

# The four mantra's on education and research politics



## Four Manthra's

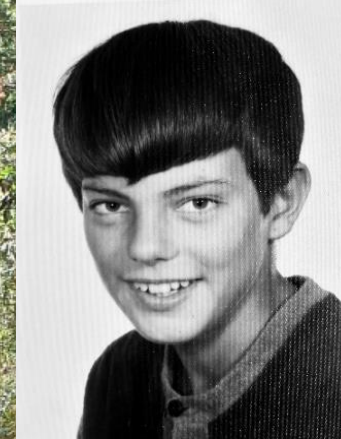
- Chemistry is Everything
- Youth for Chemistry
- Research with no Restraints
- Funding by Performance

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## Where does it all come from?

The road to success is never straight  
Science projects almost always fails initially  
You **cannot** plan so look for opportunity  
Many factors determining your path  
Fails and rise again  
Time is precious use it optimally  
Do what **YOU** find interesting/important  
Get out of your comfort zone  
Change field occasionally  
Bring your experience to use  
Study all your life



Intuition  
Imagination  
Association  
Observation  
Combination  
Creativity  
Collaboration  
Courage  
Perseverance  
Computation  
**Factual knowledge**

Idea.....experiment.....observation..... understanding.....repetition

# SPOCC: Merging peptide diversity with organic chemistry

DTU

Cambridge LMB

University of Copenhagen

**Carlsberg Laboratory**

University of Copenhagen

Solid phase organic  
combinatorial chemistry center  
SPOCC



Danmarks  
Grundforskningsfond  
Danish National  
Research Foundation

**On resin QCTs:**

Glycopeptides

Proteases

Glycosylases

Glycosyl transferases

Isomerases

**On resin QCTs:**

Diels-Alder

Aldol

Nitroaldol

Glycosylation

Transaminations

Metathesis

Wittig-reactions

Redox-reactions

Dihydroxylation-oxidations

WHE-reactions

C-Allylations

Phosphorylations

Sulfatations

Silylations

CuAAC-reactions

N-Acyl iminium ion reactions

N-Carbamyl iminium reactions

Carbene chemistry

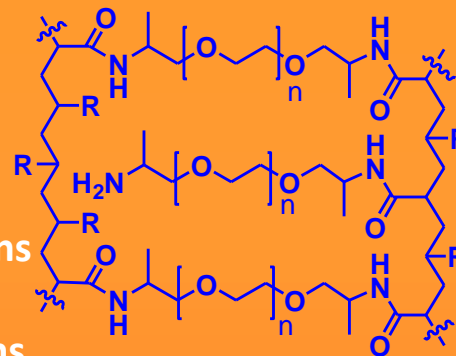
Phosphine chemistry

Palladation

Catalytic C-C bond formations

Sonogashira

Suzuki



Chemistry is the bread and butter of the Danish knowledge based society

Chemistry is essential

Medicine  
Materials  
Food sector  
Energy  
Production  
Agriculture  
Devices  
Electronics  
Defense  
Going green

Regional top15 chemistry companies

Novo Nordisk / NNF  
Novozymes  
Leo Pharmaceuticals  
Lundbeck + fond  
Topsoe  
Zealand  
Alka Bello  
Portland  
F.L. Smidth  
Carlsberg + Fond  
Christian Hansen  
ChemiNova  
Dupont DK  
Coloplast  
Danfoss

Chemistry is a wet science and learning chemistry is a balance of theory and experiments  
Education for a MSc in chemistry is only possible with a 3 year BSc and a 2 year MSc  
Denmark has one of the shortest most constrained PhD formats in the world

# Shaping of talents..... for the chemistry based society

## Factors of influence for choice of education

1. Knowledge
2. Parental influence
3. Institutional influence
4. Courage and identity
5. Status and opportunity
6. Salary
7. Existential curiosity

## Education relate to identity

Identity building starts early  
Identity building is largely emotional  
Identity from parental identity  
Identity from friends  
Identity by believe in authority  
Identity by knowledge  
Identity via influence / media

Educations matching societal needs  
How to optimize the creation of identity and selection of education  
Efficient education is without external pressure  
Knowledge and authority  
Positive reinforcement and self-esteem

START EARLY  
REWARD SELECTION

# The DG Centers attract many talents.....Example SPOCC

## Idea:

Develop organic reactions for solid phase combinatorial chemistry at the level of peptide chemistry

Combining QCT reactions with peptide diversity

New chemistry and novel structures towards drug development and material science

## Process:

Change of subject at Department of Chemistry, Carlsberg Laboratory

Application by MPM and KB

Composing an application with a strong component of new fundamental research

Tight fit between the core of the application and the hiring plan

Strong component of education in the program

Strong international composition and collaboration

# The DG Centers attract many talents.....Example SPOCC

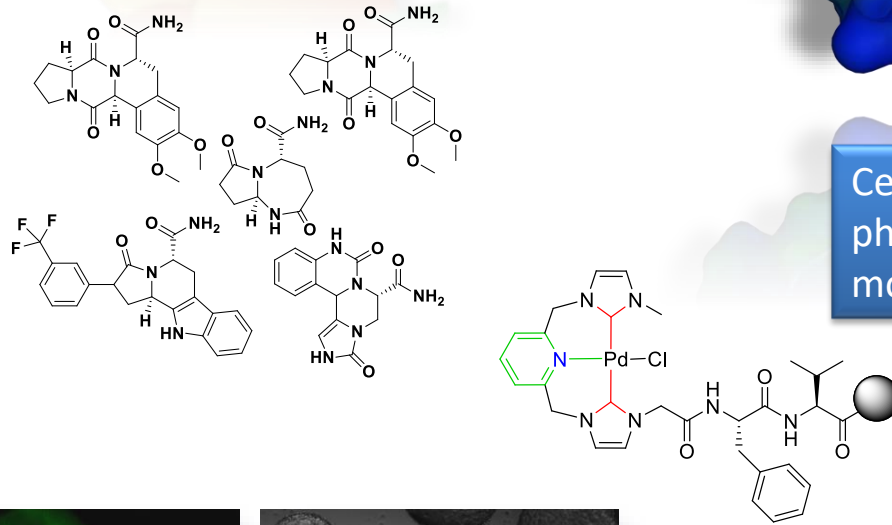
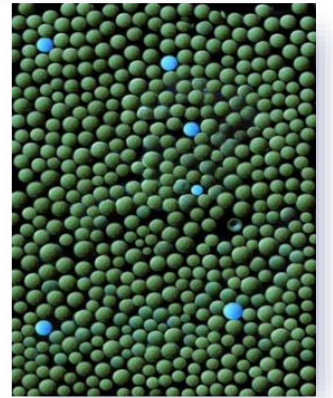
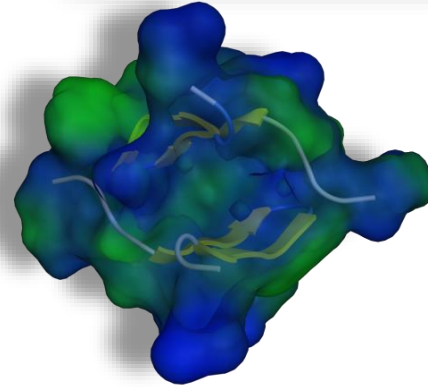
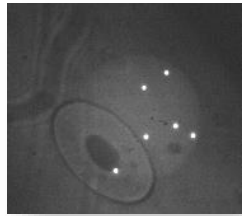
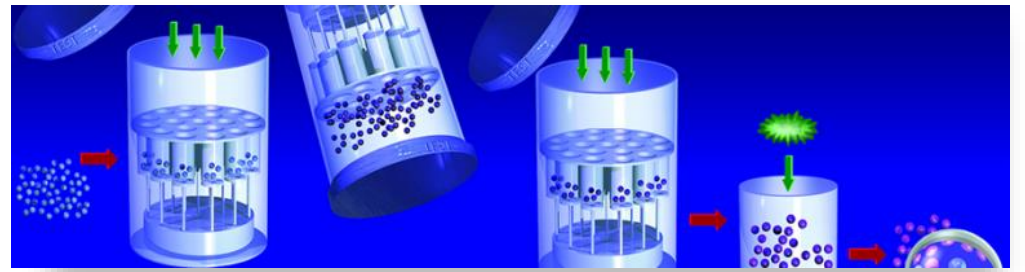
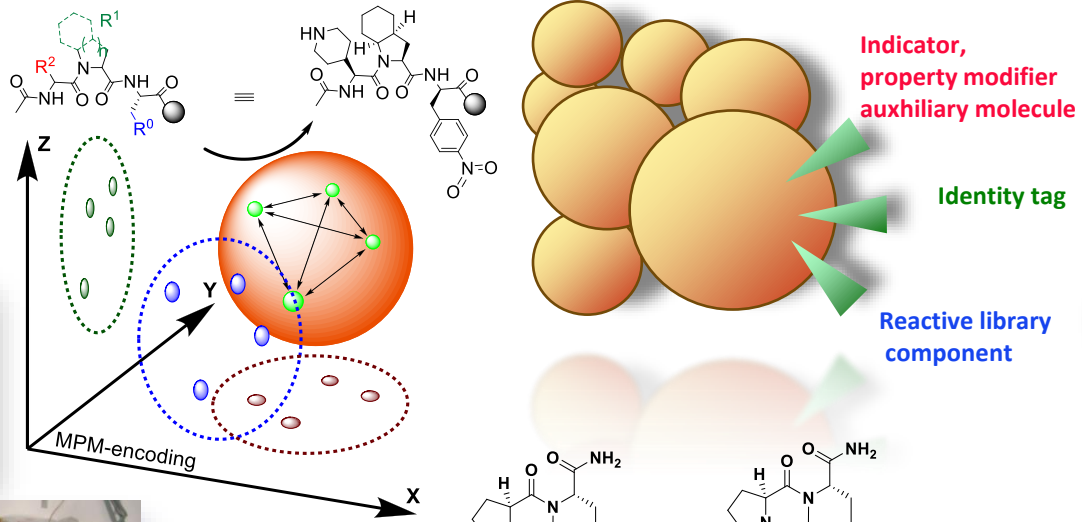
The group: Critical mass and infrastructure  
Infrastructure.... Infrastructure..... Infrastructure  
Multidisciplinary from physical chemistry to biology  
Diverse composed of researchers from around the world  
Group size: up to 25 total and ~15 on average for ten years

Reporting and dialogue with DG:  
Short annual report and meeting with DG .....results, publications and future plans  
Excellent dialog with DG at the SPOCC center  
Very positive forward looking, no administration  
Request for 30% novel plans annually  
Short resume of negotiated actions for the coming year

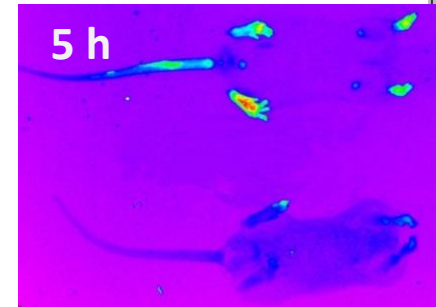
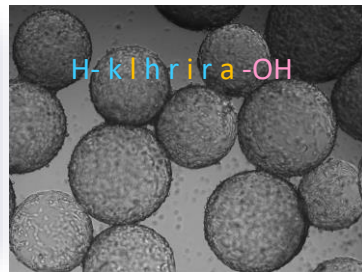
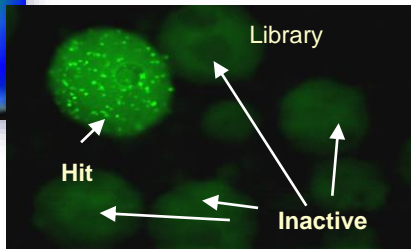
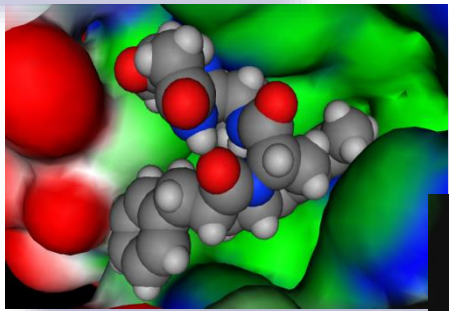
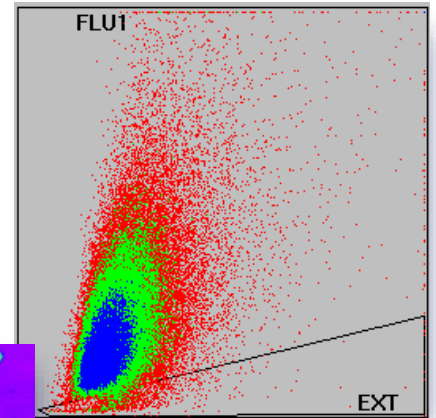
Working at the SPOCC center:  
Surprisingly excellent applicants and talents considering the private nature of CL  
MPM and KB networks were of great importance in personnel attraction  
Very short efficient process of decision and action (Shorter than on the universities)

The continuation of DG is of great importance for the future of Denmark as a knowledge based society

# The SPOCC-CECB Platform Technology



Central to all biological phenomena is specific molecular recognition





# CECB at University of Copenhagen

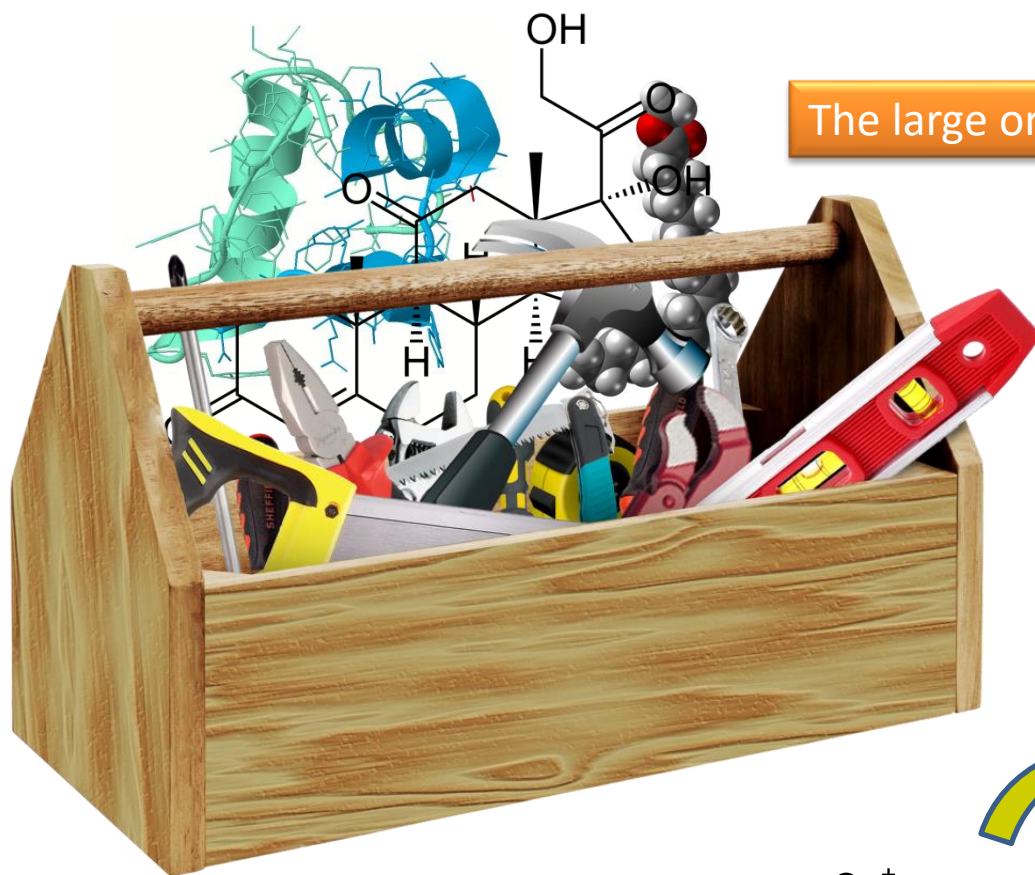
Center of Evolutionary Chemical Biology.....CECB..... a lighthouse center at KU:  
Chemical biology from a chemical perspective  
Using combinatorial organic chemistry, protein expression and cellular studies,  
Medicinal chemistry projects fitting requirements of Danish industry

Direct result of the SPOCC center (as in "not possible without")  
Platform technology developed at Carlsberg Laboratory was used  
Up to 22 coworkers, very diverse group  
Lot of expertise in complementary fields within the group  
Very positive midterm evaluation  
Application to NNF and Villum to continue was rejected  
2022 ..... Nobel Prize in Chemistry  
THANK YOU to the Danish National Research Foundation & UCPH

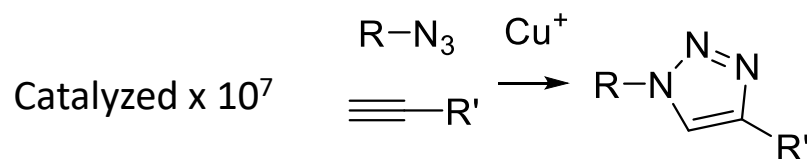
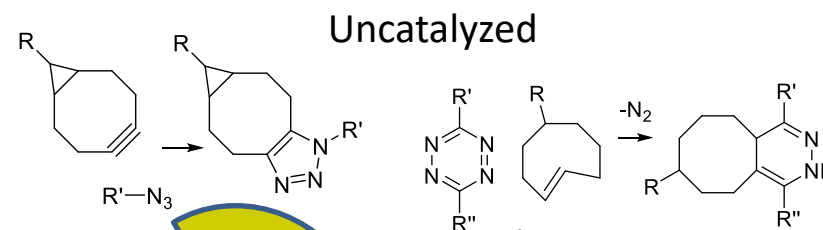
Comparing developing countries with Denmark: Saudi Arabia, Vietnam and India

Research centers with infrastructure are of great importance for the future of Denmark as a knowledge based society

# Two chemistry toolboxes



The large organic toolbox



The small orthogonal Click toolbox  
CW Tornøe & M Meldal



Intramolecular reactions

# Youth for Chemistry: ..... Chemistry is much more than an education

Chemistry is Everything  
**A global education initiative**

Chemistry curriculum early  
Pleasure driven learning  
Images rather than text

Start early, start positive  
Excite excite excite  
Visualization before quantification  
Evolve STEM interest

Young store images, even abstract  
~ Five years without formulas  
No examinations until six grade  
Visualization, Videos, VR, exp

The positive consequences of early global  
introduction to chemistry could be monumental

Environmentally  
Climatically  
Politically  
Religiously

For global equality  
For our resources  
For wealth distributions  
For peace transitions  
For health and professions

# Digital Animated Chemistry Archive (Danche)

Video, VR, Text sent to teachers and kids

60 min/week Grade 9

60 min/week Grade 8

50 min/week Grade 7

40 min/week Grade 6

30 min/week Grade 5

20 min/week Grade 4

15 min/week Grade 3

10 min/week Grade 2

5 min/week Grade 1



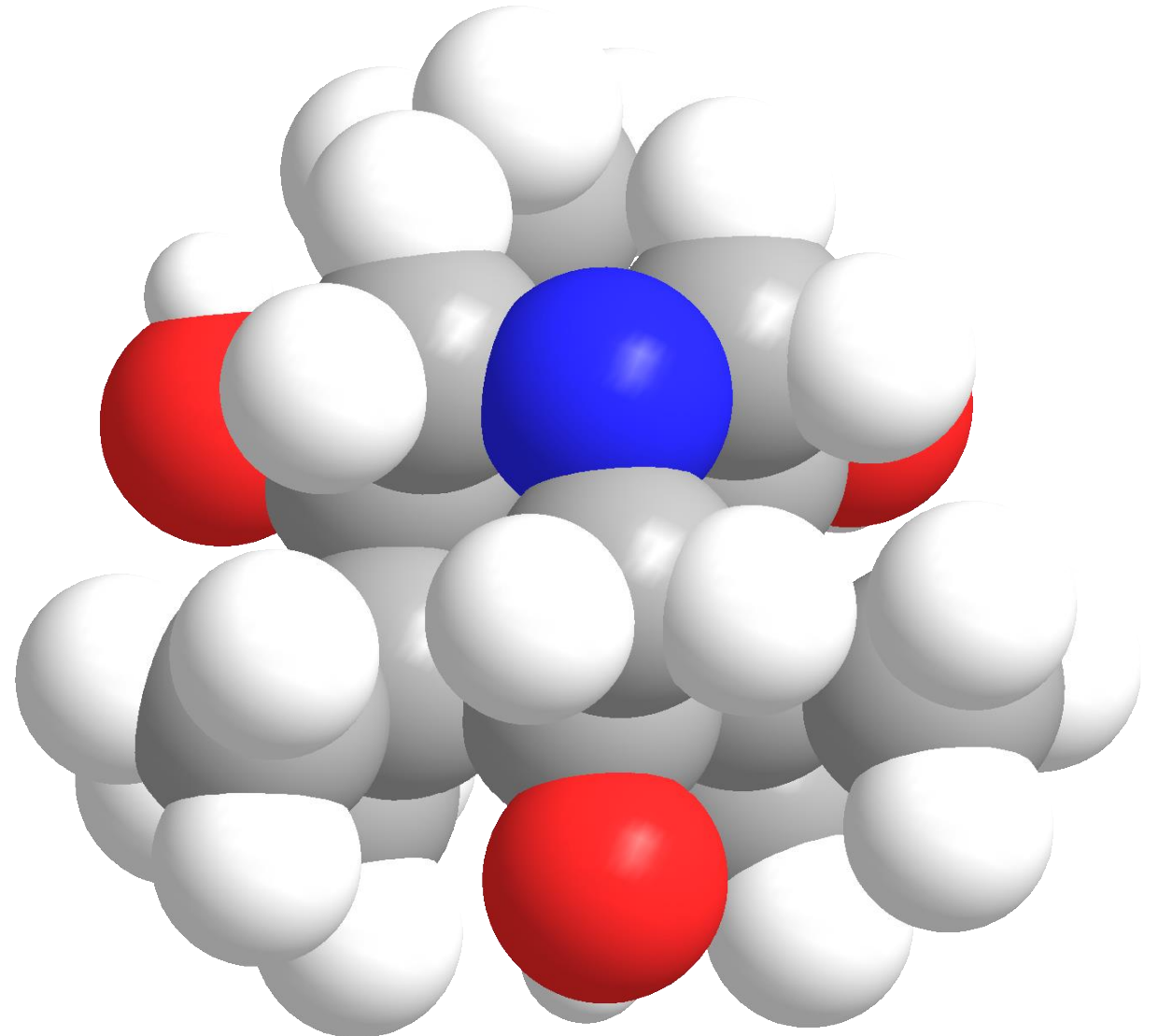
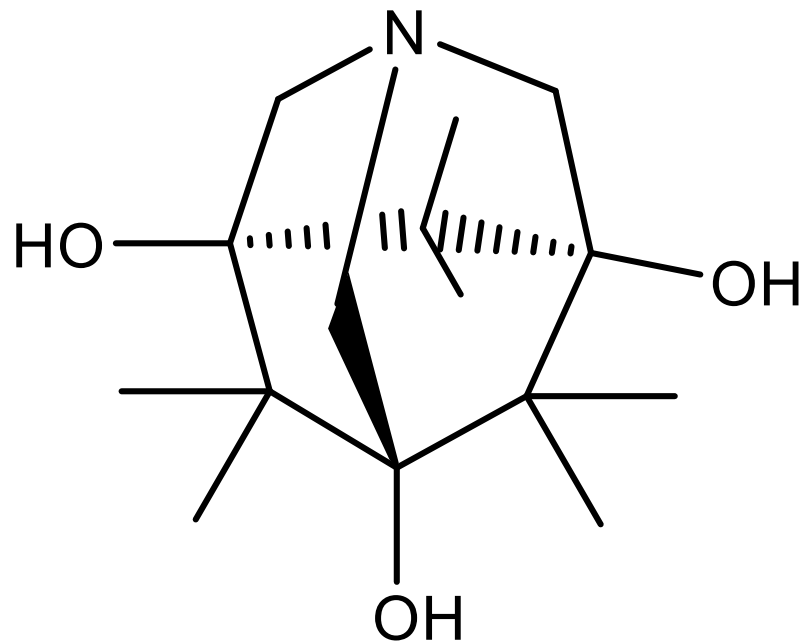
Filtered  
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and Licensed  
Material form the  
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Translation and globalization unit

# Chemistry: ..... Much more than an education Tools for schools

MOLEGO : Molecular LEGO building system

Young in chemistry  
Transformative understanding  
In three dimensions

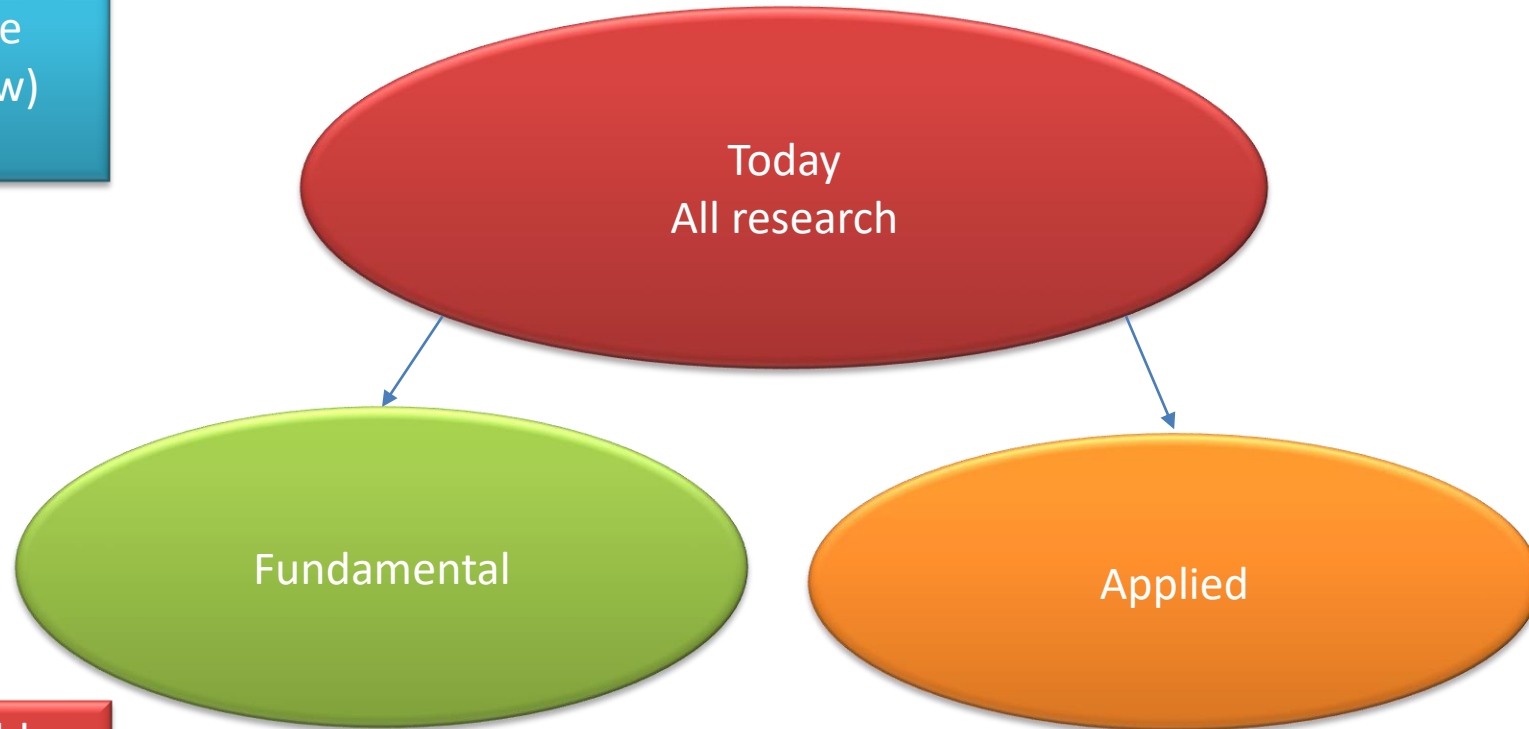


# Facilitation of research through funding without restraints

Most of the great and disruptive discoveries are SERENDIPITOUS (otherwise its unlikely to be new)  
Just look at Nobel Prize discoveries

What we want in Research funding is:  
Productivity  
Quality  
Creativity & Novelty  
Responsibility  
Translation

Great ideas are usually an afterthought to on odd behavior (e.g. Penicillin, Click chemistry, Suzuki reactions, Structure of atoms, Transistors etc)



Two completely independent funding regimes



Disruptive novel research to secure the future in competition

Optimization & application of known research results

# Chemistry Challenges : One driver could be the green agenda

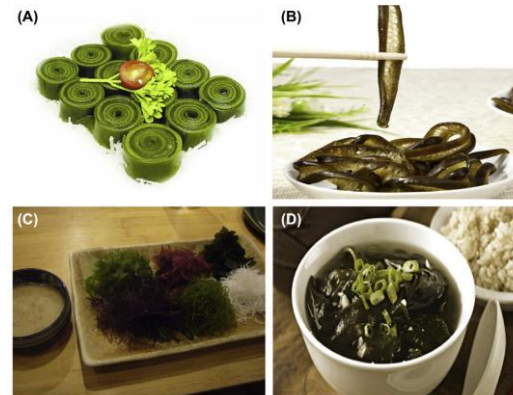


## New sustainable materials

Construction materials  
Replacement of fossils  
Packeting with cellulose  
Textile materials  
Green polymer

## Increased and improved food

Produced at location  
Adaptation to climate  
The fertilizer issues  
Packeting issues in consumption  
Processing tools



## New production processes

Less environment impact  
Less waste and energy  
Less depletion of resources  
Production at location

## Textiles and clothing

Production at location  
Recycling of fibers  
Resources of cellulose  
Other biocompatible materials



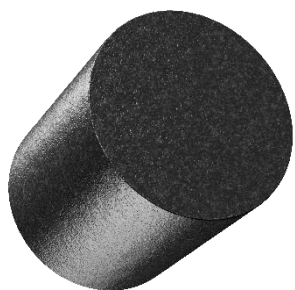
Bamboo

## Energy

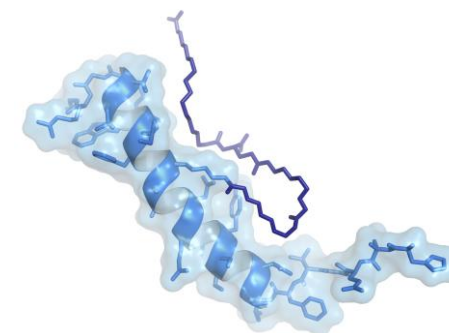
New solar technology  
New degradable wings  
Transition to H<sub>2</sub>  
Even access globally

## Transport

Carbon neutral transport  
Less transport of goods  
Weight reduction in transport  
Energy saving technologies



Catalysts



Chemistry in general education, ..... just like reading and writing

A general education in chemistry :  
Chemistry as positive fundamental science

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Masonry, bakery, food, construction, technology  
Healthy life by understanding chemistry consequences

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