Lernen von der Natur : Naturmuseum Senckenberg, JSPS Club Germany, 20.04.2018

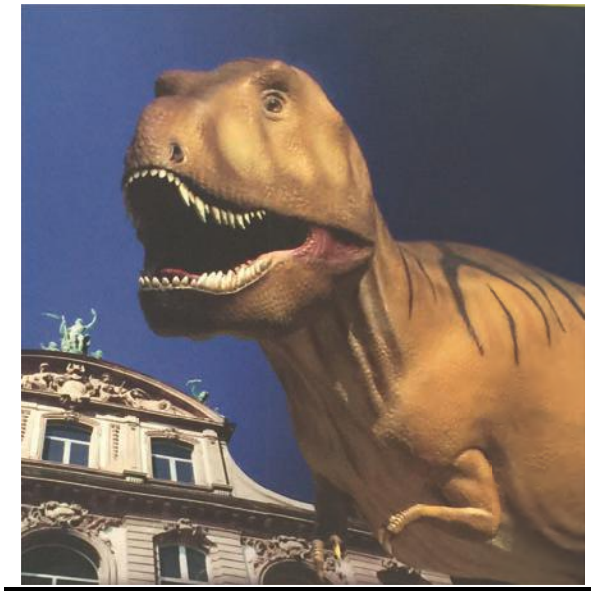
Paradigm Shift Based on Biodiversity to Innovation for Sustainability

Biomimetics is Innovative Reverse Engineering based on Biodiversity – Survival in Anthropocene –

Prof. Dr. Masatsugu Shimomura

Chitose Institute of Science and Technology
Biomimetics Network Japan
ISO TC 266 Biomimetics
Prof.emerit. Hokkaido University, Tohoku University

Biomimetics:
Lernen von der Natur
Mining the Past for the Future
温故知新



Extinction or Survival?

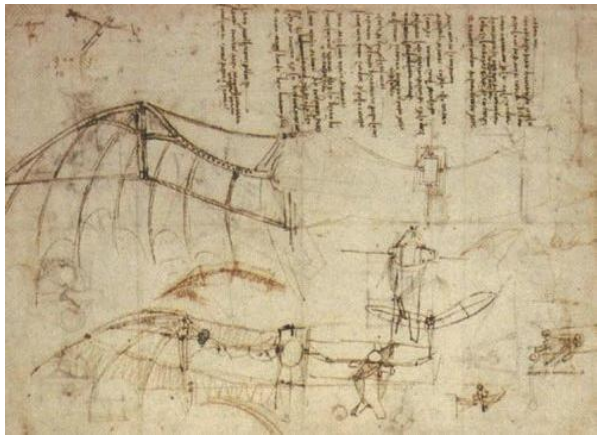
Introductory Talk on Biomimetics

Brief History of Biomimetics

Modern Significance of Biomimetics

Role of Museum on Biomimetics (Biomimetics Informatics and Trans-science)

Biomimetics in Dairy Life



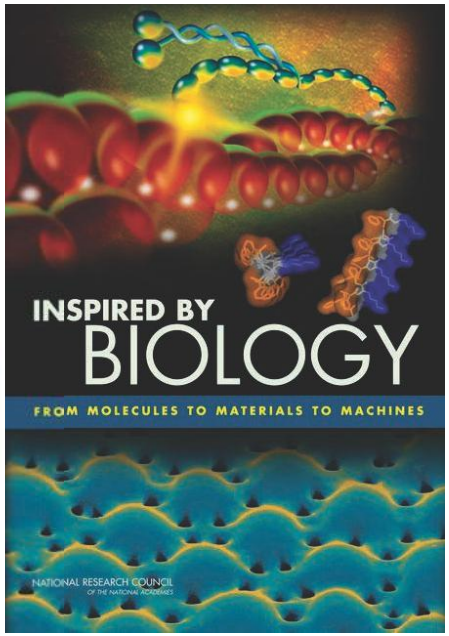
Leonardo da Vinci

Bio-inspitrtion

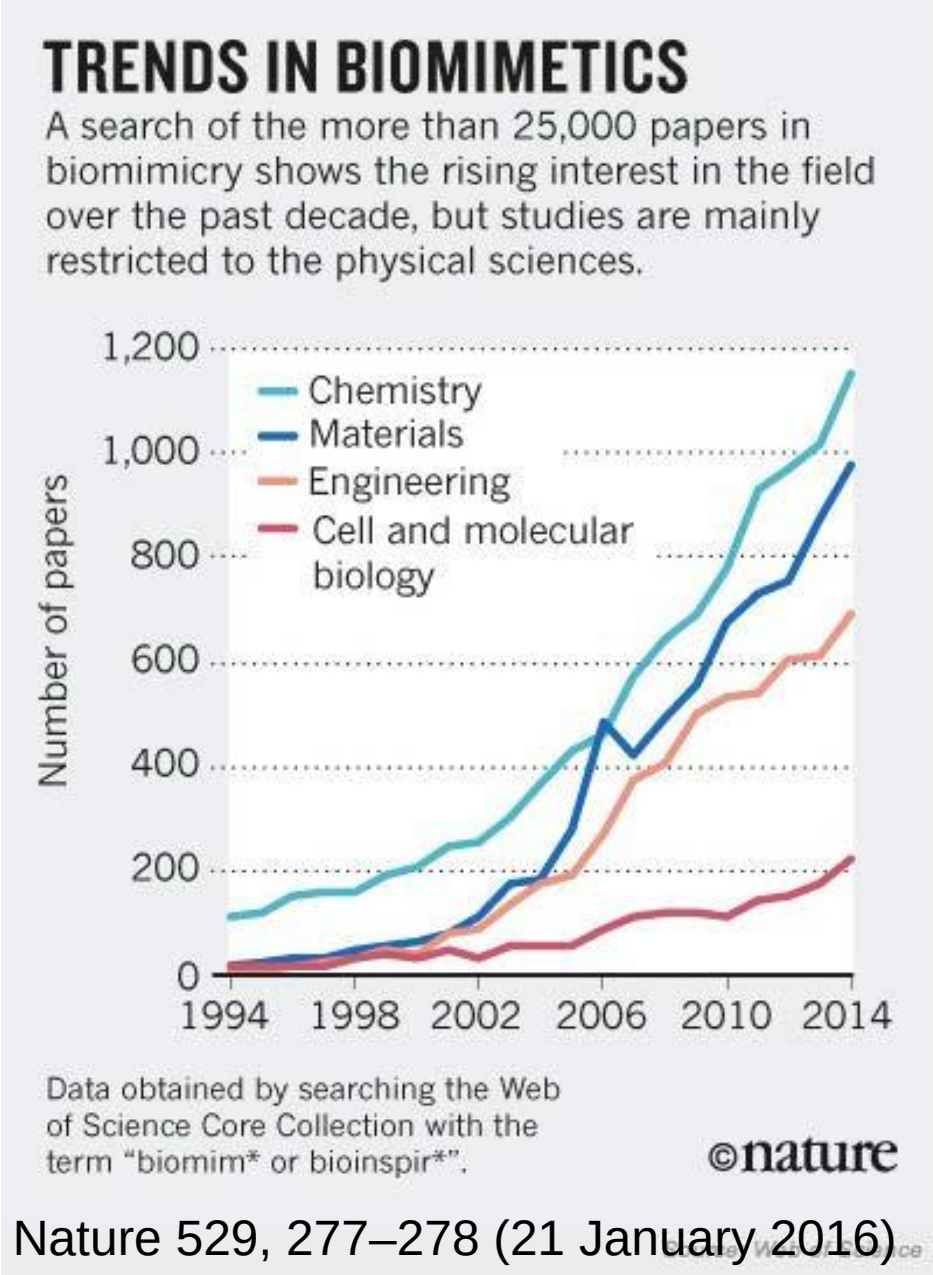
Growing Global Interest in Biomimetics

Increasing number of publications and patents

Inspired by Biology: From Molecules to Materials to Machines



NATIONAL RESEARCH COUNCIL OF THE NATIONAL ACADEMIES



Nature 529, 277–278 (21 January 2016)

Growing Global Interest in Biomimetics

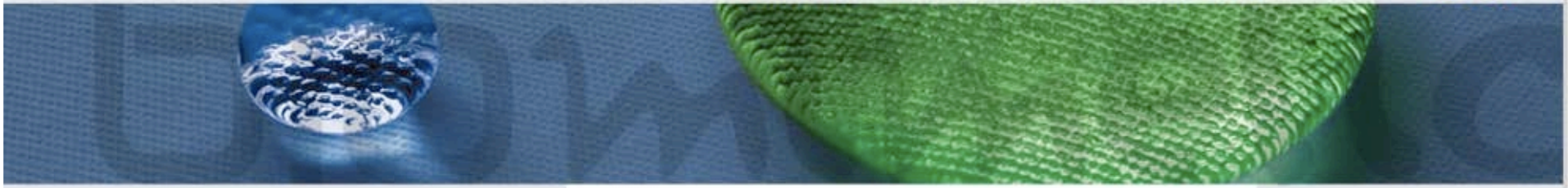
International industrial convention BIOKON

engineering powered by nature

biomimetics

International Industrial Convention on Biomimetics
on March 16th/17th 2011 · MARITIM Hotel Berlin

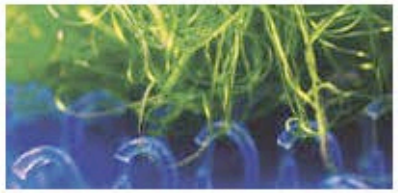
CONTACT IMPRINT SITEMAP SEARCH



INVITATION
PROGRAMME
CONGRESS VENUE
CONGRESS ORGANIZER
TERMS AND CONDITIONS
BERLIN-INFORMATION

ATTENTION: NEW DATE
biomimetics
MARCH 2011
www.biomimetics-convention.com

Invitation



Biomimetics unifies biology and technology. The basic principle of biomimetics is learning from nature. However, nature doesn't deliver blueprints. The idea is to understand the principles behind nature´s constructions. Scientists and engineers are conducting interdisciplinary work in order to implement innovative ideas and developments technically and introduce them to the market.

Nature is indeed the greatest innovator of all time! It has been developing, trying out and optimising solutions to problems for around 3.8 billion years. Biomimetics plays a key role when it is a question of making the solutions successfully carried out in nature´s test laboratory useful for our knowledge society. It is not just a melting pot of widely different biological and engineering disciplines but also a field where basic research and technical applications are interlinked at an early stage.

BIOKON international | The Biommetics Association

BIOKON
Bionik-Kompetenz-Netz

BIONA

Bundesministerium für Bildung und Forschung

Biomimetics Network Japan

Growing Global Interest in Biomimetics

International industrial convention CEEBION

CEEBIOS Centre Européen d'Excellence en Biomimétisme de Senlis

AVEC UNE THEMATIQUE À L'HONNEUR EN 2018:
Habitat, Villes & Territoires de demain
Face aux grands enjeux, nos espaces de vie(s) se réinventent.
Comment intégrer **+ de vie dans nos vies** ?

biomim expo

Le biomimétisme a désormais son grand rendez-vous annuel

QUAND LA NATURE INSPIRE L'INNOVATION

Biomim'expo®, le salon/rassemblement des acteurs et parties prenantes du biomimétisme et des innovations bio-inspirées

CEEBIOS · bpifrance · MUSÉUM · Senlis · Caisse des Dépôts · matikem · uptex · IAR · IFP Energies nouvelles · EDF · EIFFAGE · L'ORÉAL · LVMH · RTE · DASSAULT SYSTEMES · CORNING · LAB · GROUPE RENAULT · Rabot Dutilleul · iDéel · SARETEC · INSPIRE · Lunt Foundation · FONDATION FRANÇOIS SOMMER · Interface · Biomimicry Europa · orée · DARWIN · rfi · UP magazine · PLANETE +

Growing Global Interest in Biomimetics

International industrial convention Biomimetics Network Japan

Nanotech 2017
Tokyo

Français | Русский Members area

Standards About us Standards Development News Store Search ISO

Technical committees Deliverables Who develops standards Why get involved? Resource area

Standards Development › Technical committees › ISO/TC 266

Growing Global Interest in Biomimetics
International Standardization

ISO/TC 266 Biomimetics

About | Contact details | Structure | Liaisons | Meetings | Tools

Secretariat: DIN
Secretary: Dr.-Ing. Michael Schmitt
Chairperson: Mr Olaf Rehme until end 2018
ISO Technical Programme Manager: Dr Mary Lou Pelaprat
ISO Editorial Programme Manager: M. Vincenzo Bazzucchi
Creation date: 2011

Quick links

Work programme
(drafts and new work items of ISO/TC 266)

Business plans

Working area on ISOTC and Public information folder

Under strong leadership of VDI (Verein Deutscher Ingenieure, The Association of German Engineers), three standards came into effect.

Standard and/or project	
✔ ISO 18458:2015	Biomimetics -- Terminology, concepts and methodology
✔ ISO 18459:2015	Biomimetics -- Biomimetic structural optimization

✎ ISO/DIS 18457
Biomimetics -- Biomimetic materials, structures and components

Subcommittee/Working Group	Title
ISO/TC 266/TG 1	'Transparency and Stakeholder communication' *The convener can be reached through the secretariat*
ISO/TC 266/WG 2	Structures and materials *The convener can be reached through the secretariat*
ISO/TC 266/WG 4	Knowledge infrastructure of biomimetics *The convener can be reached through the secretariat*

2012 Berlin
2013 Paris, Prague
2014 Liège
2015 Kyoto
2016 Berlin
2017 Berlin

Growing Global Interest in Biomimetics for Finance and Economy

BIOINSPIRED INNOVATION AND FINANCE

Since the first Summit in 2012 the SHIFT Zurich emerged as the leading platform for impact investors, entrepreneurs and innovators from around the world, passionate to implement resilient strategies and solutions informed by nature.

Experience the SHIFT Zurich and its unmatched atmosphere, networking and business opportunities – register here and benef from the Early Bird discount.

YO DEL

TERRAPIN BRIGHT GREEN

BIOKON BIONIK KOMPETENZ NETZ

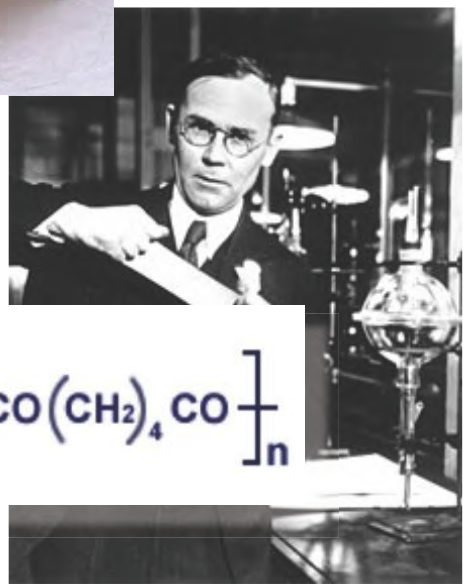
WYSS INSTITUTE

zooh! ZÜRICH

8x	27%	425Billion
PUBLISHED PAPERS INCREASE (2000 - 2013): 8 TIMES MORE	PATENTS ISSUANCE INCREASE (2012-2013): 27%	BY 2030 BIOINSPIRATION IS PROJECTED TO GENERATE: USD 425B OF US. GDP / USD 1.6T OF GLOBAL GDP

GDP
4250億ドル アメリカ
1.6兆ドル　世界
1.6 Trillion, whole world

History of Biomimetics

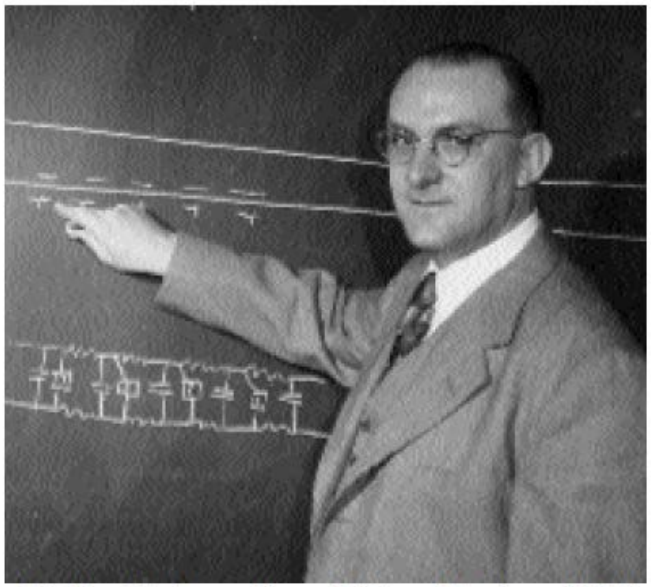


$$\left[\mathrm{NH(CH_2)_6NH-CO(CH_2)_4CO}\right]_n$$

Wallace Carothers @ DuPont

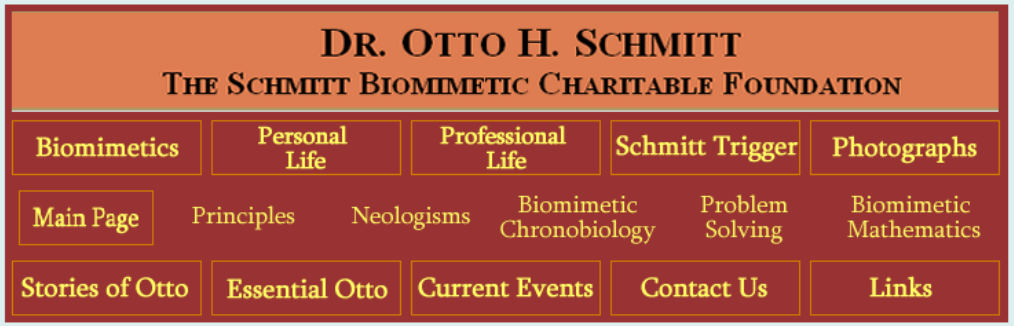
Nylon

History of Biomimetics



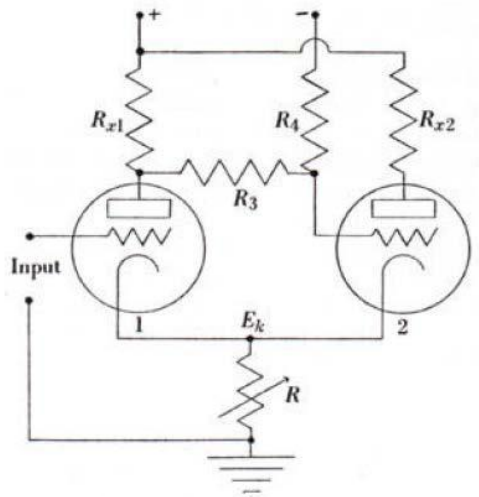
At the University of Stockholm, 1951

Otto Schmitt
made a term, *"Biomimetics"*



Biomimetics Defined

Biomimetics is "The mimicry of life", or biology. Otto was fascinated by the answers the natural world provided to problems. He saw it's potential for being mimicked, in the form of machines and processes, to help mankind.

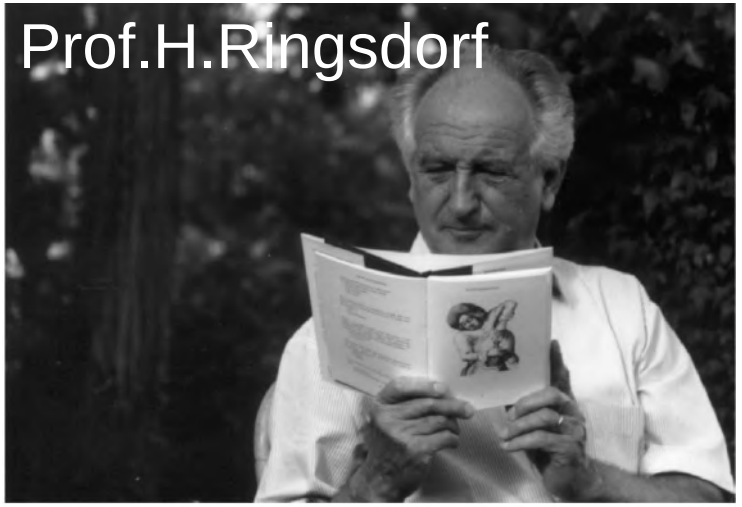


Schmitt Trigger

http://www.otto-schmitt.org/index.htm

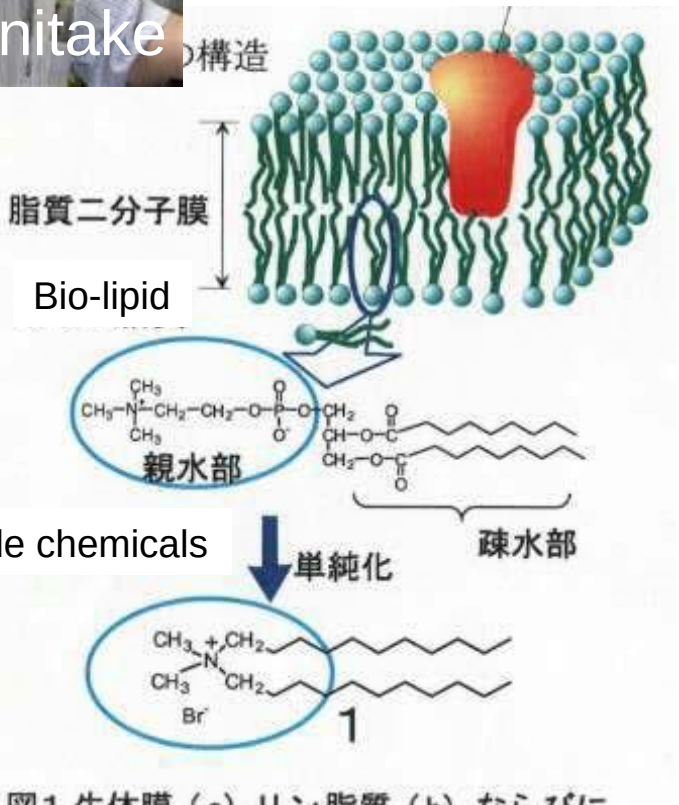
Molecular Biomimetics
Biomimetic Chemistry & Membrane Mimetics;

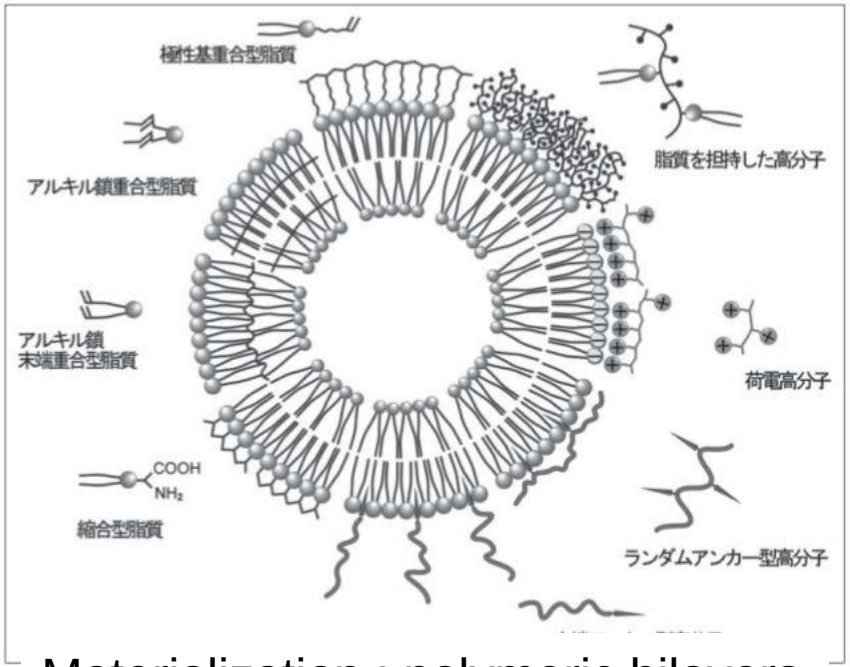
look back on it with nostalgia



T. Kunitake and Y. Okahata , "A totally synthetic bilayer membrane", J . Am. Chem. Soc., Volume 99, pp. 3860–3861 (1977).

The Medal for Culture (2014)
Kyoto Prize (2015)



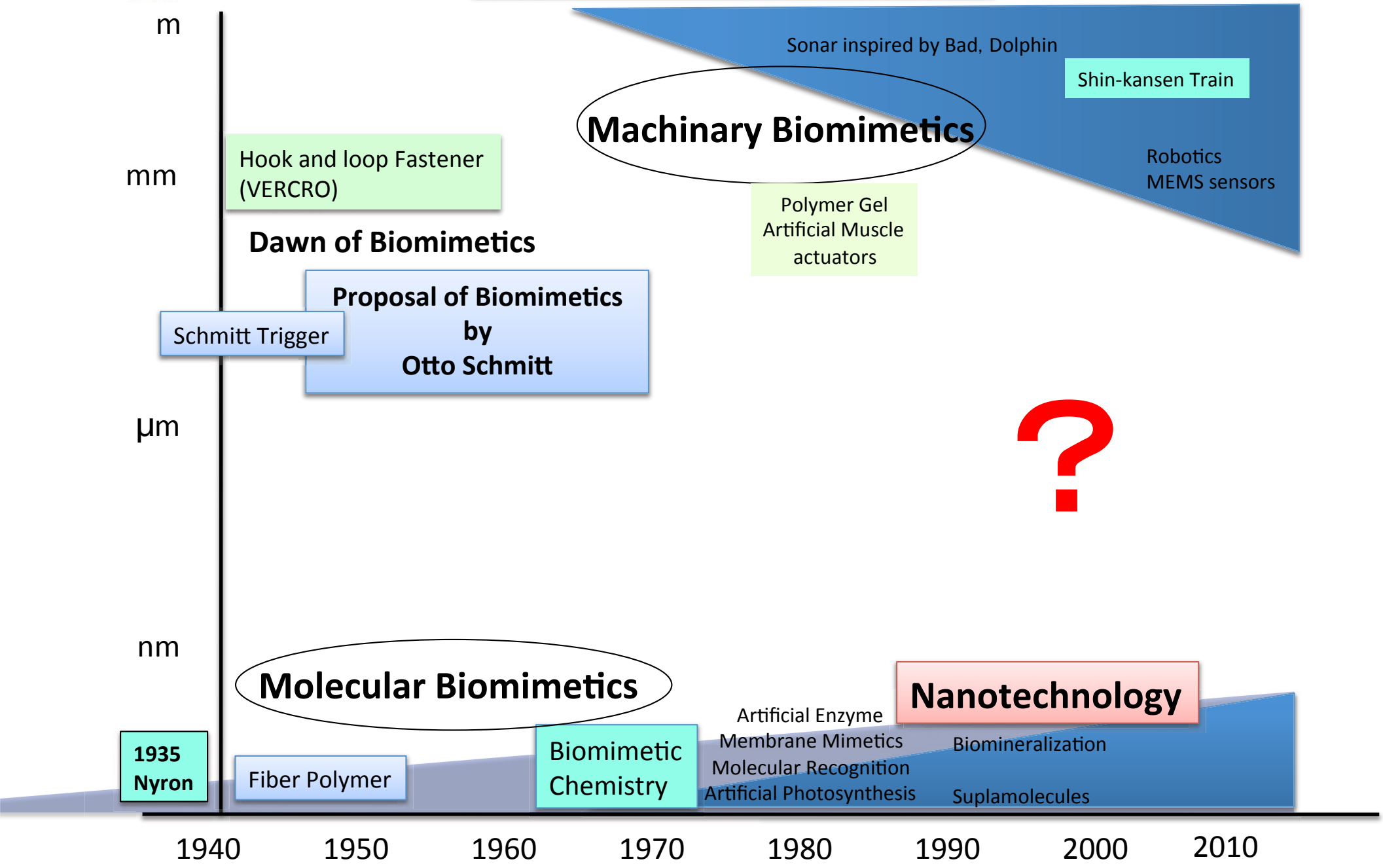


Materialization : polymeric bilayers

Machinary Biomimetics

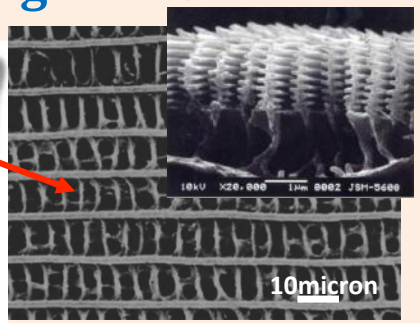
Kingfisher for Shinkanser

History of Biomimetics



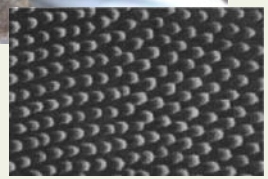
Biomimetics Emerged from Biological Researches

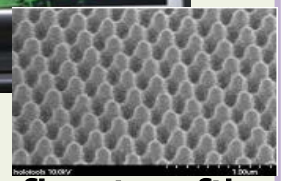
Butterfly wing-scale:structure color



→ Fibers, coating, photonics

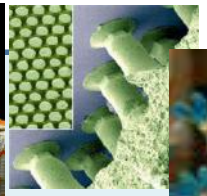
Moth-eye structure:anti reflectant





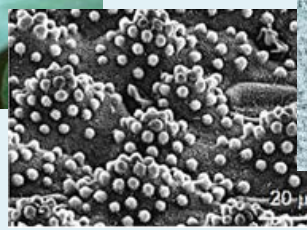
→ Anti-reflection film
photonics

Gecko Hand：adhesion



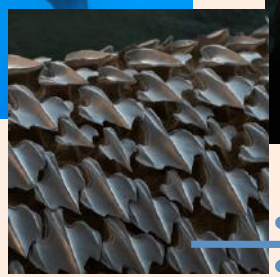
→ Adhesive

Lotus Effect：hydrophobic



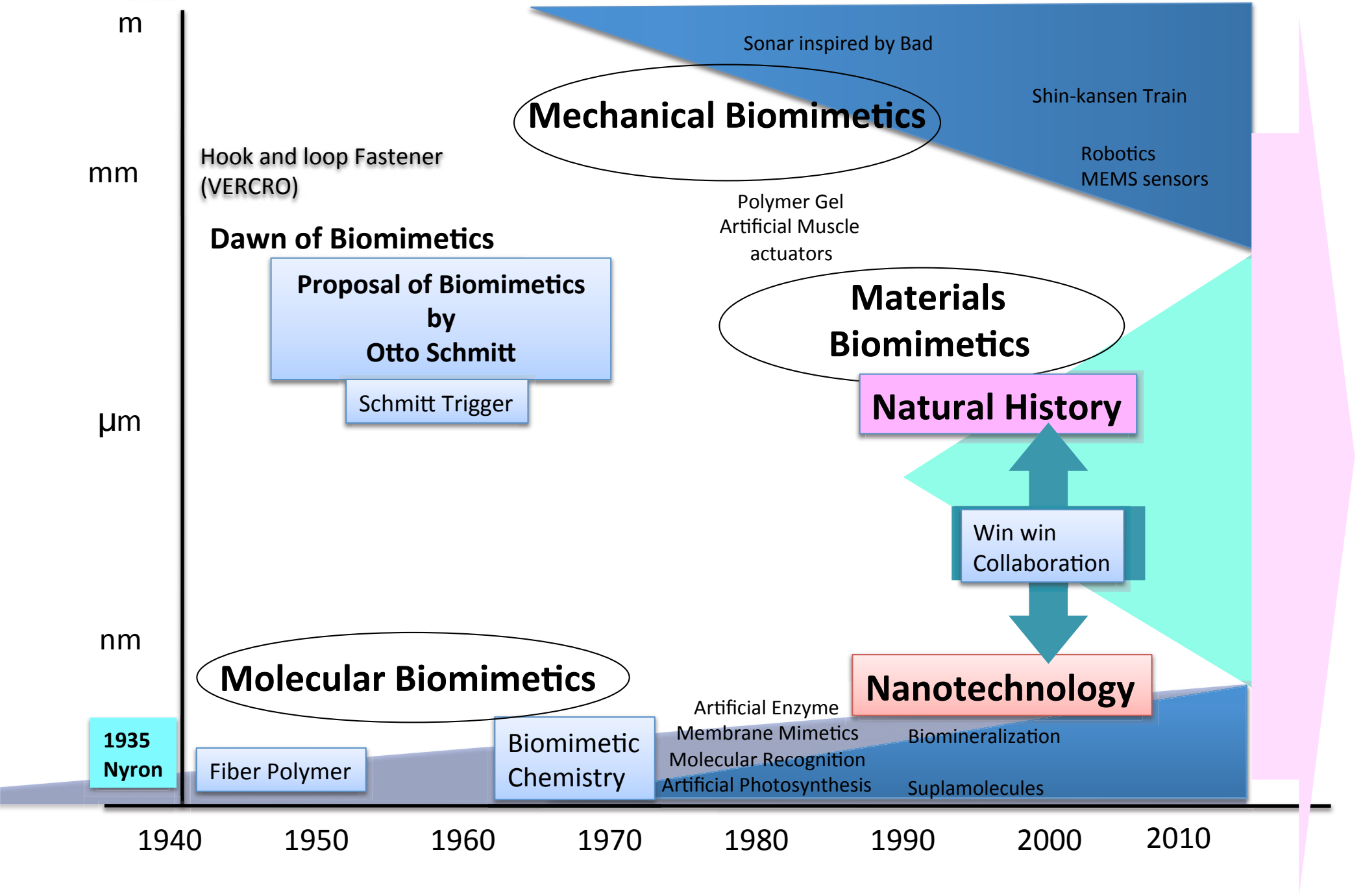
→ coating, painting, anti-fogging

Sharkskin：riblet



→ Painting, coating.
Anti-fauling

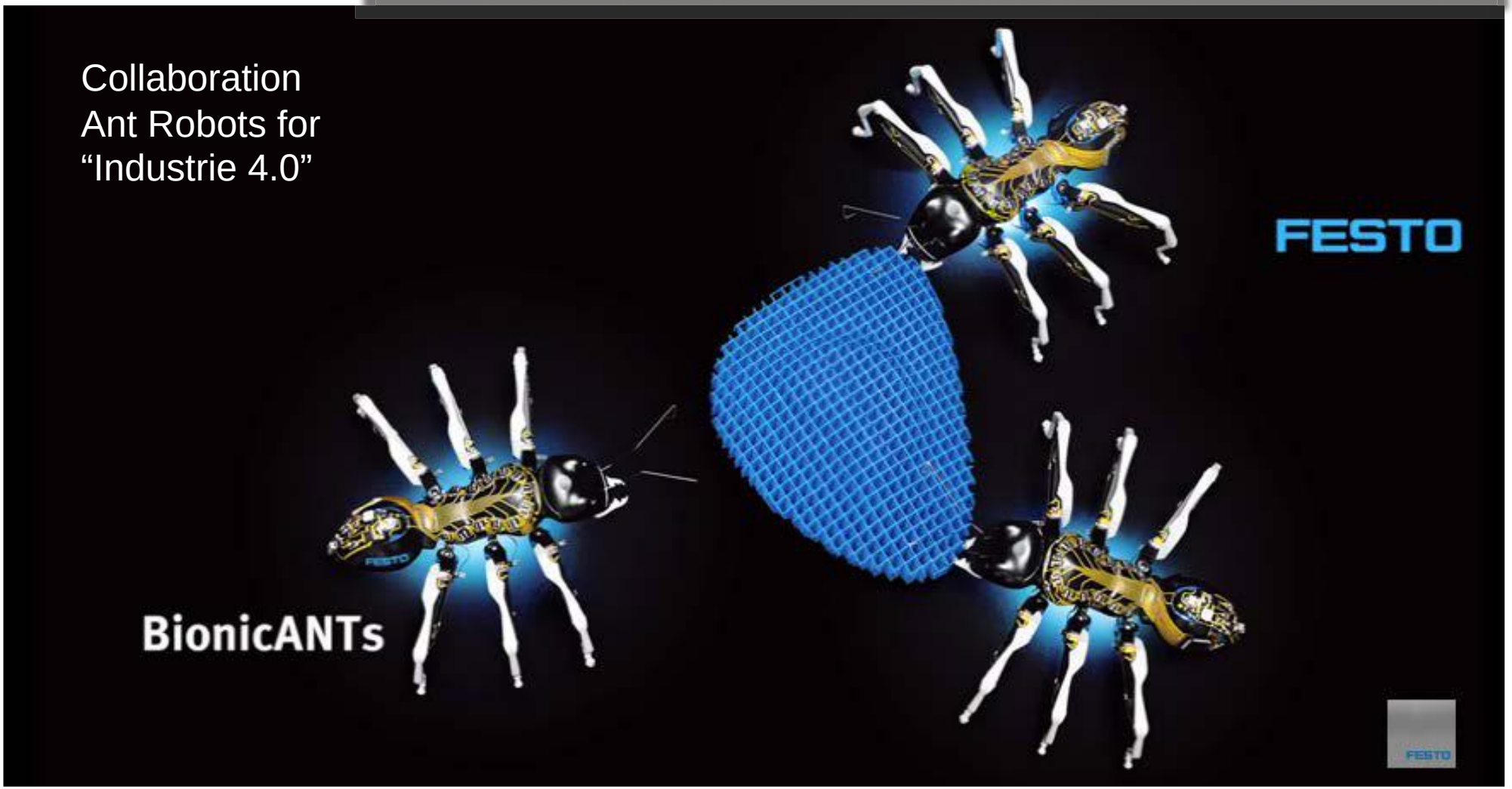
New Trends in Biomimetics: Marriage of Natural History and Nanotechnology



Growing Global Interest in Biomimetics

FESTO's Biomimetic Robot for IoT ?

Collaboration
Ant Robots for
"Industrie 4.0"



Ants: social insect as an autonomous distributed system
Self-organized Ecological System

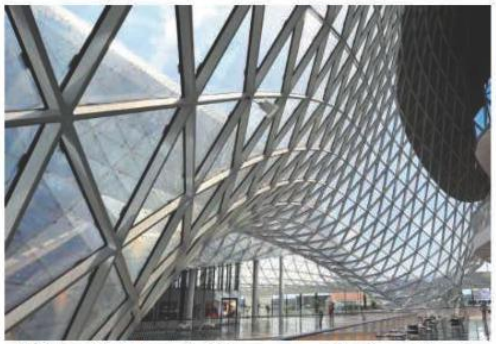
https://www.youtube.com/watch?v=FFsMMToxxls

Growing Global Interest in Biomimetics

Toward Biomimetic Architecture

SFB-TRR 141

Collaborative Research Center - Transregio 141
Biological Design and Integrative Structures
Analysis, Simulation and Implementation in Architecture

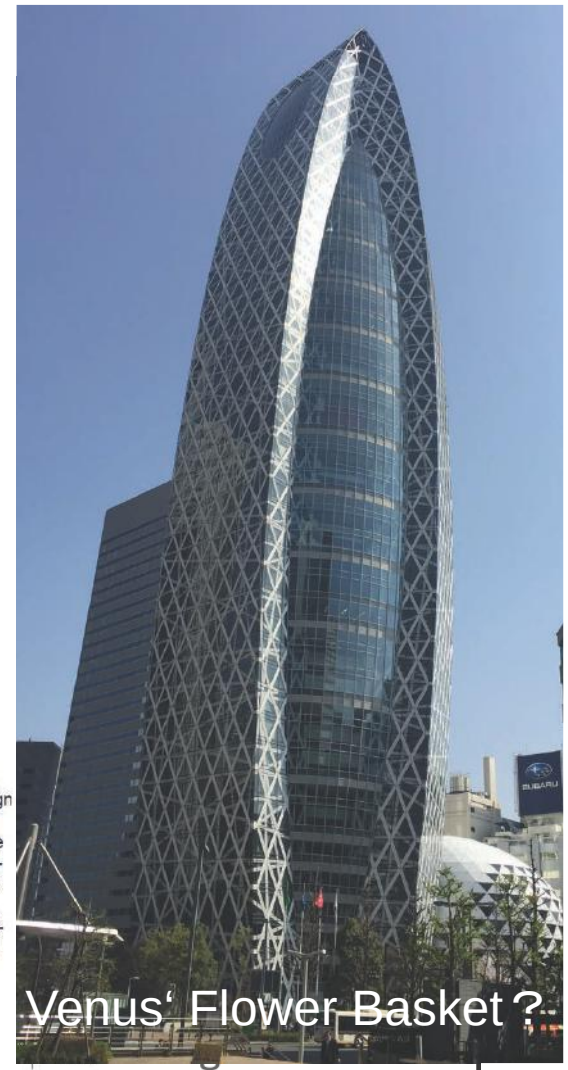


Ultra-lightweight support structure
My Zeil Frankfurt: Support structure
by Knippers Helbing Stuttgart

Biomimetic facade shading - Thematic-Pavillon Expo 2012
Yeosu, Süd-Korea

Bioinspired Research Pavillons 2011, 2012 & 2013 ICD
& ITKE Stuttgart, Univ. Tübingen & Freiburg

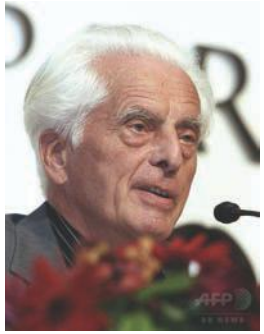
J. Knippers & T. Speck (2012): Design and construction principles in Nature and Architecture. – Bioinspiration and Biomimetics, 7. DOI:10.1088/1748-3182/7/1/015002



Venus' Flower Basket ?

Growing Global Interest in Biomimetics

Toward Civil Engineering



Frei Paul Otto

Olympiastadion München

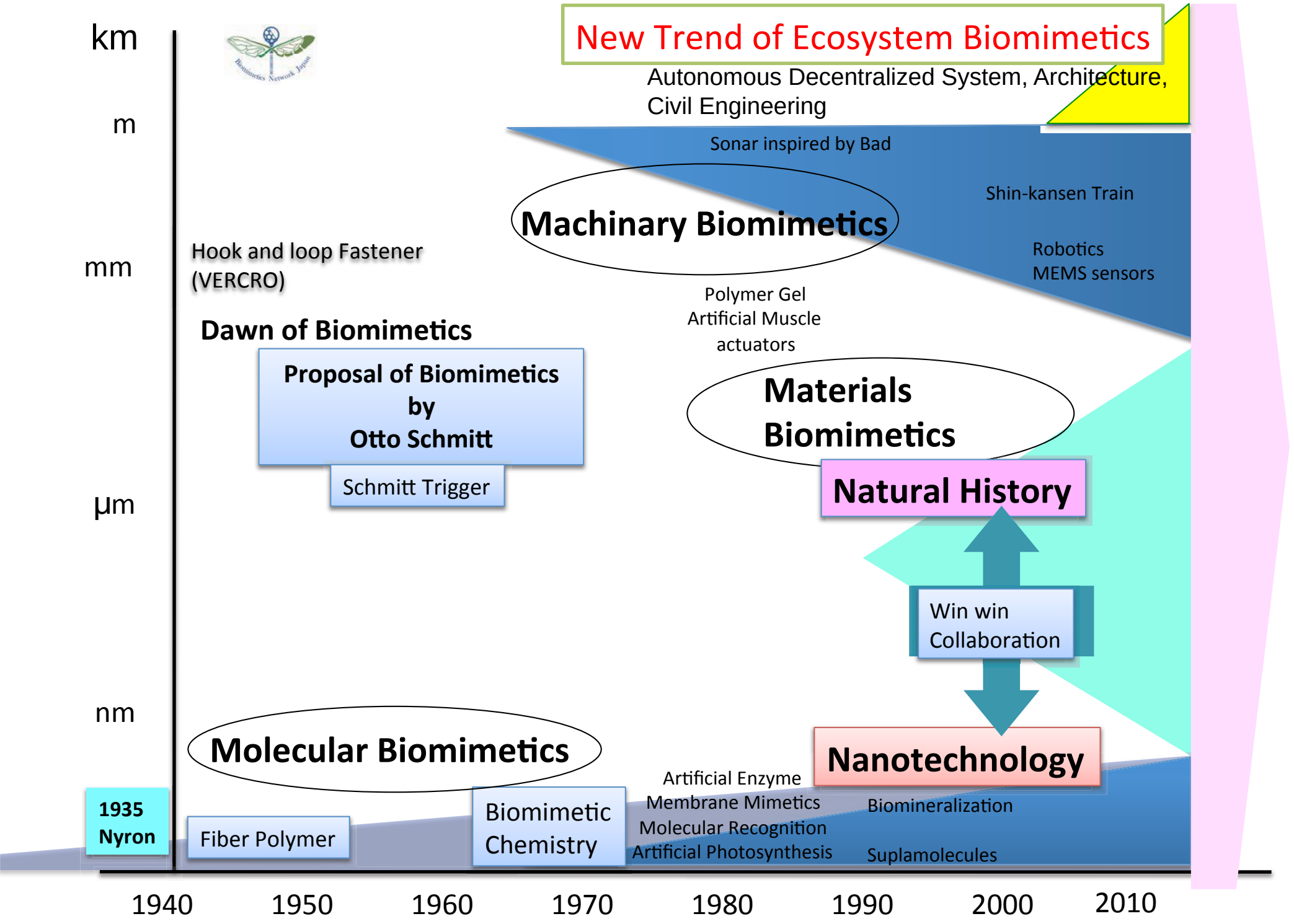
Nigeria to build biomimetic 'smart city' to celebrate its centenary

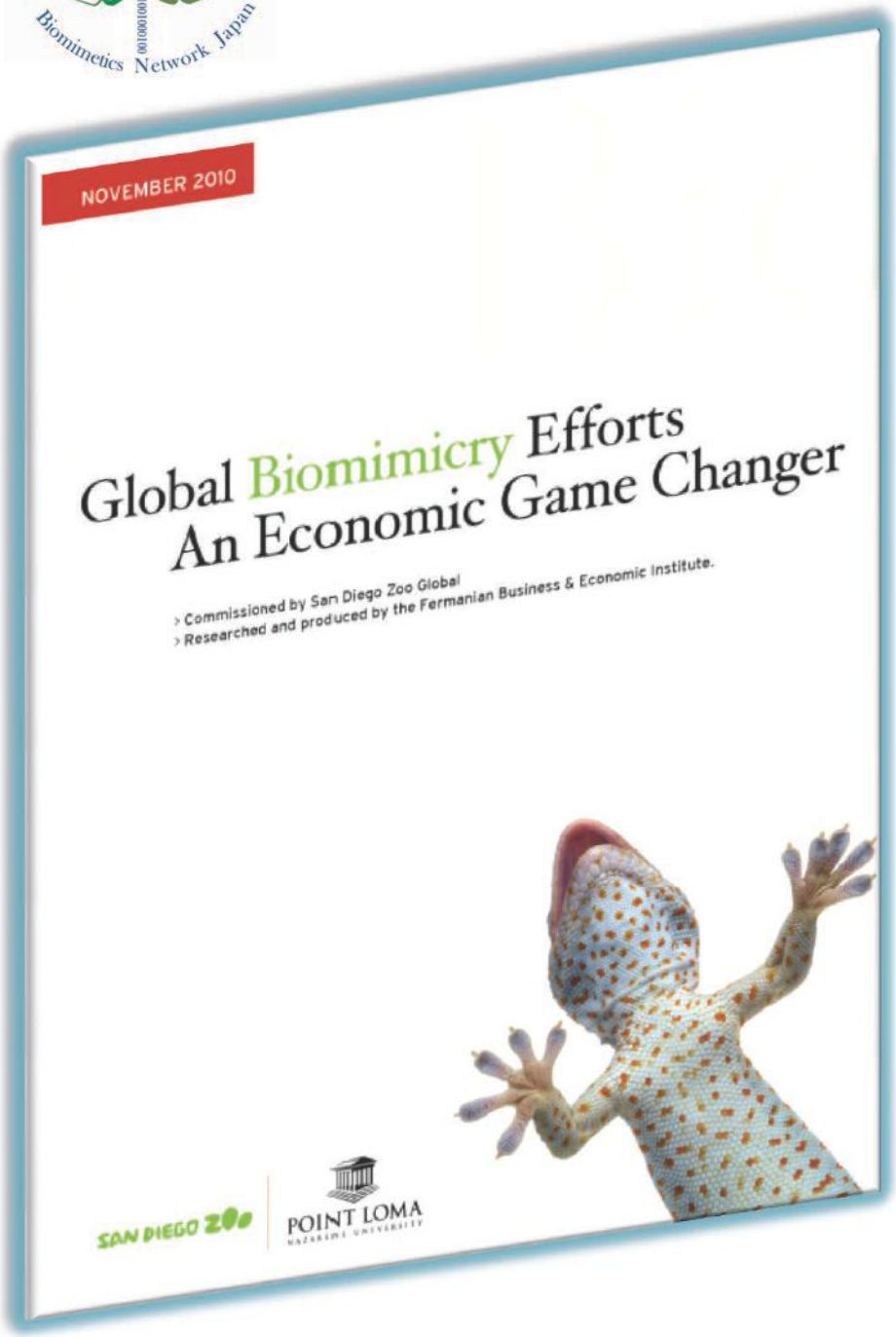
Sami Grover (@samigrover)
Design / Urban Design
September 12, 2013

Share on Facebook

Video screen capture ***Shannon Royden-Turner***

In 2014, Nigeria marks 100 years since it gained independence from the UK.


New Trend of Ecosystem Biomimetics
Autonomous Decentralized System, Architecture, Civil Engineering
km
m
mm
μm
nm
Sonar inspired by Bad
Shin-kansen Train
Machinary Biomimetics
Robotics
MEMS sensors
Hook and loop Fastener (VERCRO)
Polymer Gel
Artificial Muscle
actuators
Dawn of Biomimetics
Proposal of Biomimetics by Otto Schmitt
Schmitt Trigger
Materials Biomimetics
Natural History
Win win Collaboration
Nanotechnology
Molecular Biomimetics
1935 Nyron
Fiber Polymer
Biomimetic Chemistry
Artificial Enzyme
Membrane Mimetics
Molecular Recognition
Artificial Photosynthesis
Biomineralization
Suplamolecules
1940
1950
1960
1970
1980
1990
2000
2010



Growing Global Interest in Biomimetics

Not only for Economy

It is no surprise then to learn that biomimicry is heralded as one of the growth areas for this century. It is a genuinely multi-disciplinary field where, for instance, a research team comprising entomologists, engineers and materials scientists is not uncommon. Last year, a report by the Fermanian Business and Economic Institute in San Diego said: "While the field today is just emerging, in 15 years biomimicry could represent $300bn annually of US GDP and could account for 1.6m US jobs by 2025. Globally, biomimicry could represent about $1,000bn of GDP in 15 years."

(Paul Miles, Financial Times Aug.12 2011)

Growing Global Interest in Biomimetics

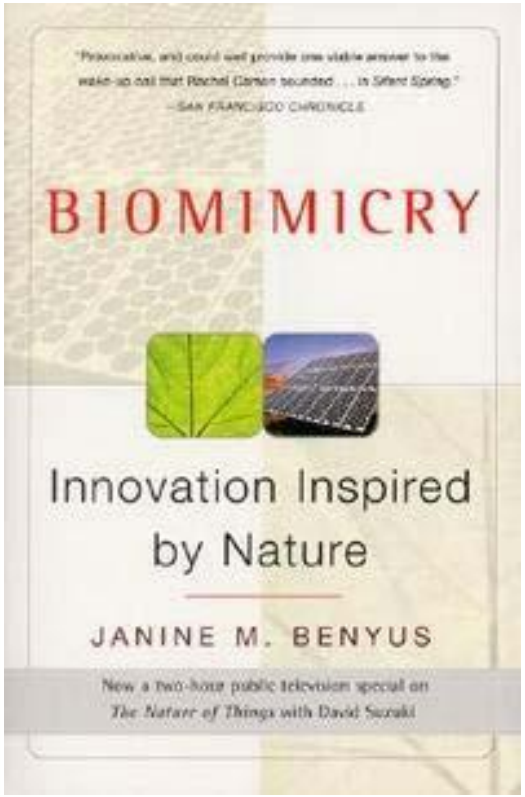
But also for Ecology

Biomimicry's Climate-Change Solutions: How Would Nature Do It?

Janine Benyus speaking at the Bioneers conference

Biomimicry — the use of nature to inspire design — could serve as a model for a greener economy that rises out of the ashes of the financial crisis, said experts meeting at a sustainability conference in the San Francisco Bay Area.

Speaking at the three-day Bioneers conference in San Rafael, Janine Benyus, a leading voice in the emerging field of biomimicry, said that nature offers lessons that can be applied to build better and more sustainable products and services as well as economic models.



Biomimicry : Ecological aspect of Biomimetics

Growing Global Interest in Biomimetics

Governmental support for “Biodiversity in Good Company”

BIODIVERSITY IN GOOD COMPANY
BUSINESS AND BIODIVERSITY INITIATIVE

Homepage > Homepage

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

- About the Initiative
- Members
- Partners
- News
- Contact
- Login

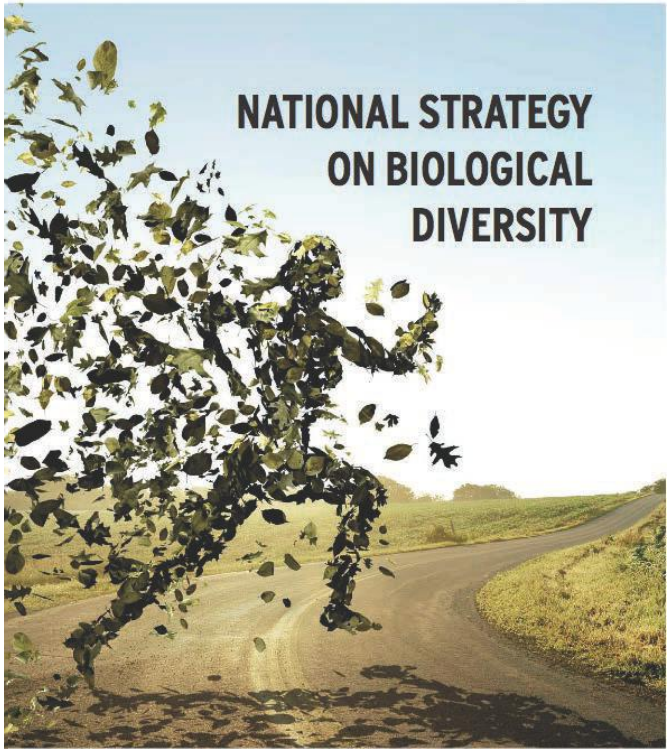
Strong signal from business: 'Biodiversity in Good Company' Initiative realigned

The Initiative has been transformed into a business-run and company-driven independent association. Thus, the former successful project established by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) in 2008 ensures its long-term future prospects.

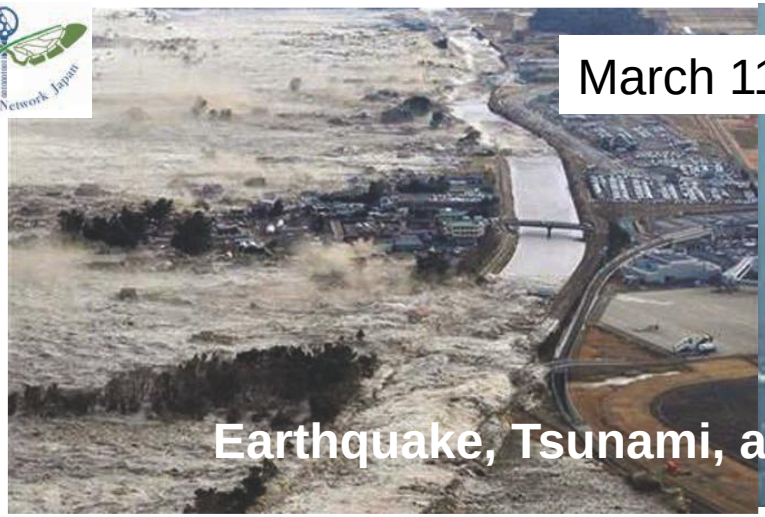
German Federal Environment Minister Dr. Norbert Röttgen welcomed the companies' commitment: *"Nature is our foundation of life. Protecting nature is the joint task of government and society. The German business community has made a vital contribution to this by founding the international network 'Biodiversity in Good Company'. German companies support the federal government in implementing the National Biodiversity Strategy and internationally agreed targets."*

Read more about the establishment of the association

Further information about the Initiative and the Good Companies



The Economics of Ecosystems and Biodiversity (TEEB)



Nature Technology

- Self Assembly Self Organization
- Solar Energy Chemical Energy
- CHOPINS

Human Technology

- High Temp High Pressure Lithography
- Fossil fuel Nuclear Power
- Fe, Al, Si Rare Metals

low environmental impact ← **Sustainability** → ?

Fukushima Nuclear Power Plant Accident, Global Warming

Paradigm shift

Learning from Biodiversity: Evolutional Adaptation (as combinatorial chemistry)

Biomimetics: Reverse Engineering

TEEB For SDGs

Learning from Biodiversity for Paradigm Shift

Biomimetics: Reverse Engineering of biodiversity

The Economics of Ecosystems and Biodiversity for Sustainable Development Goals

Modern Meaning & Significances of Biomimetics

(1) Paradigm shift for innovation
different working mechanism with multifunction
different fabrication processes

(2) Biomimetics Informatics
Technology transfer from biology to engineering

(3) Societal implication for sustainability, technology governance, ecological view from "trans-science"

Biomimetics is Survival Tool in Anthropocene ?

Biomimetics Network Japan

Toword Biomimetics Infomatics

Engineering Neo-Biomimetics

平成24年度科学研究費補助金　新学術領域研究(研究領域提案型)

生物多様性を規範とする革新的材料技術

Innovative Materials Engineering Based on Biological Diversity

Biomimetics Network Japan

- The 5 years National research project of “Engineering Neo-Biomimetics” was closed at end of March 2017.
- In this project, Prof. Haseyama has developed the biomimetics image retrieval which is a system to search for similar image in Biomimetics Database.
- Researchers of National Museum of Nature and Science have built Biomimetics Database consisting of SEM images of insects and fishes.
- Prof. Mizoguchi has developed the Keyword Exploration for retrieval from Biomimetics Database. He has a prototype of the biomimetics ontology and keyword exploration tool (OET : Ontology Enhanced Thesaurus).
- These system will support idea creation by users based on Biomimetics Database.

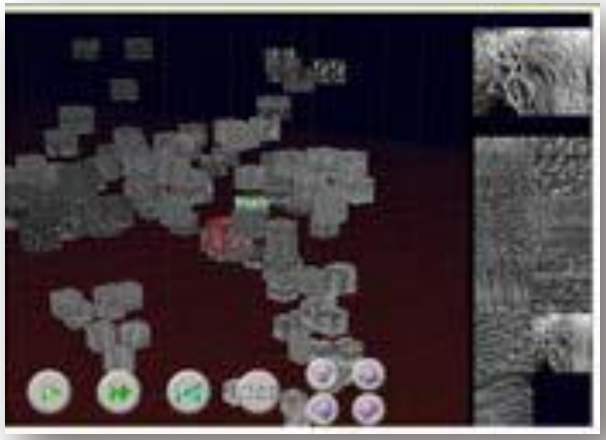
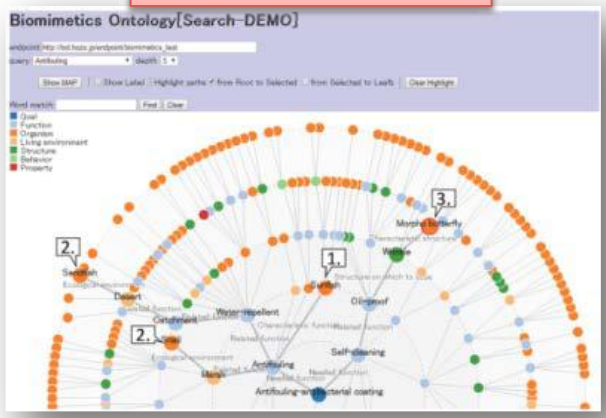


Image Retrieval

ISO TC266 WG4



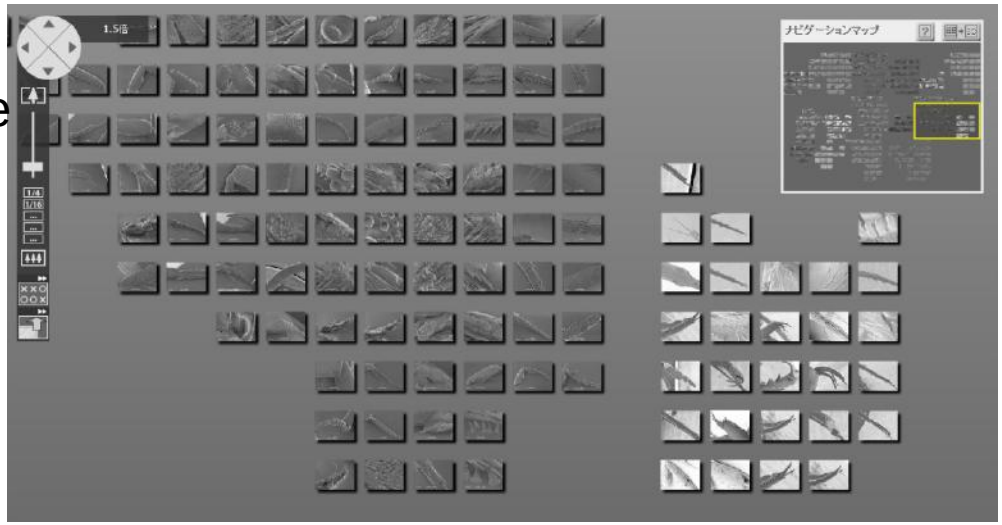
Keyword Exploration

Biomimetics Informatics : Image Retrieval

Number of SEM Data

34,000 (Insects, Birds, Fishes)

- National Museum of Nature and Science
- The Hokkaido University Museum



Important Issues

- ✓ Data Collection
- ✓ Data Management

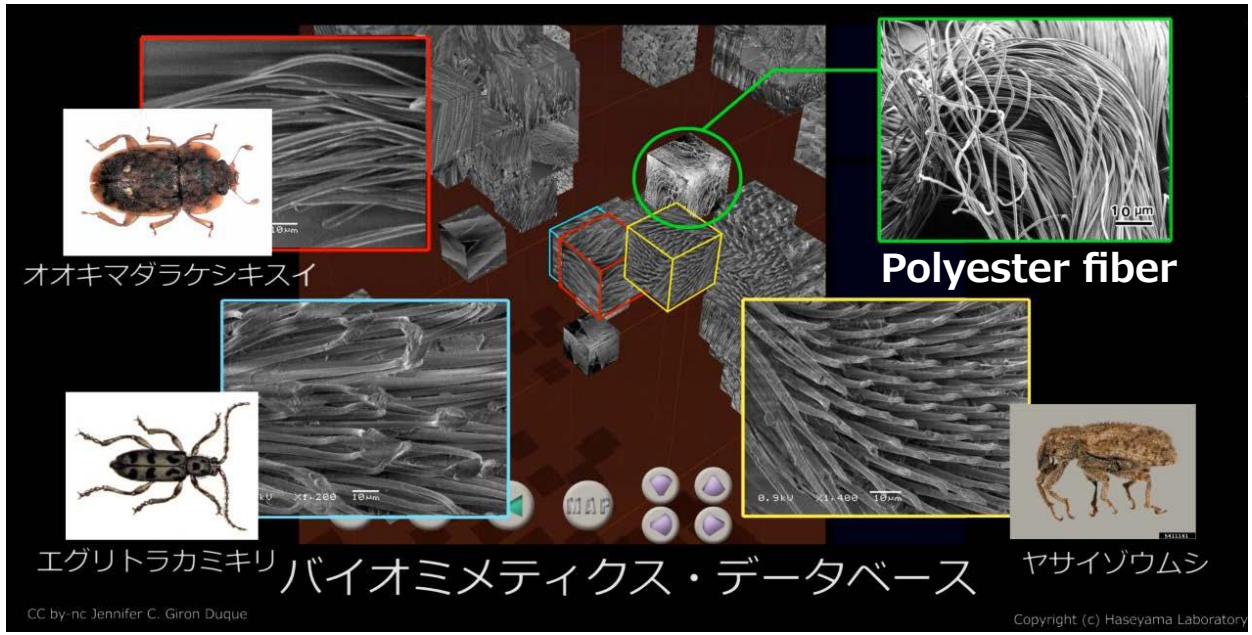
Springer

Data Journal

NIMS

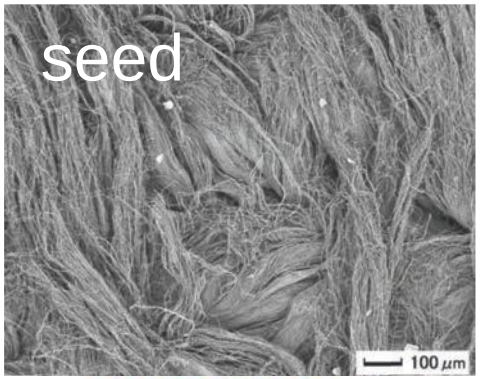
Data platform

Materials Infomatics

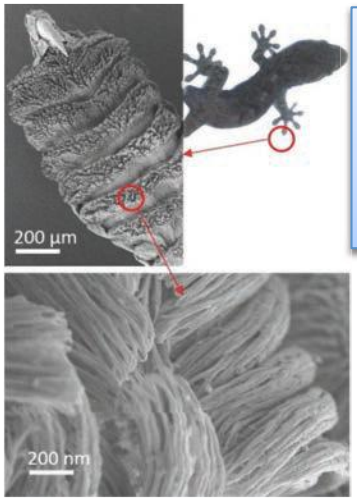


search engine retrieve similar image

Need–Seed Matching based on Biomimetics Informatics : Image Retrieval



TEIJIN
Human Chemistry, Human Solutions
帝人フロンティア株式会社



"nanofront":
Adhesive micro fiber
like Gecko finger

浜松医科大学
Hamamatsu University School of Medicine

fingerprint loss :
side effects
from Anti-
cancer drug

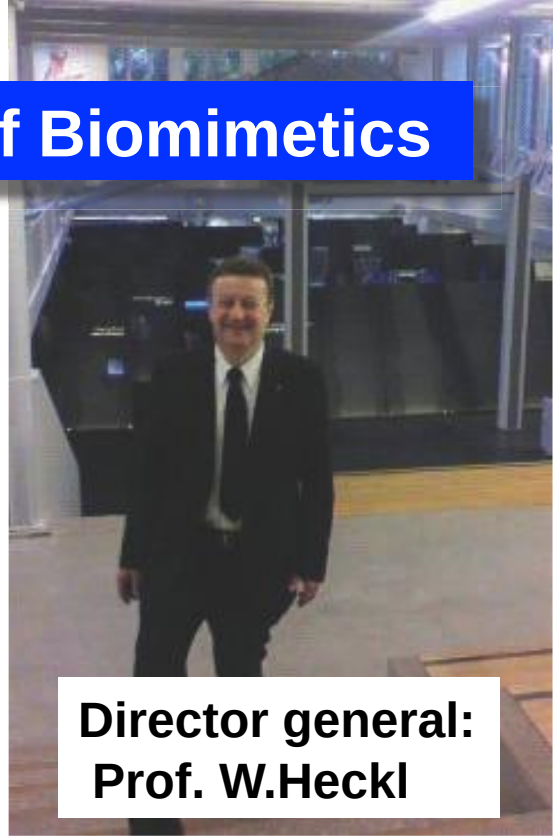
Slippery

QOL

Prof.Dr.T.Hariyama

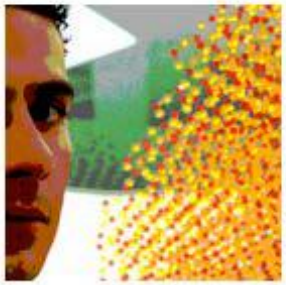
Museum as Exhibition Device of Biomimetics

Deutsches Museum



Director general: Prof. W.Heckl

Centre for New Technologies



More than an exhibition

The Centre for New Technologies presents
from science and technology.

- Nanotechnology and biotechnology exhi
- Special exhibitions
- Presentations by ZNT partners
- Three laboratories
- Event forum and café

Nanotechnology and biotechnology exhib

Research and technology in the world of th
the lotus blossom to cancer treatments: nar
less pervasive in our lives is the influence c
genome research to the production of drug
New technologies like these offer huge opp
future, but in some areas they harbour risks
invites you to form your perceptions of the "

Museums are the Societal Devices for …… : from Science–communication to Trans-science

Museum as Societal Trans-science Device

Monthly Citizen Seminar on
Biomimetics
at Hokkaido University Museum

Dialogue with many stake holders

2018年4月8日（日）

BIOMIMETICS

バイオミメティクス市民セミナー・対話篇

第76回 近代国家日本とバイオミメティクス

リバースエンジニアリングという言葉をご存知でしょうか。逆行工学とか分解工学と訳される模倣の手法です。辺境の孤島である『この国のかたち』は、模倣によって造られたと言っても過言ではありません。司馬遼太郎風に言えば、明治維新における急速な近代化、奇跡とも言える戦後復興は、模倣によって多様な価値観を柔軟かつ寛容に受け入れた日本人の“無思想の思想”によるのです。さらに寺田寅彦の慧眼をすれば、“環海の島嶼に特有の天然の無常さ”によって醸された『日本人の自然観』が背景にあります。

フランスの社会学者ガブリエル・タルドは『模倣の法則』において、人間の社会活動はすべからく模倣の産物であると説きました。オーデッド・シェンカーの『コピーキャット　模倣者こそがイノベーションを起こす』では、“模倣のプロセスは、体系的でありながら、さまざまな要素を融合させる創造的なものでなければならない”としています。サルマネでは、いけないのです。

模倣によって生物が進化することは、ミラーニューロンの発見で明らかにされました。進化適応は壮大なるコンビナトリアル・ケミストリーであり、生物多様性は生物の生き残り戦略の結果であり、思いのほかにレジリエントで口バストネスがあり持続可能なのです。それを可能としたのは、どこにでもあるユビキタス元素を使い、再生可能エネルギーを用いた自己組織化プロセスによる「モノづくり」であり、産業革命以来の人間の技術体系とは作動原理や製造プロセスのパラダイムが異なっているのです。生物学者のフランソワ・ジャコブは、“生物進化はブリコラージュだ”と言っています。ブリコラージュとは“あり合わせの道具や材料で物を作ること”だと説いた人類学者クロード・レヴィ＝ストロースは、ブリコラージュである野生（未開、前近代化）のモノづくりと近代との対比**を通じて、日本人が“過去の伝統と現在の革新の間の得がたい均衡”を持ち続けることを期待していました。**

急速なアジアの近代化は、“日本型モノづくり”の閉塞的状況をもたらしました。そして、地球の環境収容力を超えた人間活動は、“持続可能な開発目標（SDGs）”を掲げざるを得ない状況をもたらしています。さらに、シンギュラリティーは、人間の存在意義そのものを問うているのです。“歴史は繰り返す。一度目は悲劇として、二度目は喜劇として”は、カール・マルクスの名言です。もはや人間を“模倣”するのは止めて、いっそのこと、生物を真似てみてはどうでしょう。

バイオミメティクスは、究極のリバースエンジニアリングなのです。
北海道命名１５０年、今回の市民セミナーでは、
近代化がもたらした光と影に思いを馳せながら、
改めてバイオミメティクスの意義を
問い直してみたいと思います。

千歳科学技術大学　教授
下村 政嗣

浜松医科大学　特任教授
針山 孝彦

モデレーター
北海道大学　名誉教授
下澤 楯夫

主　催：北海道大学総合博物館
共　催：高分子学会北海道支部
北海道大学　電子科学研究所
特定非営利活動法人バイオミメティクス推進協議会
協　賛：千歳科学技術大学バイオミメティクス研究センター

北海道大学総合博物館
060-0810 札幌市北区北10条西8丁目
問合せ先：TEL.011-706-2658 FAX.011-706-4029
E-mail: museum-jimu@museum.hokudai.ac.jp

会　場：北海道大学総合博物館/1階「知の交流」
札幌市北区北10条西8丁目

時　間：午後１時30分から午後３時30分

Museum as Treasury Box of Biomimetics

Not only for exhibition
But also for collection

Smithsonian Insider
BRINGING YOU EVERYTHING UNDER THE SUN

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SEARCH

NEXT ENGINEERING REVOLUTION IS HIDING IN MUSEUM COLLECTIONS

IN ANIMALS, ANTHROPOLOGY, EARTH SCIENCE, MARINE SCIENCE, PLANTS, SCIENCE & NATURE / 10 JUNE 2016 / COMMENTS

BY MICHELLE Z. DONAHUE

Using a 3D digital scan of bat specimens from Smithsonian collections, engineer Rolf Müller is better able to understand how the animals' physiology influences their biological capabilities. (Image by Dane Webster, Virginia Tech School of Visual Arts)

Engineers shouldn't have to reinvent the wheel—or wings, or sonar systems—when mother nature has already done much of the heavy design work. In fact, finding a way to quickly and accurately copy and share designs in 3D from vast museum collections like the Smithsonian's could well launch a new bioinspired engineering revolution, some engineers believe. One researcher's experience with bat specimens at the National Museum of Natural History is an enticing preview of what may lie ahead on a much larger scale.

BIODIVERSITY IN MUSEUM DRAWERS

Rolf Müller, associate professor of mechanical engineering at Virginia Tech and research

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Speakers
About Virginia Tech
Registration
Committees & Contacts

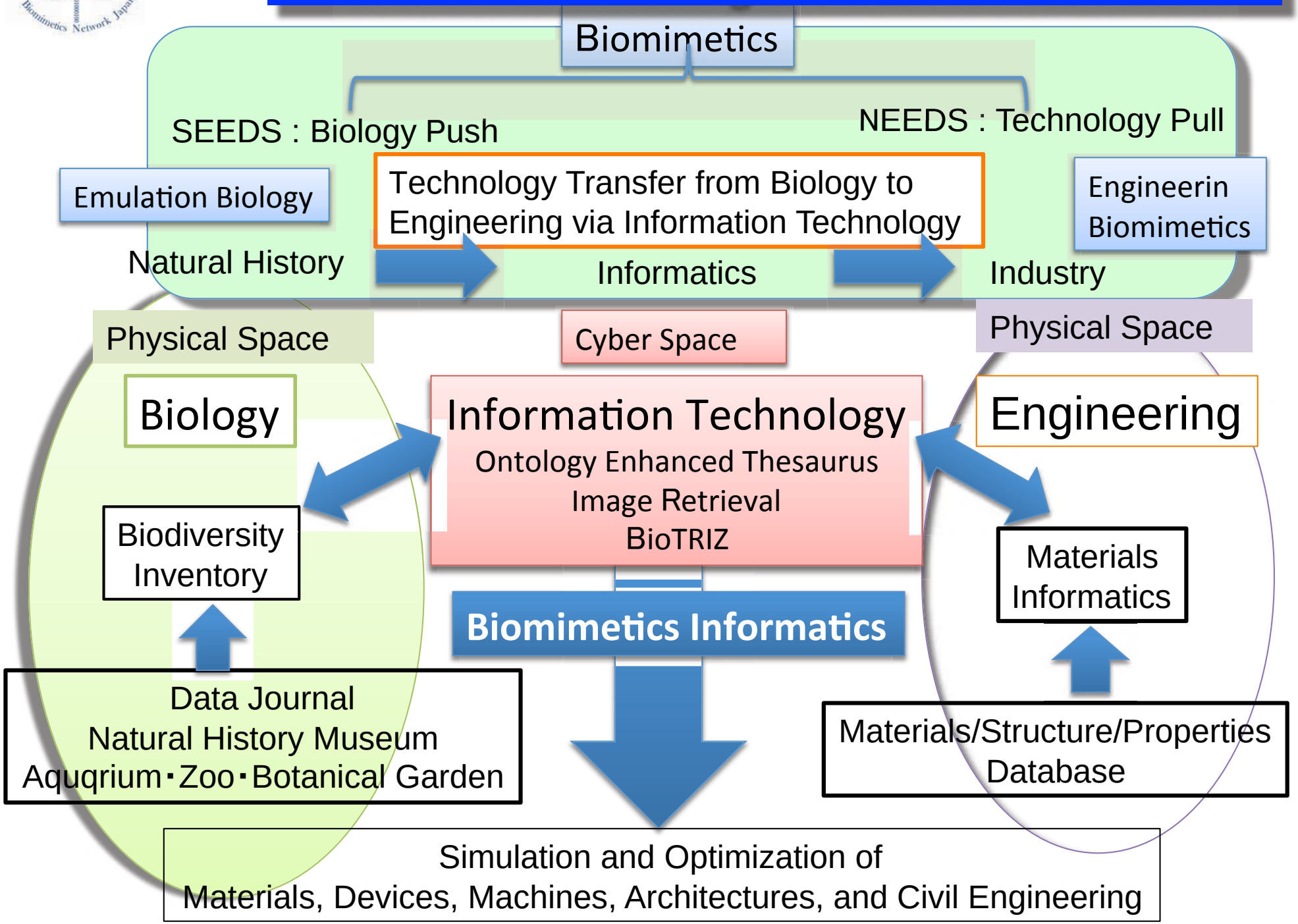
Program

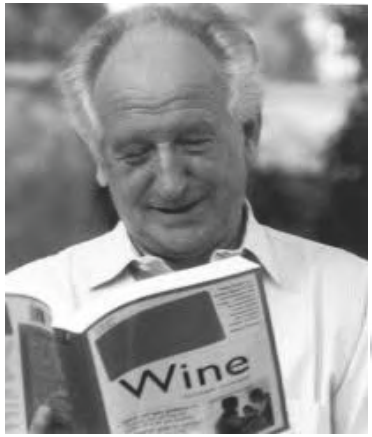
Biological evolution can be seen as an optimization process that operates on a scale that by far exceeds any human capabilities. The outcomes of this optimization process are stored in the innumerable variations on biological form and function that can be found across the many millions of biological species that make up the world's past and present biodiversity. The large natural history collections are the best libraries of the world's biodiversity that have been established so far with the largest collections housing well about 100 million specimens. Due to the vast amount of optimization results that are stored in these specimens, natural history collections could become a "natural resource" for technological innovation. This requires, however, that methods are established for reading these libraries. The workshop will discuss the relationship between biodiversity and technical innovation, methods that can be used for the engineering characterization of biological specimens, methods for the extraction of engineering knowledge from large amounts of specimen data, and the potential impact of the extracted engineering knowledge.

Agenda items:

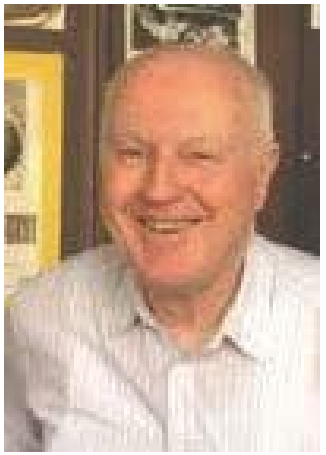
1. The role of Biodiversity for bioinspired engineering
2. Engineering characterizations of natural history specimens
3. Extraction of engineering knowledge from large amounts of specimen data
4. Potential impact of evolutionary optimization results on engineering

Biomimeics: Mining the Past for the Future





Prof. em. Dr.
Helmut Ringsdorf



Prof. em. Dr.
Erich Sackmann

After graduating from Kyushu University, MS engaged in the field of biomimetic chemistry as an assistant professor of Prof. Toyoki Kunitake's laboratory. He developed the research of polymeric Langmuir-Blodgett films at Tokyo University of Agriculture and Technology as an associate professor, and moved to Hokkaido University for starting a new laboratory of the bottom-up nanotechnology based on self-organization and biomimetics. Self-organized honeycomb-patterned polymer films are newly developed by collaboration with many industrial companies and the RIKEN institute where he held concurrently post of the principle investigator. After moving to Tohoku University he organized a national research project on Engineering Neo-Biomimetics, and started an educational program on biomimetics at Chitose Institute of Science and Technology. He worked with Prof. Helmut Ringsdorf of Mainz University (1982) and Prof. Erich Sackmann of TU-Munich (1987), respectively.

vielen Dank! und viel Spaß

schon gegessen ?

Conference
Banquet
at
Night
Museum

Senckenberg
Museum

骨しか残ってないよ～