Time Management by Living Systems.
A General System Theory of the Time Modularity of Living Systems: Zeitgebers Interactions Design Conics Running Timelines.

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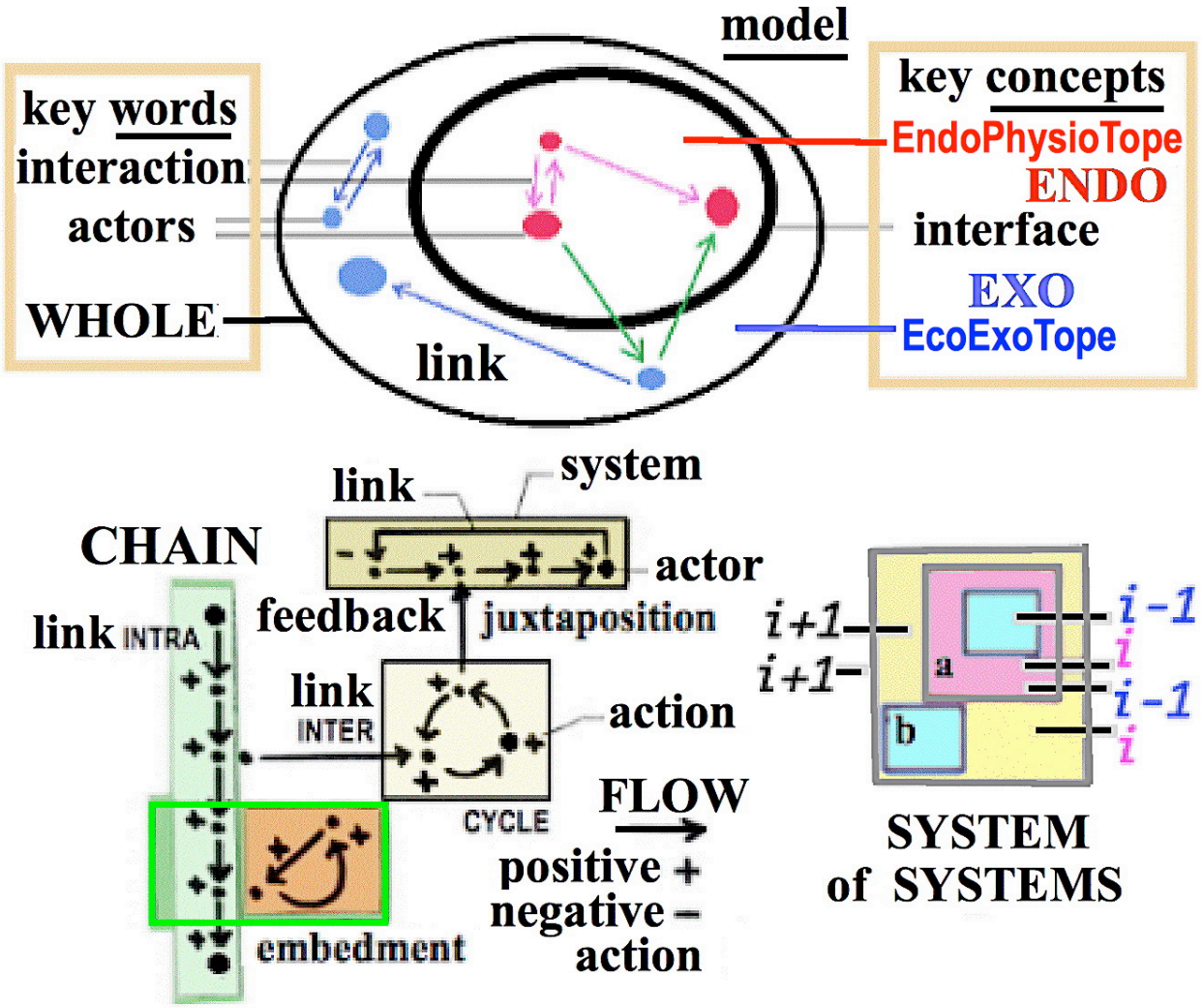
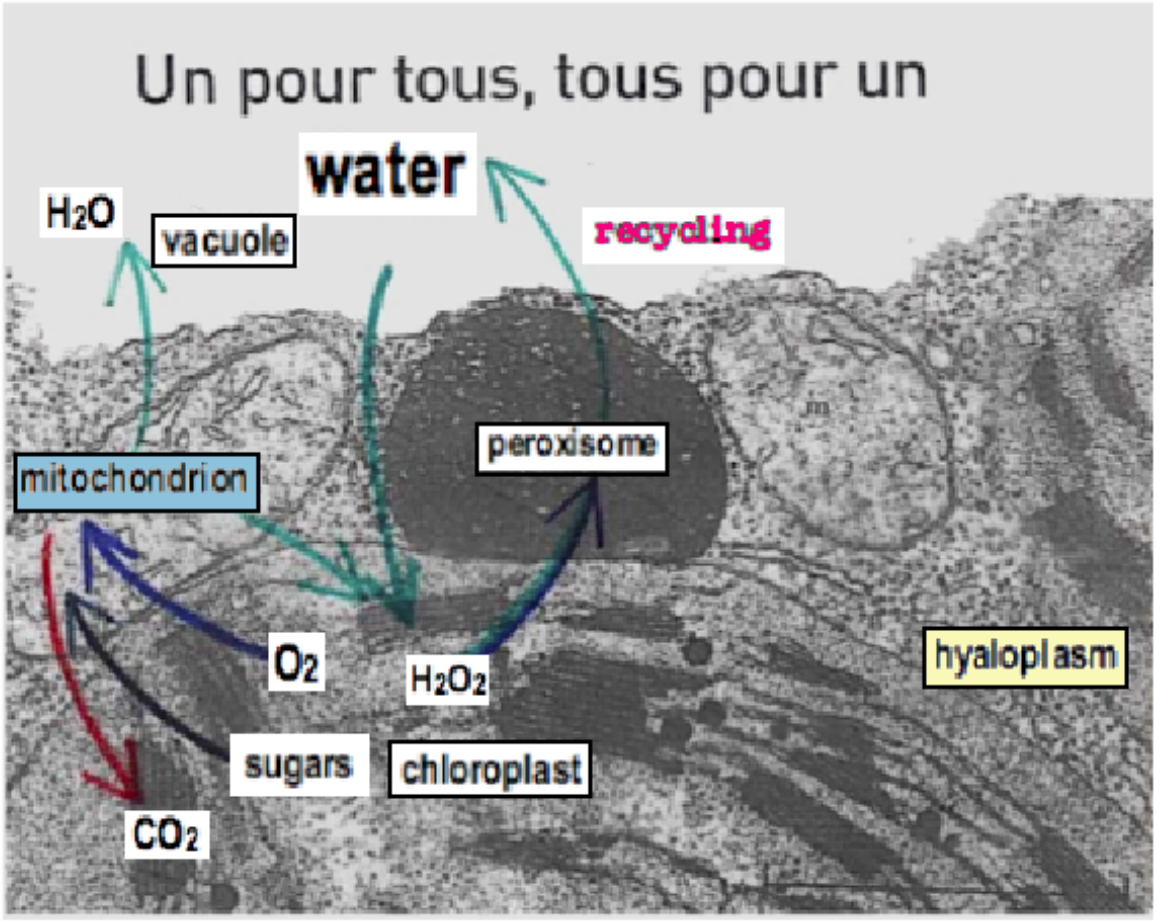

model
key words
interaction
actors
WHOLE
link
key concepts
EndoPhysioTope
ENDO
interface
EXO
EcoExoTope
link
system
CHAIN
actor
feedback
juxtaposition
link INTRA
link
INTER
action
CYCLE
FLOW
positive +
negative –
action
embedment
i+1
i+1
i -1
i
i -1
i
a
b
SYSTEM
of SYSTEMS

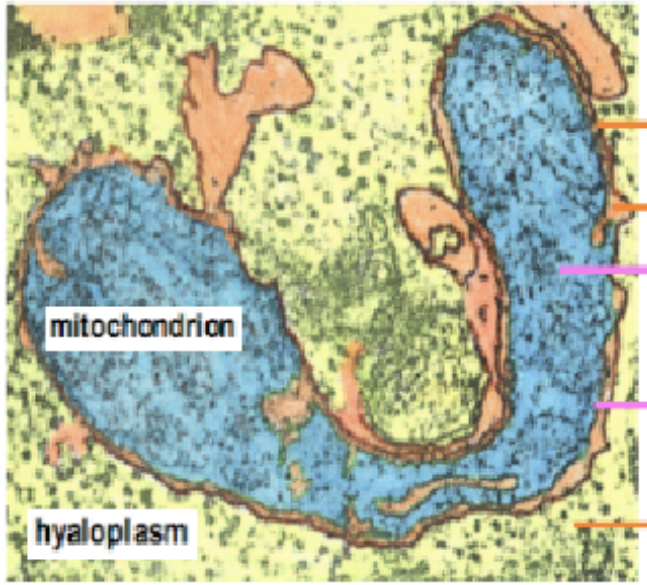
E pluribus unum

Unus pro omnibus, omnes pro uno



juxtaposition

In varietate concordia



encasement

interface

EcoExoTope

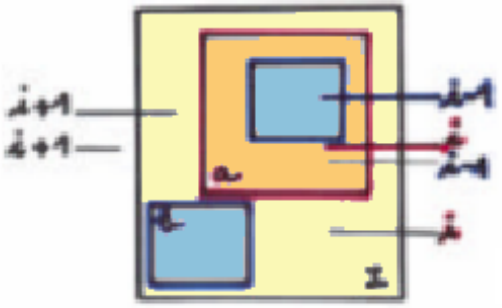
EndoPhysioTope

i-1

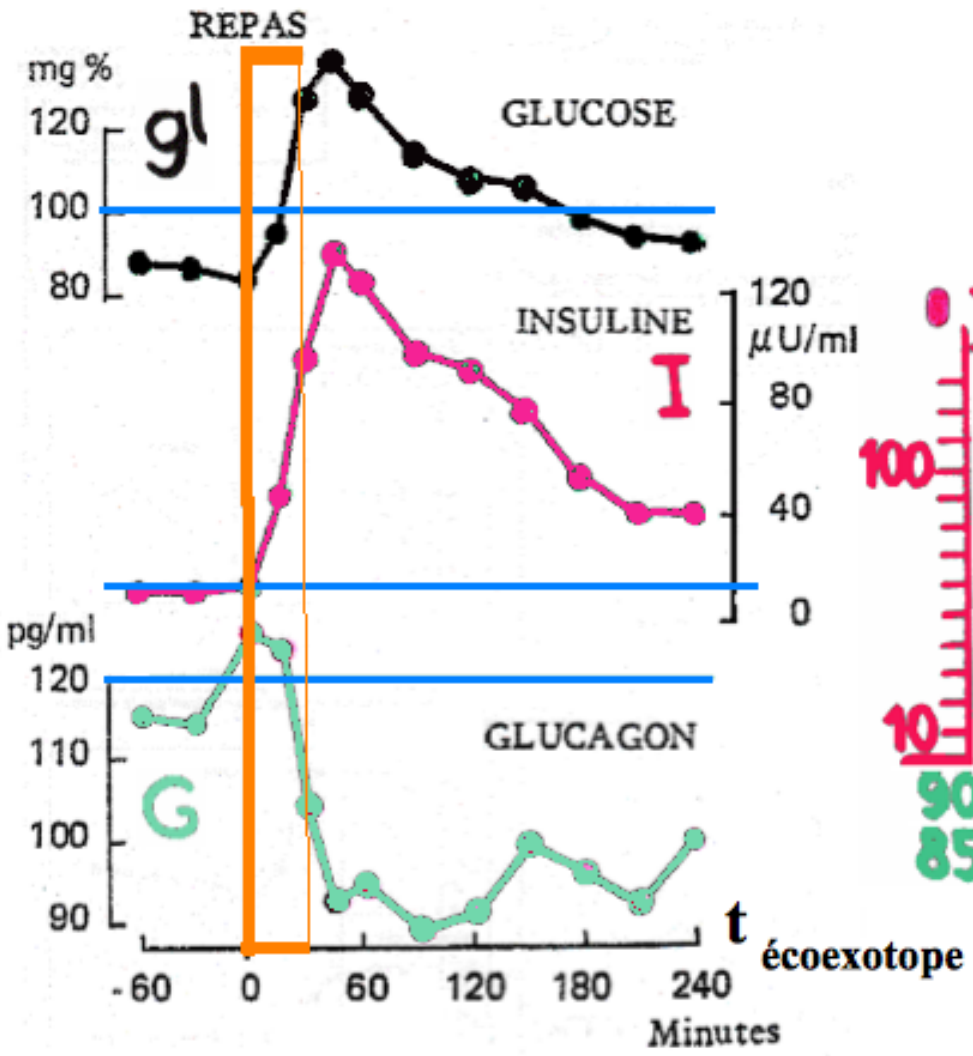
interface

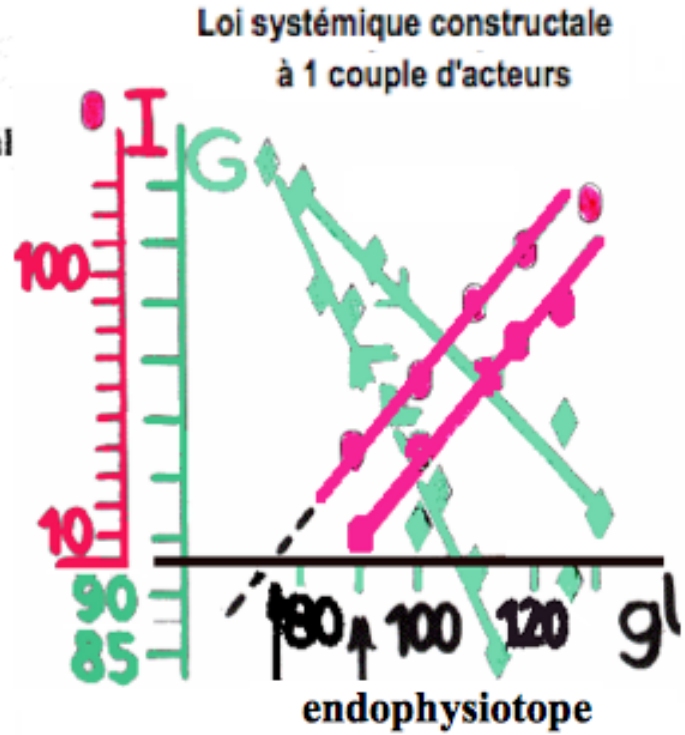
EcoExoTope

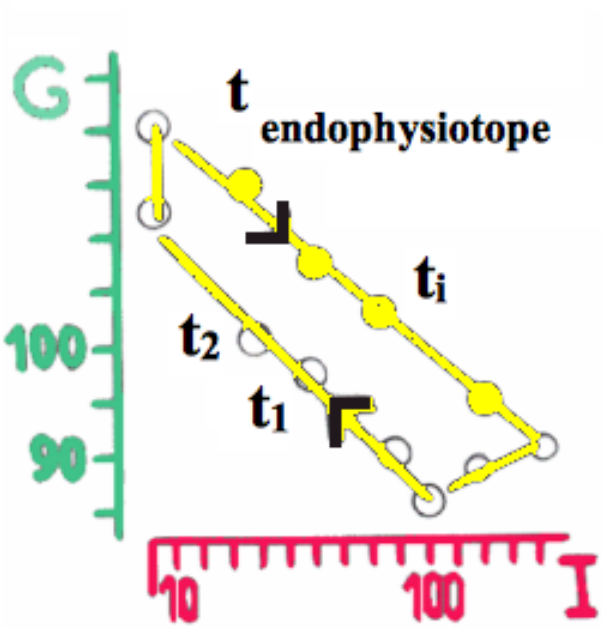
i

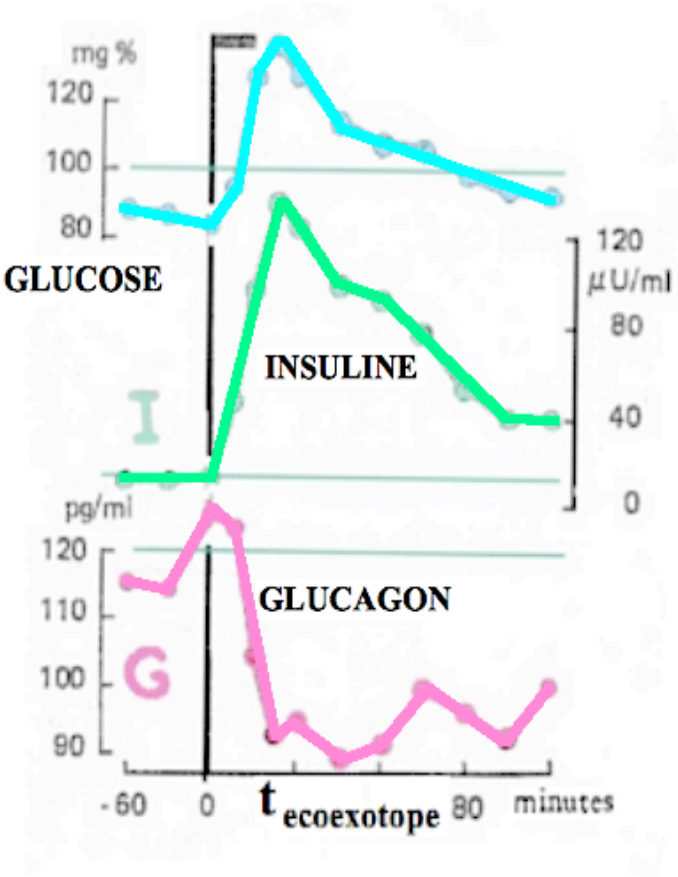


System-Of-Systems

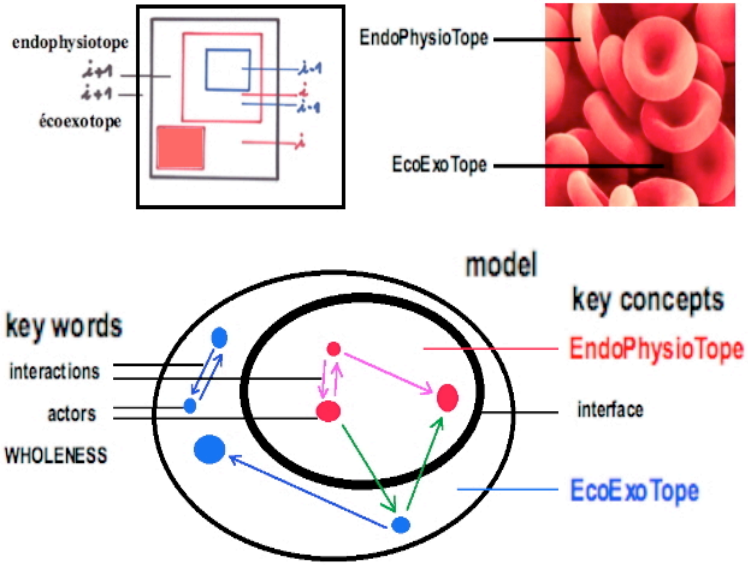

REPAS
mg %
120
100
80
gl
GLUCOSE
INSULINE
I
120
µU/ml
80
40
0
pg/ml
120
110
100
90
GLUCAGON
G
t
écoexotope
-60
0
60
120
180
240
Minutes

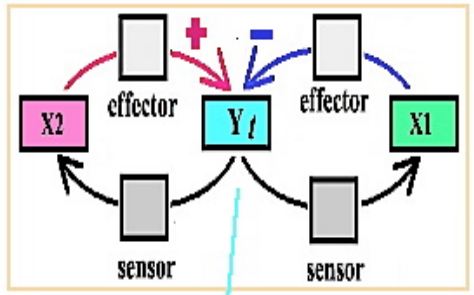

Loi systémique constructale
à 1 couple d'acteurs
I
G
100
10
90
85
80
100
120
gl
endophysiotope

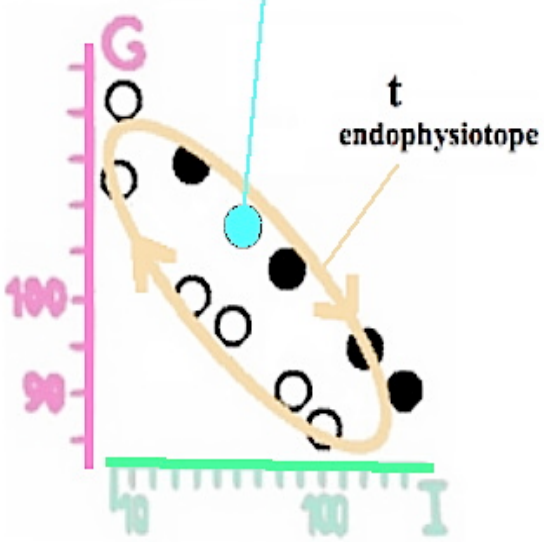

G
t
endophysiotope
t_i
t_2
t_1
100
90
10
100
I



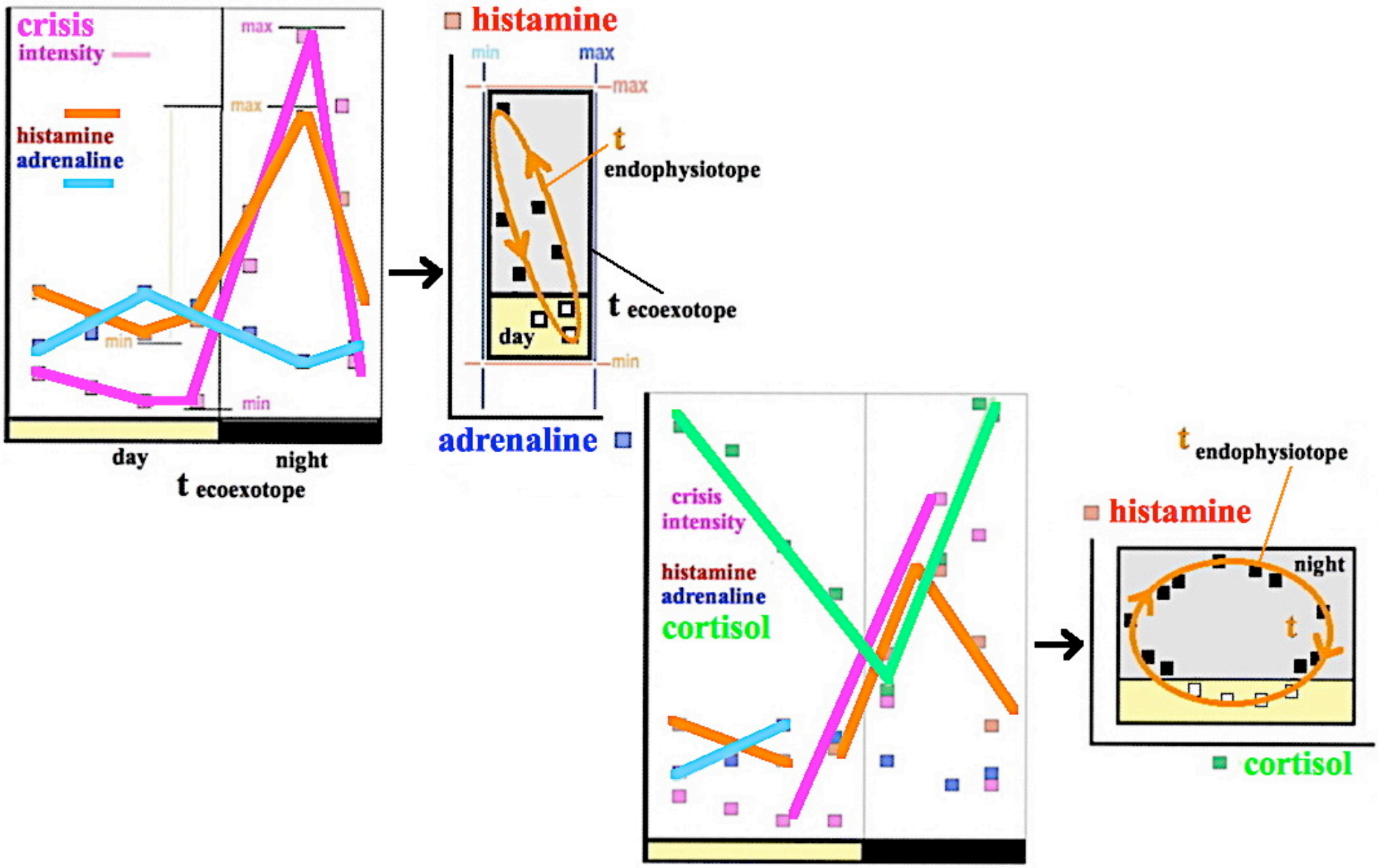
Simultaneous variations in man glycaemia (mg%), insulinaemia I (µU/ml) & glucagonaemia G (pg/ml), external time of the ecoexotope in minutes.
(R. Unger, New England J. Med., 1970, n° 282, p. 109.)



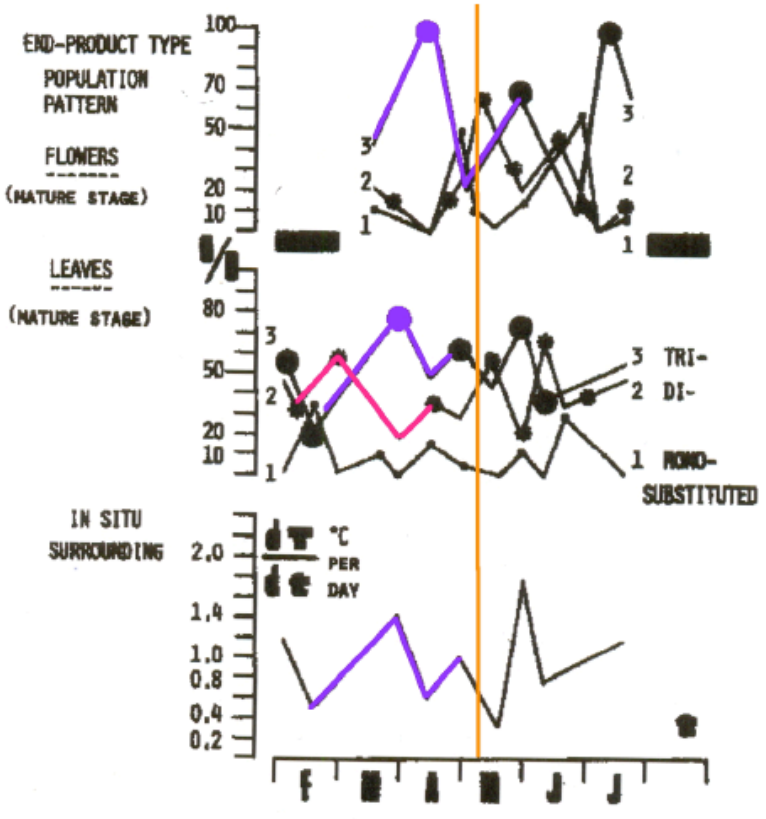


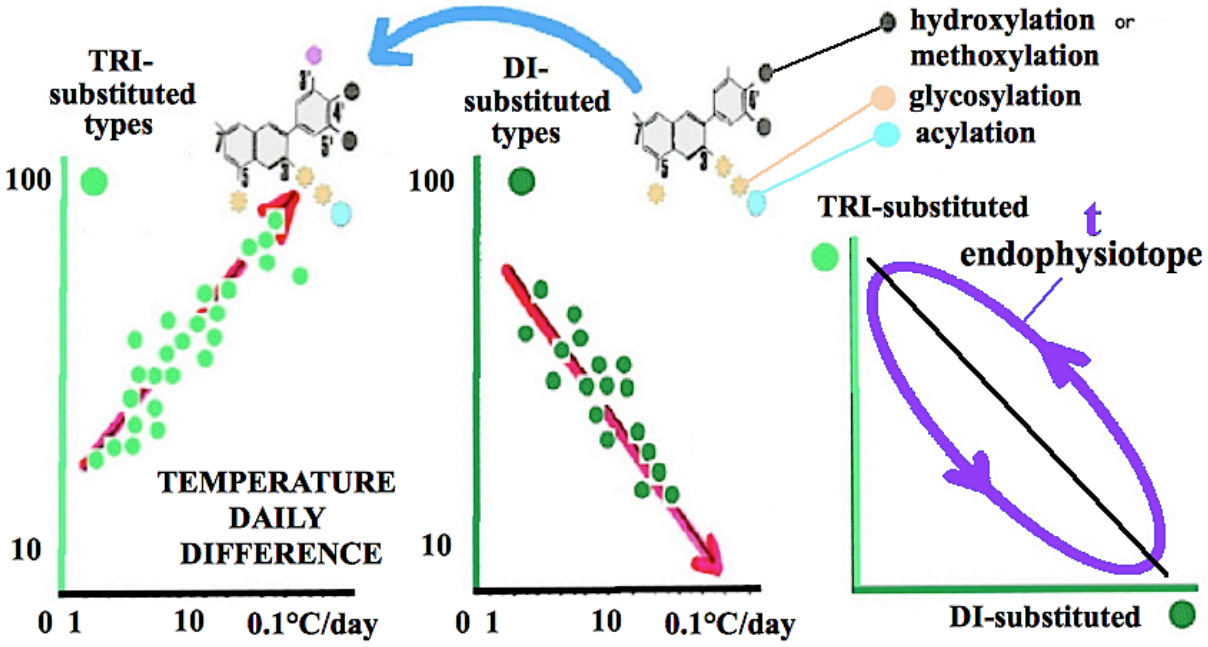


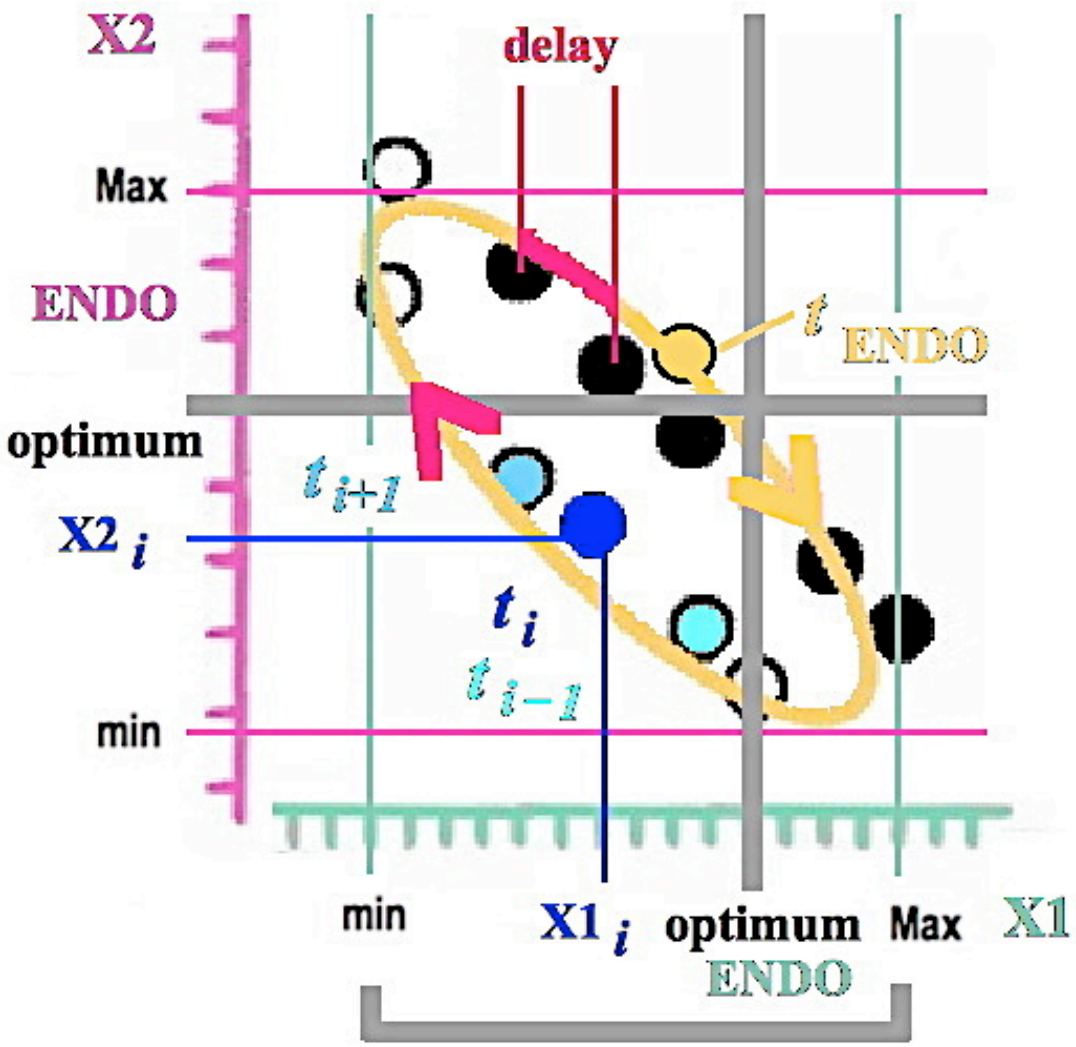
Time oriented elliptic graph of the successive agoantagonistic states of hormones counterbalancing.
(P. Bricage, 2007)


crisis
intensity
histamine
adrenaline
max
max
min
min
day
night
t ecoexotope
histamine
min
max
max
t
endophysiotope
t ecoexotope
day
min
adrenaline
crisis
intensity
histamine
adrenaline
cortisol
t endophysiotope
histamine
night
t
cortisol

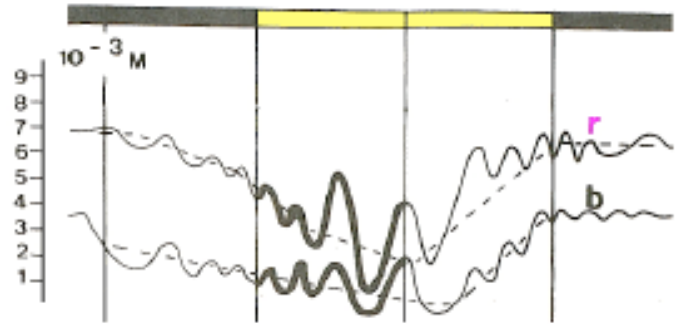
Bricage P. (1985) Multiple molecular steps and pathways of in situ anthocyanin biosynthesis in Lathyrus macrorhizus Wimm.
I. The leaf steps and pathways. p. 106-107.
II. The glycosylation-acylation network. p. 108-111.
III. The end-product population pattern. p. 112-126.
1rst International Coll. Lathyrus, Chemical aspects.
Institut de Biocénotique Expérimentale des AgroSystèmes, Pau.



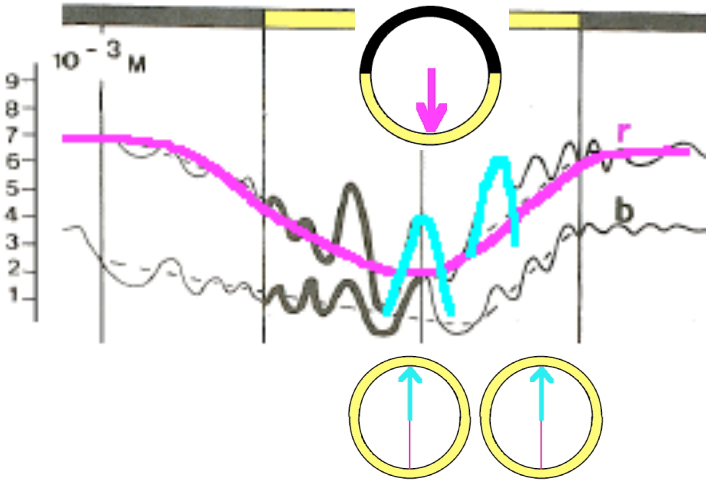


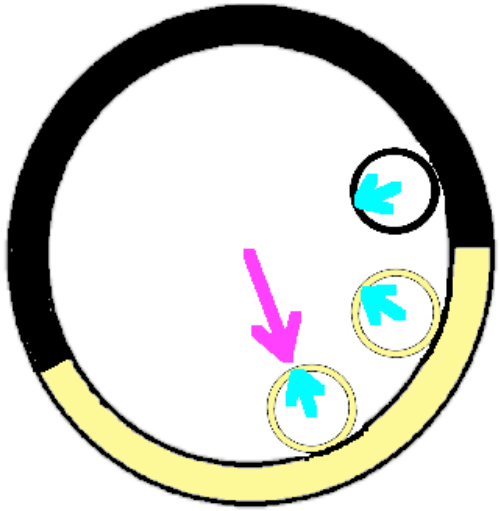

X2
delay
Max
ENDO
t ENDO
optimum
t i+1
X2 i
t i
t i−1
min
min
X1 i
optimum
Max
X1
ENDO

Living Systems' Space-Times



Chronologie des minima relatifs et des maxima correspondants de l' acidité titrable équivalente et positions des pics d' activité peroxydasique.





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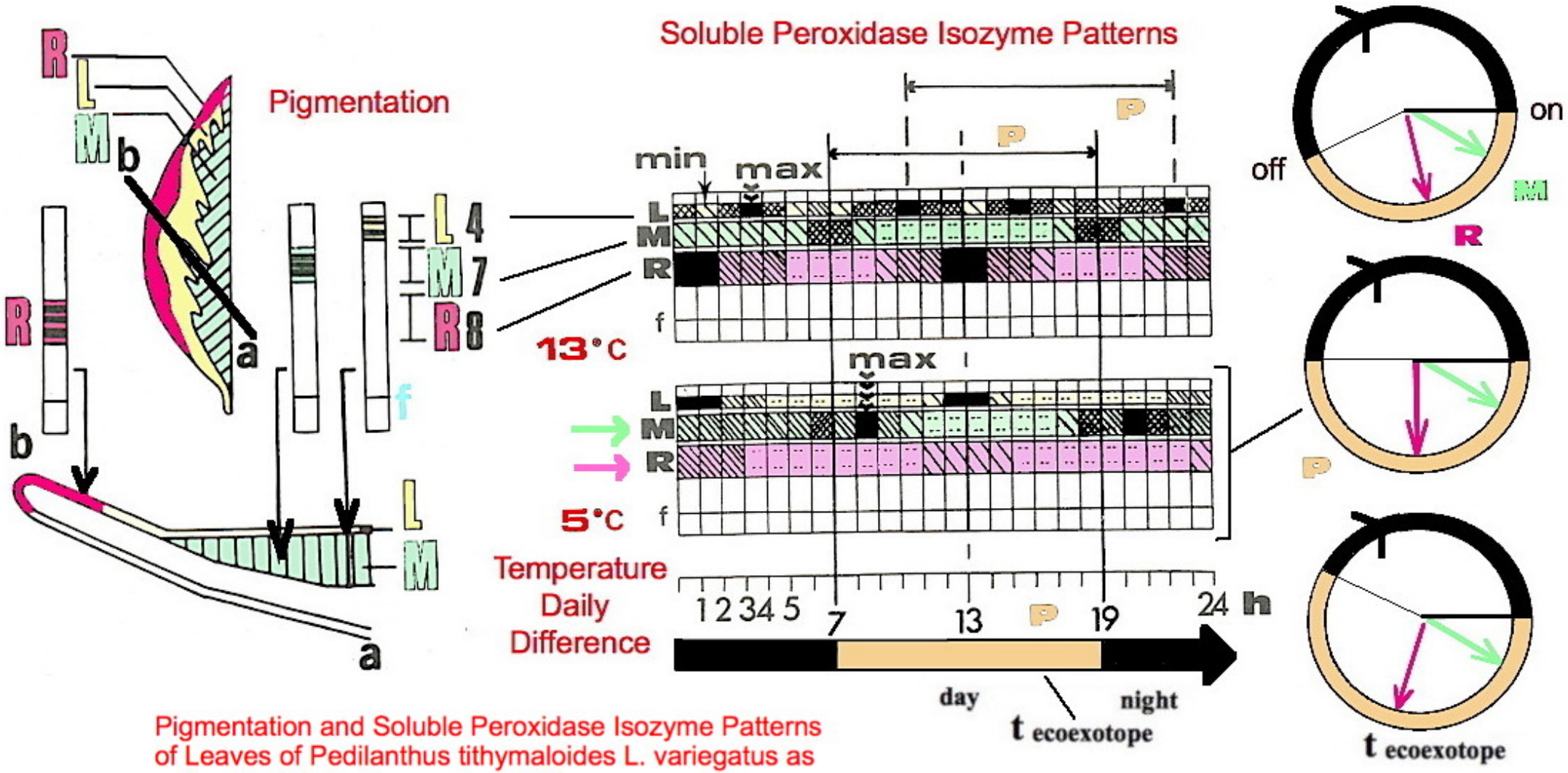
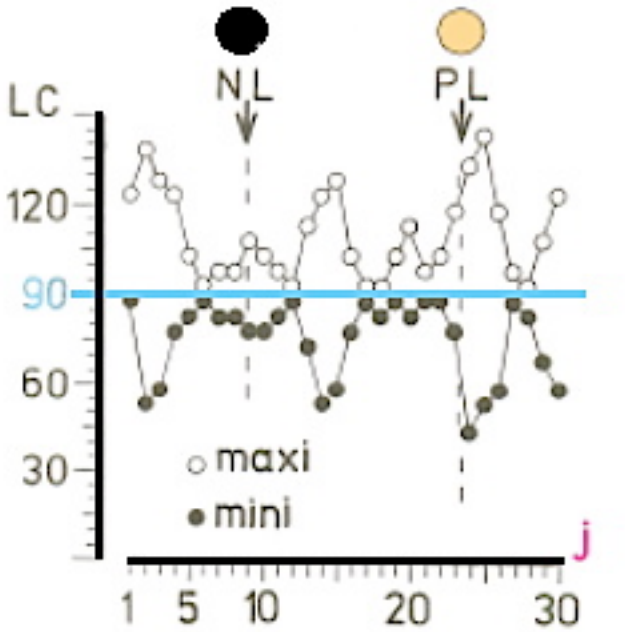
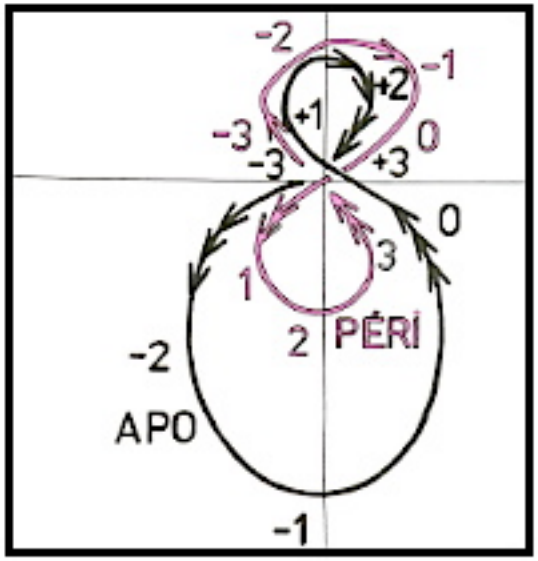
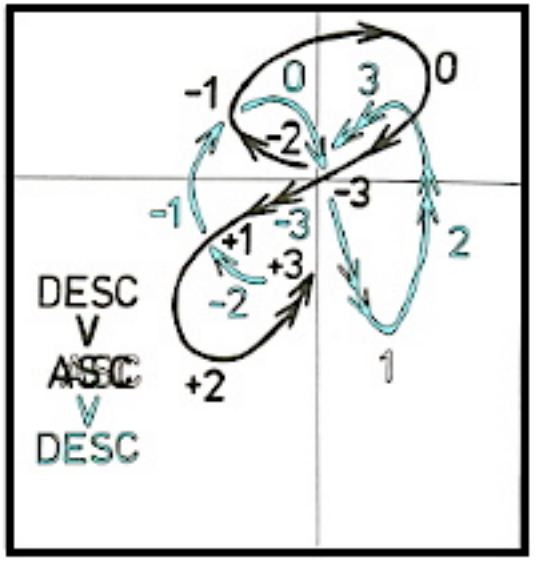
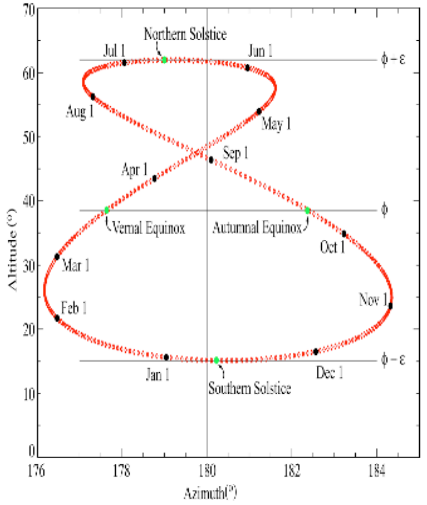


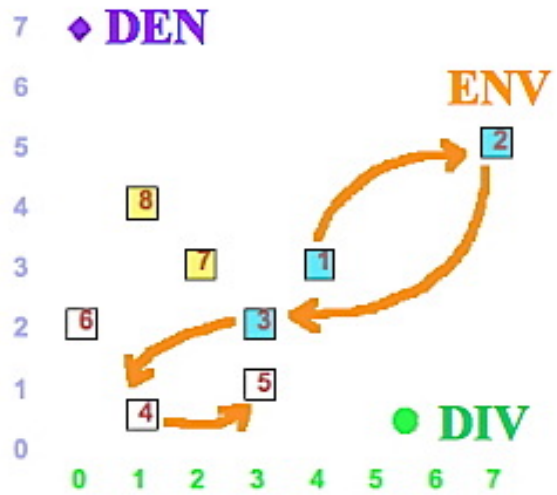
Pigmentation and Soluble Peroxidase Isozyme Patterns of Leaves of Pedilanthus tithymaloides L. variegatus as a Result of Daily Temperature Differences

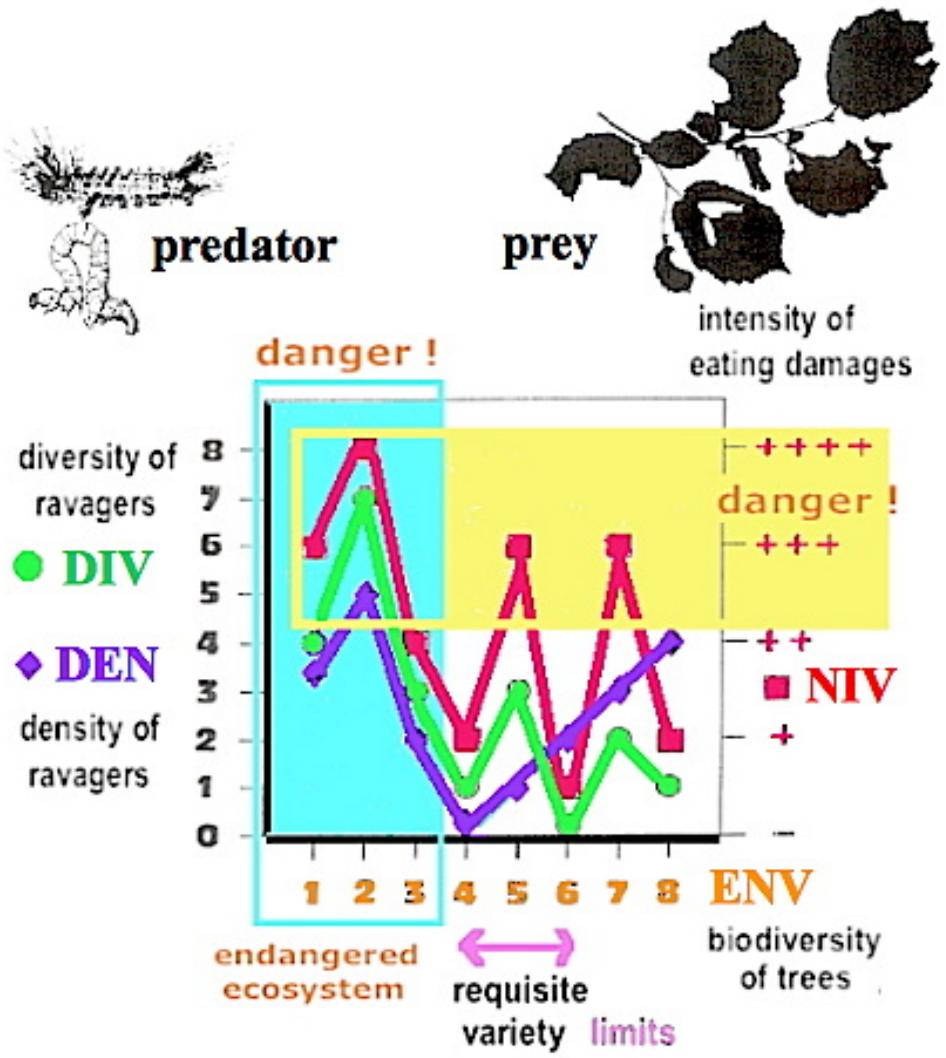

LC
NL
PL
120
90
60
30
maxi
mini
j
1
5
10
20
30

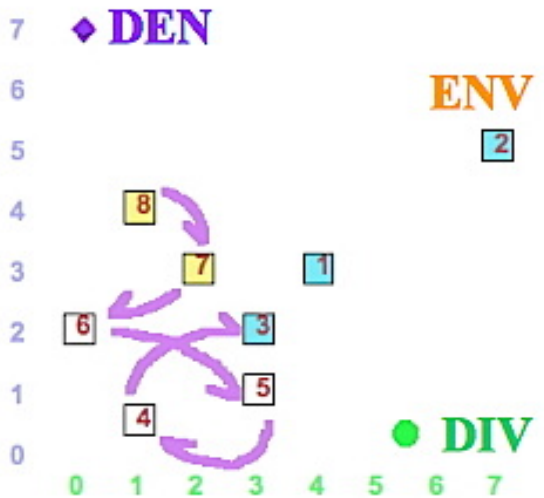

-2
-1
+2
+1
-3
-3
+3
0
0
3
1
2
PÉRI
-2
APO
-1

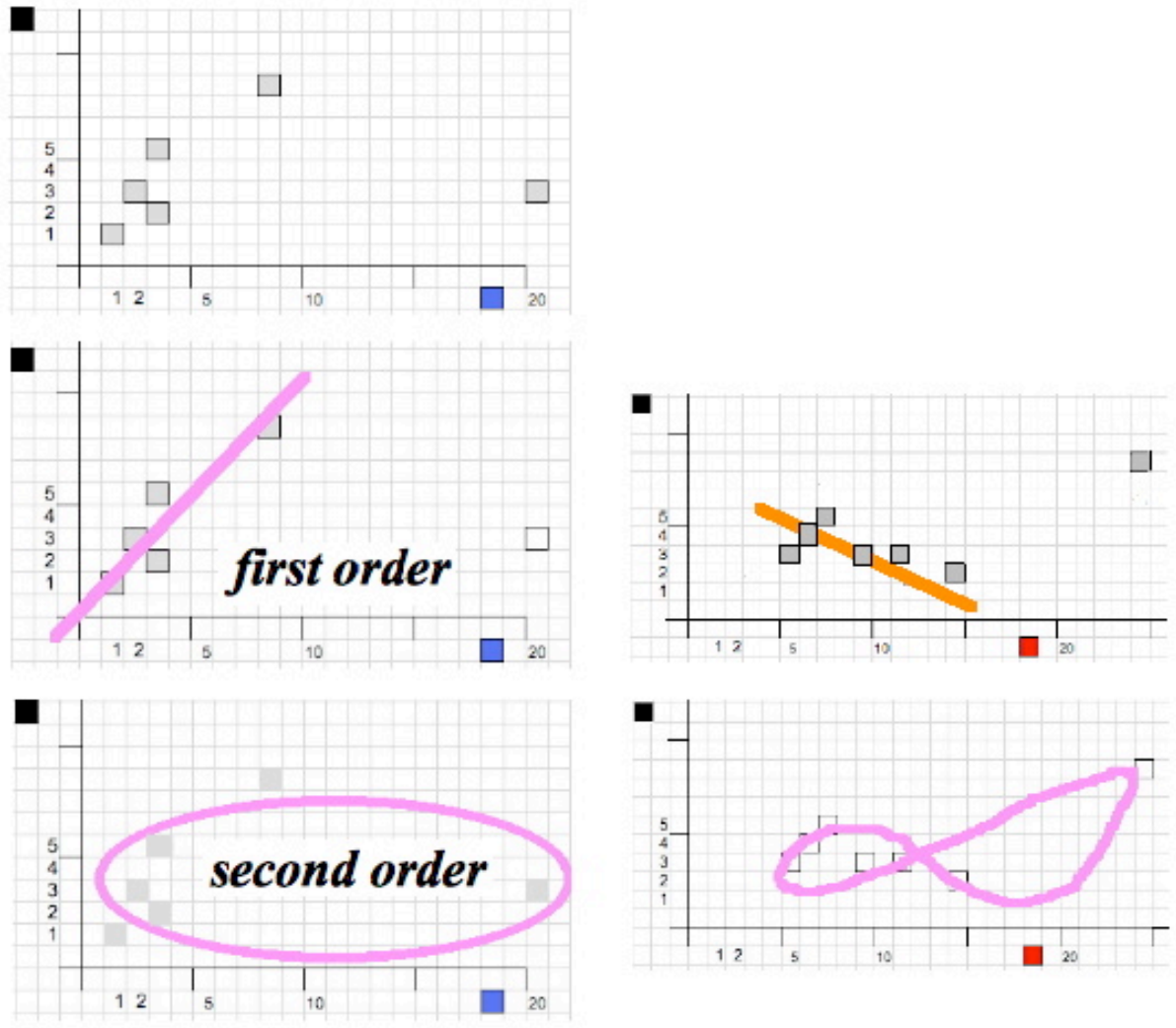

-1
0
3
0
-2
-3
-1
+1
-3
2
+3
-2
DESC
V
ASC
V
DESC
+2
1


Northern Solstice
Jul 1
Jun 1
ϕ − ε
Aug 1
May 1
Sep 1
Apr 1
ϕ
Vernal Equinox
Autumnal Equinox
Oct 1
Mar 1
Feb 1
Nov 1
Jan 1
Dec 1
ϕ − ε
Southern Solstice
Altitude (°)
Azimuth(°)
70
60
50
40
30
20
10
0
176
178
180
182
184


DEN
ENV
DIV
0 1 2 3 4 5 6 7
1 2 3 4 5 6 7 8


predator
prey
intensity of eating damages
danger !
diversity of ravagers
DIV
DEN
density of ravagers
++++
danger !
+++
++
NIV
+
–
ENV
biodiversity of trees
endangered ecosystem
requisite variety
limits


DEN
ENV
DIV
0 1 2 3 4 5 6 7
1 2 3 4 5 6 7 8


5
4
3
2
1
1 2
5
10
20
first order
second order

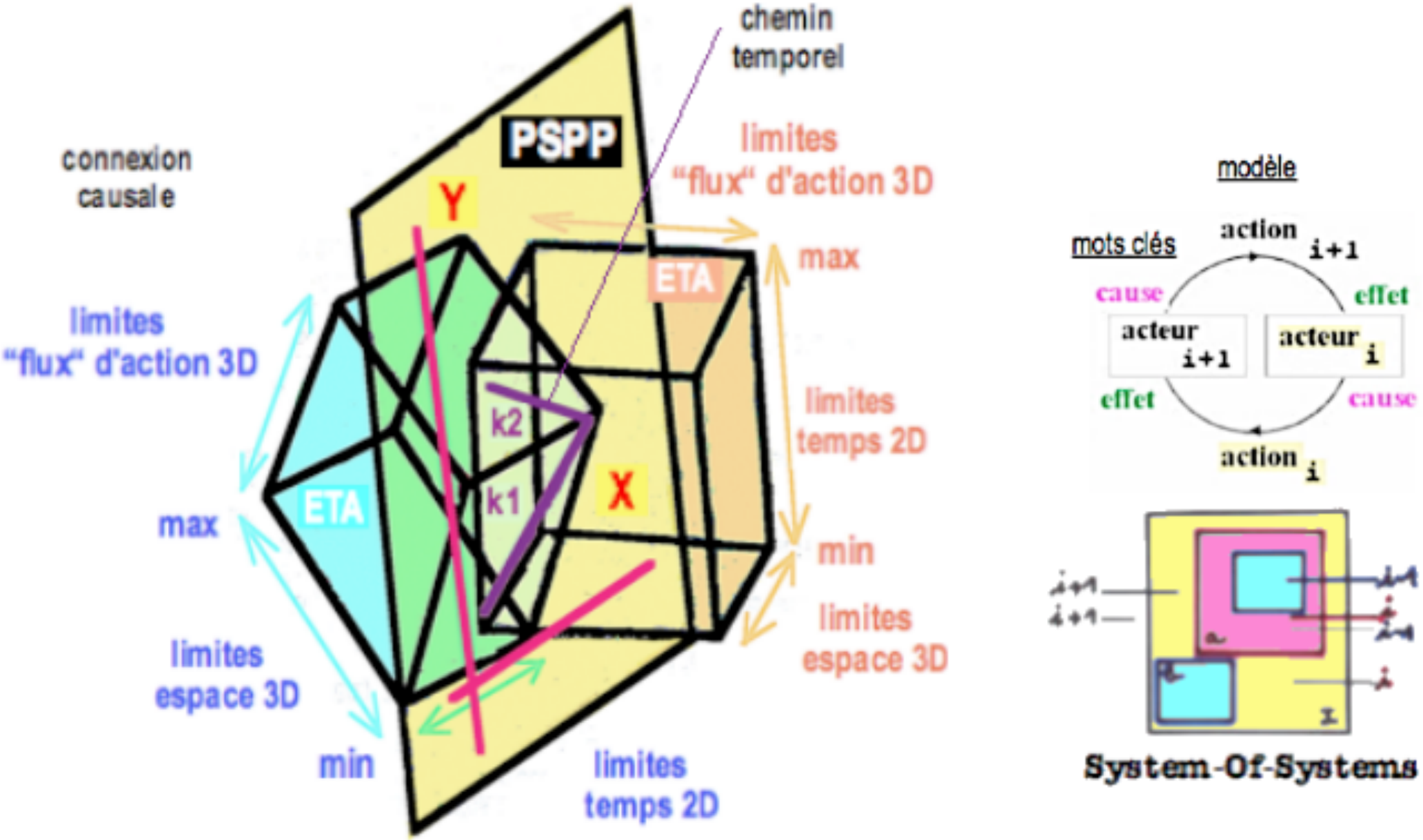
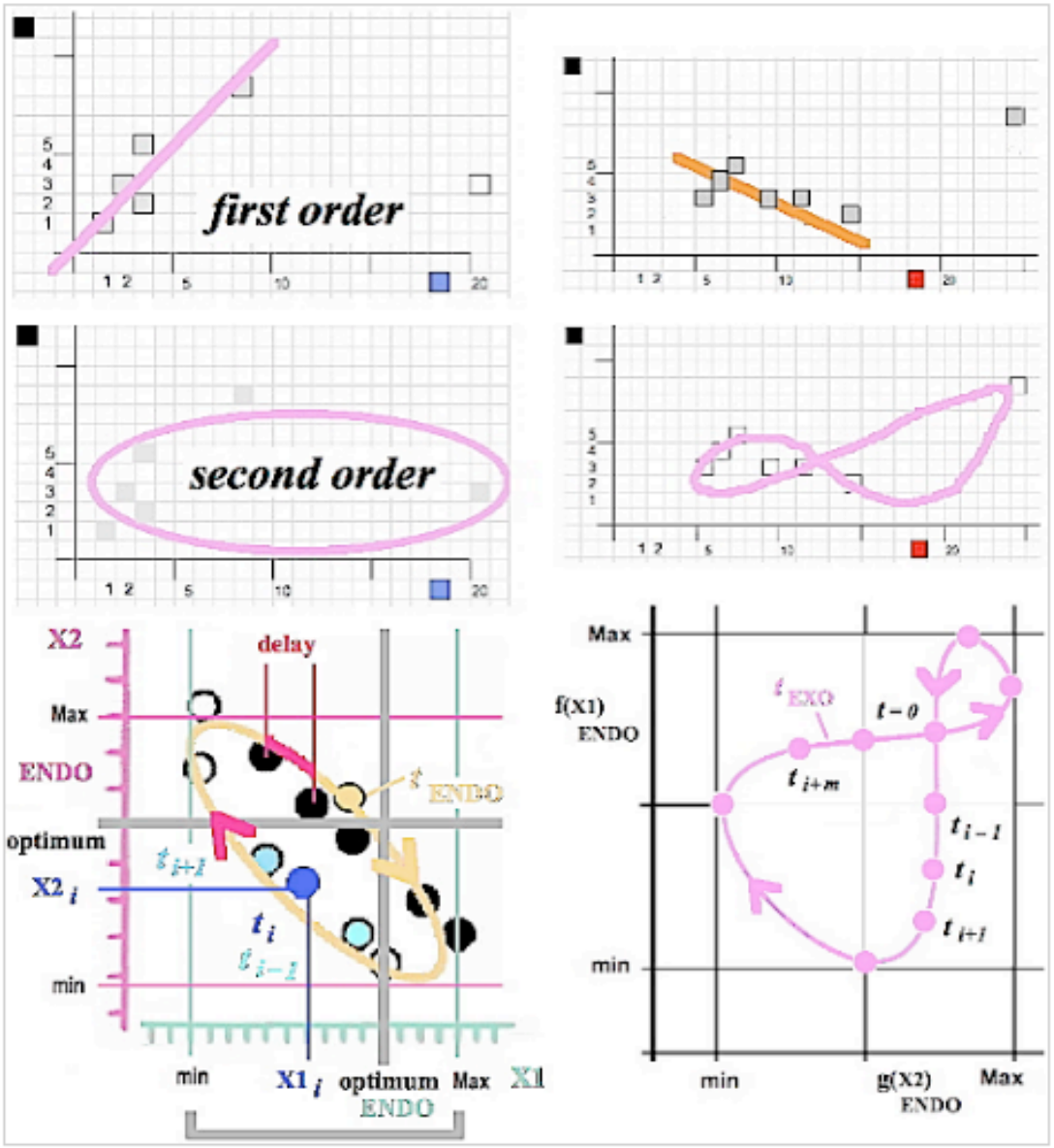
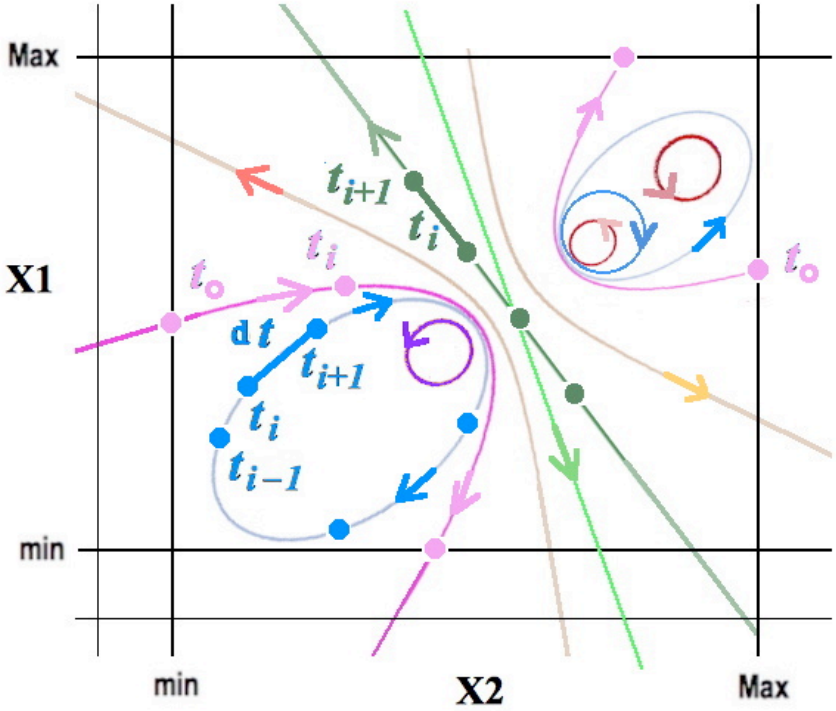


Figure 14. Détermination du plan le plus simple de la trajectoire (géodésique ou horocyclique).


first order
second order
X2
delay
Max
ENDO
optimum
min
X1 i
optimum
Max
X1
ENDO
f(X1)
ENDO
t EXO
t – 0
t i+m
t i–1
t i
t i+1
min
g(X2)
ENDO
Max


Max
X1
min
min
X2
Max
t i+1
t i
t i
t o
d t
t i+1
t i
t i–1
t o

The WHOLE is both more and the less than the sum of its PARTS.

$\mathbf{T = K}$ or $\mathbf{ti = Ki}$ **independence** of the parts ***ti*** and the whole **T**

$\mathbf{T = \sum (ki \cdot ti)}$ the WHOLE is limited by the PARTS,
limiting factors of the whole, or

$\mathbf{ti = k'i \cdot T}$ the PARTS are limited by the WHOLE,
limiting factor of the parts

The *welcome capacity* is limited by the *to be welcomed capacity*, reciprocally
the *capacity to be welcomed* is limited by the *welcome capacity*.

$\mathbf{bT = \sum (ai \cdot ti) + K}$ ***"The whole is bigger than the sum of the parts."*** (Confucius)
but it can also be the sum of its parts,
sometimes it is smaller, but mostly "it is different"!

Line **in 2D (n= 2)** $\mathbf{a1 \cdot X1 + a2 \cdot X2 = K}$ (which is a conic)

X1, *X2* are the building actors, ENDO T is running in a unique way along the line.

The WHOLE is more and less than the product of its PARTS.

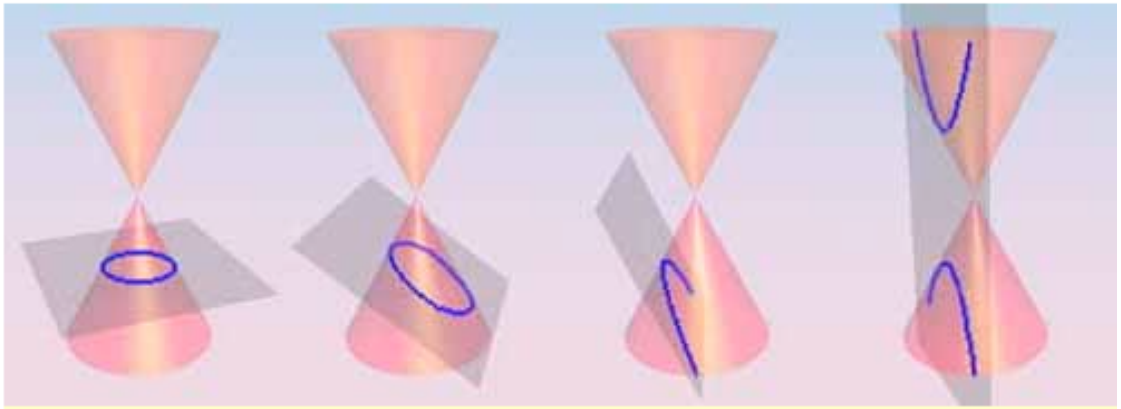
The simplest graphic **2D** representations are always conics or assembly of conics.
The usual space trajectory of a mobile in a field of gravity, is a conic.
The same for "the time trajectory" of a living system ENDO moving in its ECO.
Its projection on the plane (x, y) is a **CONIC**: $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$
x, y are the building actors, ENDO T is running in a unique way along the ellipse.

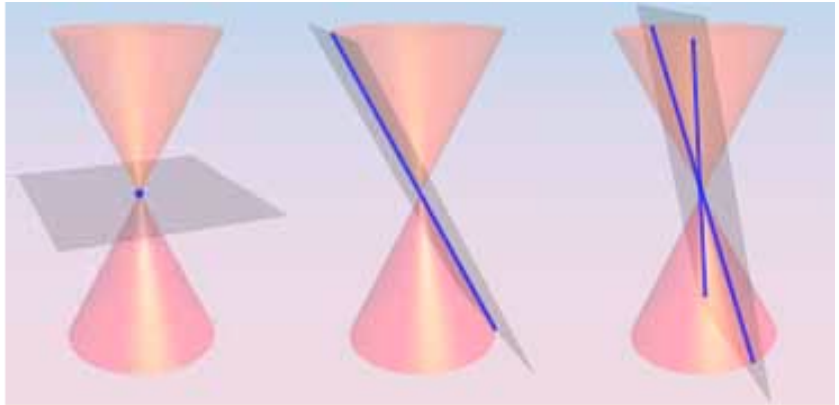
Circle $\mathbf{Xi^2 + Xj^2 = K^2}$ (in the plane of projection **Xi , Xj**)

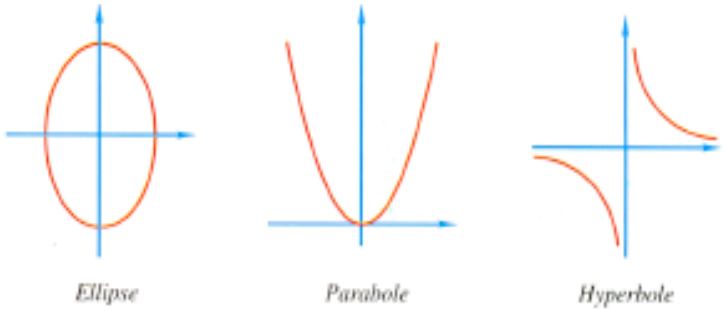
Parabola $\mathbf{Xi = k \cdot Xj^2 + K}$

Hyperbola $\mathbf{Xi \cdot Xj = K}$ the WHOLE is the product of the parts
(*welcome capacity*) x (*capacity to be welcomed*) = K,
$\mathbf{(X1+X2)\cdot(X1-X2) = X1^2 - X2^2 = K}$ **in 2D (n= 2)**
the WHOLE is the product of the sum and the difference of the parts

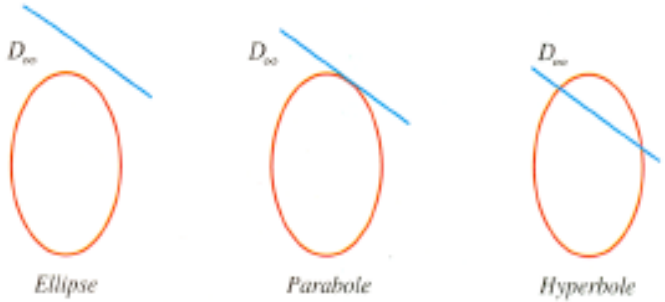
Ellipse $\mathbf{(X1+X2)\cdot(X2+X1) = X1^2+X2^2+2X1X2 = K}$ **in 2D (n= 2)**
the WHOLE is the square product of the sum of the parts.





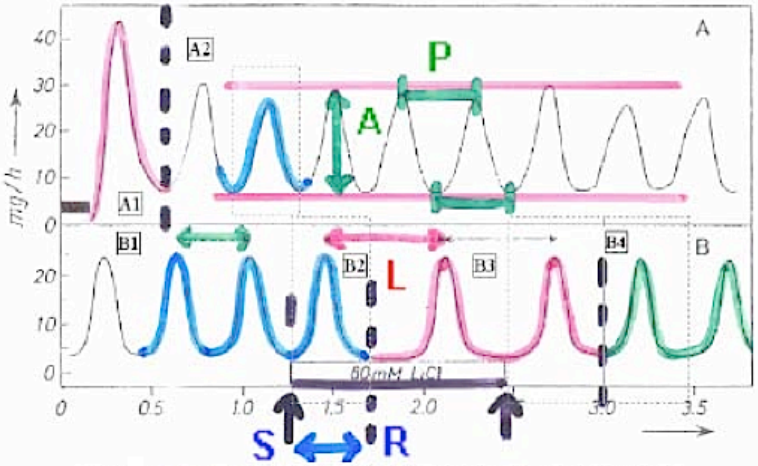


Dans le plan affine (sans la droite à l'infini)



Dans le plan projectif (avec la droite à l'infini D_∞)

Figure 1. Rhythm's changes in response to lithium salt stimulus.
Transpiration rhythm (**mg of water per hour**) of Avena plants, before and after a lithium treatment (80 mM LiCl),
Only after a **time delay**, that is a first **atypical cycle** A1 with a different amplitude (**in red**), a continuous **constant rhythm** A2 (**in blue**), **with invariants** (in green) **A** rhythm's **amplitude** and **P** rhythm's **period**, is running.
B1 A2-like rhythm (**A, P**), **in blue**, before the **stimulus S** (**the black arrows quote the start and the end of the stimulus**), **R** start of the **response** (in **red**, after the **black dotted line**), **SR latency**, **L time Lag**,
B2 no change in **A** & **P**, B3 no change in amplitude **A** but **P** doubled (**P=2xP**), B4 after an other latency, an other period (**P=1.5xP**) is running. (time in hours **h**).



When , and with what biological objective, would a drug be used ?
And what **time duration** is it imperative to wait before to observe an effect ?
What minimal time duration must a treatment last ?

graph of a **repetitive oscillation** X (1 actor)

sine wave or sinusoid

$$X(t) = A*\sin(\omega t+\phi)$$

A **amplitude**

What is the peak deviation of the function from its centre position?

ω **angular frequency**

How Many oscillations occur in a unit time interval ***t*** ?

ϕ **phase**

Where in its cycle, $t = 0$, the oscillation begins ?

parametrising of **2 antagonistic juxtaposed**

running oscillations X*1*, X*2* (2 actors)

$$X1(t) = a1 + A1*\cos(\omega_1 t+\phi_1)\ ,$$

$$X2(t) = a2 + A2*\sin(\omega_2 t+\phi_2)$$

ellipse if a **same EXO zeitgeber** is synchronising the 2 ENDO waves

$$\omega_1 = \omega_2$$

parametrising of **3 agoantagonistic juxtaposed and embedded**

running oscillations X*1*, X*2*, X*3* (3 actors)

Moebius strip

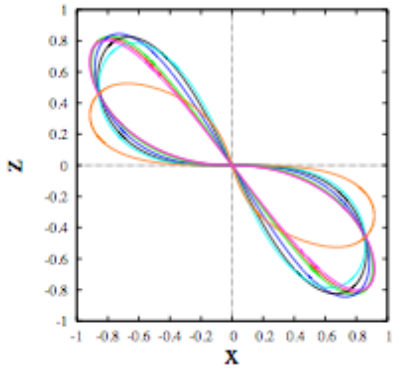
$$X1(t) = (a+ A*\cos(\omega t/2))*\cos(\omega t)\ ,$$

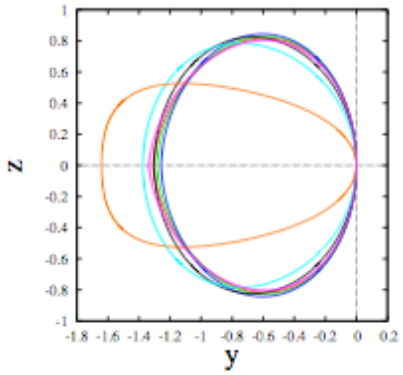
$$X2(t) = (a+ A*\cos(\omega t/2))*\sin(\omega t)\ ,$$

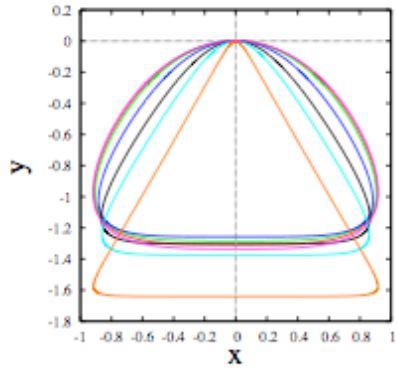
$$X3(t) = A*\sin(\omega t/2)$$

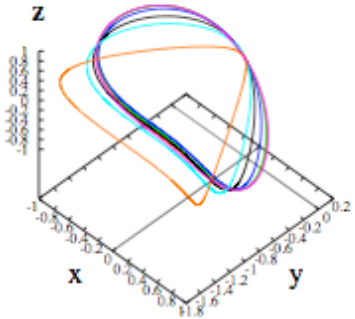
E.L. Starostin, G.H.M. van der Heijden

1. Möbius strip centrelines:









- graph of a **repetitive oscillation** **X** (1 actor) (Bricage, 2005c):

sine wave or sinusoid
$X(t) = A \cdot \sin(\omega t + \phi)$
time interval t

A amplitude
ω angular frequency
ϕ phase

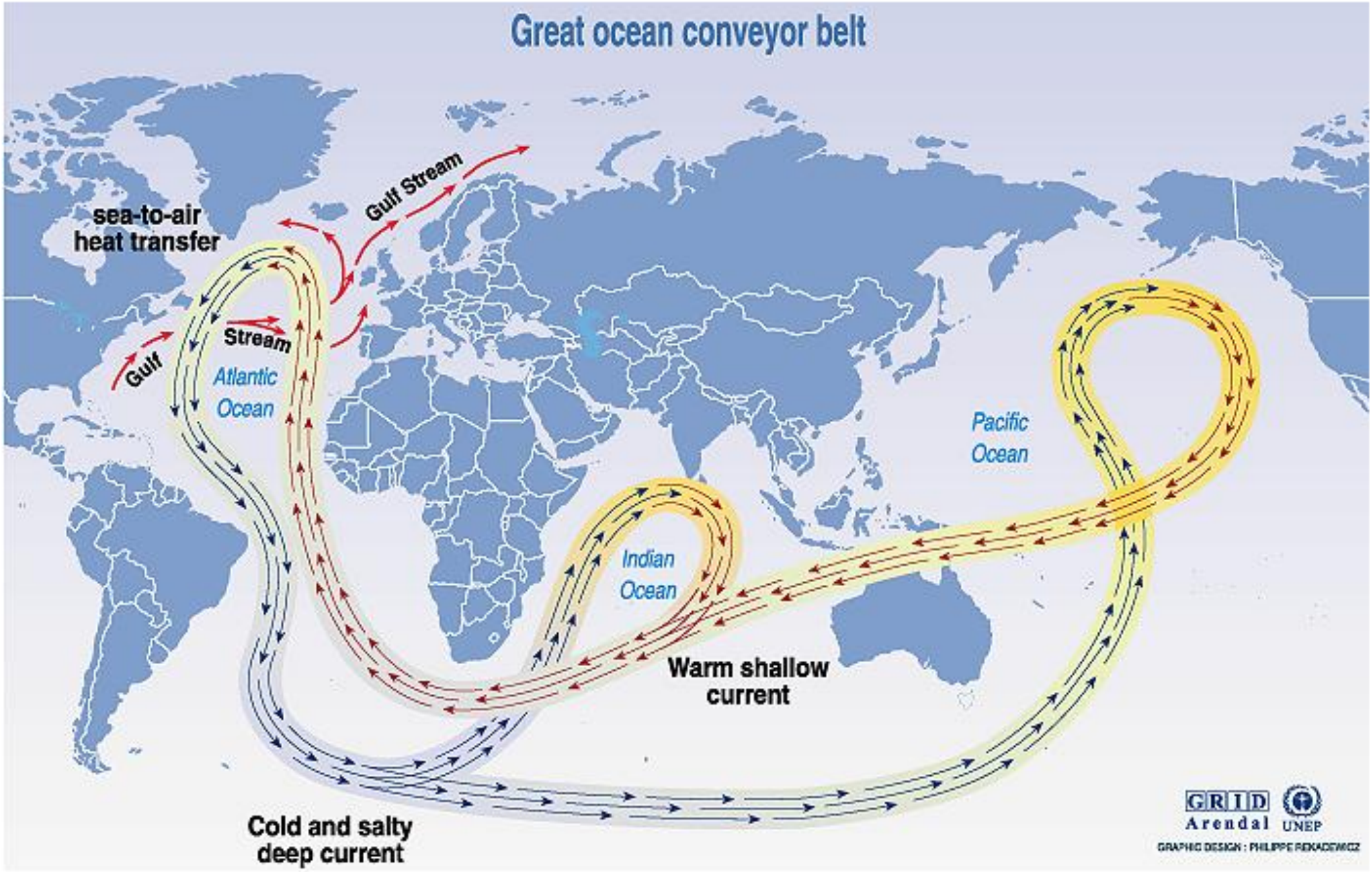
In the affine plan, with orthonormal axes,
the resultant of 2 oscillations the variations of which are antagonistics,
$X1(t) = a1 + A1 \cdot \cos(\omega_1 t + \varphi_1)$, $X2(t) = a2 + A2 \cdot \sin(\omega_2 t + \varphi_2)$
gives an ellipse as a periodic stable configuration.

if a **same EXO zeitgeber** is synchronising the 2 ENDO waves:
$\omega_1 = \omega_2$

- parametrising of **3 agoantagonistic juxtaposed and embedded** running oscillations X1, X2, X3 (3 actors):

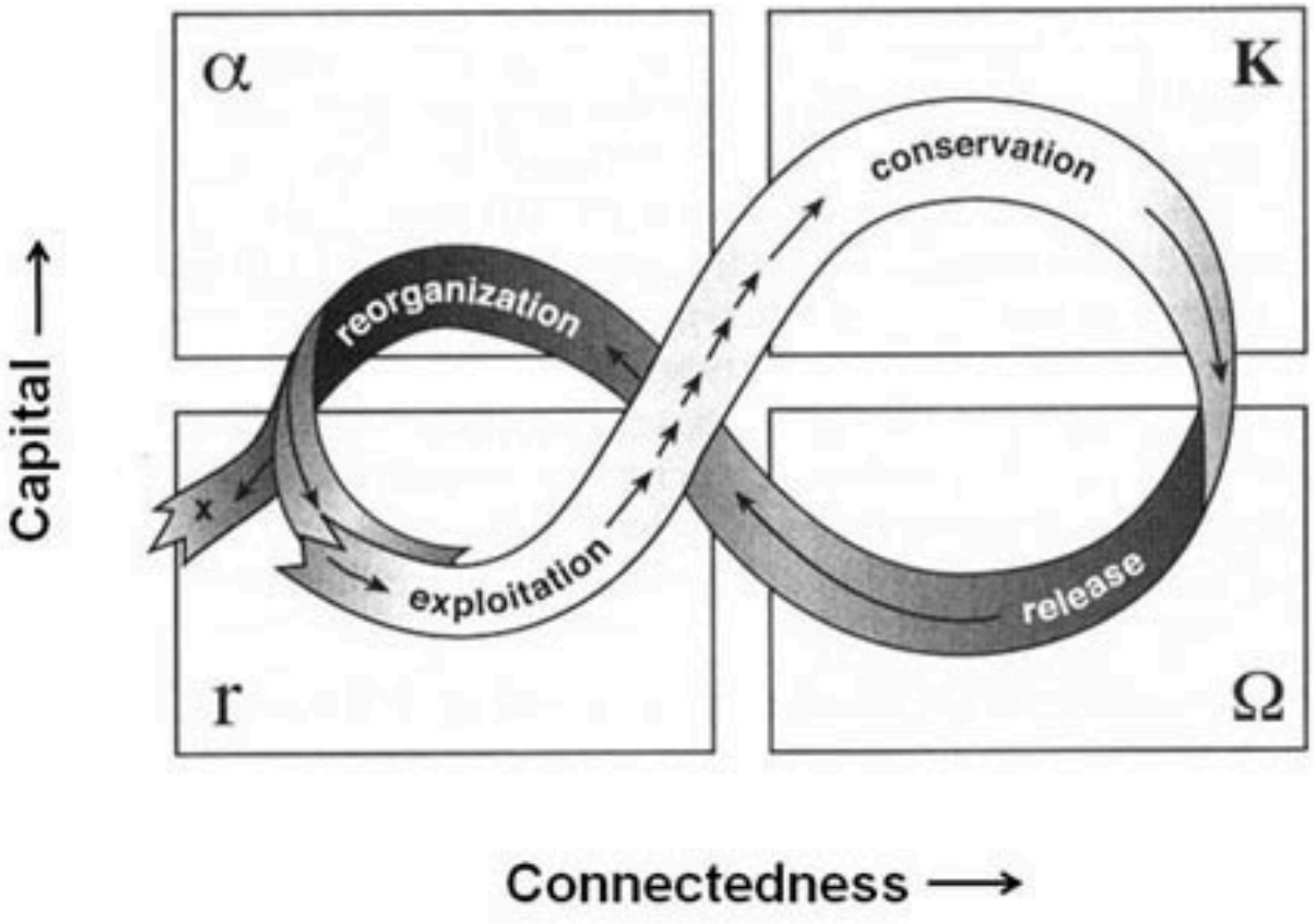
Moebius strip

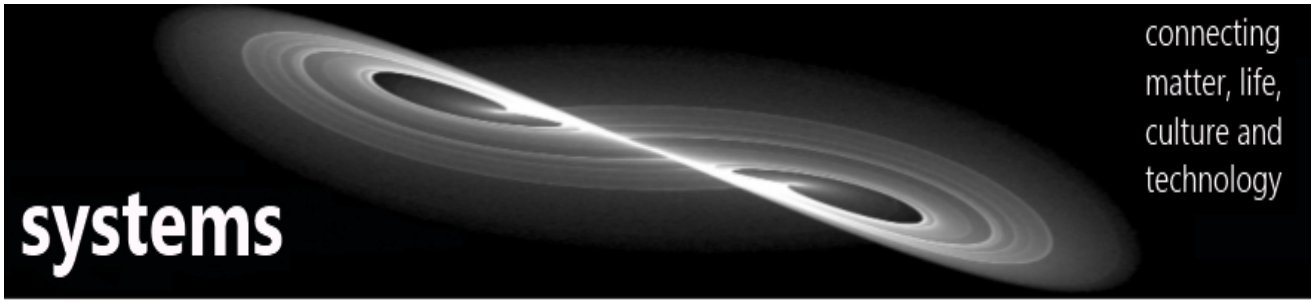
$X1(t) = (a + A \cdot \cos(\omega t/2)) \cdot \cos(\omega t)$,
$X2(t) = (a + A \cdot \cos(\omega t/2)) \cdot \sin(\omega t)$,
$X3(t) = A \cdot \sin(\omega t/2)$



Source: Broecker, 1991, in Climate change 1995, Impacts, adaptations and mitigation of climate change: scientific-technical analyses, contribution of working group 2 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge press university, 1996.

Fig. 2. Adaptive cycle showing the increase in capital accumulation (potential) and connectedness from the exploitation to conservation phases. From Panarchy: Understanding Transformations in Human and Natural Systems edited by Lance H. Gunderson and C.S. Holling. Copyright © 2002 Island Press. Reproduced by permission of Island Press, Washington, DC.





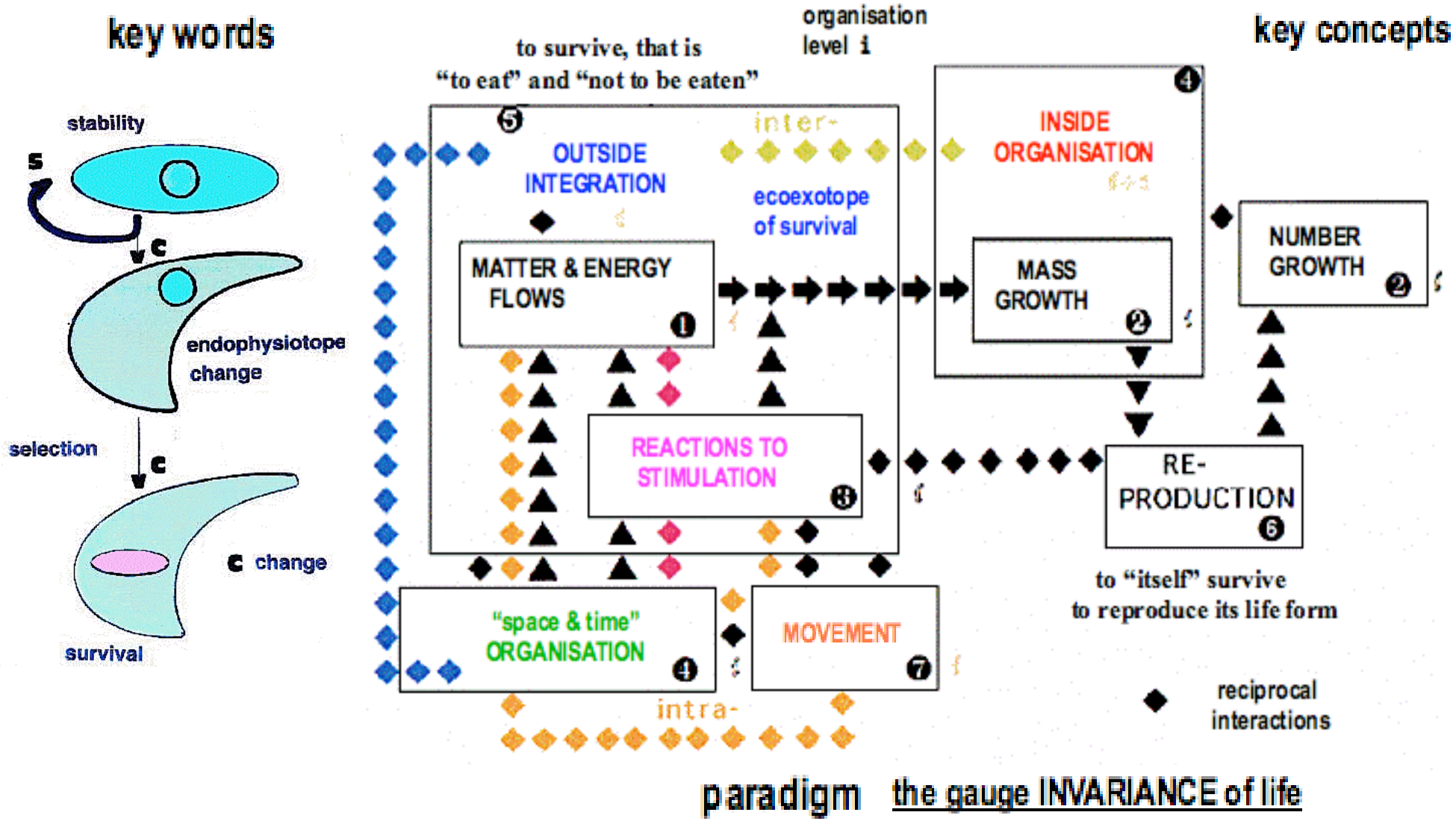
emcsr 2012

european meetings on cybernetics and systems research

UES-EUS Union Européenne de Systémique
European Union for Systemics

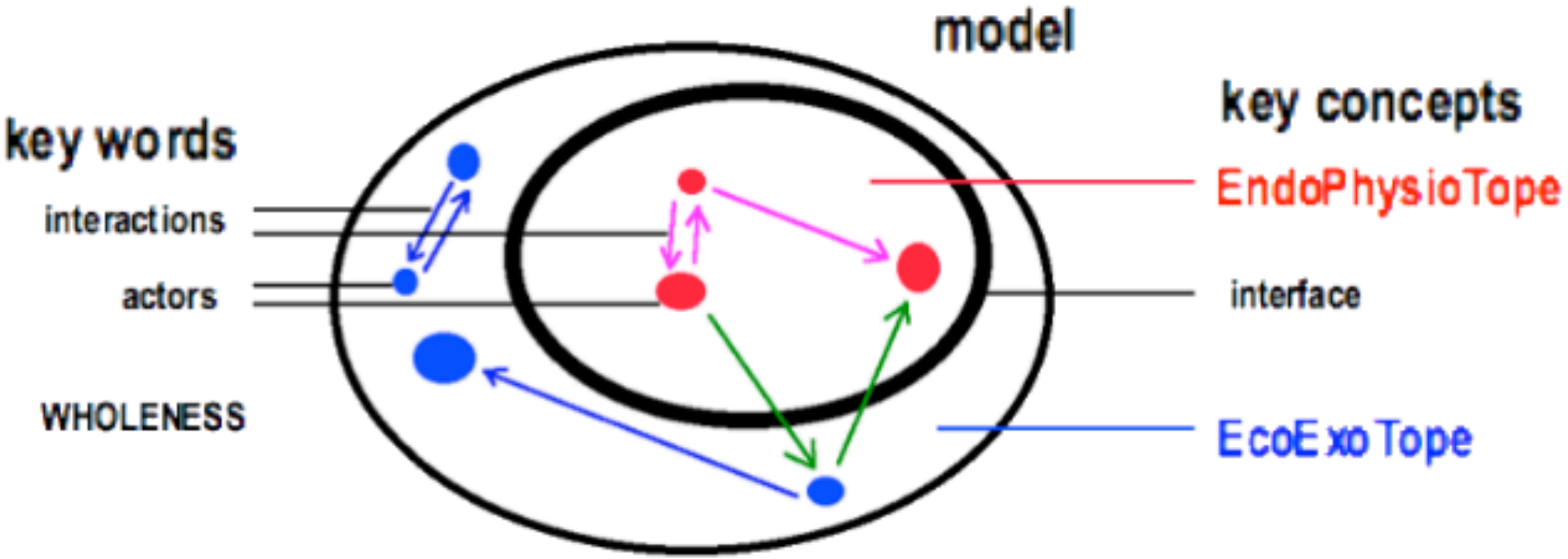
ISSS July 18-23, 2010, Wilfrid Laurier University, Waterloo, ON, Canada. Balancing Individualism and Collectivism Chair: Janet McIntyre

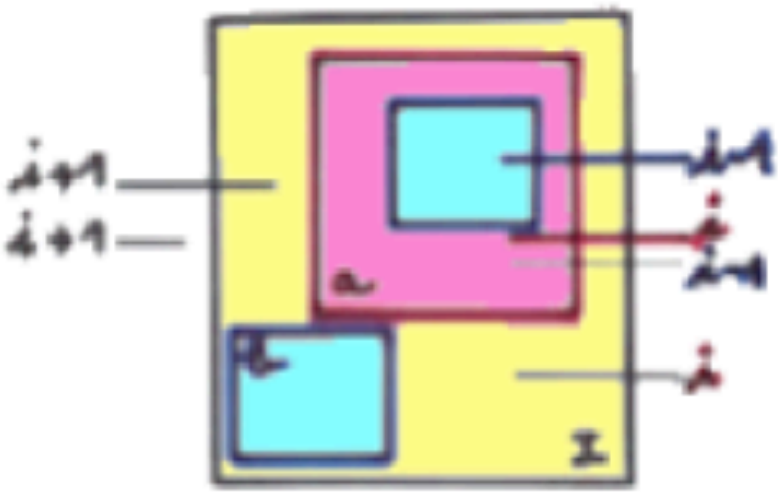
Associations for the Reciprocal and Mutual Sharing of Advantages and DisAdvantages. pierre.bricage@univ-pau.fr



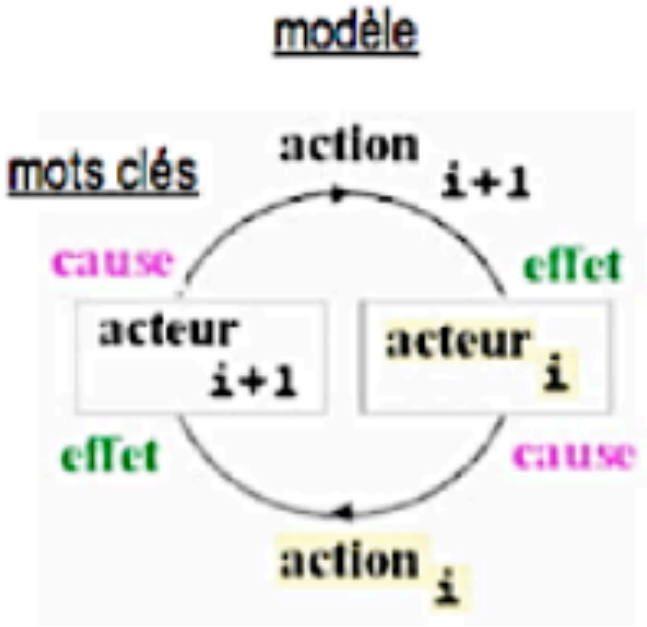
The way, to be resilient and self-sustainable, the living systems run through. Pierre BRICAGE

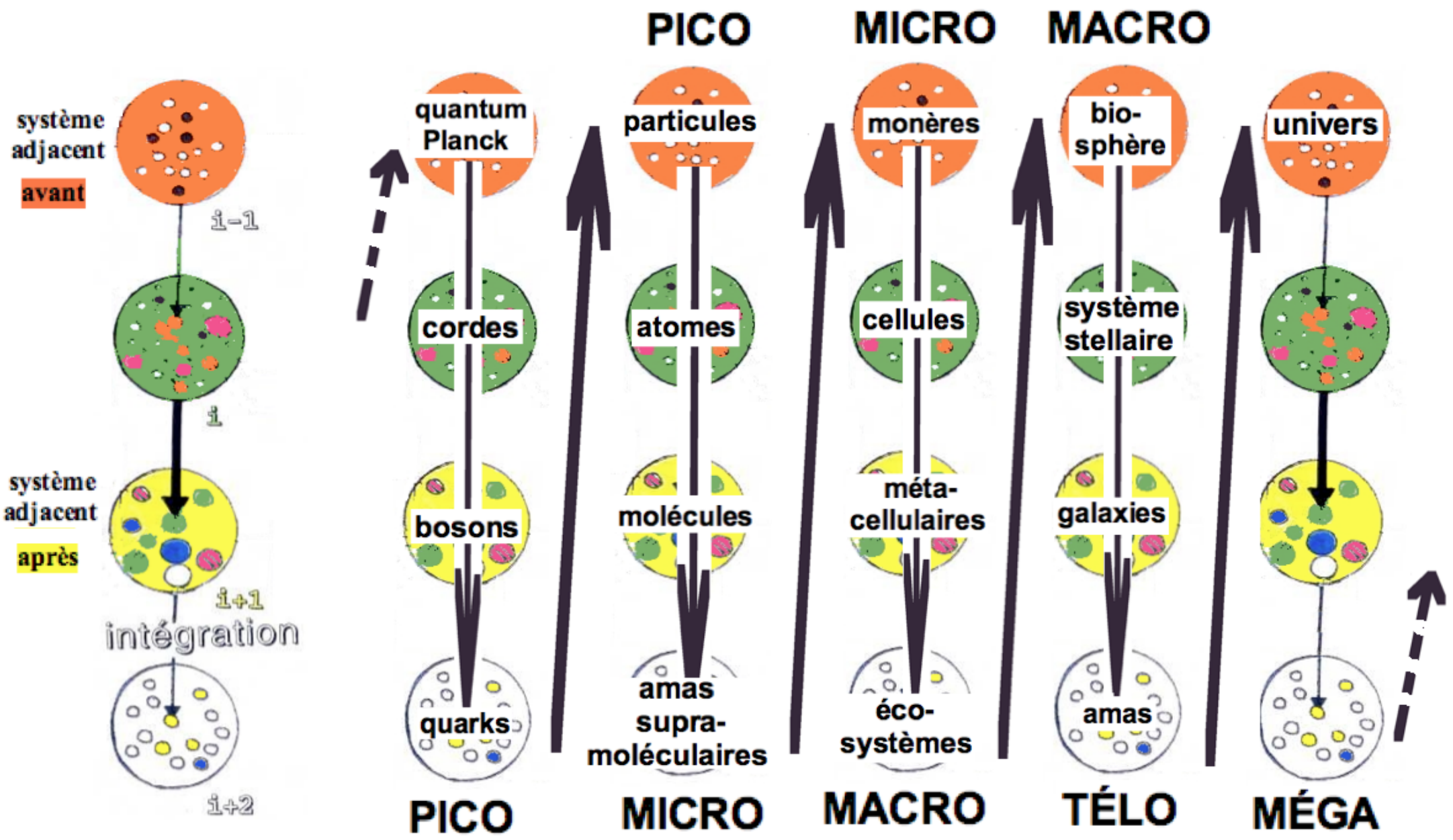

AVOIDING
ATTACK
Energy
for
animal life
Embryonic
Stem Cells
COMPARATIVE
COGNITION
Animal
Locomotion
The
Origin &
Evolution
of Mammals
Sex, Size & Gender Roles
intra-

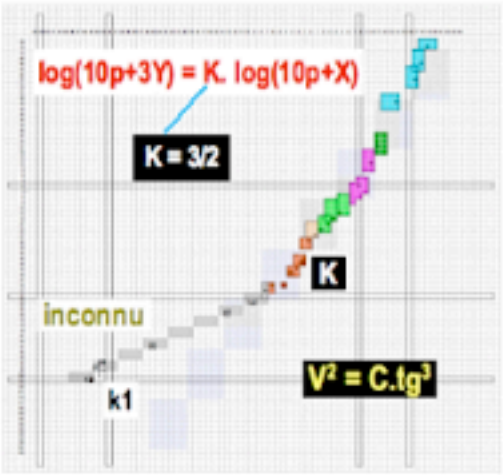


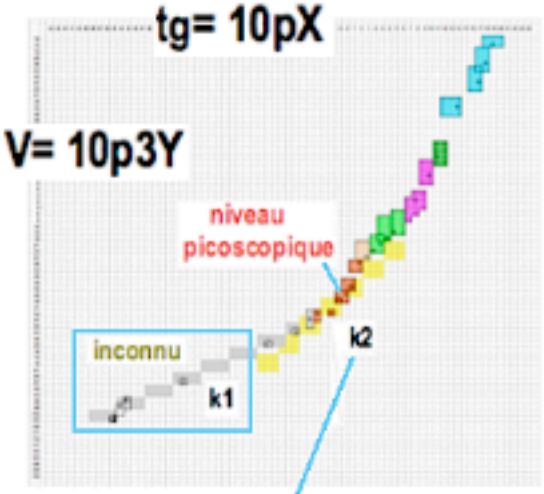


System-Of-Systems




PICO
MICRO
MACRO
système adjacent avant
i-1
i
système adjacent après
i+1
intégration
i+2
quantum Planck
cordes
bosons
quarks
particules
atomes
molécules
amas supra-moléculaires
monères
cellules
méta-cellulaires
éco-systèmes
bio-sphère
système stellaire
galaxies
amas
univers
PICO
MICRO
MACRO
TÉLO
MÉGA





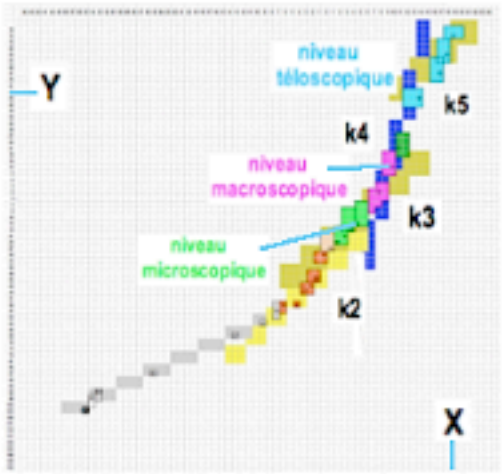
Vo et to "définissent" l'échelle de Planck

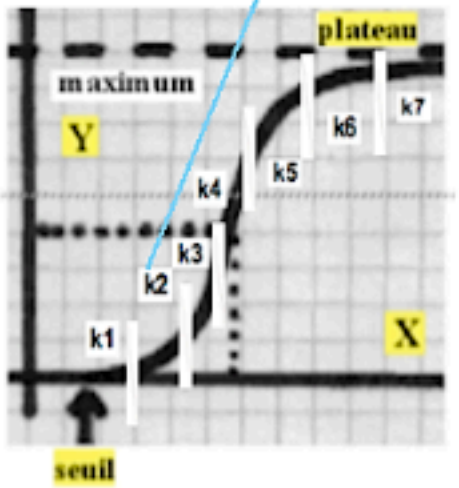
3/2

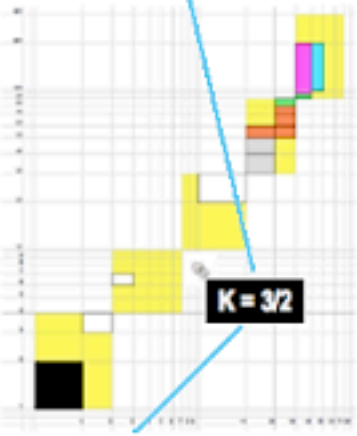
3/2

2,25

V = k. Vo . (tg-to)

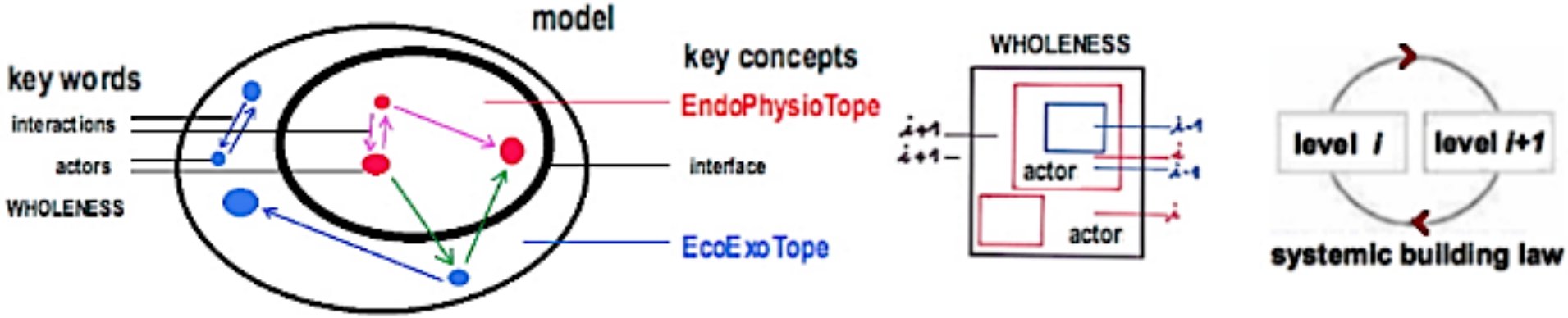




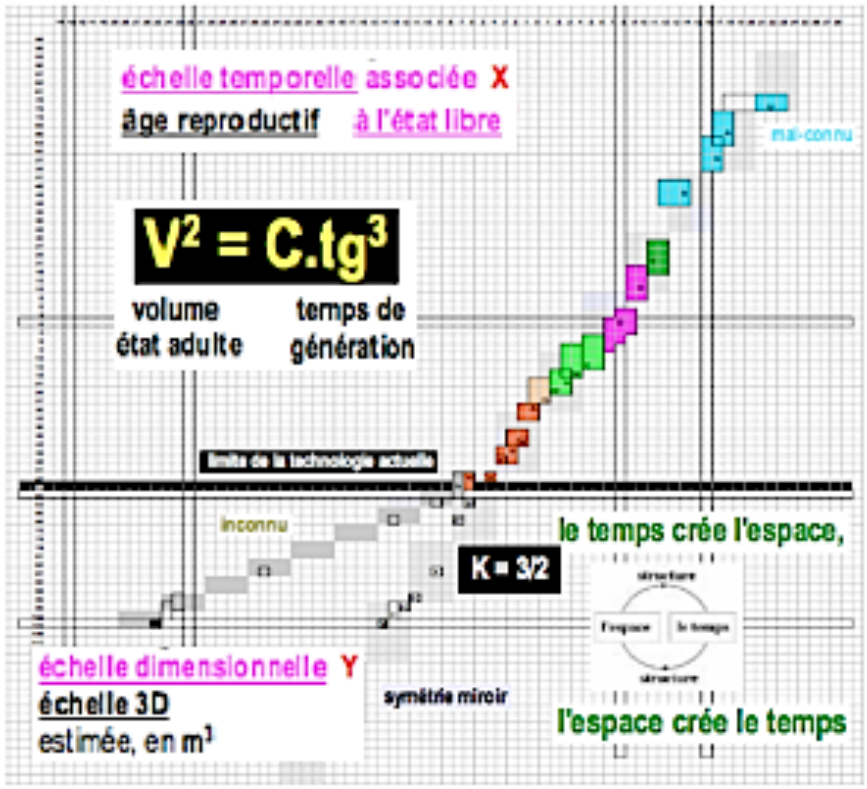


log(log(V)) = K". log(log(tg))

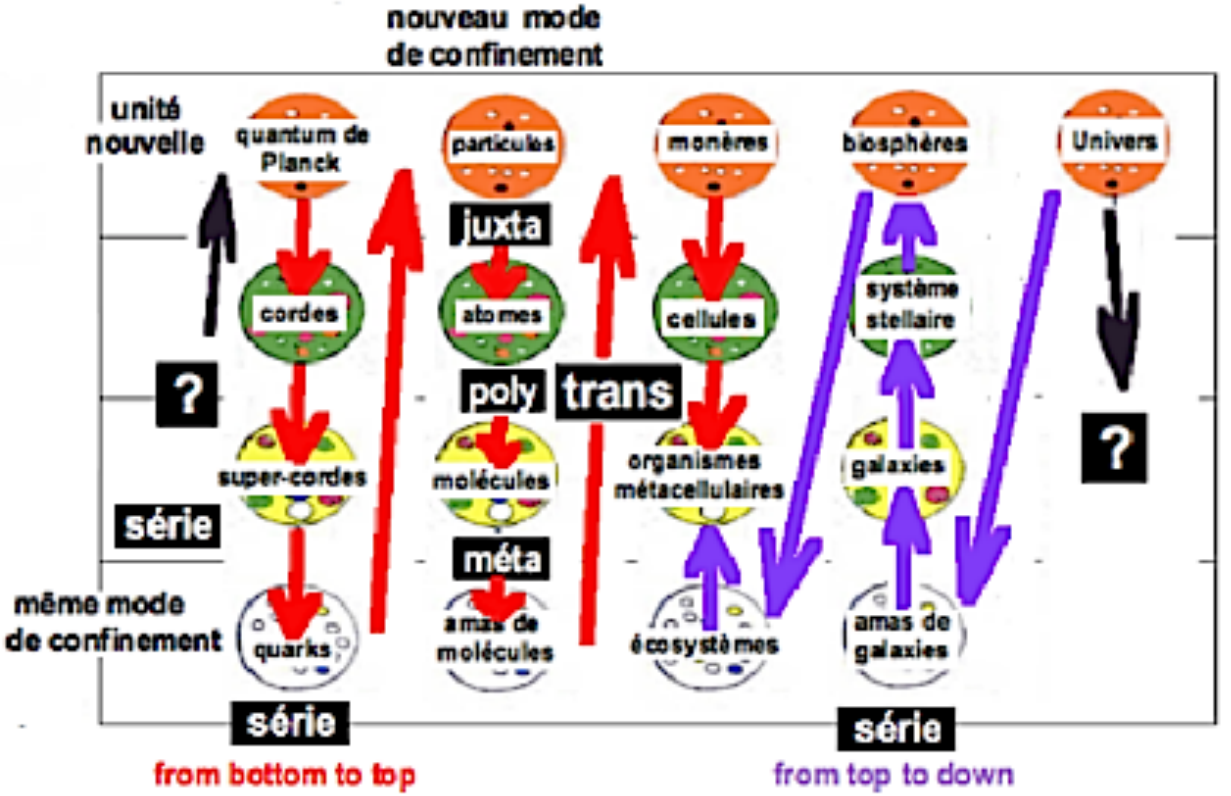
Figure 3. Les "plans" d'organisation de l'espace-temps-action du vivant (Bricage, 2009)
3a. The invariant qualitative law of growth [11].
3b. Living beings are systems of systems [11].

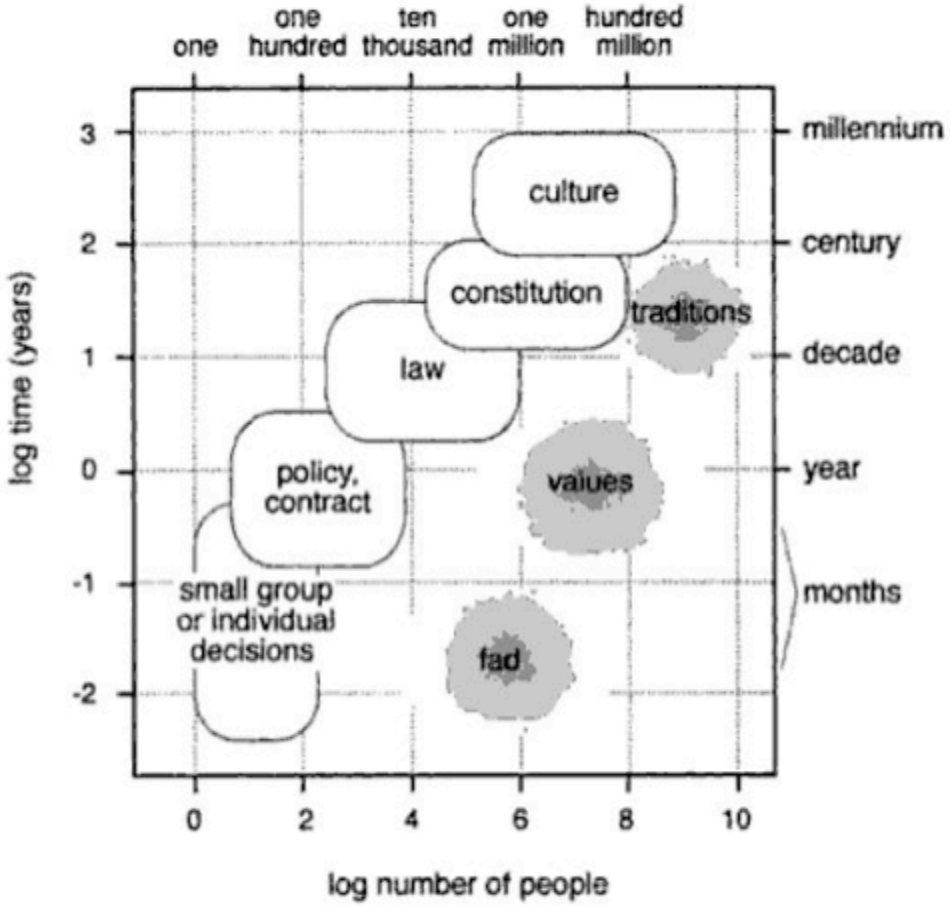


3c. The global quantitative law of growth of the Whole is not depending on the local time & space scaling.



3d. The periodic table of the living systems' steps.

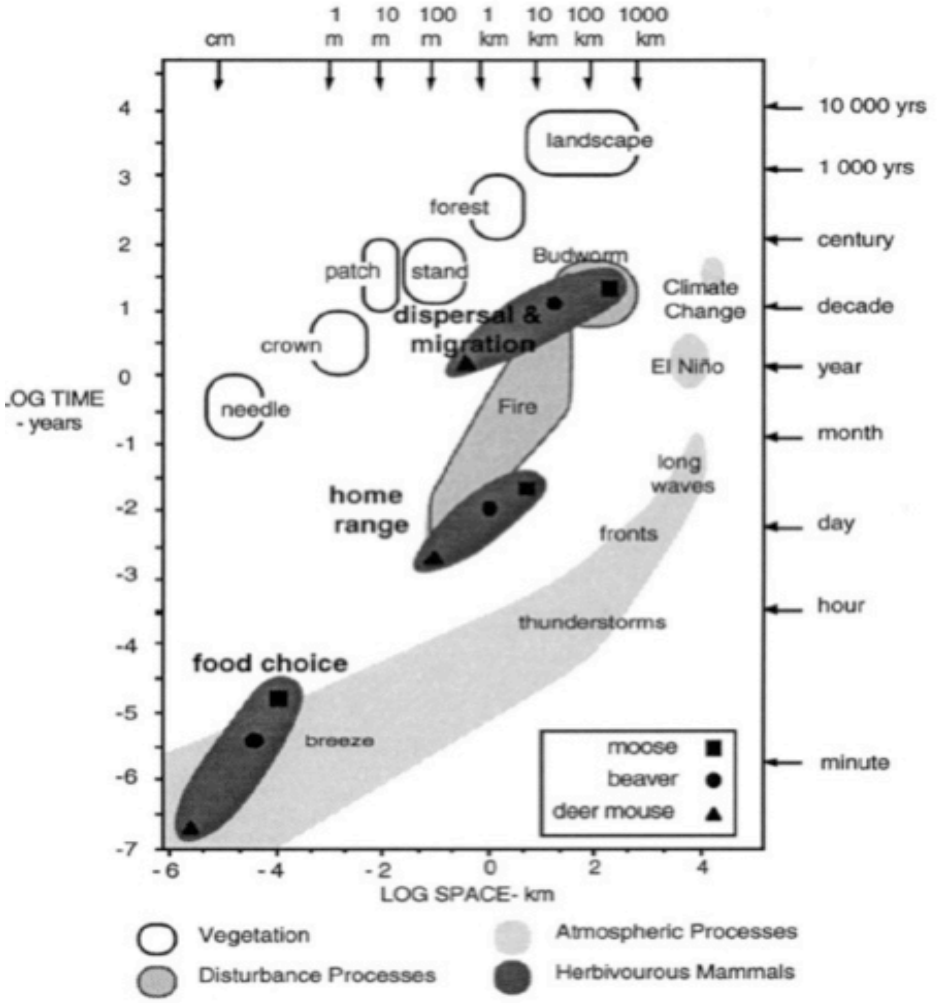




Institutional hierarchy of rule sets. In contrast to ecological hierarchies, this one is structured along dimensions of the number of people involved in rule set and approximate turnover time.

V_A 3D size
t_g generation time

$$V_A^2 = C \cdot t_g^3$$



ime and space scales of the boreal forest and their relationship to some of the processes that structure the forest. These processes include insect outbreaks, fire, atmospheric processes, and the rapid carbon dioxide increase in modern times. Contagious mesoscale disturbance processes provide a linkage between macroscale atmospheric processes and microscale landscape processes. Scales at which deer mouse, beaver, and moose choose food items, occupy a home range, and disperse to locate suitable home ranges vary with their body size.

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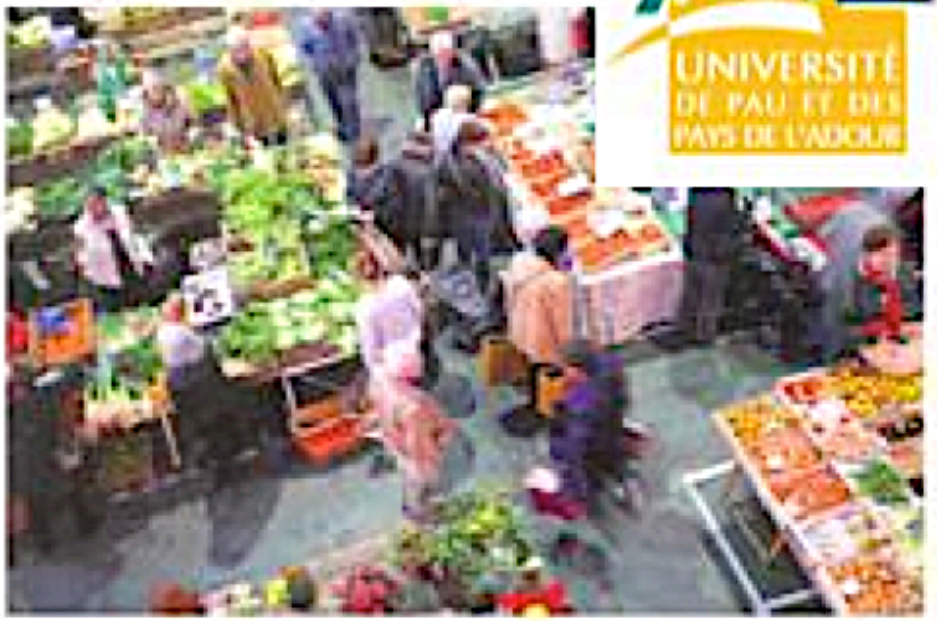

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