BIORNAMETICS

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Leoben 2010 workshop on the prospects of BIONICS for functional materials science and engineering

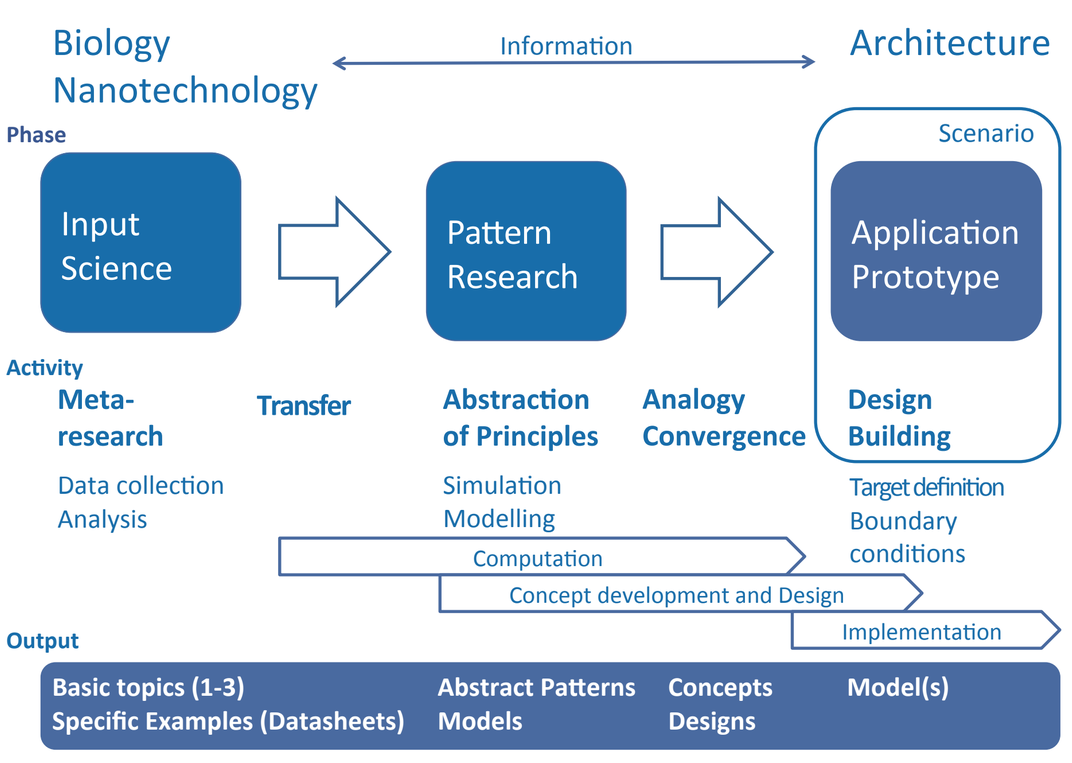
BIORNAMETICS - Architecture Defined By Natural Patterns explores a new methodology to interconnect scientific evidence with creative design in the field of architecture. It takes on the history of one of the composed parts of this word "ornament" referring to Adolf Loos and extends into another: "biomimetics [bionik]". The "New Ornament" as an emerging contemporary design practise based on digital techniques that assembles from controlling programs and codes, less concerned with serial rationality but with algorithmic, digital operations and connecting the processes of planning and production.

Biomimetics [Bionik] is the strategic search for nature's solutions in order to gain innovation. Intrinsic to "design" in nature are efficiency and intelligence. The hypothesis underlying this strategy is that living nature has evolved in a process of continuing adaptation to a complex changing environment, and that the exploitation of highly optimised solutions is likely to deliver innovations, that provide more intelligence and better efficiency than our standard methods.

Role models from nature, static and dynamic patterns (e.g. growth principles, movement patterns, adaptation and differentiation as key for emergence of patterns etc.) will be investigated and the findings applied to design strategies. The emergence of patterns in nature at all scales of existence of organisms as one of the most important signs of life – order – is not arbitrary, but highly inter-connected with boundary conditions, functional requirements, systems requirements, material and structure.

The main objectives are the exploration of aesthetic and functional interpretation for a new architecture together with the utilisation of new manufacturing technologies, and elaboration of the biomimetic design method and the "New Ornament".

workflow



role models

selected models for three main topics

01 COLEOPTERA, Jewel Beetle
structural colour, iridescence

02 SARRACENIA FLAVA, Pitcher Plant
growth shape, folding mechanism, surface

03 MORPHO PELEIDES, Butterfly
morphogenesis, iridescence, structural colour

04 VICTORIA AMAZONICA, Giant Water Lily
lotus surface, deployment, growth, floating structure

05 HALIOTIS, Abalone Shell
growth, self healing, nacre, iridescence, structural colour

06 PAVO CRISTATUS,Peacock
fast deployment, iridescence, structural colour

07 ASTERACEAE, Thistle
morphology, shapes, development stages

08 EICHHORNIA CRASSIPES,Water Hyacinth
geometry, function, lotus surface, floating structure

09 MIMOSA PUDICA, Mimosis
deployment, motion

10 BETULACEAE, Hornbeam
deployable, folding

11 IPOMEA ALBA, Morning Glory
deployable, folding, vine

12 TRIDACTA GIGAS BIVALVE, Giant clam
rim growth, edge growth, self healing, nacre

13 ECHINOIDEA, Sea Urchin
shape, growth, variable stiffness

14 ARABIDOPSIS EPIDERMIS
communication, info transfer

15 DIODONTIDAE, Puffer Fish
extensivity, soft to rigid, fast deployment

16 HYLIDAE, Frog
extensivity, fast deployment

17 DASYPODIDAE, Armadillo
deployment, shape change

18 FICUS BENGHALENSIS, Banyan tree
roots, desalination, structure

19 VINEA, Vine
vine, tendrils, leaf patterns

20 ENTADA GIGAS, Monkey ladder
vine, roots, desalination, structure

21 PINACEAE, Pine Cone
passive mechanism, fibre structure, deployment

22 RHIZOPHORACEAE, Mangroves
roots, desalination, structure

23 SPIDER SILK
length adaptation, pattern

24 LEAF SHAPES
thermal & mechanical adaptation, leaf growth, deployment

25 SWARM BEHAVIOUR
communication, adaptive structure control, swarm behaviour

26 CELL WALLS
fibre structure, growth, structural change

27 ARISTOLOCHIA, Pelican Flower
vine, structural change, growth of complex shape

28 SUCCULENTS, Living Stones
volume/surface ratio change

29 FORMICIDAE, Ants
communication, traffic organisation

30 FISH FIN
structural adaptation

31 INSECT LOCOMOTION
fast muscles, stability, robustness, failure tolerance

32 SELF HEALING
adaptation, growth, self healing

33 BONE
adaptive material, lightweight structural system

NANOSTRUCTURE MATERIAL SURFACES

SHAPE, GROWTH DEPLOYMENT

ADAPTATION REORGANISATION

role model concept diagrams

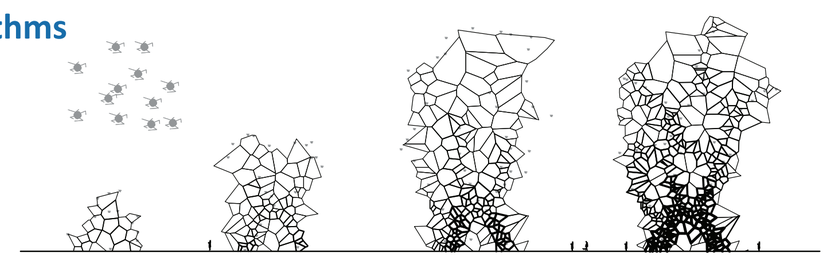
exemplary drawings

pitcherplant attraction pattern

mimosa pudica fast deployment

ficus benghalensis parasitic takeover

building agents growth algorithms



biornametics

architecture defined by natural patterns

Barbara Imhof — space design, Liquifer
Petra Gruber — biomimetics in architecture, transarch
Waltraut Hoheneder — architecture, Liquifer
Ille Gebeshuber — physics, bio-nanotribology, Malaysia
George Jeronimidis — biomimetics, Reading UK
Clemens Grünberger — physics, information technology

Hisham Abdel-Aal — physics, nanotribology, Paris
Natasha Chayaamor — design, second university of Naples

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