



# Bioprospecting & Convention of Biodiversity, Options and Challenges!

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Soldier

# Bioprospecting is a part of Knowledge-based bioeconomy, KBBE



**KBBE => a need for more biological solutions,  
biological processes and products**

**Climate change and food crises are also drivers**

**Biological solutions can give more sustainability**

- **an option! Use it!**
- **discoveries from natural biodiversity –  
bioprospecting- is one of the measures**



## Biodiversity - An industrial perspective:

Tropical biodiversity has a rich species diversity

but

Extreme habitats are specifically interesting for their biochemical diversity! e.g.

- deserts (xerophiles)
- hot springs (thermophiles)
- salt mines and soda lakes (halophiles)
- arctic and marine habitats: (psychrophiles)



# An example on importance of diversity





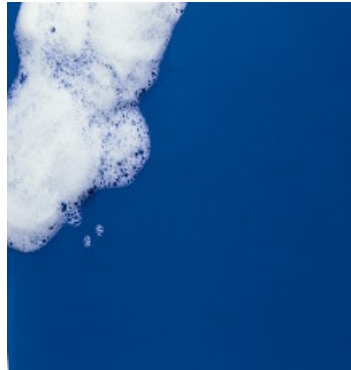
## Enzymes are eco-friendly solutions

### Replacing chemicals



Enzymes replace bromate in bread production

### Saving energy



Detergents with enzymes wash the clothes at lower temperatures

### Diminishing pollution



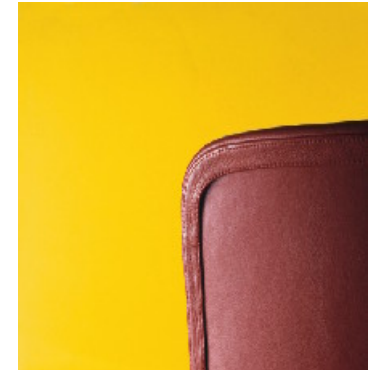
Enzymes in animal feed reduce the amount of phosphorus in the dung

### Better use of raw materials



Enzymes squeeze out all of the juice from the fruits

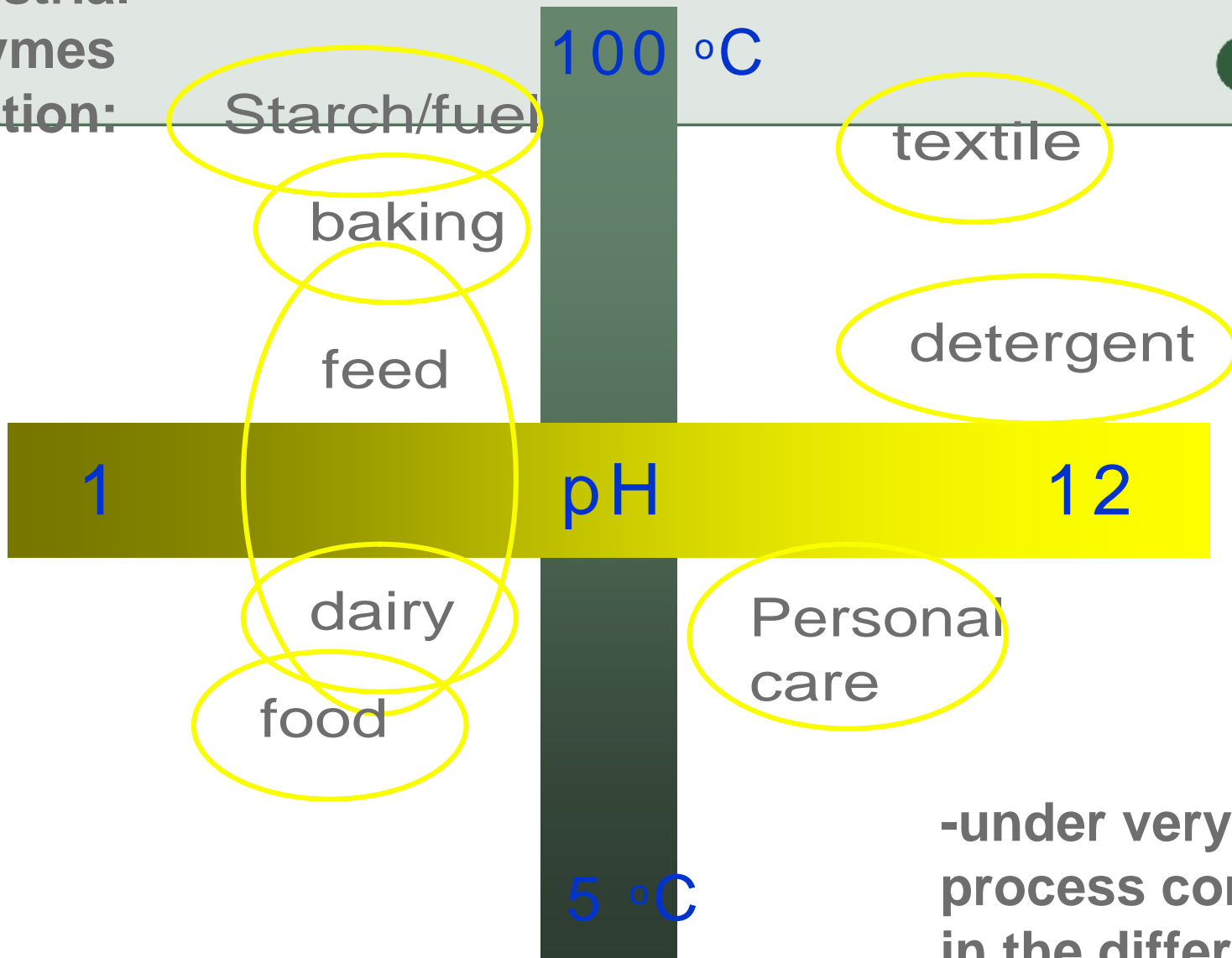
### Saving water



With enzymes, tanneries use less rinse water in leather production



industrial  
enzymes  
function:



-under very varying  
process conditions  
in the different  
market segments!

# Diversity is in demand!



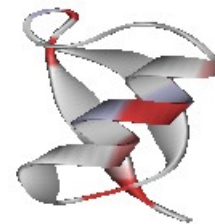


# Accessing the biodiversity - only one part of the discovery pool

**Biodiversity - directly  
from nature**



**Man-made diversity**



***In silico* discovery**







## Competing sources of diversity:

### **genome sequencing**

- => more genes from fewer organisms

### **other types of organisms as gene donors**

- not only microbes; also plants and animals

### **synthetic biology/genes for heterologue expression**

### **family and domain shuffling give new diversity**

- not just Protein Engineering

### **sophisticated bioinformatics searching tools**

- searching also among unknowns

## **But access to natural biodiversity is still interesting!**



- this requires a constant focus on the Convention of Biodiversity, CBD



## How to be in CBD compliance

Before access and transfer of any biological material (soil sample, fruiting body, pure culture):

- Prior informed consent must be achieved = PIC
  - from proper national governmental authority
- under a contract of mutually agreed terms = MAT



## **Desirable: CBD should not be a barrier!**

CBD should not be a barrier for scientific studies,  
for international collaboration, or for  
sustainable exploitation of nature's  
biodiversity

CBD compliance should be achievable through  
win/win collaborations between the country of  
origin

- without exceeding red tape!

How do we get there?



## **Novozymes Guiding Principles ( 1995), will do the utmost to ensure that:**

no microbial strains or natural material obtained without prior informed consent from the country of origin will be included in screening

all such accessed materials must be covered by contracts and/or material transfer agreements

conditions should be on mutually agreed terms and should include benefit sharing, intellectual property rights and technology transfer where appropriate

contracts should be cleared by the proper authority in the country of origin

the country of origin should do the collections and will be named in relevant publications and patent applications

SCIENCE  
UNIVERSITY OF COPENHAGEN

# Novozymes Annual Environmental Report -part of the Tripple bottom line reporting





## **The basic principle of good practice: Establishing win/ win collaborations**

Include both monetary and non-monetary compensations (viz technology transfer and capacity building)

Include compensations to country of origin for the mere option to screen accessed strains AND benefits if later commercialized

Prioritize scientist to scientist collaboration



## Many Grey areas: are they covered by CBD or not?

- isolation from exported/ traded products?
  - normally you have exhausted your rights when selling the product, if not specifically stated
- botanical gardens?
- seed borne microbes?
- universally ubiquitous species?
- accessions from before 01.12.93?



Rodney Roberts - USDA







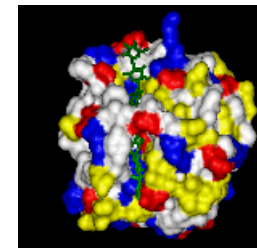
## Five CBD Pitfalls

Mismatch of expectations!

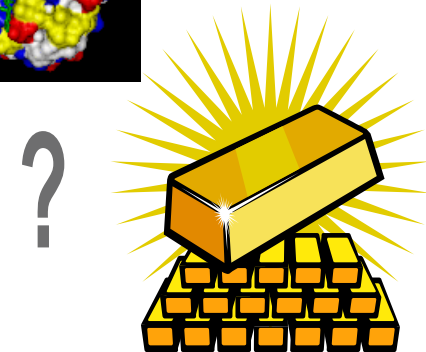


Middle-men takes the benefit!

Difficulties to get PIC!



Obstacles for "Scientist to Scientist" collaboration!





## More CBD Obstacles

### **academia not fully implementing CBD!**

- we risk that the hits end up in industry and when we ask for PIC it cannot be provided => we can not evaluate the new hit

## **International discussions, two major outstanding CBD issues!**



### **Integration of CBD in the patent system?**

- done e.g. by making a voluntary or compulsory disclosure of origin a demand for patent application completion

### **How could indigenous people's rights be ensured?**

- even if the Biodiversity Convention builds on and specifically states that the biological resources are the government's sovereign rights

## Accessing from International Culture collections = an important CBD issue!



**A Code of Conduct for accessing culture collection strains is needed**



# Knowledge sharing in International Scientific Community



From totally open to regulated and restricted:

- Publications, books and scientific papers
- Published patent applications
- Deposited sequences for genes and proteins
  
- Traded products
- Specimens in Herbaria and Botanical Gardens
  
- Culture Collections
- Directly accessed and transferred new isolates
  
- Quarantine objects
- Endangered species; Red listed; Sites conventions

## Recommendation for code of conduct on CBD/Culture collections



- Purchased strains from culture collections should be freely included into both scientific and industrial screening/evaluations but only moved into commercialization when CBD compliance has been ensured
- The establishment of an international fund for such CBD compensations should be considered



## Two alternatives for "CBD for Academics"

Alt.1: Academic researchers (taxonomists etc) adopt the full CBD procedure (PIC, MAT etc)

- => do not sample in countries where PIC cannot be obtained

**Alt.2 A "CBD-light" procedure is developed:**

- **Biodiversity-rich countries develop easier bottom-up procedures for local scientists to obtain PIC**
- **Visiting scientists collaborate with local mycologists & acquire PIC before sampling**
  - **copy of cultures/ specimens left in the country of origin**
  - **local mycologists included whenever relevant as authors**

## International Expert Group, IEG: Bioprospecting, Norway



### Recommendations:

#### Establish "Norway Bioprospecting cluster"

- A competitive program on arctic aquatic biodiversity
- A competitive program on extreme habitats biodiversity
- A Business Development (BD) unit



## International Expert Group, IEG: Bioprospecting, Norway (Recom. cont.)



Start establishing the BD unit

Build on R&D commercialization experience in the  
pharma, food and oil & gas sector; and  
university tech trans experience

Make a two tier procedure, Expression of Interest  
followed by a round of invited full applications

Use the BD unit as match makers between  
academia and industry

## **Bioprospecting Norway should go international!**



Focus on:

Arctic and Extreme habitats bioprospecting

Collaborate with:

- Russia
  - Greenland, Denmark
  - Sweden
  - US
  - Canada
- 
- Implement CBD by win/win collaborations
  - Remember the indigenous people rights



## Expectation management

Profit margin is varying between different business segments

- Royalty rate expectations must reflect this

Royalty rates for the Enzyme business (ex):

- Kerry ten Kate and Sarah A. Laird wrote in "The commercial use of Biodiversity" (1999):
- Sample only       => 0.05%-0.1% royalty on actual sales
- Isolated strain=> 0.1-0.2% royalty on actual sales
- Active strain       => 0.2-0.5% royalty on actual sales

## Good CBD governance gives basis for good partnerships



Access to biological resources should be done by PIC under MAT, preferably through scientist to scientist collaboration, leaving copy strain in country of origin

Code of conduct should be worked out for obtaining PIC (Prior informed consent) and approved templates for MAT (mutually agreed terms) should be made



## Code of conduct for ABS

The screening phase:

industry gets CBD-option to evaluate new strains  
country of origin receives capacity building and  
technology transfer

The commercial phase:

Country of origin receives monetary benefits (up front  
lump sums or royalties), based on the contribution  
made and on actual sales

The Result: Win/Win in every case!



## Concluding remarks

### **Invest in Bioprospecting**

- but get organized
- early discoveries are abundant and have almost no commercial value

### **Ensure full CBD compliance (ABS Bonn Guidelines)**

- Build credibility
- Gives basis for good partnerships

### **Use bioprospecting (also) for biodiversity studies**

- base lines for climate change, invasive species
- international collaborations, protecting precious habitats for the future



**Thank you for your attention!**  
**I am looking forward to a good discussion**  
**lene**