



Nanoeffects - From New Materials to Innovative Business

V. Hilarius, M. Kursawe, O. Klaeffling, M. v. Tettau
Merck KGaA, Darmstadt, Germany

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Merck Chemicals

Major divisional products & markets / key figures



Liquid crystals and components for the display industry



Rapid test kits & culture media for microbiology & hygiene control



Effect pigments for the coating, plastics, printing and cosmetic industries



Analytical reagents



Active ingredients and natural substances for cosmetics, nutraceuticals & preventive care



Mobile systems for food & environmental analysis



Products & services for the entire drug development chain

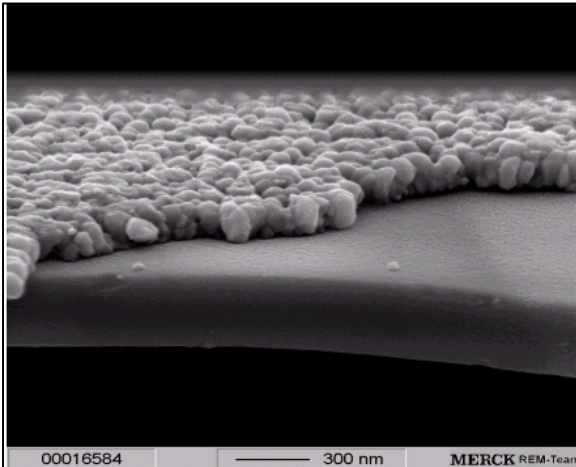
Merck KGaA Key Figures 2005 Chemicals & Pharmaceuticals

Turnover: 5.9 bn EUR (Chemicals 1.9 bn EUR)
R&D: 713 mn EUR (Chemicals: 132 mn EUR)
Empl: ca. 29,000 worldwide
Headquarter: Darmstadt, Germany

From nano effects to innovative solutions

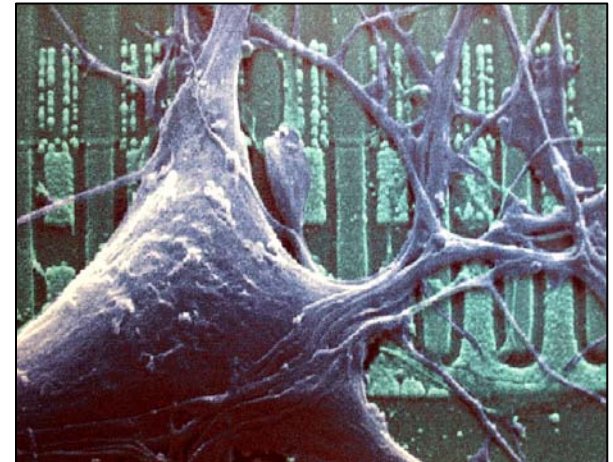
Nano products – Utilization of nano effects

Novel effects based on nano sized properties

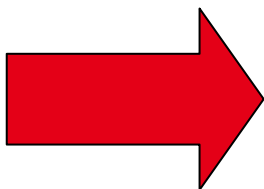


Nano particle film on a ultra flat alumina surface
Source: Merck KGaA

- Very small particles
- Ultra thin films
- Atomic flat surfaces
- Molecule sized porosity
- Tunable surface properties
- Extremely high reactivity
- Quantum effects
- Shift of bulk properties
- Biological compatibility
- Structural effects

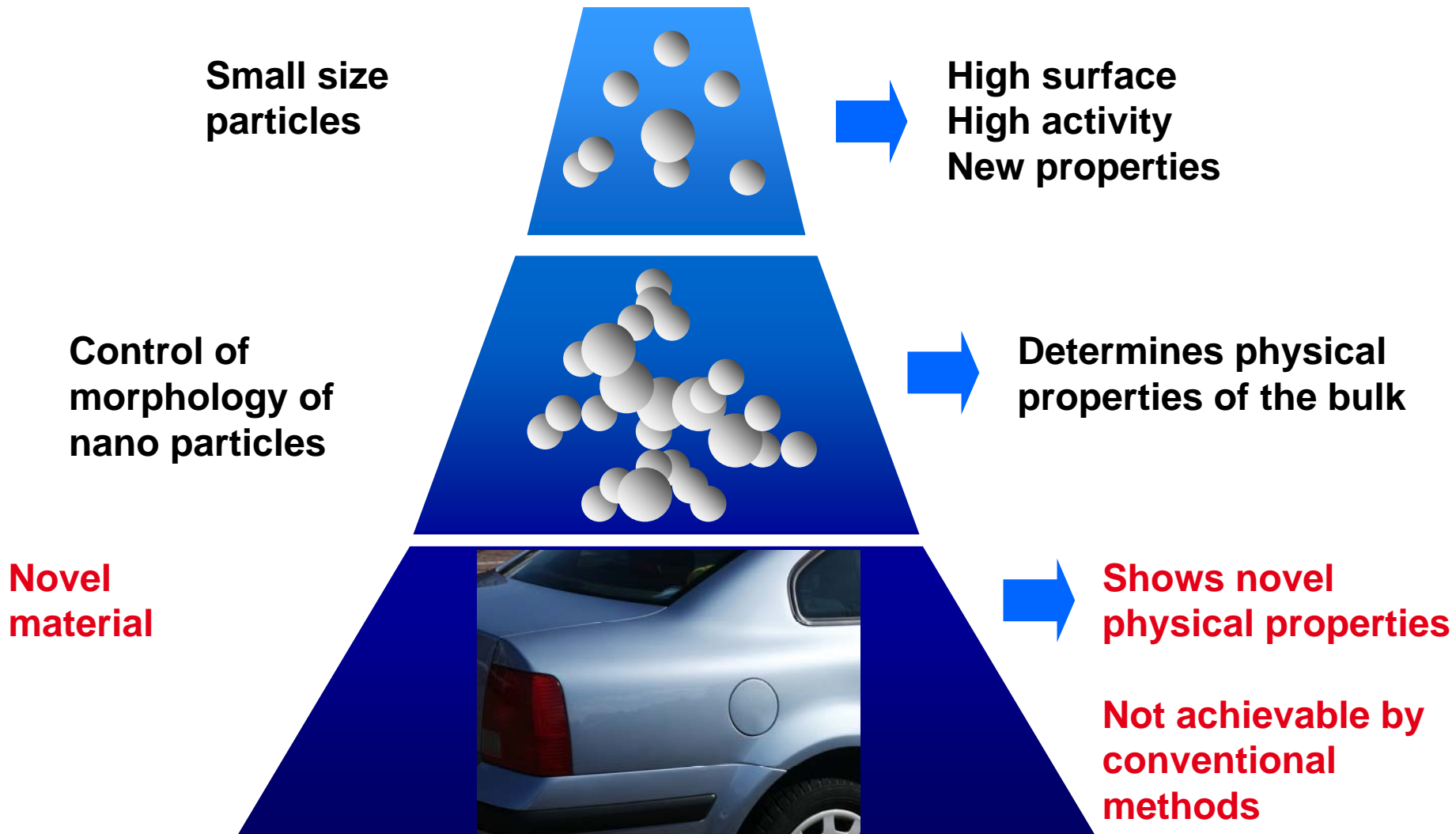


Biological cell on a silicon microchip
Source: P. Frommerz, Martinsried



Nano technology is more than nano particles

Nano technology as enabler for novel materials



Today's Merck competences on nano effect based materials



Materials for solar collectors

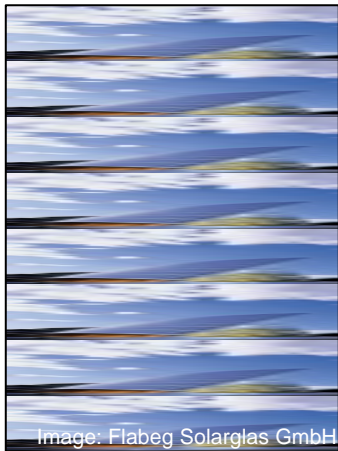


Image: Flabeg Solarglas GmbH

UV-protection and controlled release



Bioseparation and chromatography



Pigments and coating materials



Wet chemical precipitation
Sol/gel processes
Micro encapsulation
Agglomeration/deagglomeration

Surface functionalization
Control of porosity
Inorganic/organic matrix composites
In situ processing

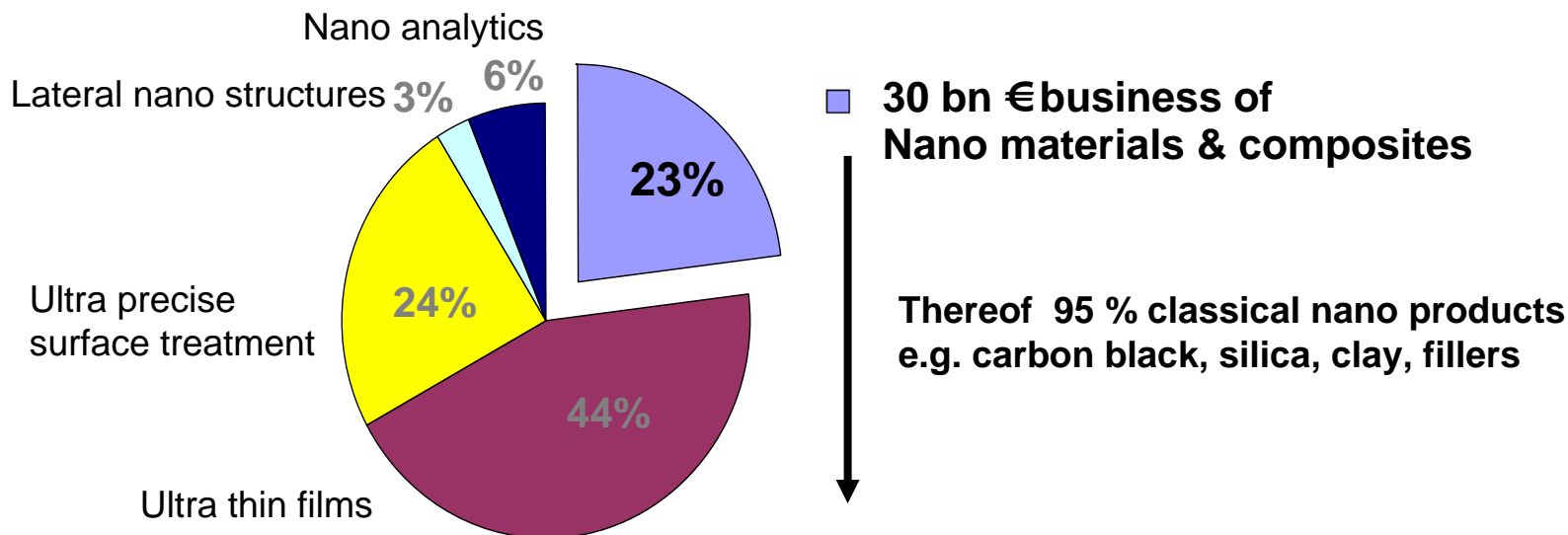
Wet chemical platform technology

Nano products means nano business?

Strong market growth generated by new nano materials



Nanotechnology activities count for a business of 130 bn € (2005)



Fast growing business with new nano materials:
→ CAGR: > 15 %
1,5 bn € (2005)
> 3 bn € (2010)

Strong market growth by novel materials based on nano sized effects

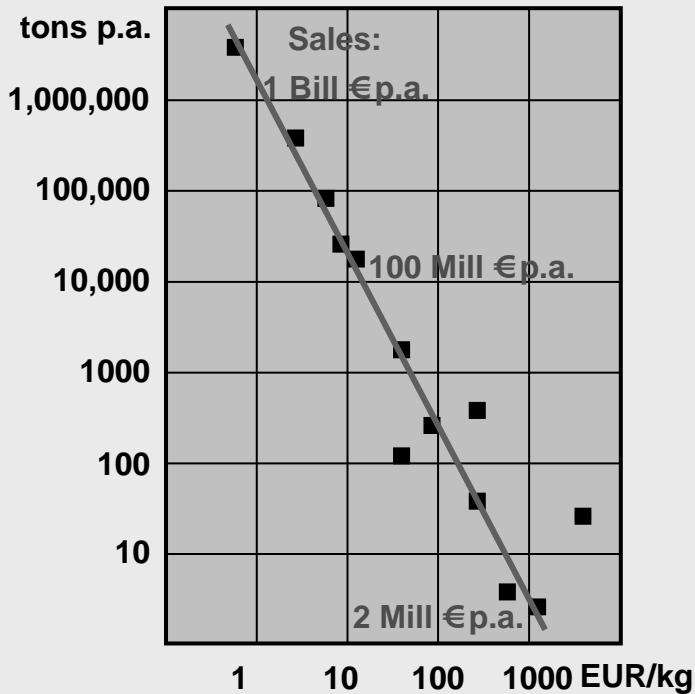


Nano technology based business: Drivers and Facts

- In 2005 corporate funding of R&D exceeds government funding
- Nanotechnology R&D nearly doubled in past two years
- Growing importance of **Asia** (2nd Asian NanoTech Forum Tokyo 2006, China No 2 in patent applications in 2004)
- Strong and focused nanotechnology programs under direct control of the top management in the chemical and application industry (e.g. BASF, Bayer, Degussa, Merck, L'Oreal, Bosch,...)

Nano materials = Nano business?

Global nano materials market



The trap of nano chemistry

Small size, small quantities, less chemicals

Value creation by application

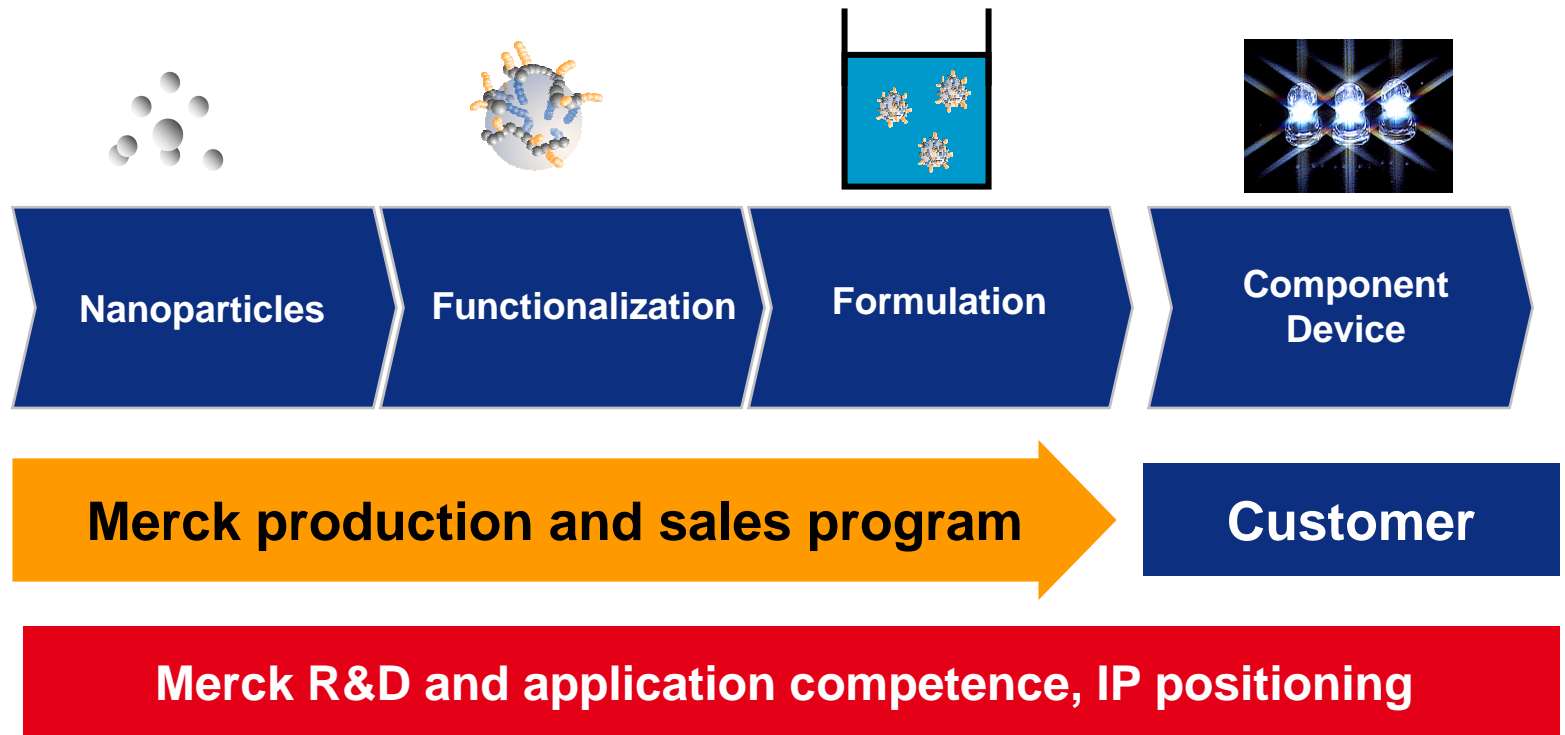
Increasing complexity of applications
Interdisciplinary requirements

Value of chemicals becomes unimportant

Essential

Forward integration within the value chain

Value chain knowledge and forward integration is key for business success

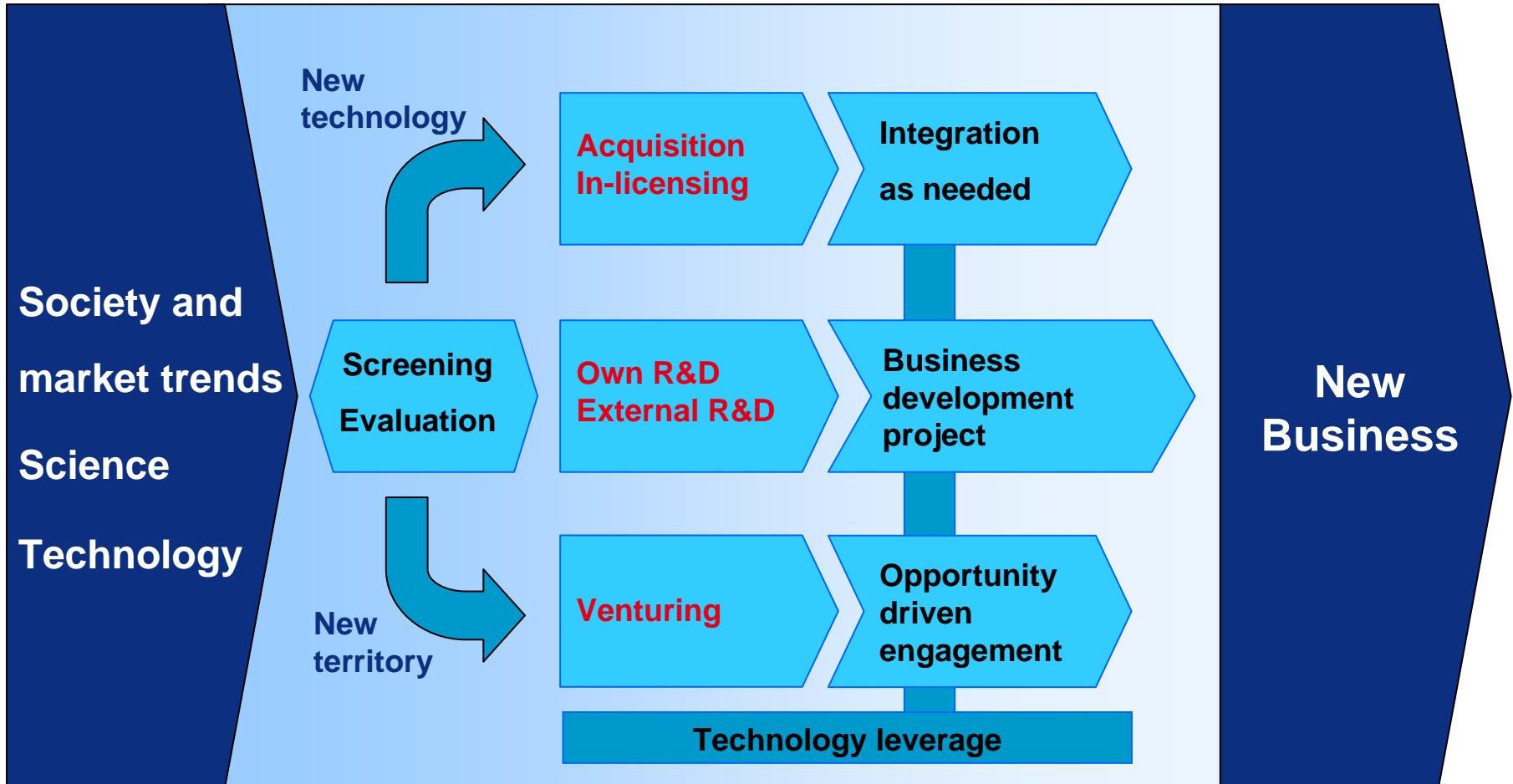


- **Functionalization and formulation generates significant value & high margins**
- **Technical and marketing know-how up to application/device level**
- **Possibilities for cooperation, ventures and partnerships**

Business Development Chemicals

... A key driver for innovation & business growth

Business Development uses different pathways for success



Targets:

- Exploration of external capacities for further development, virtual extension of R&D capacities
- Creating value on extended exploitation of existing IPR
- Gain access to VC and other risk funding financial resources
- Built up an independent value stream by equity, milestone payments and license fees
- Prepare business cases for future in-sourcing

It is more than simple in/out-licensing of IPR

Three major exploitation pathways

Internal or external IP portfolios

In sourcing of projects

- Support start up companies for future stepwise take over
- Search for the portfolios of seed funds and VCs
- Increase value of the projects by external development resources
- Virtual extension of R&D

Extension of existing R&D projects

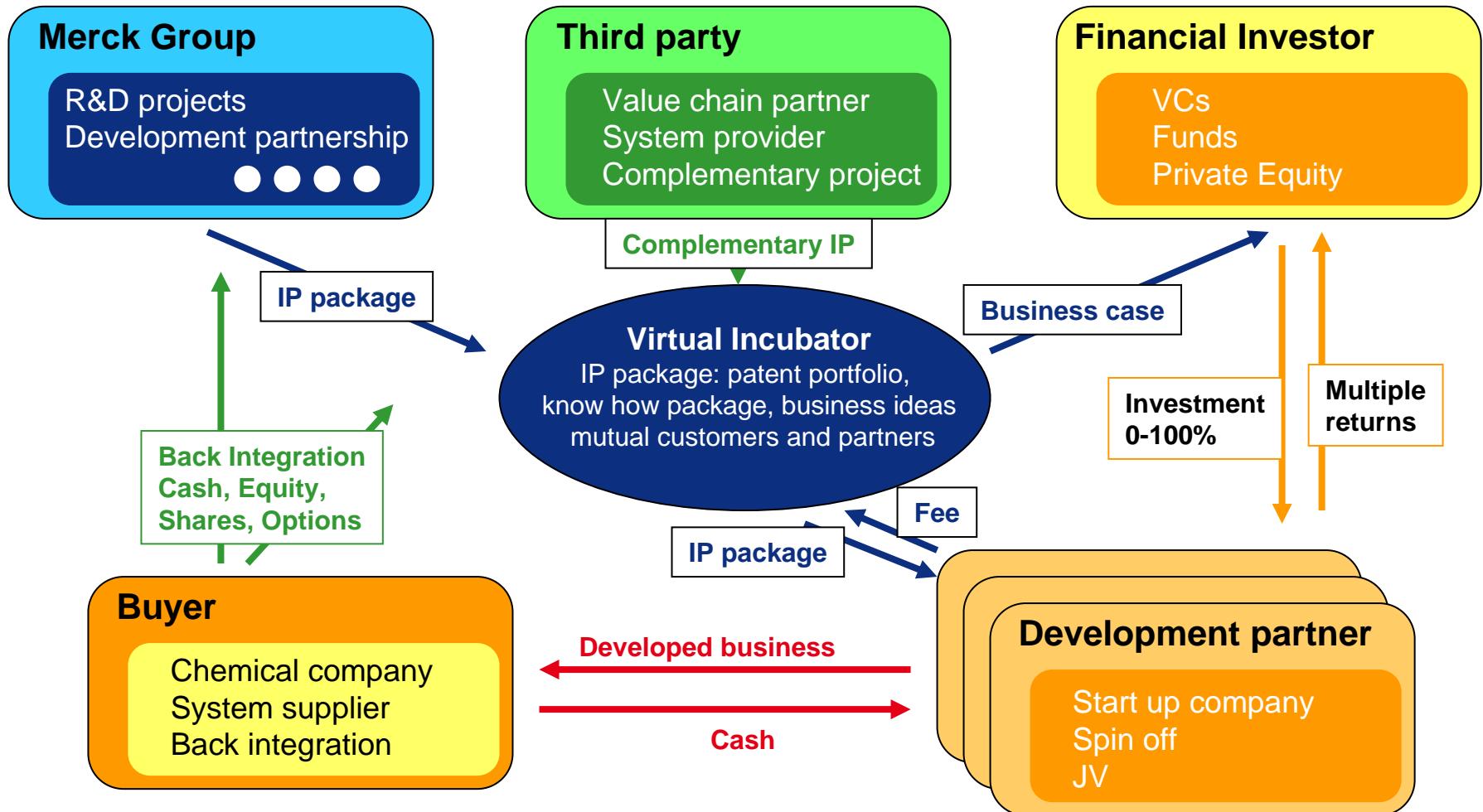
- Team up with
 - Value chain partners
 - Complementary projects
 - System provider
- Create more powerful external projects with fast progress
- Exploit external resources

Financial exploitation of existing IP

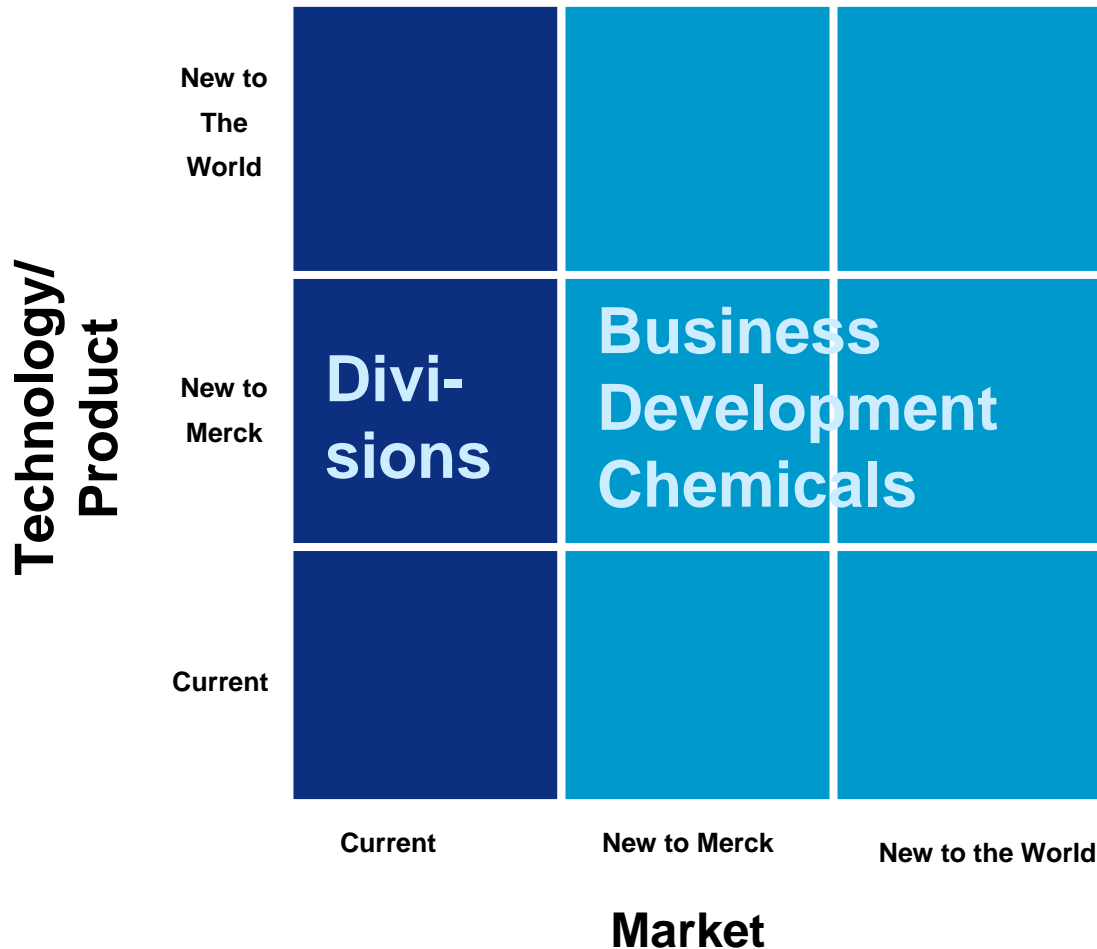
- Exploit sleeping IPR to create a financial reward
- Further development and value creation with the final target to exit
- Explore technology agencies for exploitation of smaller IP portfolios

Enhance value based on equity and exploitation of external resources

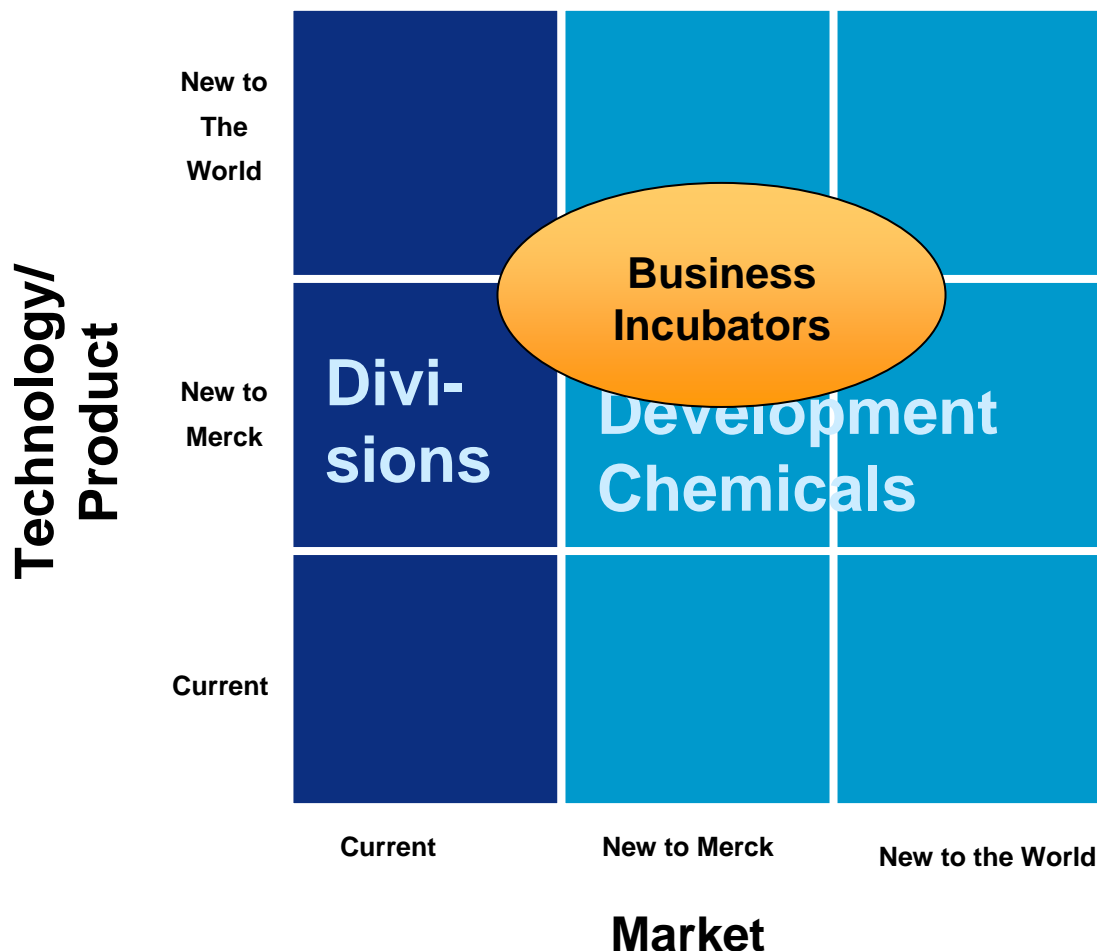
IP based Business Incubator Business model



Incubator models are placed in the high risk areas of business development



Incubator models are placed in the high risk areas of business development



Functions of Incubators:

Divisions:

- Business development for new technologies in high risk areas

Business Development Chemicals:

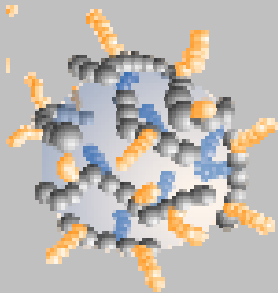
- Addressing new markets with new technologies

high risk

We focus on innovative applications of nano materials



Additives



Functionalized nano particles for

- Coating additives
- Anti scratch
- UV protection
- Reinforcement of Polymers

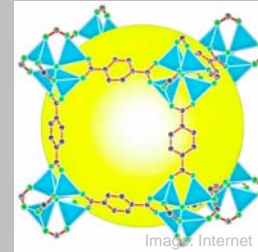
Optics



Nano-optical materials for

- Optical coatings
- Lighting systems
- Photonics

Energy



Nano materials for

- Energy storage
- Energy conversion
- Gas storage
- Solar cells

Printable Electronics

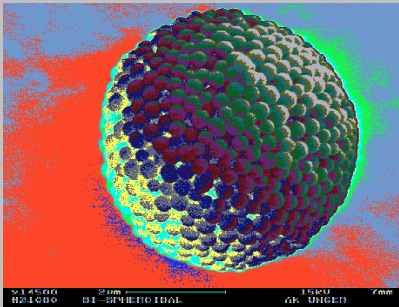


Nano materials for

- Low cost electronics
- Flexible displays
- RFID
- Printable conductors and semiconductors

Nanotechnology focus for life science and analytics – surface functionalization

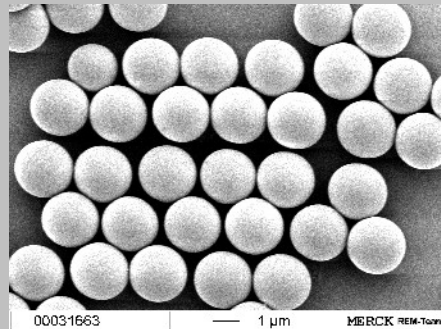
Enrichment, isolation and separation



Functionalized surfaces and nanomaterials for

- Sample preparation
- Chromatography materials
- Capture of biomolecules (e. g. magnetic)

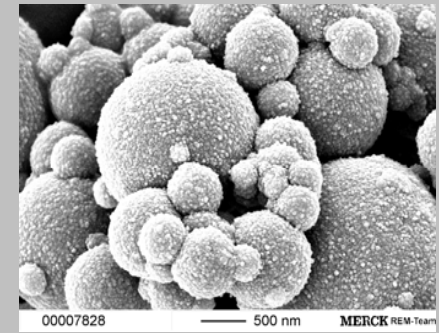
Detection



Nanoparticles for

- Detection of micro-organisms
- Immuno assays
- Protein arrays
- Tissue staining

Formulation and drug delivery



Nanomaterials for

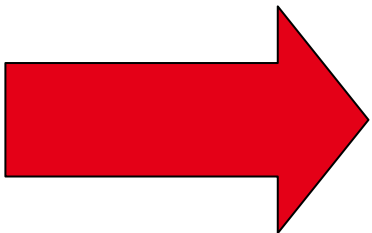
- Liposomes
- Coated nanoparticles
- PEG-protein conjugates

Merck as partner for nano materials



We make your innovative nano approach to a real business

- Evaluation by experienced due diligence competence
- Technology competence based on platform concepts
- Scale up capabilities in the related key markets
- Interdisciplinarity and cross functionality
- Integrated application technology, captive use
- Existing business partnerships with key players world wide
- Financial power for development up to a world wide positioning



Merck KGaA, Darmstadt, Germany

Future Growth Markets - Merck KGaA

Your partner for success



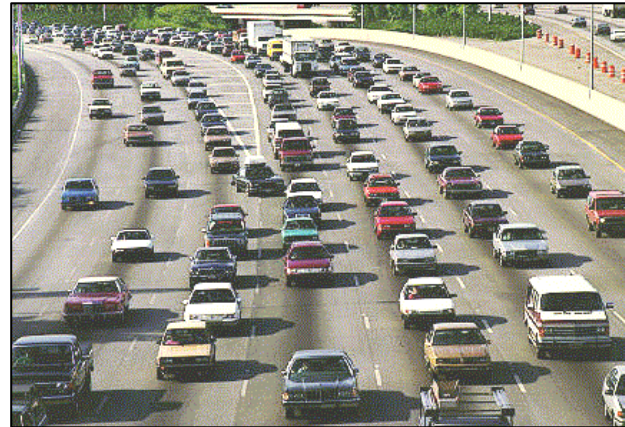
Quality of Life

Health, Nutrition, Cosmetics,
Secure the Environment



High Tech Applications

Information, Communication,
Entertainment, Energy, Transportation



- Natural products for health & cosmetics
- Cosmeceuticals, nutraceuticals
- Active ingredients
- Bioanalytics and bioprocessing tools
- Delivery and controlled release systems
- Preventive healthcare

- Additives for coatings and polymers
- Materials for power storage and solar cells
- Novel colorants
- Printable displays/ E-ink applications
- Energy saving lighting systems
- Printable electronics