



**Novozymes meeting with
Canadian Biotech research**
*“Access to global knowledge is
necessary maintaining the
competitive edge”*

**A perspective from Novozymes
September 2010**

Henrik Bisgaard-Frantzen, Senior Director
Innovation office
Research & Development
Novozymes A/S



Personal



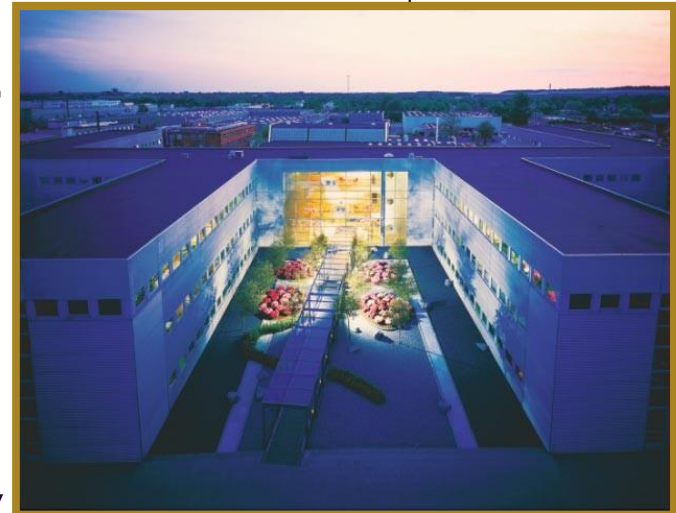
- Employed at Novozymes for the past 25 years, the last 10 years as Senior Director in R&D
- Management and strategic responsibilities for several of our R&D functions
- Appointed 3 years ago to set up a professional structure gaining access to global knowledge and bring ideas and new technology to Novozymes – Connect&innovate (C&I)
- This assignment has been the most challenging I have had with no silver bullet and no “right or wrong”

Agenda

- Novozymes in Brief – setting the scene
- Access to global knowledge – Challenges and dilemmas from a Novozymes perspective
- The Novozymes concept for “Connect & Innovate”
- Novozymes offerings and present interests

- World leader in industrial enzymes & microorganisms with 47% global market share
- Sales of \$1.5 billion
- 5,200 employees
- 700 products sold in 130 countries in 40 different industries with > 50 new products launched during the last 5 years
- New products represented around 30% of total sales in 2009
- 13–14% of revenue invested in R&D
- More than 6,000 granted patents and pending patent applications
- Major production facilities in China, US, Brazil, Denmark

NOVOZYMES IN BRIEF

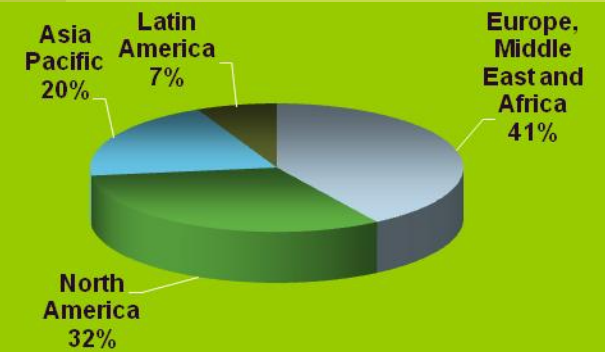


Novozymes' world wide presence



- Sales Offices
- Production
- Research

Turnover by region 2007



What we do – our business today

Enzyme business ~ 80% of R&D resources

BioBusiness ~ 20% of R&D resources



Detergent enzymes

New, improved cleaning and fabric care properties, new concepts, improved dishwashing products



Technical enzymes

New technologies and improved processes for starch and fuel ethanol

Bioprocesses

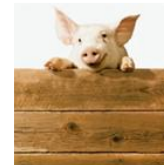
New concepts for treatment of textiles



Food enzymes

Improved dough products, non-bread products. Yield and quality improving concepts for brewing

Food specialties – dairy products, oils & fats



Feed enzymes

Improved phosphorus release. Enhanced digestibility of vegetable protein, aquaculture



Micro-organisms

Institutional & Household cleaning: odor reduction, oil & grease degradation

BioAgriculture: inoculants, biofungicides, growth enhancement

Waste treatment: ammonia and nitrite control, color removal, hydrocarbon degradation



Biopharmaceuticals

Hyaluronic acid and potentially other biopolymers

Antimicrobial peptides

Cell cultures ingredients

Digestive disorders

Currently three main commercial areas being developed within BioBusiness:

Biopharmaceutical products and services:

Novozymes Biopharma
Novozymes Biopolymer

Microorganisms for industrial & agricultural applications

Novozymes Biologicals

Conversion of Renewables

- Sustainable, bio-based substitutes for petroleum-based products with the potential for reducing the environmental footprint of these

Platform xx

Bioinnovation will allow us to replace many of the polluting practices of industry today. In the future we believe biological processes will be involved in the manufacturing of more and more products, foods and pharmaceuticals. With bioinnovation, the only limit is our own creativity – and we'd like to explore these opportunities in partnership or cooperation with customers, authorities etc.

Being a global market leader within white biotech doesn't come for free..

Corporate R&D focus areas

✦ **Strong investment in R&D to drive of top-line growth through Innovation**



- Growth in sales and growth in earnings..
 - 7 years' EBIT CAGR ~ 10%

✦ **Systematic optimization of our productivity which provide continuous improvements in profitability and delays investments**



- ..Improves margins and reduces CAPEX
 - 2009: 20.0% EBIT Margin
20.3% ROIC
 - ...despite USD/DKK decline

✦ **Strategy to leverage expertise outside enzymes -> BioBusiness**



- ..Adds additional growth opportunities and diversifies the business

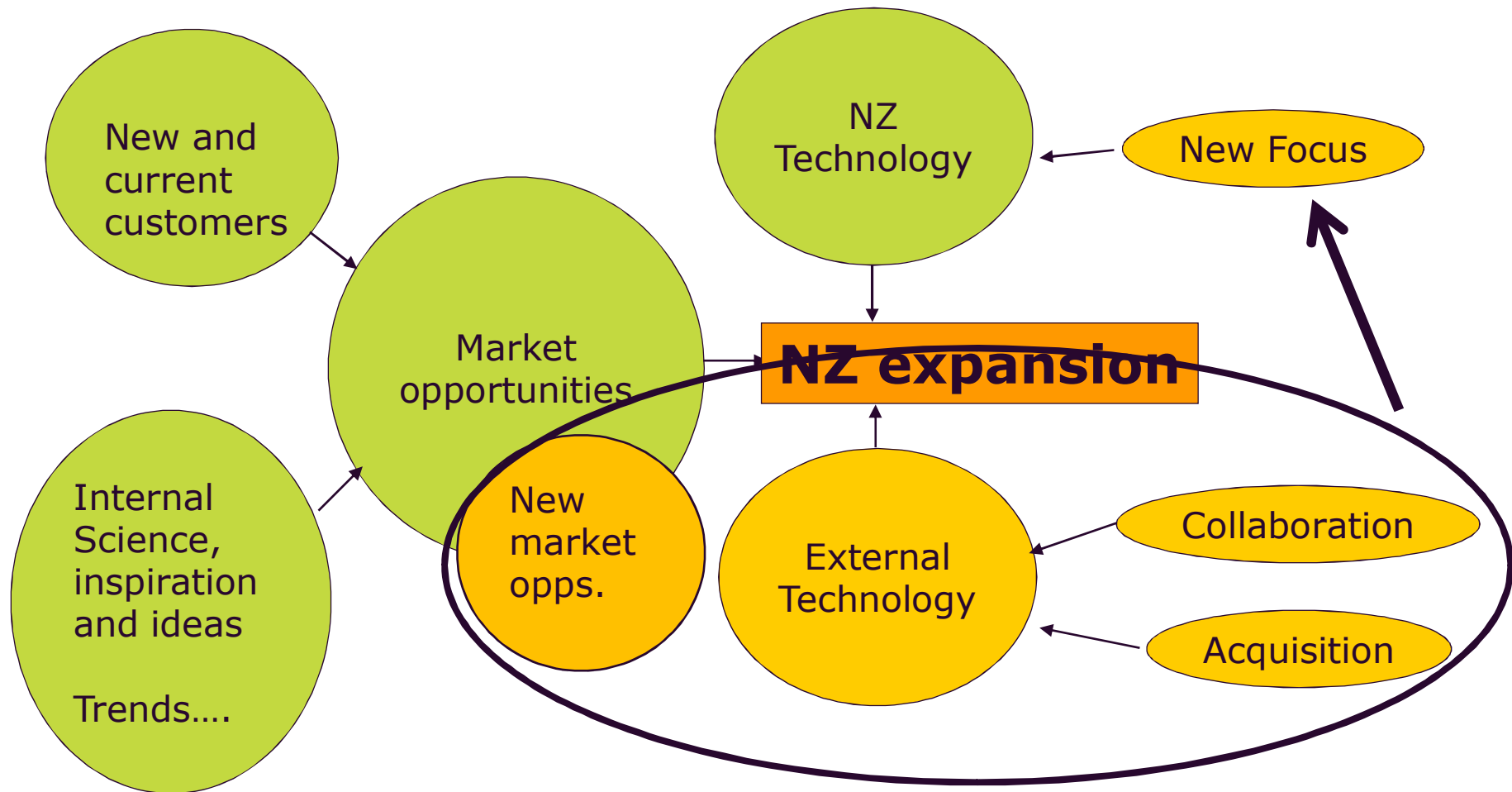
Novozymes can only deliver performance if we master our core technologies to perfection

We have to monitor for new technology developments w.w. in our core areas as well as scout for new opportunities and ideas



What's Novozymes challenge ?

(when it comes to selecting the best business opportunities)



Scouting for new technology and new opportunities ! – We have a “few” challenges and dilemmas

- The development of new technology is increasing with accelerated speed in many other regions than just US. and Europe
- What is our long term future needs without being able to predict the future developments from a technology point of view ?
- Who to engage with, where and with what focus ?
- How to do it ?, acknowledge that global knowledge is not the same as global information
- Some of it can be worked out in our strategic work !, but not all and we have to apply an opportunistic approach



A few examples

Technology development with accelerated speed - New technology in the classical Biotech area develops very fast !



Screening of new enzymes

10 years ago :

Earth samples → isolation of microorganism → prep. Of gene libraries in E.coli → screening with selection criteria → Id. Of relevant enzyme → testing → optimization of prod. organisms with native gene

Today:

Database genome screening based on homology and sequences → direct cloning based on gene synthesis → testing → optimization of prod. Org.

- One of the changes has been the development of inexpensive genome sequencing

- 10 years ago:

- Cost/bacteria genome > 100.000USD,

Enzyme diversity explode !!!

- Today:

- Cost/bacteria genome = 3000 USD,

- Genome sequenced > 1000,

- Done in days

Not knowing the future - The future technology development will not be like the present !!



An analysis of the history of technology shows that **technological change is exponential**, contrary to the common-sense "intuitive linear" view. **So we won't experience 100 years of progress in the 21st century -- it will be more like 20,000 years of progress (at today's rate)**. The "returns," such as chip speed and cost-effectiveness, also increase exponentially. There's even

For example When the human genome scan started 20 years ago, Critics pointed out that given the speed which the genome could then be scanned, it would take thousands of years to finish the Project, however the fifteen year project was completed slightly Ahead of schedule

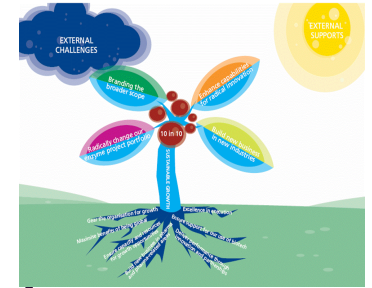
based humans, and ultra-high levels of intelligence that expand outward in the universe at the speed of light.

Published on KurzweilAI.net.

Who to contact and where ?...not all skilled scientists work at Novozymes

- Approx. 1000 people is engaged with research at Novozymes – among these approx. 400 research scientists
- Global research population is 7,2 mio. researchers w.w. (UNESCO statistics 2007), increased 20% within the past 5 years primarily in China and India
 - Defined by: professionals engaged in creation of new knowledge, products, processes, methods and systems
 - Assuming that 5% is within white Biotech, 5% is highly skillful = 20.000 global scientists Novozymes would like know

We have realized that the world is changing around us and a pronounced outward looking mindset has become a significant part of our R&D strategy



Foster an innovation culture

.....

Outward looking mindset

- Scout and connect to external expertise centers and service providers whenever it makes sense. To be an integrated part of our R&D process – leading at faster and more cost-efficient access to new technologies.

Enable growth with new technology platform

.....

Formation of a new function in R&D – "Innovation office"

Connect & innovate is a central element in "Innovation office"

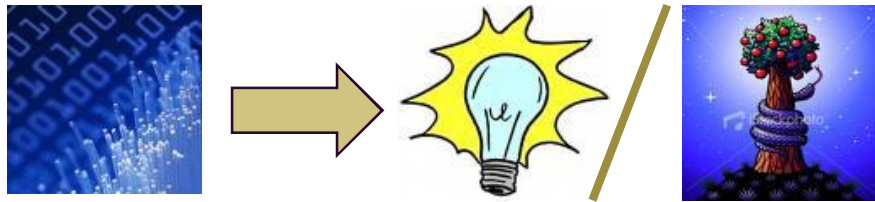
A new approach within Novozymes, supporting development of new business/technology platforms accelerating our present work and deliver new options to our pipeline by keeping an "opportunistic eye open



C&I have 4 concrete tasks

- Challenge the conventions in the organization and our technology needs “are we doing the right things and are we doing things right ?”
 - Turning information into knowledge providing ideas and innovations
 - Growing external networks
 - Focusing in particular on emerging regions
-
- Which require: Tools, Competencies and “Modes of Operation”, while being pragmatic :

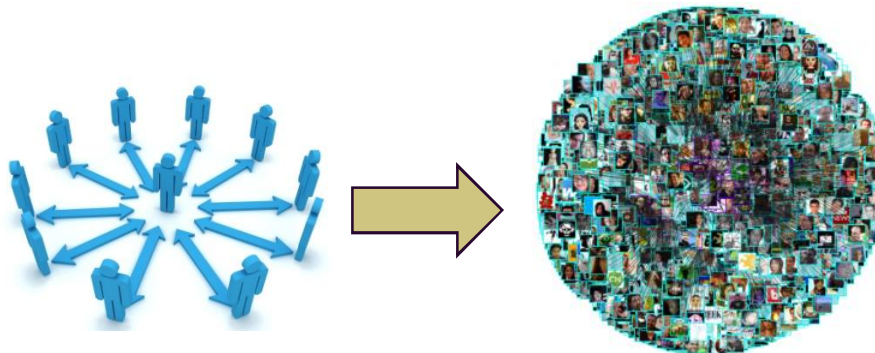
"Modes of Operation"



Turning information into knowledge, ideas and innovations

Specific analysis within new defined areas of interest by employing external service providers such as Consultants and embassies etc

Search for and establish contact to relevant centers of excellence w.w. within white biotech

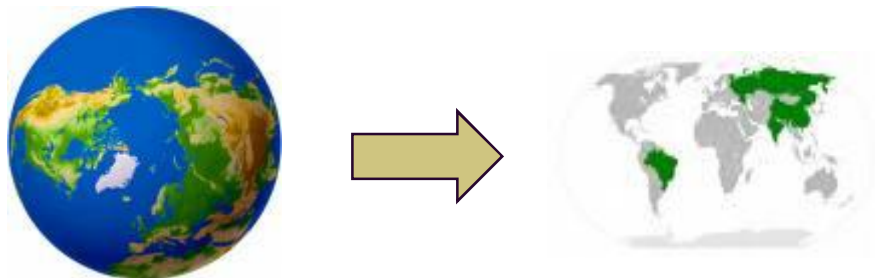


Growing the external network in close collaboration with the local Nz. Org.

Collaborative efforts – Projects/JV

Providing seed funding / contract research projects -some explorative, some anchored with R&D org.

"engage" with top professors in S&T –



Focusing on regions (relatively) new to Novozymes

Addressing BRIC concerns ex. the environment, food, energy and feed supply and for the dramatic urbanisation

Addressing developed areas for new inspiration and collaboration

Insights by being there.

The Novozymes offering to future partners



- Undisputed global leader in “White Biotech”:
 - Creating the frontiers within our core technologies
 - Technology and cost/performance
 - Taking ~10 new products annually to successful commercialisation through globally extended and highly diversified customer network
 - Being very close to real care-aboutments among global leaders in
 - e.g., the consumer industry
 - We master the entire elements from development of Idea to launch of new product
- Through ~50 years as a player in Biotech a quite thorough understanding of what could be hot – and what not – in Biotech.
- Global presense in R&D, Production, Sales and Marketing – also through global corporate alliances within agricultural, pharma and consumer related market segments.

The Novozymes view on technology partnerships



- Novozymes must have significant contributions to the total package of technologies employed.
- Profit sharing must be fair from combined perspectives of funding and "ideation" provided, technological contributions made, financial risks taken and commercialisation opportunities exploited.
- For new concepts/enzymes which require significant investments, the potential annual revenues for Novozymes must be ≥ 20 M\$
- Novozymes must have freedom to operate within field

21 Currently, our most burning interests reside within:



- Changing the textile industry to a higher degree of "sustainability"
- Biological concepts for Water purification and recycling
- Expanding our enzyme diversity for biomass fractionation, second generation BioFuel as well as for production of Biogas
- Bio-processing of agriculture products, Soy and other large volumes crop; care about and trends
- Identifying applicational expertise within "Food and Feed":
 - Food processing and preservation
 - Feed digestibility and preservation
- Biological agriculture: Biofertilizers, Bioherbicides, Bionematocides
 - Stimulating crop growth while reducing dependency on fertilization and pesticides
 - Low cost formulations for improved survival/stability of microbes employed
- Feed probiotics
- Biotechnological tools for control of microbial activity
- Unique/complementary enzymes, enzyme applications and application expertise, keeping an open mind for "The Unexpected"
- New methods and technologies within Molecular biotechnology which set new benchmarks for how Novozymes should conduct research in the future
 - Eg. Metagenomics/comparativ metagenomics
- Platform chemicals produced by fermentation; Engineering metabolic pathways and other characteristics of microorganisms
- Exploring capabilities and market potentials within composite and functionalized materials

