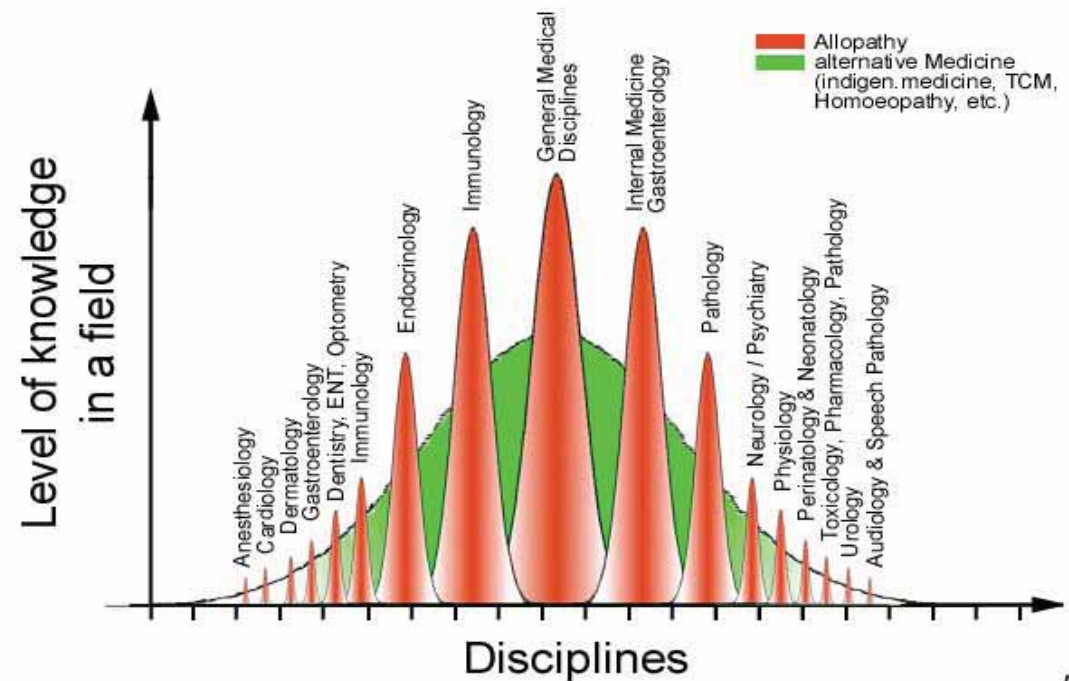
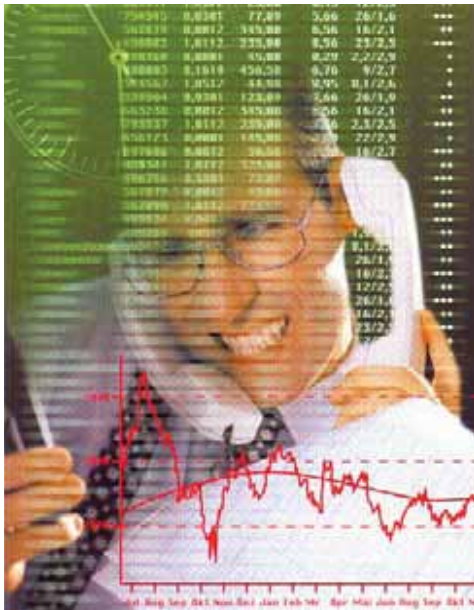
Triadic Relation of Sustainability



Intro (3/4)

Example: Information overload & Hyper-Specialization

Example: Medicine

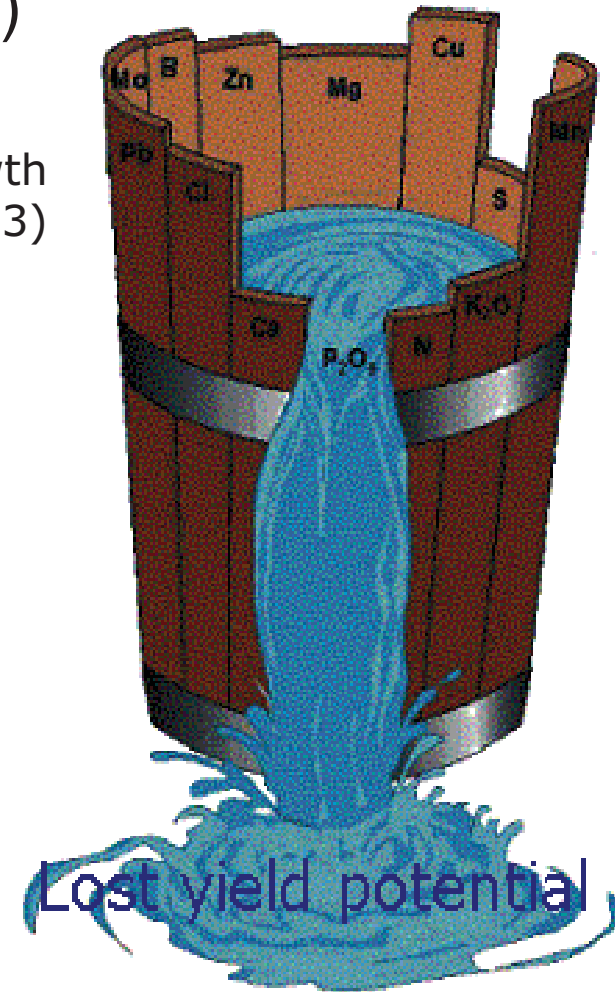
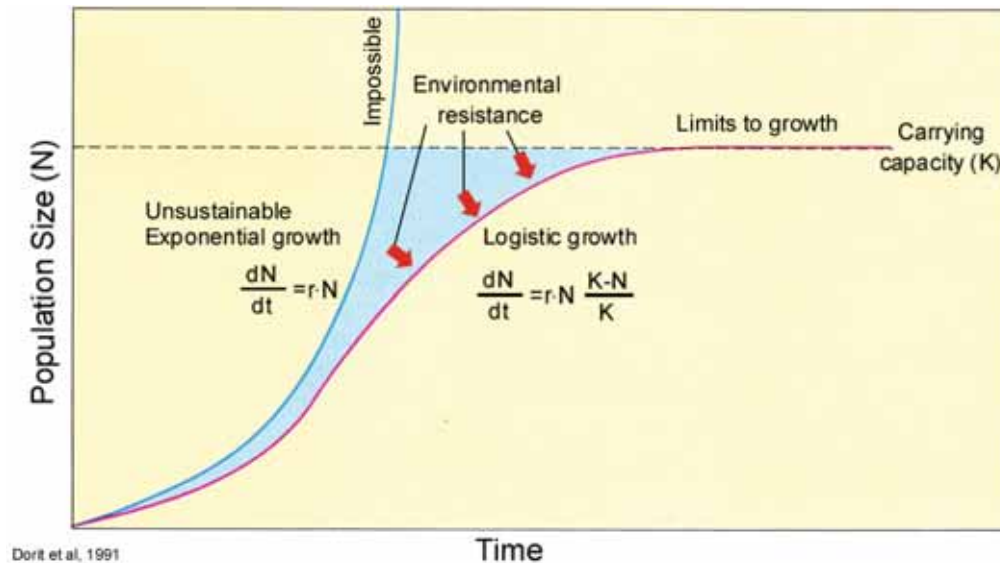


5/6

Systems (1/6)

Example: law of the minimum & the limits to growth
(J.v.Liebig, 1863)

Pattern of Growth:



Systems (2/6)

Human intellect tends to simplify, however nature is far more complex:

	Point of View	Symbolism	Occurrence	Properties	Aristotelian equivalent
complemented with the four Aristotelian equivalents	1		class. western natural sciences	logic / systematic	<i>causa efficiens</i>
	2		Cybernetics (chaos), Quantum T.	dynamic / systemic	<i>causa materialis</i>
	3		Social sciences	construct. / symbolic	<i>causa formalis</i>
	4		Spirituality	holistic / symbiotic	<i>causa finalis</i>

modified after Kratky, 2003

Linear Worldview



Classical Mechanics

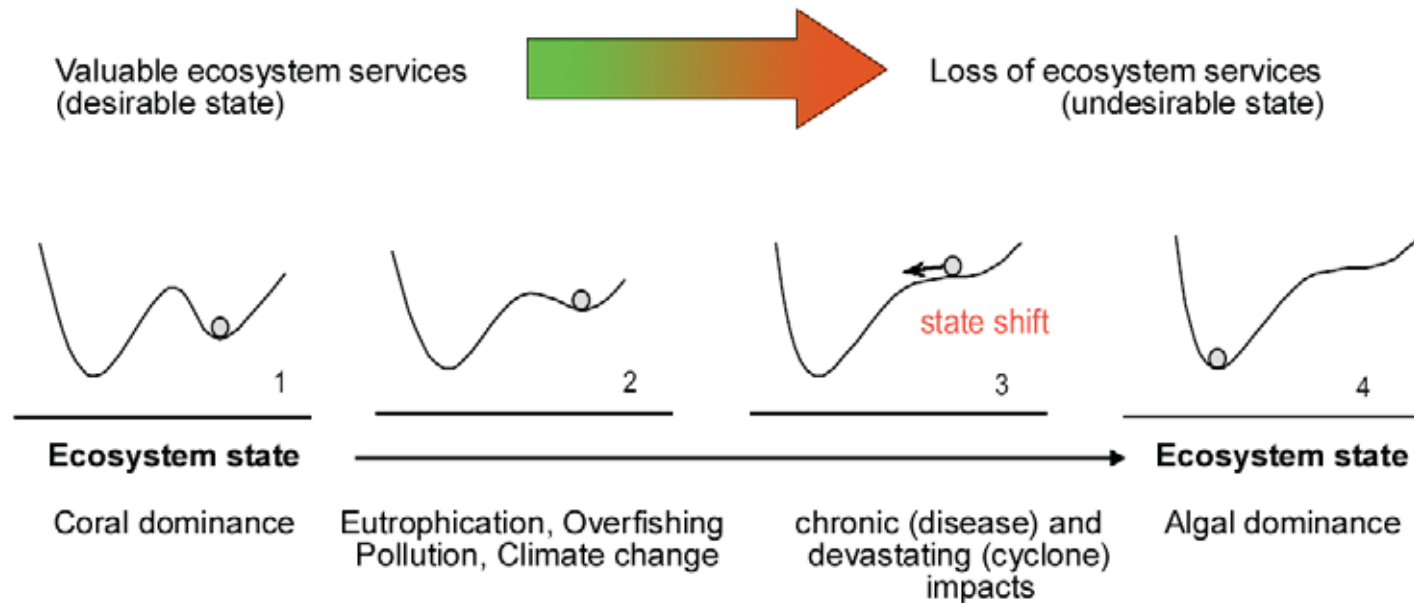
Nonlinear Worldview



Quantum-Mechanics

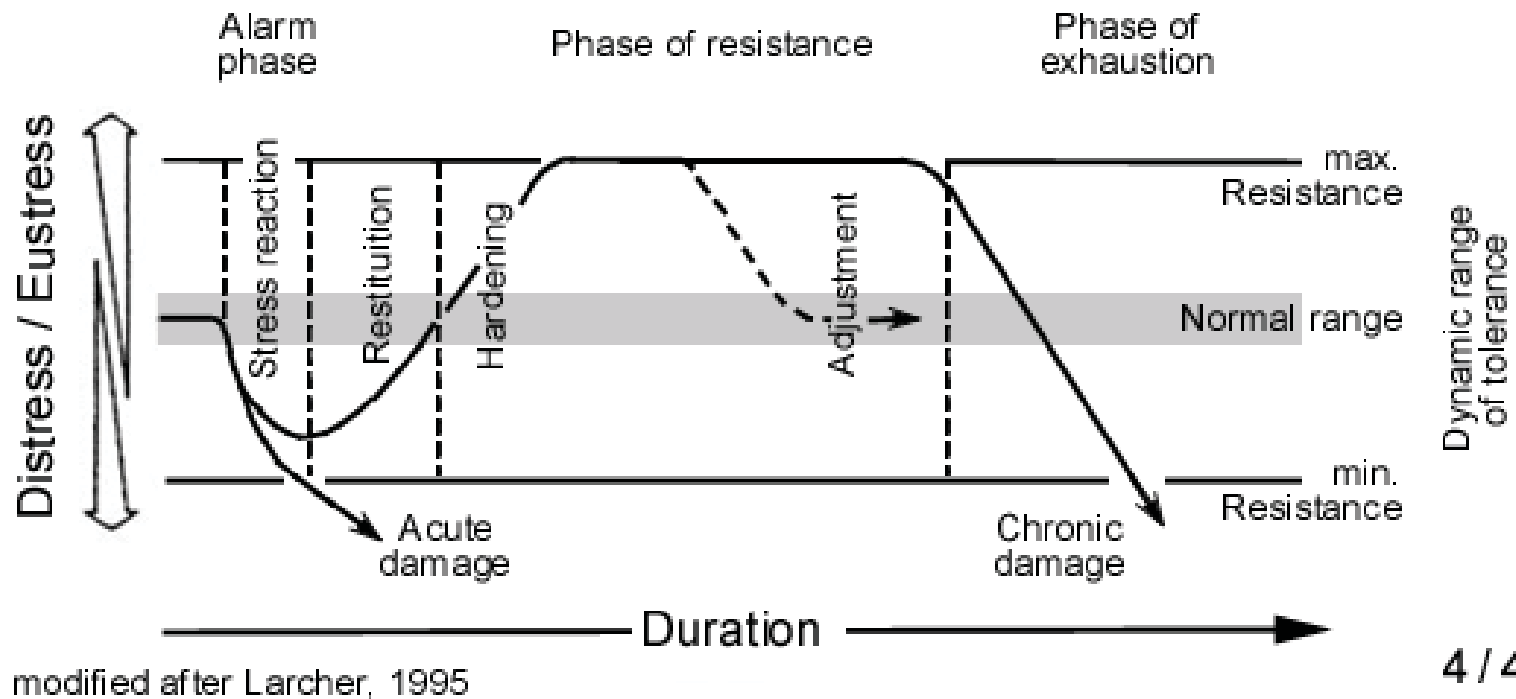
Systems (3/6)

Example of an Oscillating Systems that is capable to respond to external stimuli:
e.g **Coral Reef**



Systems (4/6)

System Dynamics – what is a robust System?



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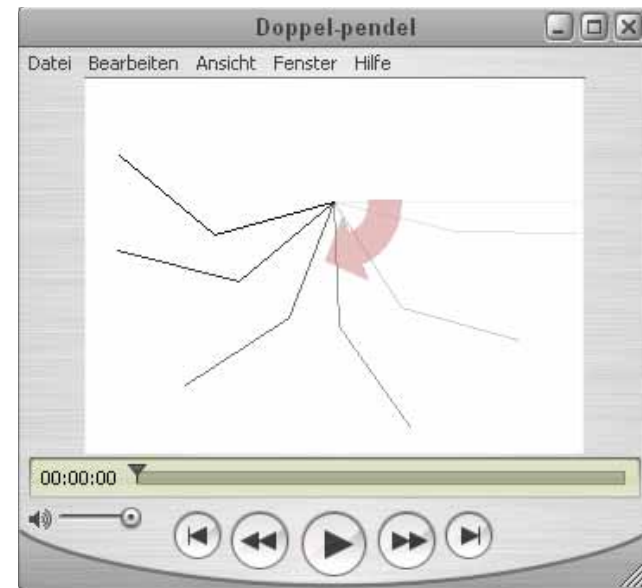
Systems (4/6)

The dynamic balance in oscillating systems:

Double Pendulum: The pendulum is most sensitive to external influences when the system is about to change direction

Point of Inflection.

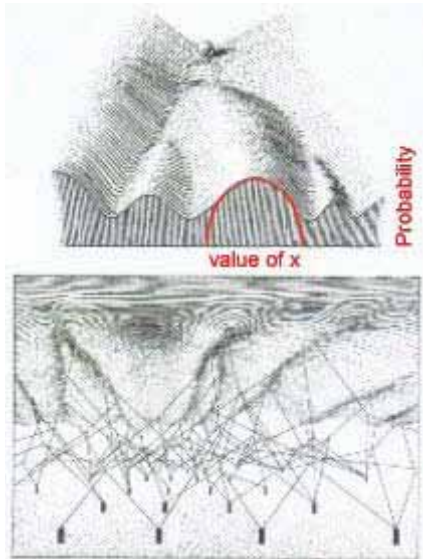
Chaotic oscillation



Systems (6/6)

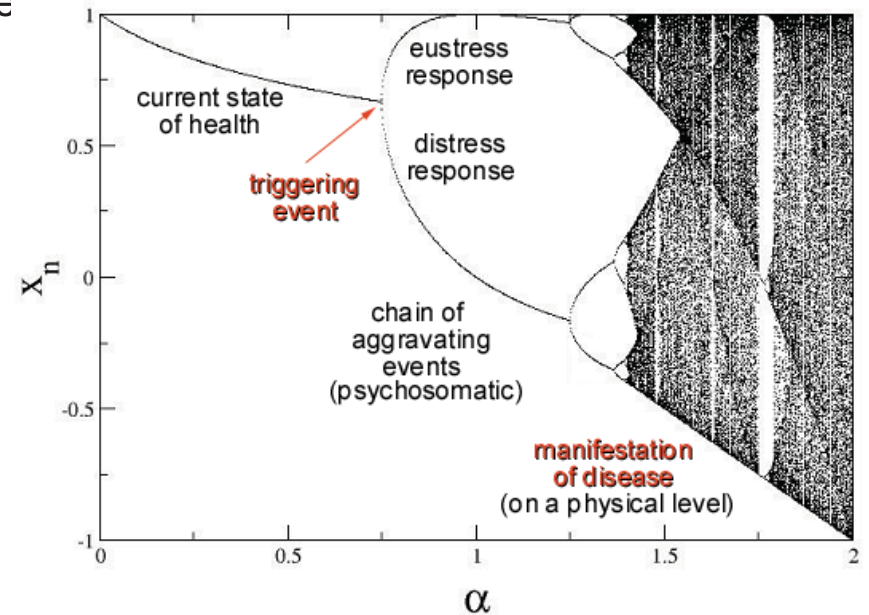
The dynamic balance between Health & Disease

Chaos: non-linear dynamics



Bifurcation Pattern

Epigenetic
Landscape



modified after Willeboordse, 2002

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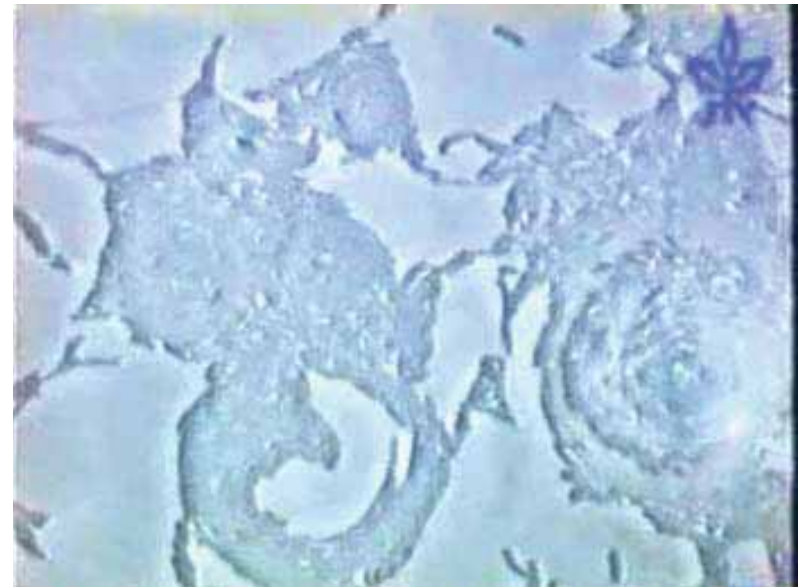
Nature (1/8)

Adaptation of communication processes established in bacterial colonies :

Bacterial: Hierarchical colony pattern generated by *Paenibacillus vortex* bacteria

Bacterial colony responding to external stimuli
(magnification x500)

(courtesy of EBJ: http://online.itp.ucsb.edu/online/pattern_c03/benjacob/)

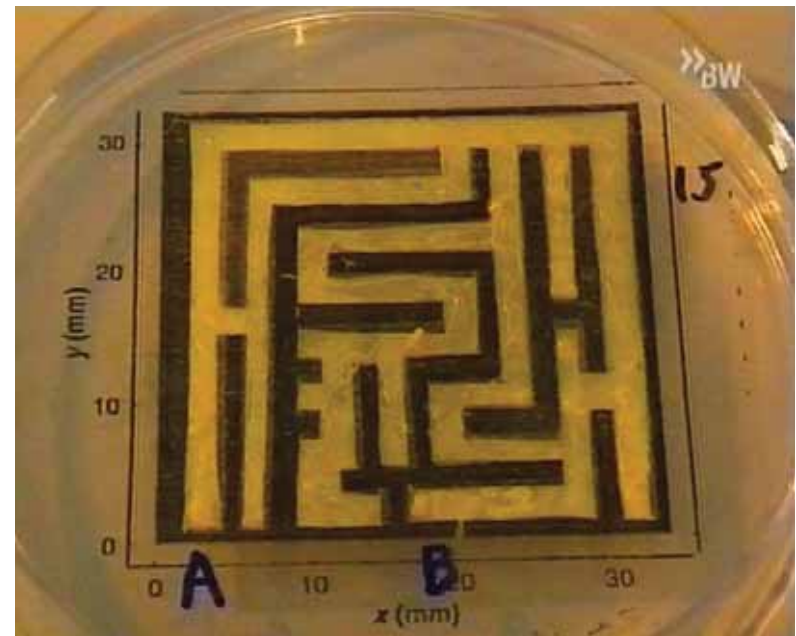


Nature (2/8)

Adaptation of communication processes established in fungal colonies :

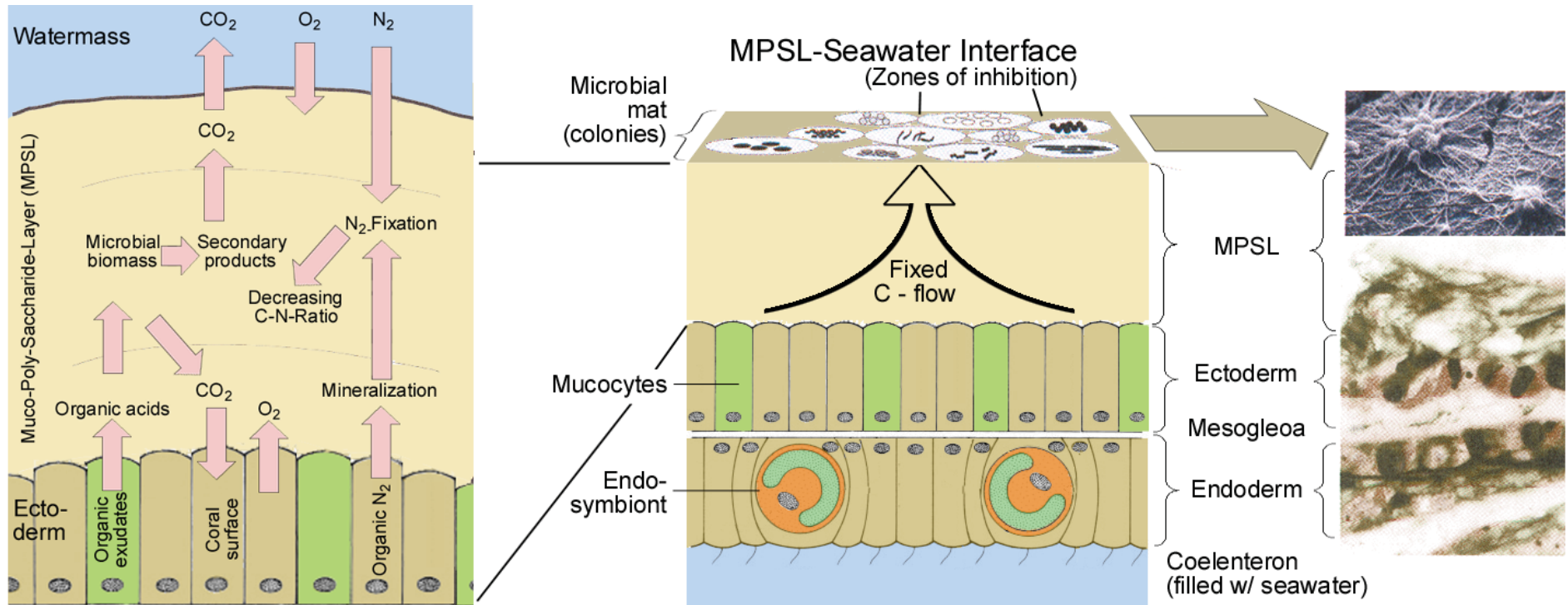
Mold: Hierarchical colony pattern generated by *Hemitrichia imperialis*

Slime mold responding to external stimuli
(courtesy of BW-TV:<http://www.swr.de/tv/bw/index.php>)



Nature (3/8)

Coherence in biological systems (cont'd) : Exosymbionts in Coral colonies



Nature (4/8)

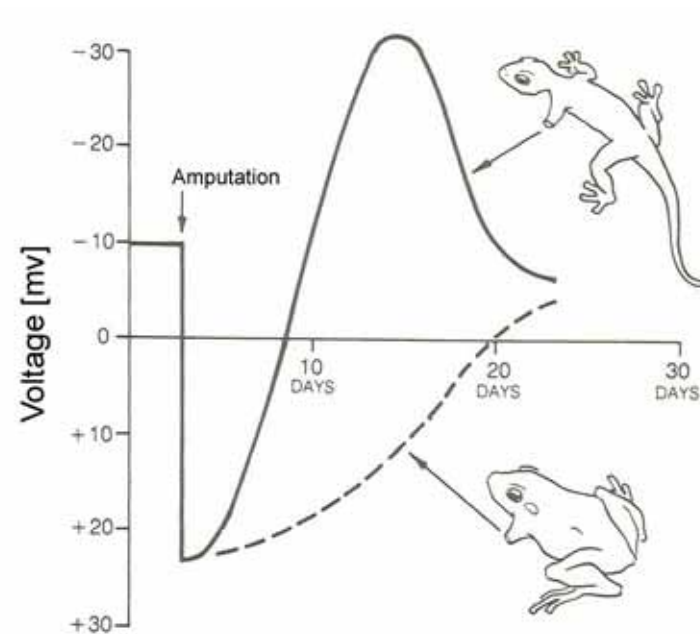
Coherence in biological systems (cont'd) :

Egg: electrostatic field across the equatorial plane;

Human: voltage difference b/w left and right finger;

Regeneration: The frog-salamander experiment

The current of Injury,
Salamander vs. Frog



Nature (5/8a)

Coherence in biological systems
(cont'd) :

- Coral

The extremely thin veneer on top
represents the living
structure

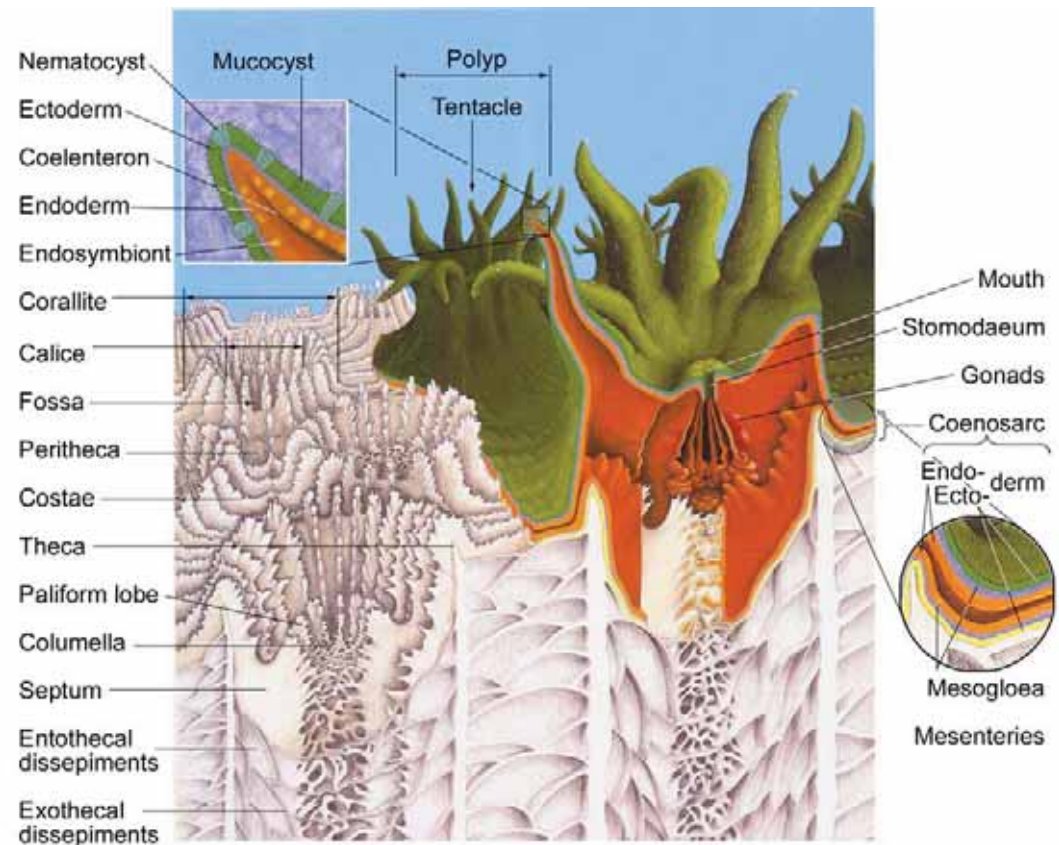


Fig.2.3: Schematic diagram of the major anatomical elements of the basic skeletal features of scleractinian corals.

(modified after Veron, 1986)

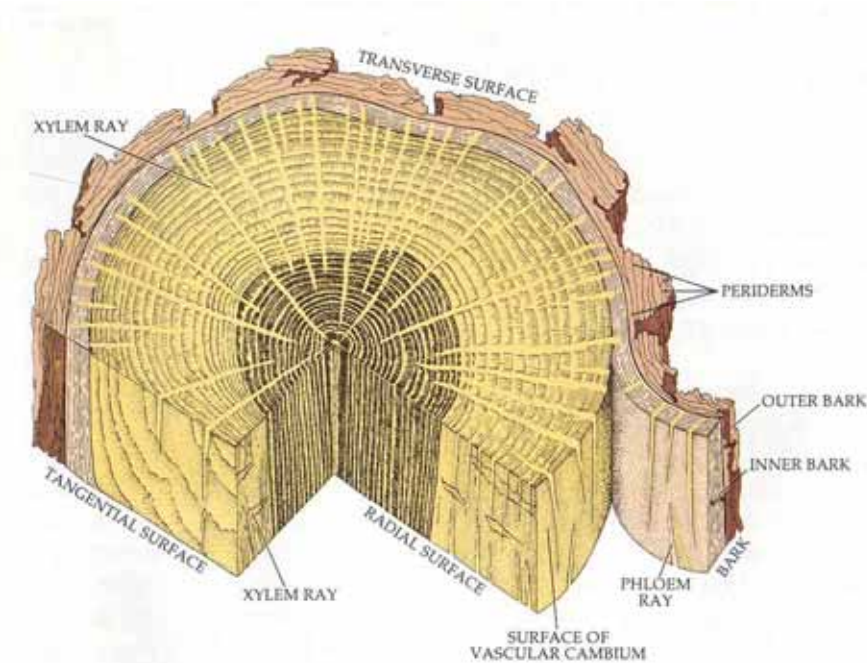
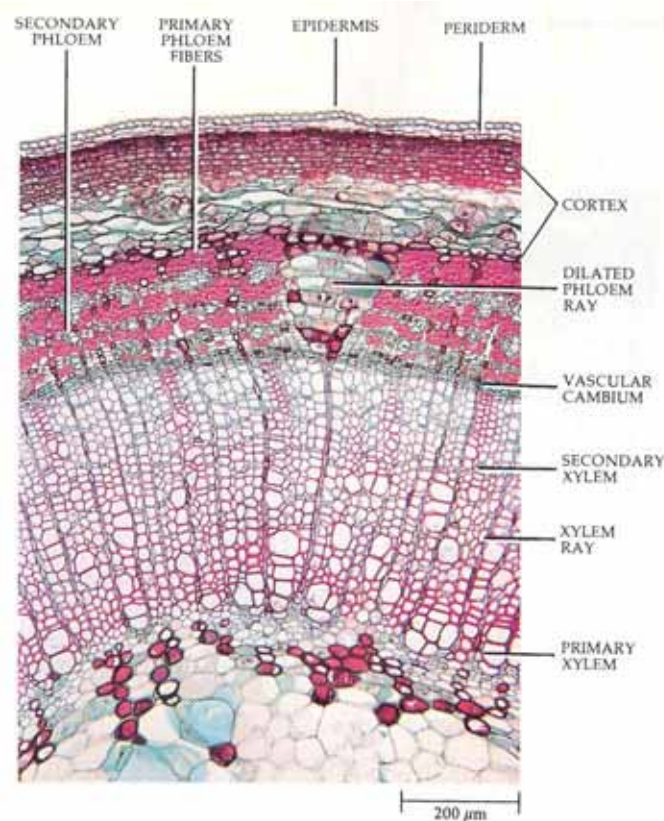
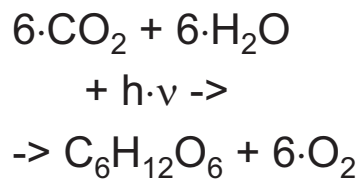
Nature (5/8b)

Coherence in biological systems
(cont'd) :

- Coral
- Tree

Photosynthesis:

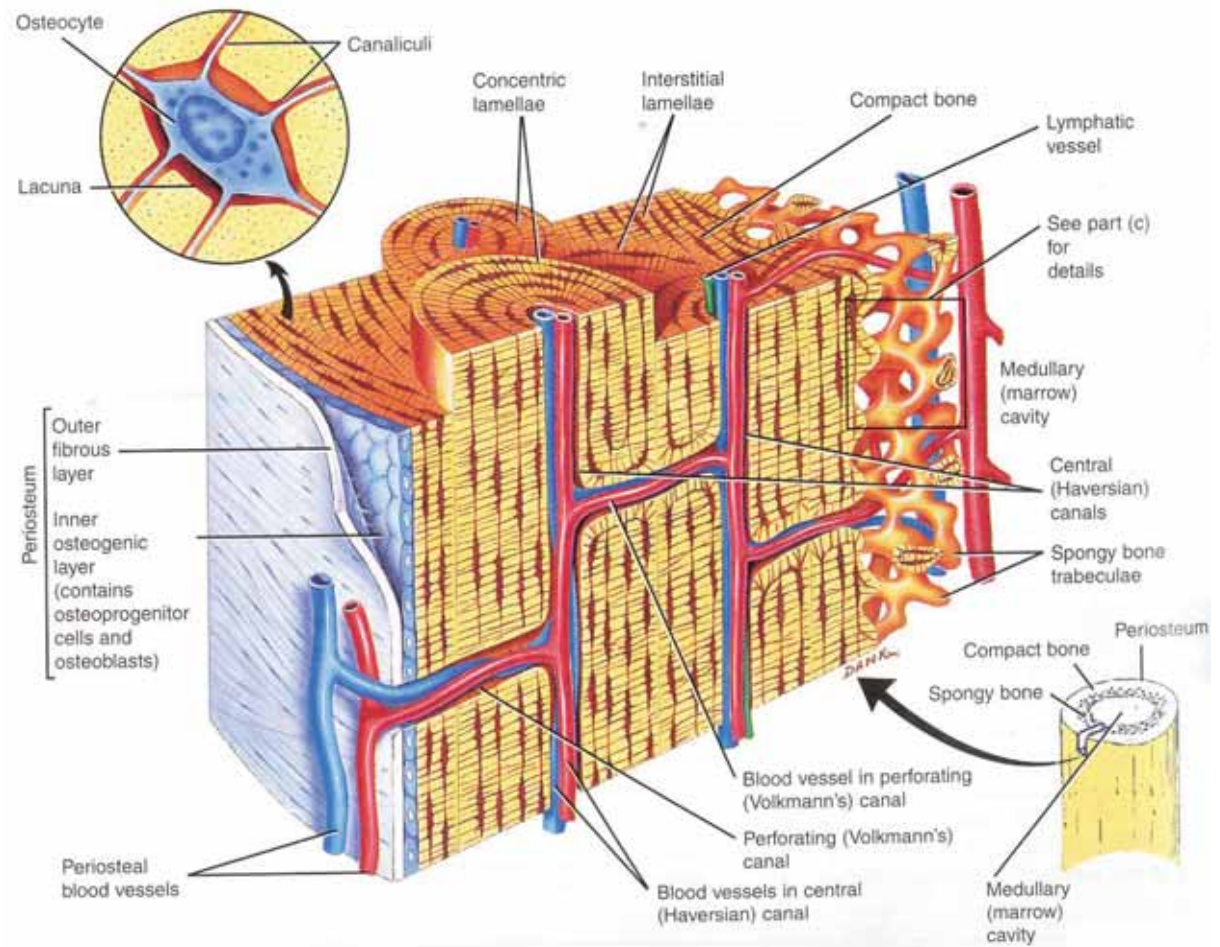
Energy from *outside*
is **pumped** into the
biological tissue



Nature (5/8c)

Coherence in biological systems
(cont'd) :

- Coral
- Tree
- Bone



Nature (6/8)

Coherence and Synchronization in biological systems on a larger scale:

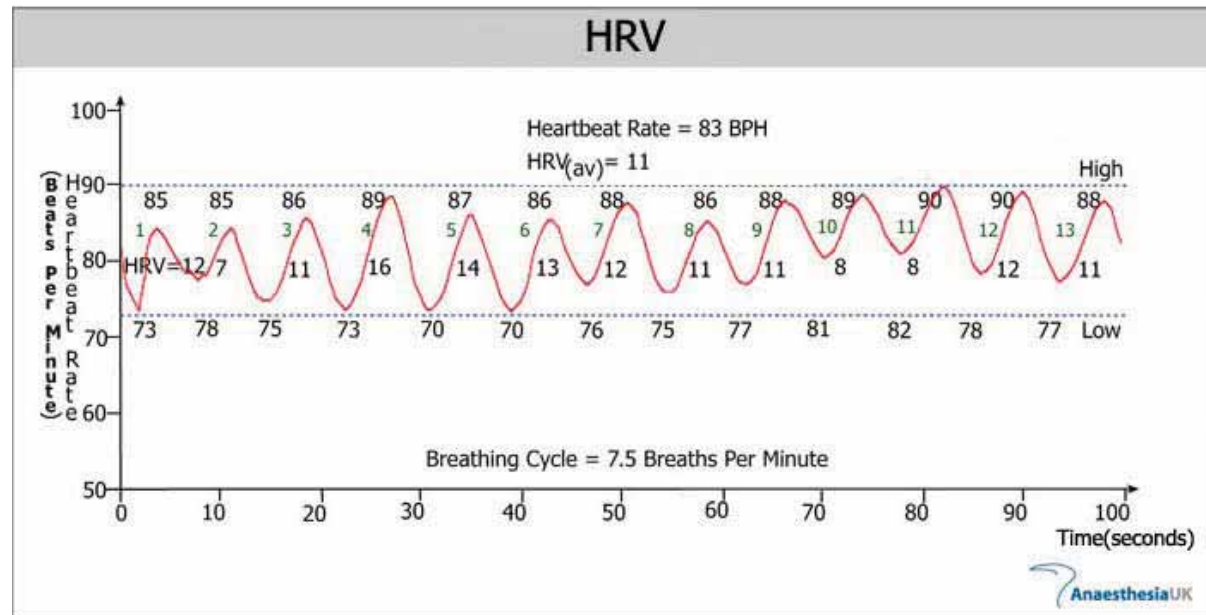
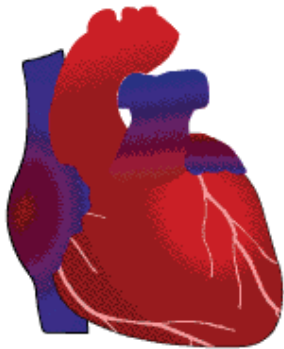
- Biological Rhythms act like oscillators;
- Phase locking of oscillations



Nature (7/8)

Coherence and Synchronization in biological systems on a larger scale (cont'd) :

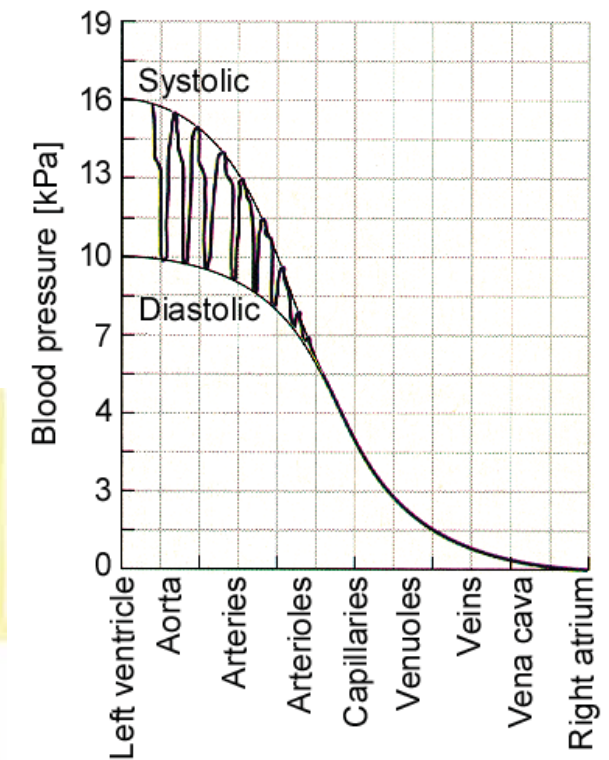
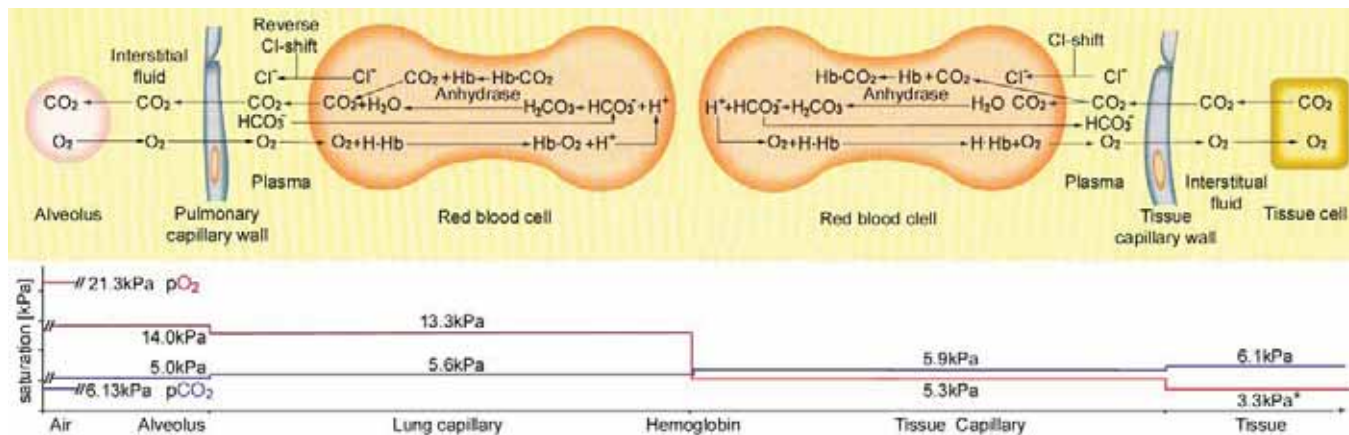
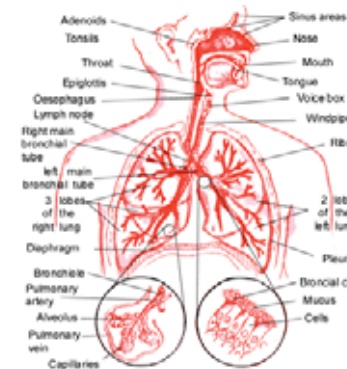
- Heart Rate Variability



Nature (8/8)

Coherence and Synchronization in biological systems on a larger scale (cont'd):

- Gas exchange in mammals



mEI (1/5)

Concepts of the implicate Order in Nature

The information-matter-energy triad:

IEM-Triad: Nature must be interpreted as matter, energy and information

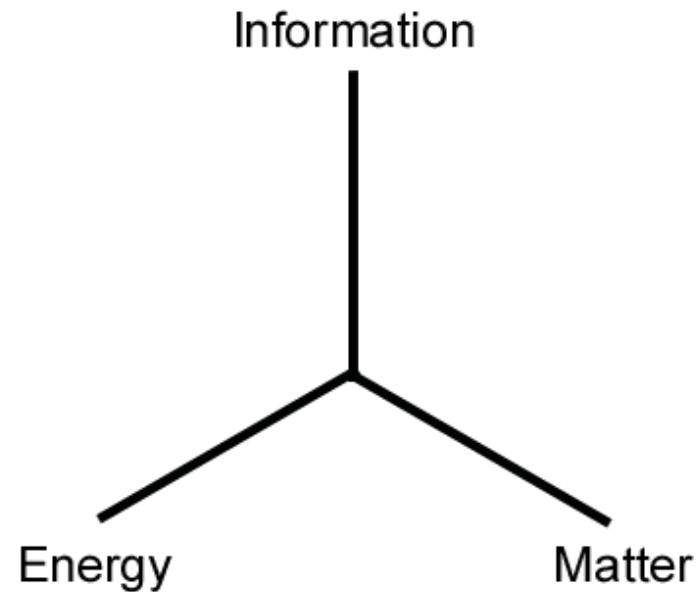
$$E_{QM} = h \cdot \nu_0,$$

$$E_{RT} = m_0 \cdot c^2$$

Energy: the potential for causing change;

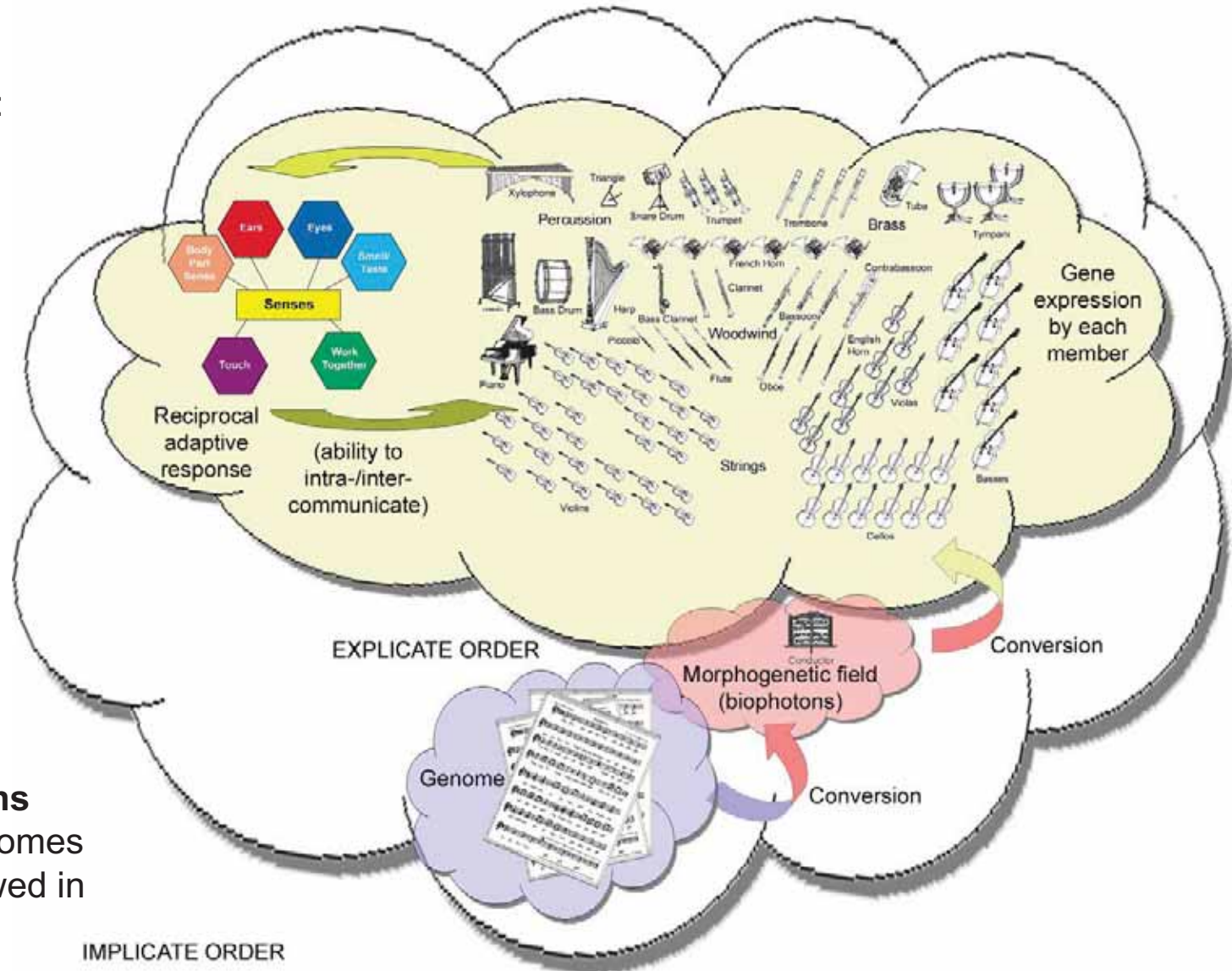
Information: the quality of a message;

Matter: the physical world;



Organism vs. Society:

Maximizing
Coherence



....Its all about **Relations**
(each single entity becomes
meaningless when viewed in
isolation).

Organism vs. Society:**mEI (3/5)**

Maximizing coherence

Resonance on a larger scale:

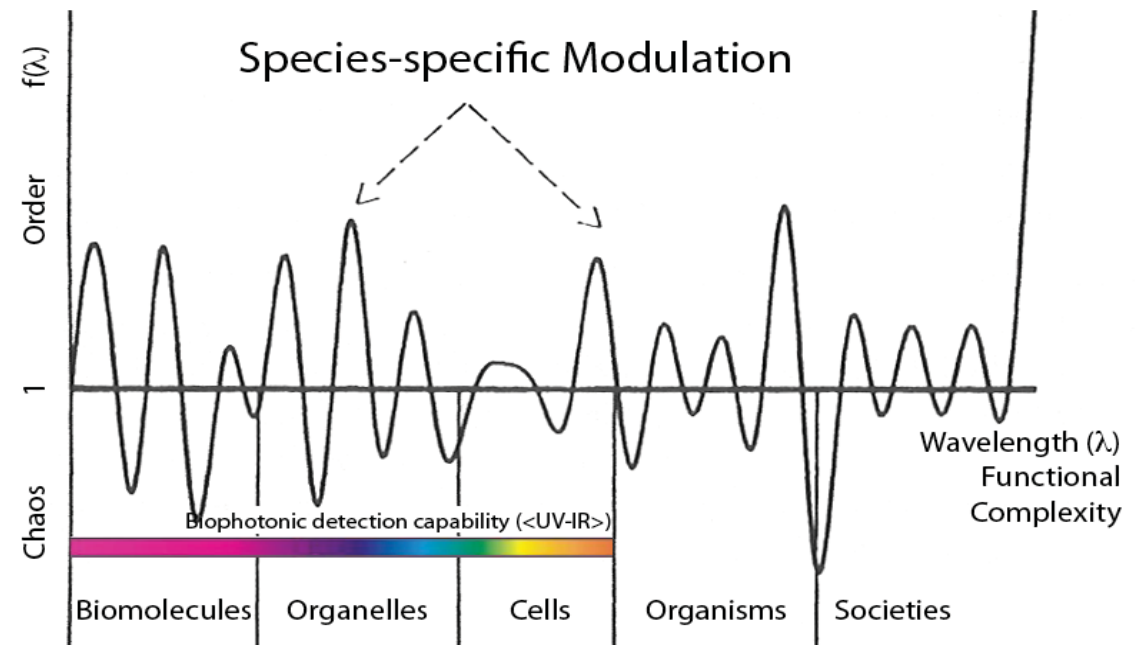
Biomolecules: DNA, RNA,

Organelles: ribosomes, mitochondria, centrioles, etc.

Cells: of all biota (Archaea, Eubacteria, Protista, Eukaryota)

Organs & Organism: Multicellular living beings;

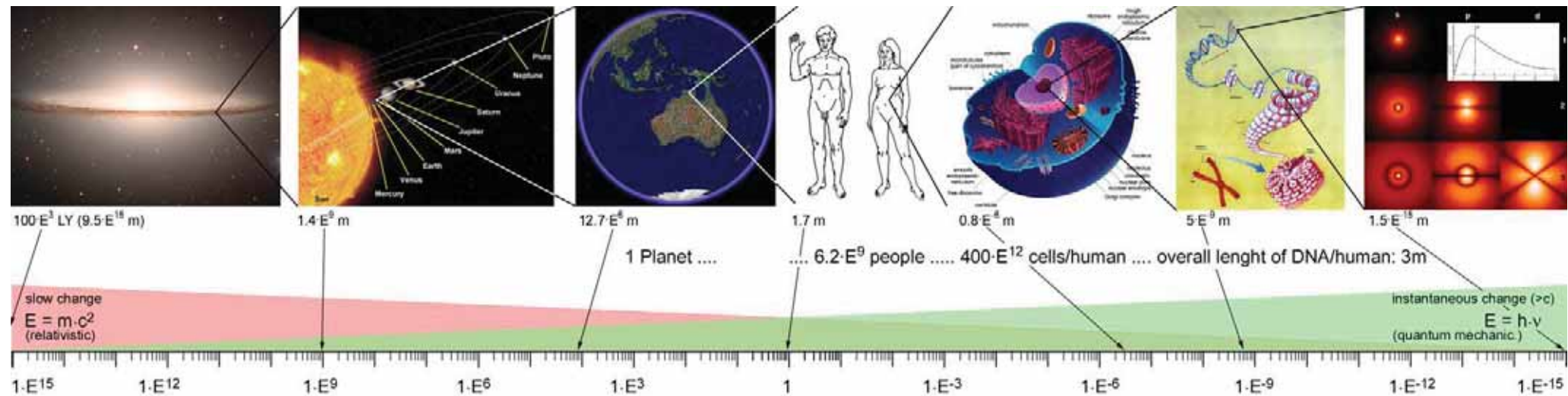
Society: group of single species (population) that can also share common cultural rules (*Homo sapiens*);



Organismic Structures:

mEI (4/5)

Coherence from the cosmic to the atomic level.



Decoherence due to **Over-specialization**:

Science pretends to be objective, but since *Heisenberg*, *Schrödinger* and *Planck*, we know that there is no such thing as objectivity.

Everything can be explained scientifically – but it would no longer make any sense (*Einstein*).

mEI (5/5a)

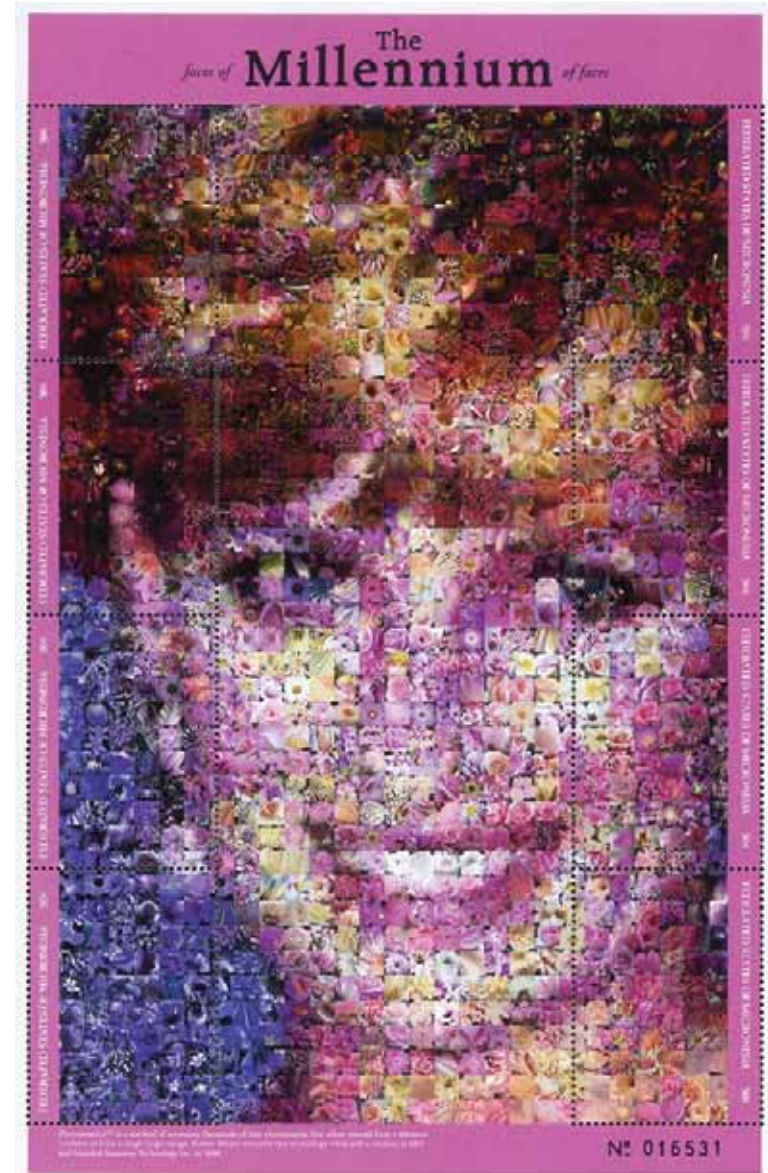


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mEI (5/5b)



Conclusion

We have to look beyond to finally ask the right questions:

- Physics: **What is matter**
- Biology: **What is life;**
- Medicine: **The origin of disease;**
- Psychology: **The origin of the soul;**
- Sociology: **The universal connectivity among living beings;**
- Economy: **Sustainable development;**

The only thing that matters is the **RELATION** (where it fits and why it matters) not the isolated entity as such.

The 6 criteria of a new-paradigm thinking in science should be:

1. The part and the whole;
2. The shift from thinking in terms of structure to terms of process;
3. The shift from objective science to epistemic science;
4. The age-old metaphor of knowledge as a building;
5. The shift from truth to approximate description;
6. The shift from an attitude of domination to one of cooperation;

Danke für Eure Aufmerksamkeit - Thanks for your attention