



Informatics and Knowledge Management at the Novartis Institutes for BioMedical Research (NIBR)

Enable Science *in silico*
&

Provide the Right Knowledge to the Right People at the
Right Time to enable the Right Decision!

Manuel Peitsch

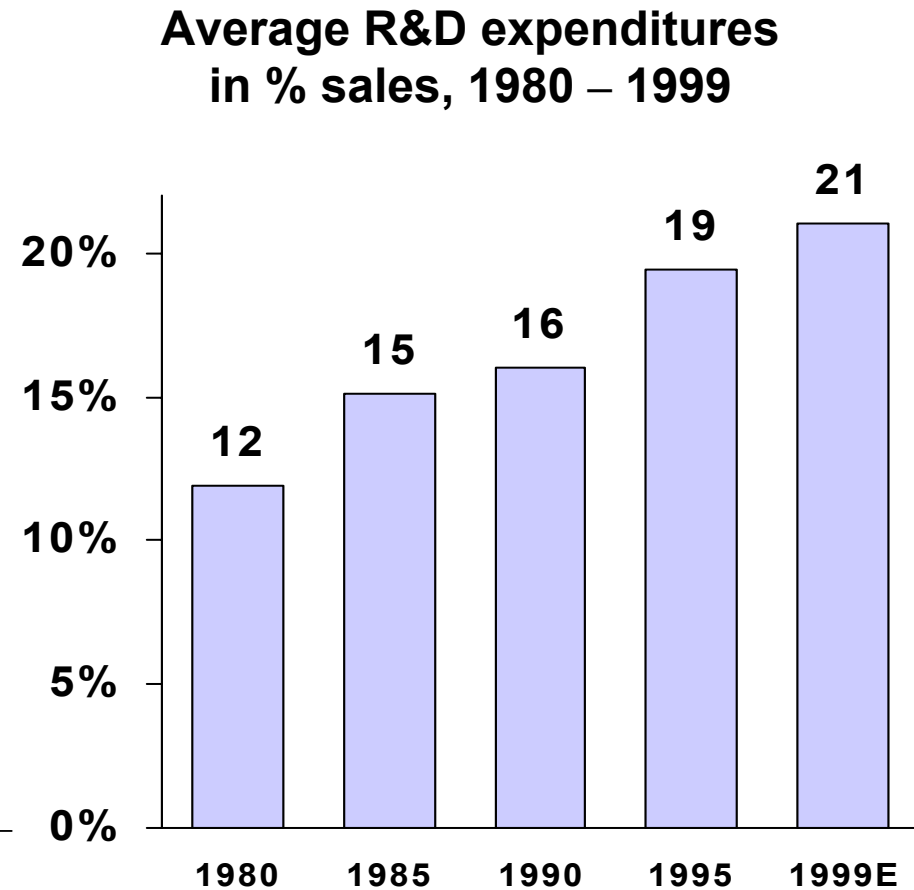
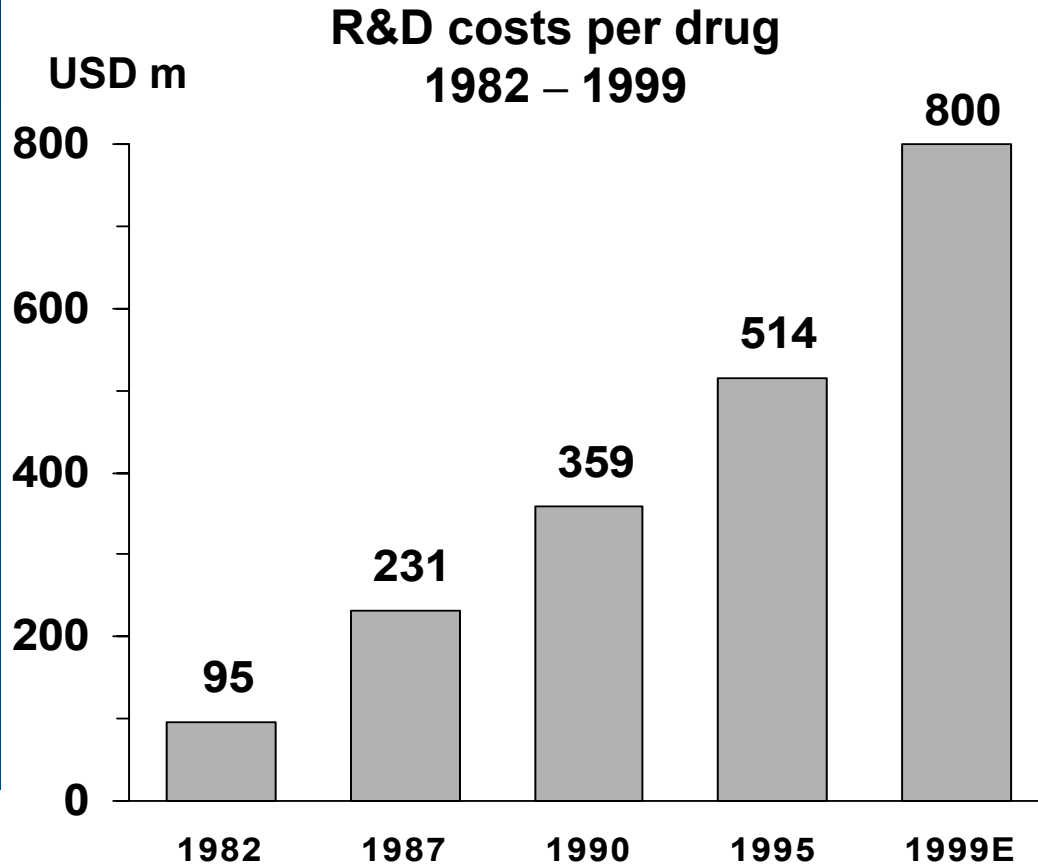
Agenda

- **Business Challenges faced by Pharmaceutical Industry**
- **The Information Age and its Challenges to our Industry**
- **Scientific Challenges of Drug Discovery**
- **The Vision and its benefits**
- **The Knowledge Space Strategy**
- **Implementing the Strategy**
- **Conclusions**

Drivers for Change in the Pharmaceutical Industry

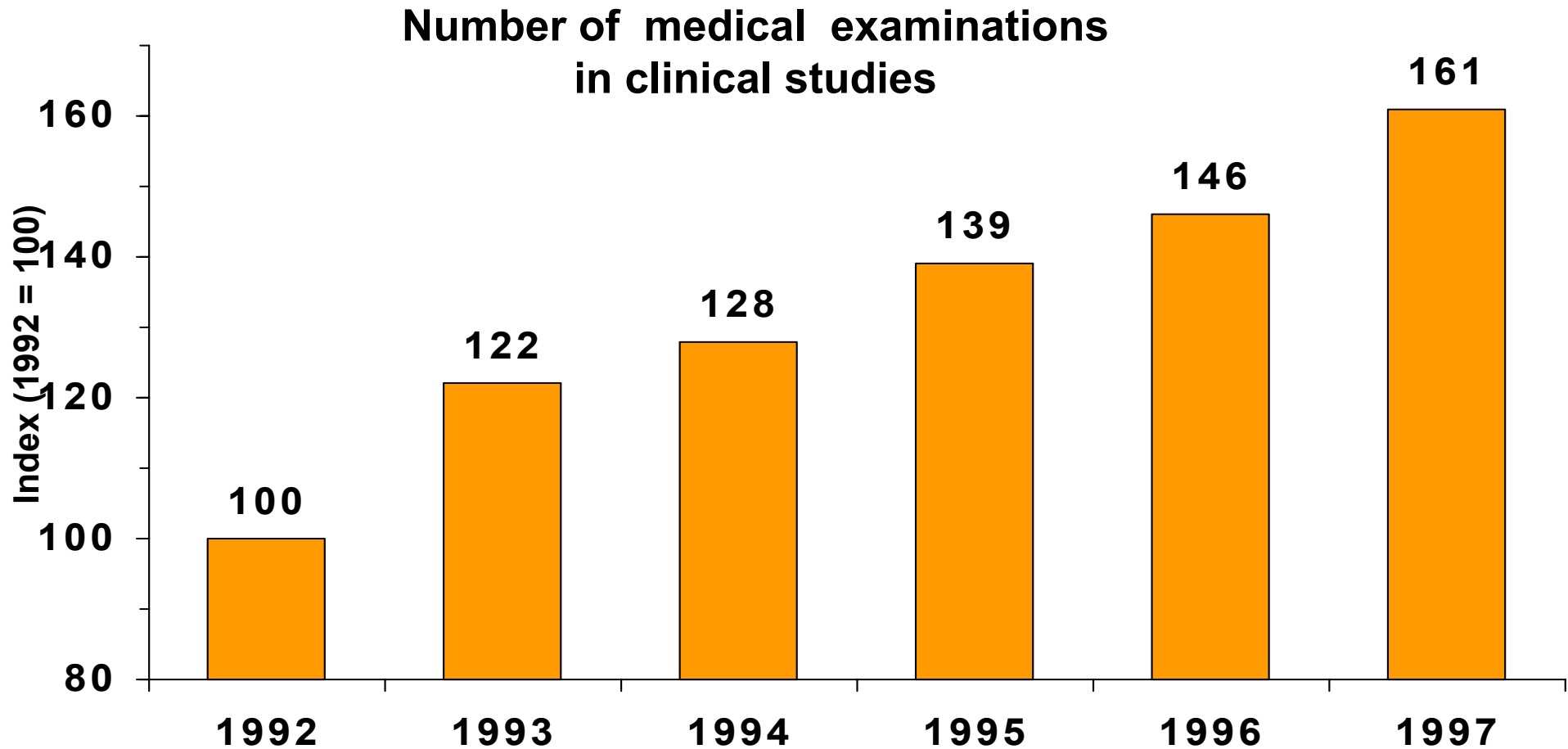
- **Globalisation**
- **Raising Costs for Research, Development and Commercialisation**
- **Generics and Product Life Cycles**
- **Financial Markets**
- **Political Environment**

Increasing Costs for R&D



Source: PhRMA* 1997/1999, analyst reports, Novartis; * Research-based pharmaceutical companies

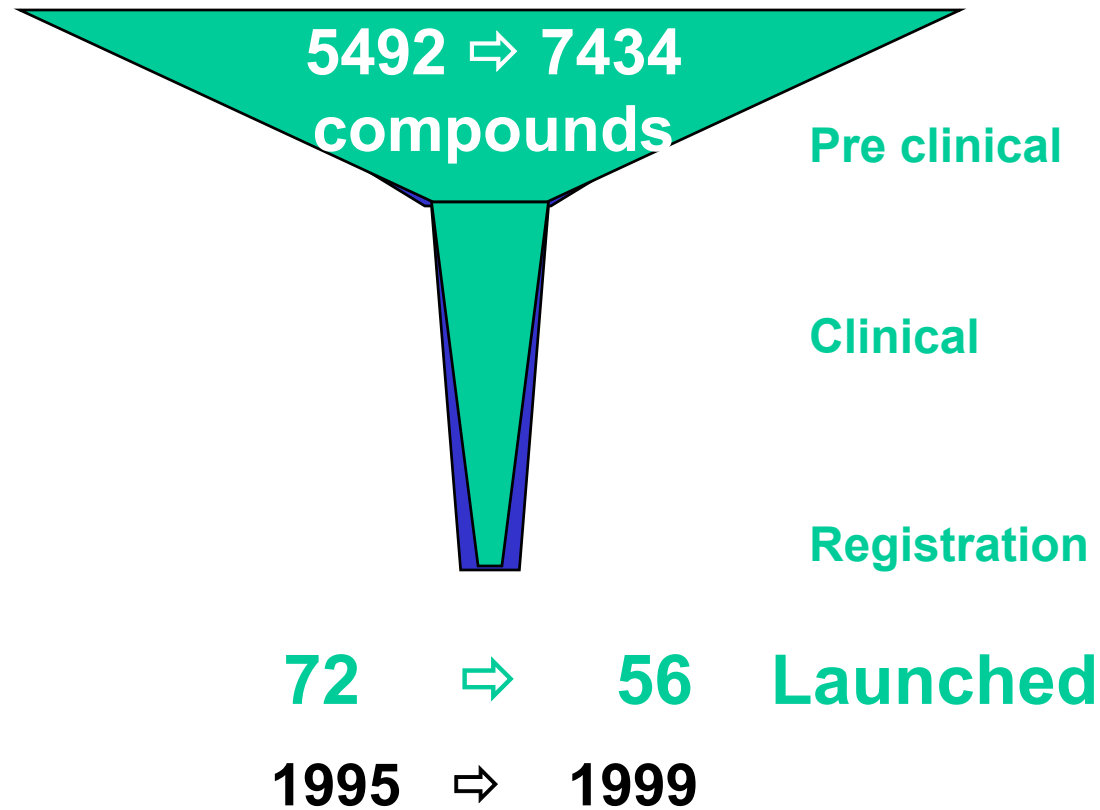
Increasing Demands on Clinical Studies



Source: DataEdge, 1998

NIBR / Manuel Peitsch

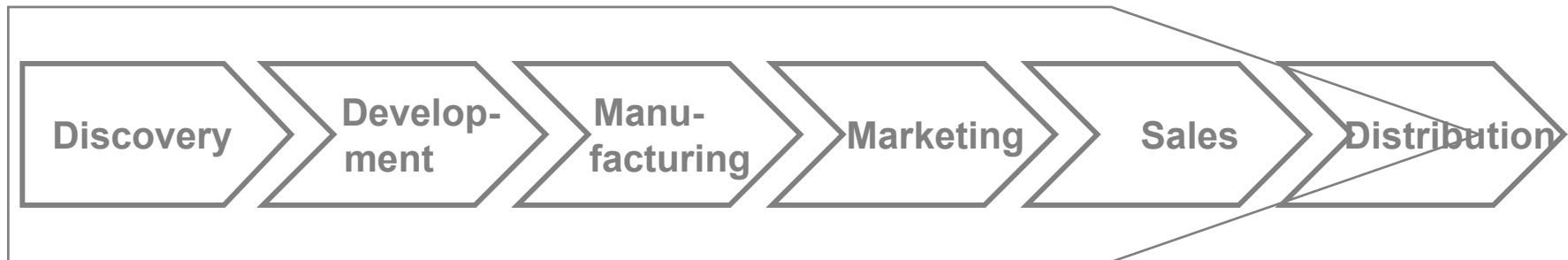
Innovation: Rich pipeline - Decreasing Output



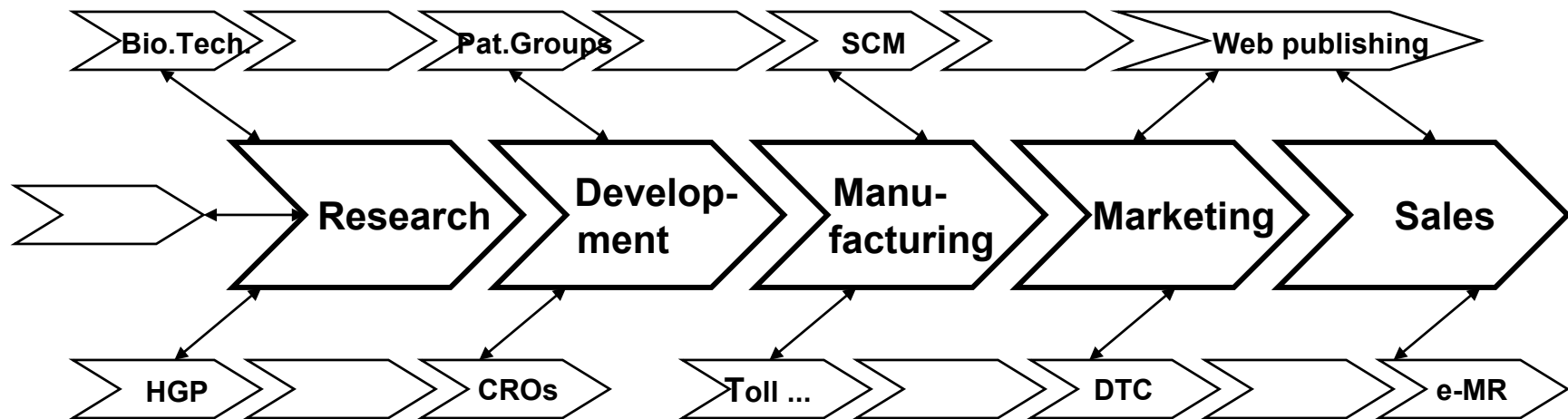
Source: Strategic Management Review IMS HEALTH, 1999-2000

Pharma Company Value Chains are Changing

Heavily vertically integrated



New value chain is heavily networked



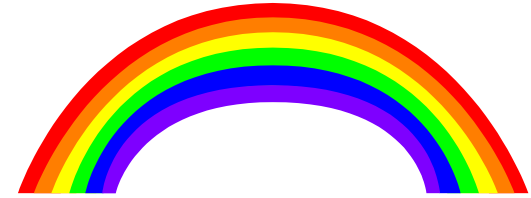
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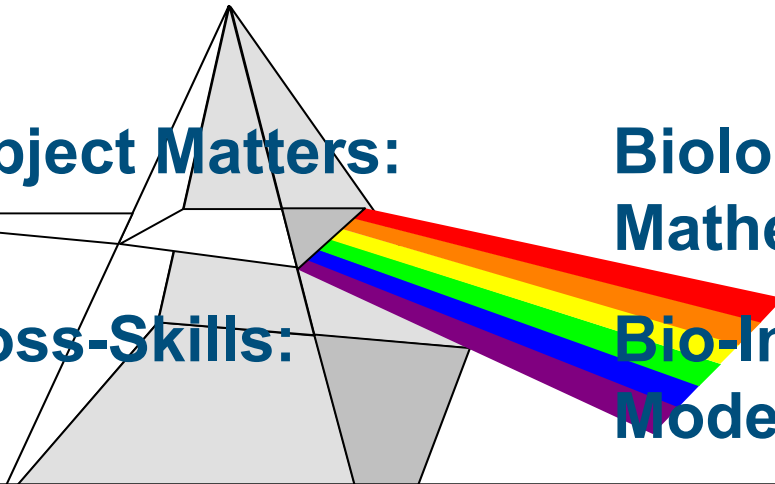
The Times, when a 'Universal Genius' could know everything are over.

- Aristoteles: Philosophy
- Descartes: Philosophy & Mathematics
- Leonardo DaVinci: Arts and Techniques



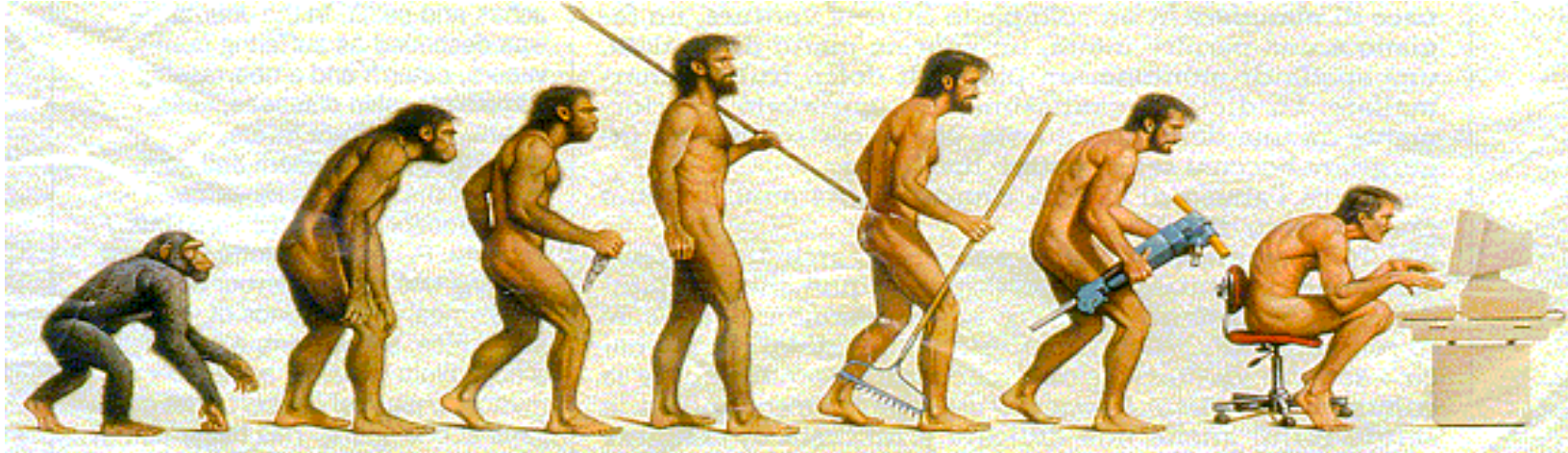
- Subject Matters: Biology, Chemistry, Physics
Mathematics, Fine Arts, etc.

- Cross-Skills: Bio-Informatics
Modelling and Simulation



 ***The Knowledge-Worker of today is highly cross-trained.***

Knowledge Generation and Change are Accelerating



***Homo erectus* age**
Begin 2,5 - 1,5 M y. ago
C-Cycle = ~0,5 M y.

Tribal age
Begin 10 000 y. ago
C-Cycle = ~1000 y.

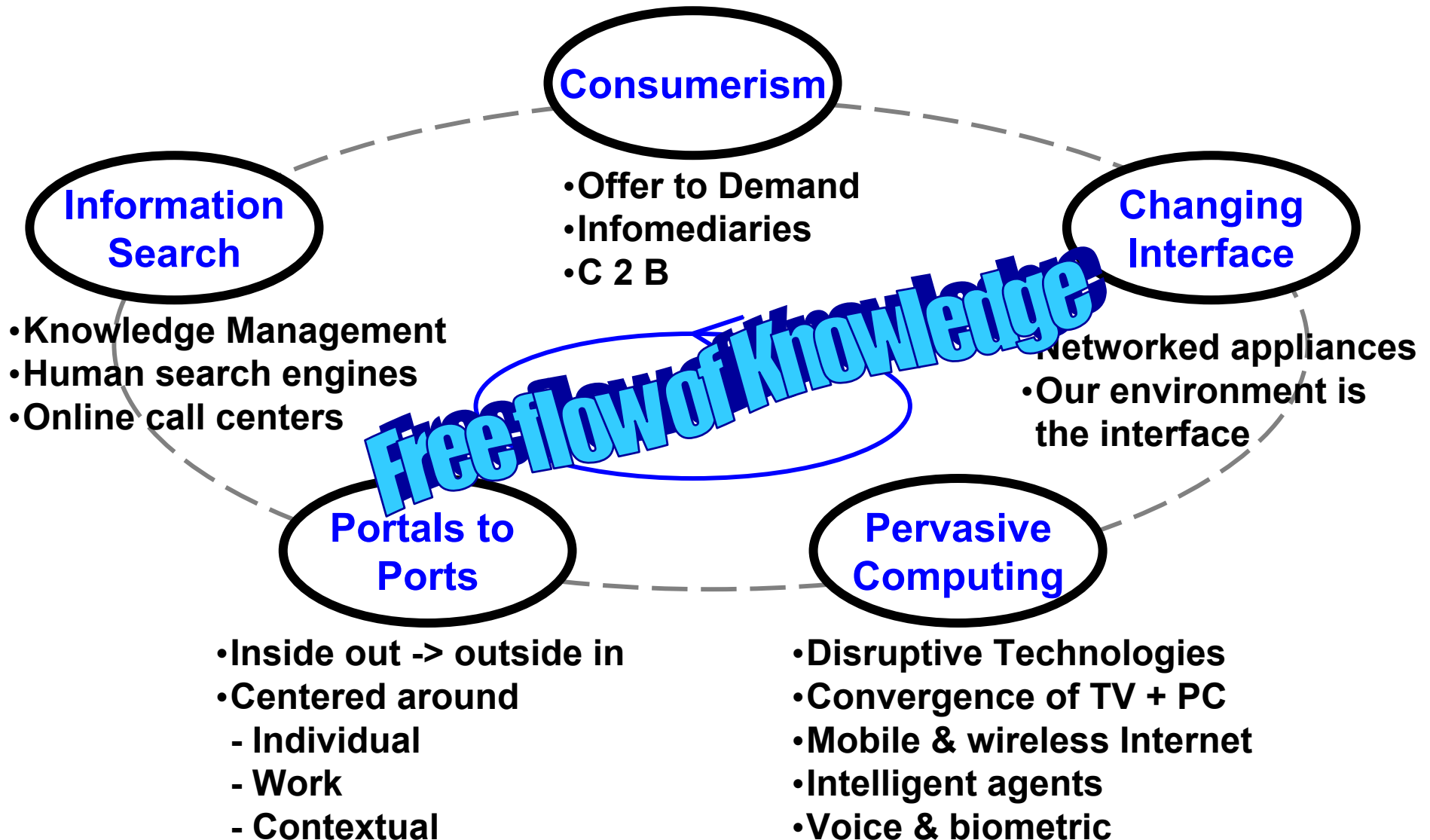
Industrial age
Begin ~100 y. ago
C-Cycle = ~Decade

***Cro Magnon* age**
Begin ~ 100 000 y. ago
C-Cycle = ~10000 y.

Rural age
Beg.~2000 y. ago
C-Cycle = ~100 y.

Information age
emerging now
Change-Cycle
= 1 year to 1 quarter

Information Age: Democratization of Information & Communication



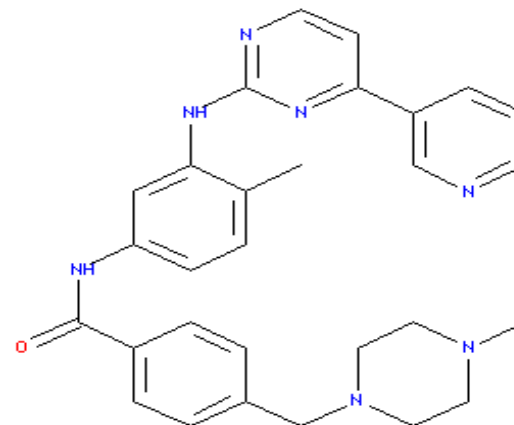
The Information Wave

- **Biology and Chemistry are producing more data and Information than ever before:**
 - Genetics
 - Genomics
 - Proteomics
 - High Throughput Screening
 - Profiling
 - Competitor and other Intelligence



Many Ways to Look for the Same...

- **Product:** Imatinib
- **Brand:** Gleevec / Glivec
- **Indication:** Chronic Myelogenous Leukemia
- **Target:** Bcr-Abl (Tyrosine kinase)
- **Mode of action:** Tyrosine kinase inhibitor
Protein kinase tyrosine inhibitor
Tyrosylprotein kinase inhibitor
Hydroxyaryl protein kinase inhibitor
- **Compound Code:** CGP057148
- **Formula 1:** $C_{29}H_{31}N_7O$
- **Formula 2:**

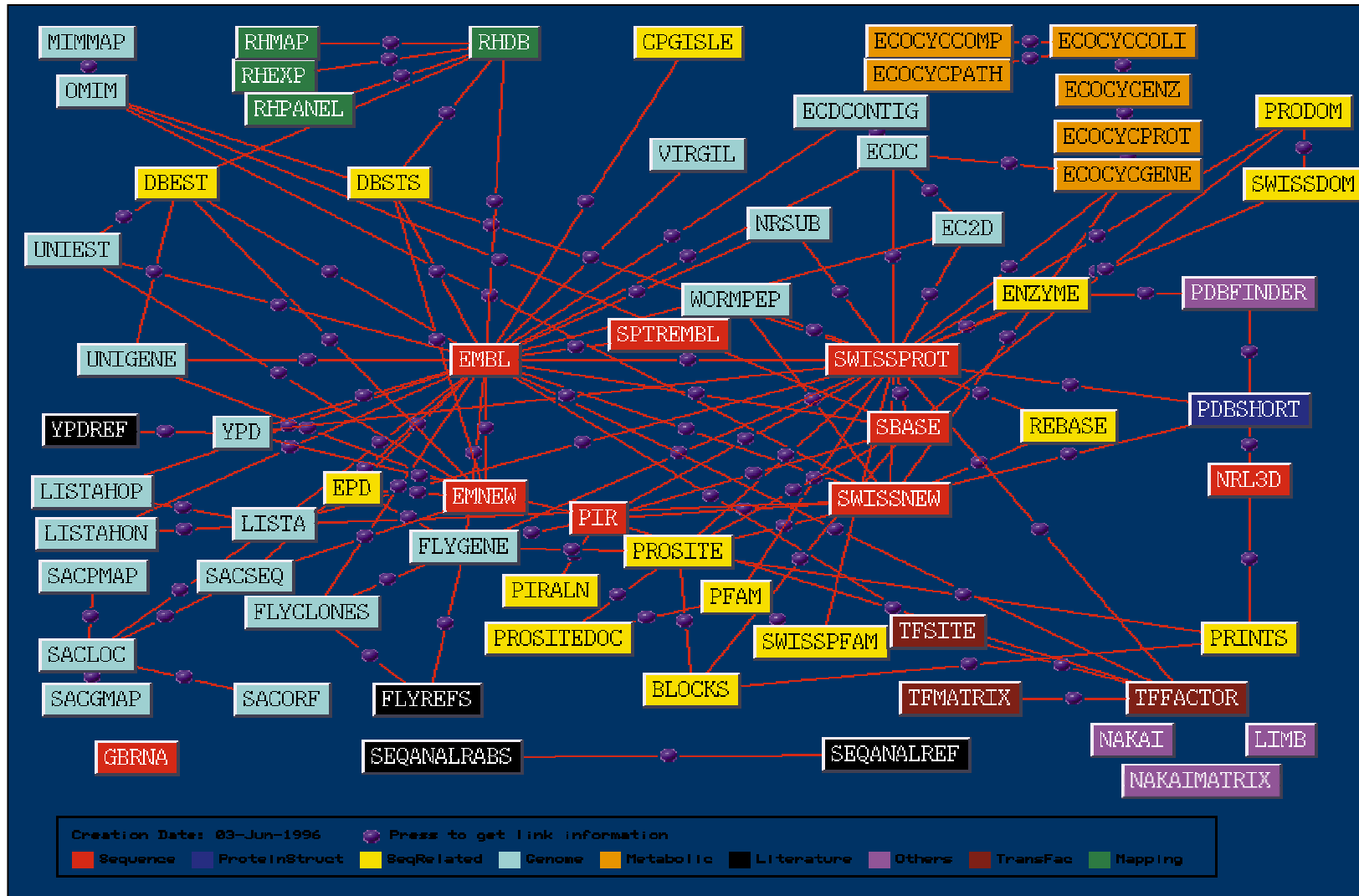


The Downside

- Fragmented information and Information silos
- Incomplete, unreliable and outdated data and Information
- Lack of context
- Information and knowledge sharing are low priority
- Short term fixes with no comprehensive and coherent strategy and approach
- Consequences:
 - Associates spend more than 15% of their time searching for data and information.
 - Bad and slow decision making



Complexity of the information source landscape



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The Challenges of Drug Discovery

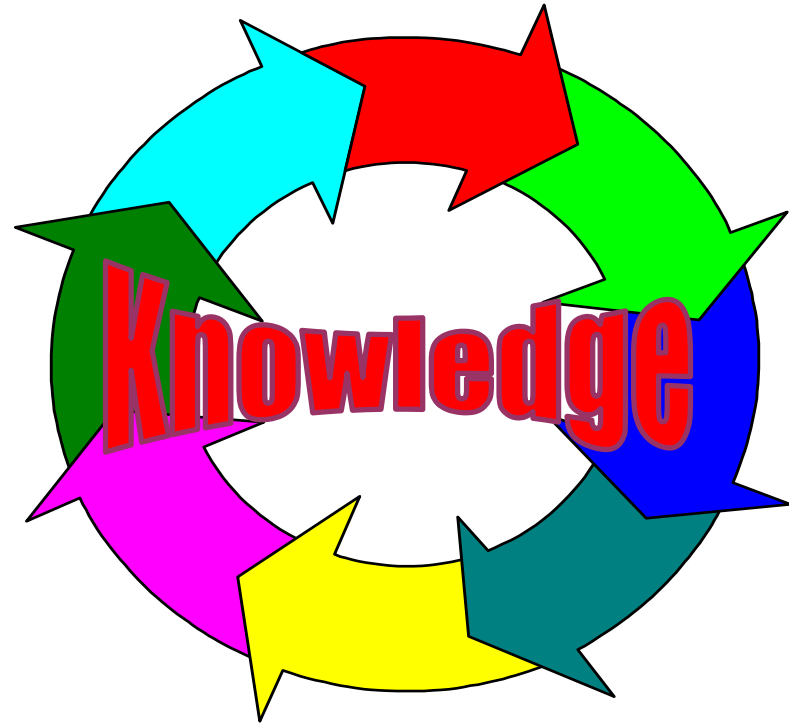
- Human Genome sequence is known
 - Find all genes
 - Assign biological function to all genes
 - Discover which genes are implicated in human diseases = Drug Discovery Targets
 - Find drugs for newly discovered Targets

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The Ultimate Challenge: Knowledge about

- **Markets**
- **Competitors**
- **Products**
- **Stocks, Supply Chain**
- **Trials, Results**
- **Genome**
- **Compounds**
- **.....**

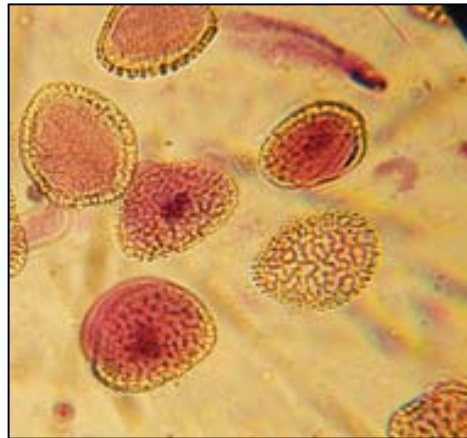


Evolution of the Pharmaceutical Industry:

In Vivo



In Vitro



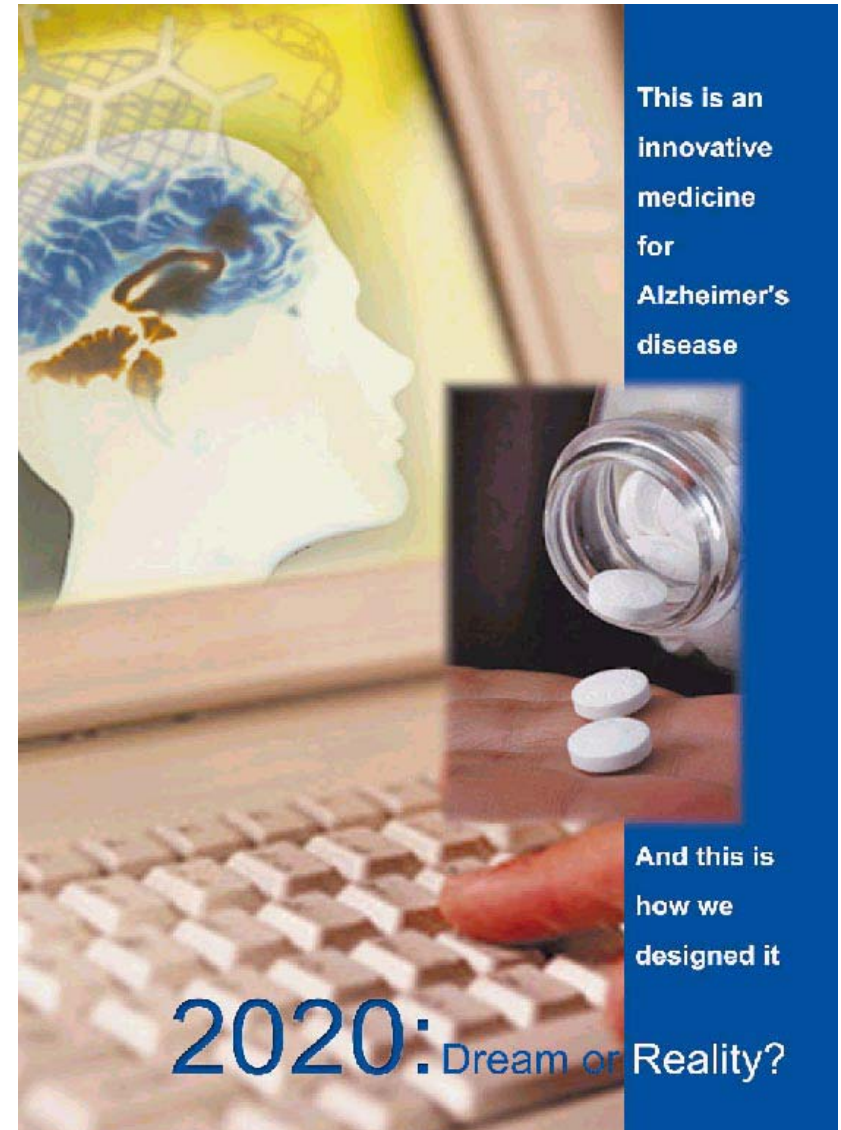
In Silico



The Vision

**Enable and transform
Research and the Drug
Discovery process through:**

- **Comprehensive and reliable
Data and Information**
- **Set in context**
- **‘One-touch’ access**
- **Turning Data into Knowledge
using in silico science**



Benefits to the Company

- **Improved decision making for R&D projects**
 - Consistent, improved information quality - reliable, current, comprehensive
 - Increased success rate and quality of drugs in R&D.
 - Increased number of high quality projects in R&D for constant R&D resources
- **Culture of growing knowledge assets**

Benefits put into numbers

- If the target productivity of Research is 25 Early Selected Compounds leading to 3 NCEs per year, then
- in every 5 year period, 100 ESCs will lead to 15 NCEs.
- Considering that the implementation of Knowledge Management has the potential to increase the Research productivity by 5%, then one would get 1 additional NCE on the market from the same number of ESCs in every 5 year period. Considering NCEs with peak sales of 1 BCHF (600 M\$)/NCE, we can easily state that Knowledge Management can contribute an additional 1 BCHF/y peak sales NCE in every 5 year period.

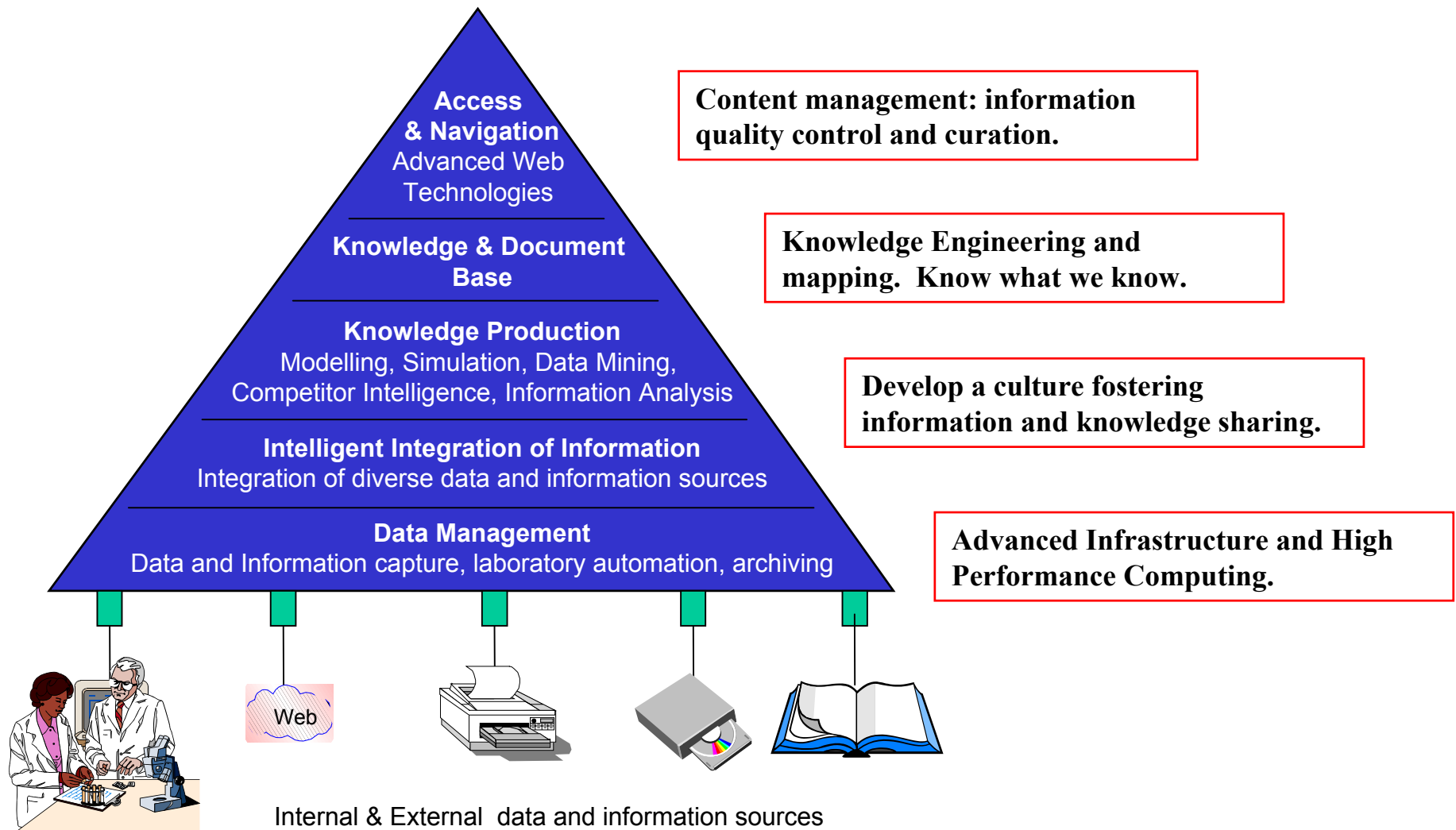
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What we need to get there

- **A Global and Coherent Strategy based on these themes:**
 - Coherent, global and integrated Data, Information and Knowledge management.
 - Modelling, Simulation and Prediction.
 - Data (all types) Mining and Visualisation.
 - Seamless Access and Navigation.
 - Work Culture and Processes.

The Knowledge Space Concept



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How to get there

- **Key activities and projects within the framework of the strategy - building the Knowledge Space:**
 - **Data Management:**
 - Coherent and well managed data capture and data flows.
 - Global Archive Tracking System integrated with electronic Data Capture. Electronic Notebook support.
 - **Scientific Computing Infrastructure/Services:**
 - Integration of data within domains/disciplines
 - Bioinformatics, Chemoinformatics, etc...
 - Integration data between domains/disciplines
 - Seamless integration of Bioinformatics and Chemoinformatics.
 - Automated and large scale mining and computing

How to get there

- **Key activities and projects within the framework of the strategy - building the Knowledge Space:**
 - **Access and Navigation:**
 - **Knowledge Space Portal**
 - Seamless navigation in the Knowledge Space. Portal technology making use of Meta Data model and the Knowledge Map.
 - **Knowledge Production:**
 - **Simulation and modelling of processes. Application of statistical and mathematics to life sciences in *In silico* chemistry and biology.**
 - **Information analysis:**
 - Intelligent analysis and interpretation of written information in such areas as Competitor Intelligence, Pharmacovigilance, Patents, etc...

How to get there

- **Key activities and projects within the framework of the strategy - building the Knowledge Space:**
 - **Knowledge Base:**
 - **Text and document management systems**
 - Managing the production of scientific documents in Research. Interconnecting knowledge assets with all possible data and information sources.
 - **Skill base**
 - Using the body of scientific documents in the Knowledge Base to build a skill base of Novartis.
 - **Curation**
 - Ensuring that the Knowledge Base complies with the Research Quality Systems

How to get there

- **Key activities and projects within the framework of the strategy - building the Knowledge Space:**
 - **Knowledge Centre:**
 - **Import external Information sources.**
 - **Provide access to external information through a combination of approaches:**
 - **From classical libraries to fully electronic libraries. Search and retrieval services through content experts.**
 - **Curation**
 - **Ensuring that the Knowledge Centre provides the best and most complete information resources. Quality and completeness judgement and statements.**

How to get there

- **Key activities and projects within the framework of the strategy - building the Knowledge Space:**
 - **Knowledge Engineering:**
 - **Building the Knowledge Map and Meta Data Layer of Novartis.**
 - Based on ontologies, vocabularies and thesauri.
 - **Text Mining and Information extraction.**
 - Common technology platform for Competitor Intelligence, Genomics literature mining, Patent mining, etc...
 - **Integration of databases, information source and the Knowledge Base through text mining.**

How to get there

- **Key activities and projects within the framework of the strategy - building the Knowledge Space:**
 - **High performance Computing GRID:**
 - Supported by a combination of Clusters (Linux), PC GRIDs, LSM compute servers, Application Specific Integrated Circuits and external collaborations (CPU on demand).
 - **Work culture:**
 - Basel Campus redesign – AGORA: creation of a “Knowledge Centre of the future.
 - E-Learning and meeting implemented more widely.
 - Assigning a value to Data/Information and Knowledge to drive priorities and strategy.
 - Grow a culture of Knowledge being a company asset

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Summary & Conclusion

- We are definitively entering the Information Age
- The Pharmaceutical Industry is a Knowledge Industry
- Knowledge and Information become the most important production factors
- *Information*Technology becomes one of the critical tools
- Everything becomes inter-related and networked
- The speed of change is accelerating
- Knowledge working culture is a key success factor

 **Flexible, Fast and Business-oriented Knowledge-Management-Systems will build the Fabric of Success**

Thank You



**for your
Attention and Interest!**

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