Understanding how Pharmaceutical & Biotech Companies Work

Summary

- Introduction to Healthcare & different Products
- Role of Pharmaceutical in Healthcare
- Drug Details
- ✓ What a drug is made of ?
- ✓ Classification of drugs
- ✓ Product Life Cycle of a Drug
- Drug Development Phases
- Regulatory Framework & various Regulatory Bodies

Introduction to Healthcare

- One of the world's largest and fastest-growing industries
- Also called medical industry
- Provides goods & services to treat patients with curative, preventive, rehabilitative & palliative care

Different Healthcare Products

Products	Description
Pharmaceutical	Medicine/vaccines for human use, may have a trademark, may be prescribed or over the counter
Diagnostics	Equipment & Supplies used in screening, detecting, diagnostics
Medical Devices	Advanced instrumentation & appliances used for medical therapy e.g. joint replacements, pacemakers, syringes, infusion pumps
Medical Supplies	E.g. surgical gowns and gloves
Durable Medical Equipment	Reusable products e.g. walkers, wheelchairs, oxygen equipment

Role of Pharmaceutical in Healthcare

- Socially important
- Varied use from Out patient (self-administered) to Inpatient (professionally administered)

- Spectrum of Care Settings

✓ Home based Care

✓ Primary Care

✓ Secondary Care

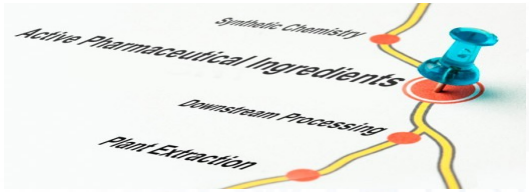
✓ Tertiary Care

✓ End Stage Care

Drug Details
1) Drug Definition/ Drug Category

- **Drug Definition**
  - ✓ Any substance that produces a physical /psychological change
  - ✓ Under FFDCA – Any substance intended for use in diagnosis, cure, mitigation, treatment or prevention of a disease
  - ✓ Examples :
  - ✓ Aspirin , antibiotics, products contained in food – caffeine & others like fluoride

- **Drug Category**



Drug Details (cont.)
2) What are Drugs Made of ?

- (API) Active Pharmaceutical Ingredient – Used in drug manufacture. API – mainly fall into 2 categories:

✓ Chemical - Small molecule products (manufactured by chemical process)

✓ Biological– Large molecule products (manufactured from living materials – humans/plants/micro-organisms

- Biological Division :

✓ Genetically Engineered (recombinant)

✓ Non Recombinant

Drug Details (cont.)
3) Drug Classification

- Classification based on

- ✓ Therapeutic Categories
- ✓ Target Customers
- ✓ Novelty
- ✓ Market Potential
- ✓ Access Rights

Drug Development Life Cycle

- Discovery
- Development
- Launch & Growth
- Maturity
- Generic Erosion
- Commodity/ Obsolete Product

Drug Development Life Cycle
Discovery Phase

- Represents **first stage**
- Is the process by which drugs are **discovered and/or designed**
- To understand how **disease and infection** are controlled at the molecular and physiological level and to target specific entities based on this knowledge
- Identify cellular and genetic factors that play a role in specific diseases

Drug Development Life Cycle
Drug Discovery - A Closer Look

- ❑ **Disease and Target Selection**
  - ✓ Select the disease targets
  - ✓ TPP
- ❑ **Lead Identification**
  - ✓ Search for one or more lead compounds
  - ✓ Compound screening, Molecular Modeling, Simulation
- ❑ **Lead Series and Lead Optimization**
  - ✓ Means of identifying promising compounds
  - ✓ Involves testing
- ❑ **Discovery Phase goes till 2-4 years**

Drug Development Life Cycle
Discovery Phase – Patent Protection

❑**Patent Protection**

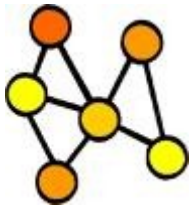
✓A truly promising set of lead compounds – need to be protected

✓Primary means of protection – is called PATENT

✓Also called as **"Composition of Matter"**

✓Undiscovered molecule is called **(NCE)/ (NME)**

✓Patent is given by a regulatory body and issued for **20** years



❑**Patent Authority of India**

✓**The Patent Controller of India**

Importance of Regulatory Framework

- Regulations are designed to:
  - ✓ Protect **public welfare**
  - ✓ Ensure that critical new therapies reach market quickly & safely

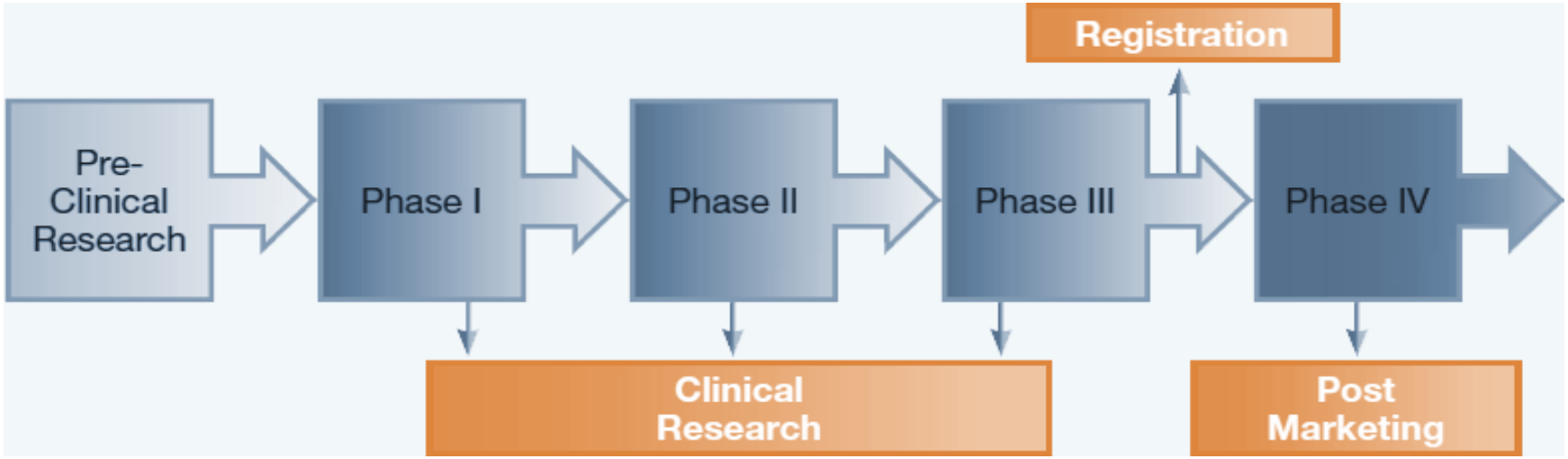
- Some of the Regulatory bodies :
  - ✓ **FDA – Food and Drug Administration, US**
  - ✓ **CDSCO - Central Drugs Standard Control Organization, India**
  - ✓ PMDA - Pharmaceuticals and Medical Devices Agency, Japan
  - ✓ EMA - European Medicines Agency, European Union agency

Drug Development Life Cycle
Development Phase

- ✓ Phase where promising compound is transformed into a marketable product/shelved
- ✓ Process of taking a new chemical lead through the stages necessary to allow it to be tested in human clinical trials
- ✓ Development Phase goes **till 12-13** years

Drug Development Life Cycle
Development Phase - A Closer Look

Development Phase is further divided into



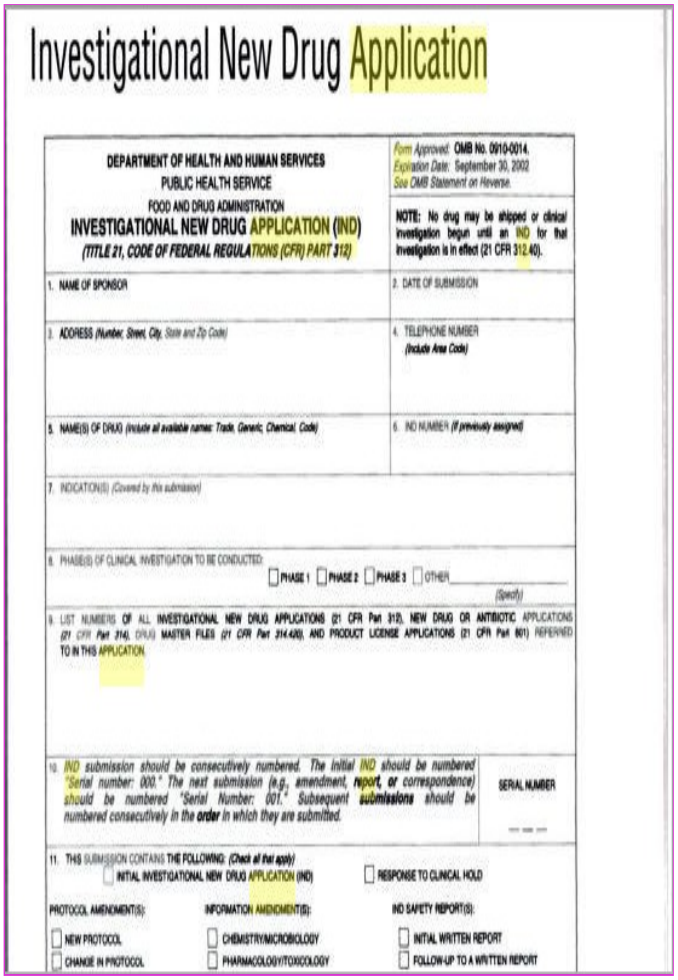
Drug Development Life Cycle
Preclinical Development

"FIRST LINE OF DEFENSE"

- ❑Establish initial parameters for safety and efficiency
  - ✓Bioavailability
  - ✓Effectiveness of the compound in terms of - **ADME** (Absorption, distribution, metabolism and excretion)
  - ✓Toxicology/Pharmacology

- ❑Develop initial formulation and manufacturing plan
- ❑Perform both in **vitro** and in **vivo** studies
- ❑Key milestone – submission of IND to FDA

Drug Development Life Cycle
Investigational New Drug (IND)



Investigational New Drug Application

DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
FOOD AND DRUG ADMINISTRATION
INVESTIGATIONAL NEW DRUG APPLICATION (IND)
(TITLE 21, CODE OF FEDERAL REGULATIONS (CFR) PART 312)

Form Approved: OMB No. 0910-0014.
Expiration Date: September 30, 2002
See OMB Statement on Reverse.

NOTE: No drug may be shipped or clinical investigation begun until an IND for that investigation is in effect (21 CFR 312.40).

1. NAME OF SPONSOR
2. DATE OF SUBMISSION
3. ADDRESS (Number, Street, City, State and Zip Code)
4. TELEPHONE NUMBER (Include Area Code)
5. NAME(S) OF DRUG (Include all available names: Trade, Generic, Chemical Code)
6. IND NUMBER (If previously assigned)
7. INDICATION(S) (Covered by this submission)
8. PHASE(S) OF CLINICAL INVESTIGATION TO BE CONDUCTED: PHASE 1 PHASE 2 PHASE 3 OTHER (Specify)
9. LIST NUMBERS OF ALL INVESTIGATIONAL NEW DRUG APPLICATIONS (21 CFR Part 312), NEW DRUG OR ANTIBIOTIC APPLICATIONS (21 CFR Part 314), DRUG MASTER FILES (21 CFR Part 314.420), AND PRODUCT LICENSE APPLICATIONS (21 CFR Part 601) REFERRED TO IN THIS APPLICATION
10. IND submission should be consecutively numbered. The initial IND should be numbered "Serial number: 000." The next submission (e.g., amendment, report, or correspondence) should be numbered "Serial Number: 001." Subsequent submissions should be numbered consecutively in the order in which they are submitted. SERIAL NUMBER
11. THIS SUBMISSION CONTAINS THE FOLLOWING: (Check all that apply)
INITIAL INVESTIGATIONAL NEW DRUG APPLICATION (IND) RESPONSE TO CLINICAL HOLD
PROTOCOL AMENDMENT(S): NEW PROTOCOL CHANGE IN PROTOCOL
INFORMATION AMENDMENT(S): CHEMISTRY/MICROBIOLOGY PHARMACOLOGY/TOXICOLOGY
IND SAFETY REPORT(S): INITIAL WRITTEN REPORT FOLLOW-UP TO A WRITTEN REPORT

The application filed by pharmaceutical company to obtain permission for sending the new (or experimental) drug for clinical trial studies

Information contained in IND:

- ✓Composition & source of drug
- ✓Manufacturing information
- ✓ALL preclinical data
- ✓Protocols for clinical studies
- ✓Names & qualifications of physicians conducting the trials

Drug Development Life Cycle
Clinical Trials

- Process of testing a drug in human subjects
- The trial may be carried out in a clinic or other medical facility
- First 3 phases termed as – Regisrational or label enabling

- PHASE I : Human Pharmacology
- PHASE II : Initial Clinical Trials
- PHASE III : Comparative Clinical Trials
- PHASE IV : Controlled Marketing

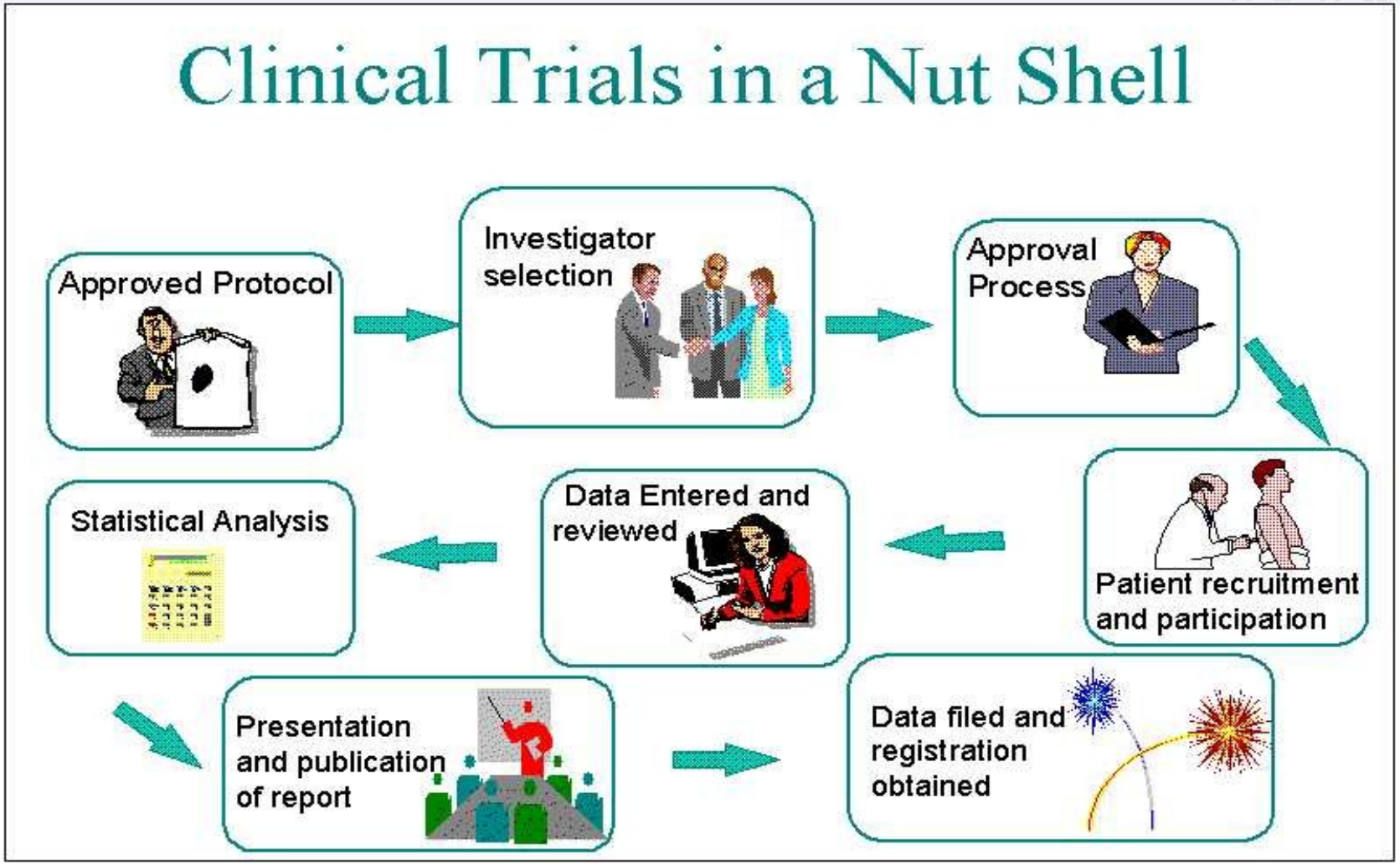
Development Life Cycle
Phase I, II

Phase Name	Activities	Goal
Phase 1	• **First administration to humans** • Testing on a limited population of healthy volunteers • To establish – safe dosage range	• To demonstrate that drug is safe to be tested with target disease
Phase 2	• **Establish EFFICACY & appropriate dosage** • First set of test of the drug for patients who have disease/condition • Small scale trails of patients with the target disease (100-200)	• To generate POC • To establish min & max effective dosage • To look for side effects

Drug Development Life Cycle
Phase III, IV

Phase Name	Activities	Goal
Phase 3	• **Extensive, multiple sites, clinical trials** • Testing on a large scale randomized blinded, placebo- controlled trials in app 1,000-5,000 subjects with the target disease • Elaborate design • Represents largest investment in terms of money and time	• To provide basis for a New Drug Application (NDA)
Phase 4	• **Post-Marketing Surveillance/Post Approval** • Occurs after FDA issues an NDA Approval and under controlled marketing • Addition explorations • Additional safety studies	• To generate additional data base to demonstrate the efficiency and safety of

Clinical Trials in a Nut Shell



BIOTECHNOLOGY AND MEDICINE

SCHEME

- Introduction
- Definition
- Applications
- Drug production
- Pharmacogenomics
- Gene therapy
- Genetic testing
- Questions

What Is Biotechnology?

- Scientific processes to get new organisms or new products from organisms.

- It is the use of living organisms or processes to develop products useful for mankind.

History

- Has been existing since centuries
- Begin with the first action of human on life for his welfare
- Term coined by a Hungarian engineer Karl Ereky
- Modern biotechnology started in California in 1970's

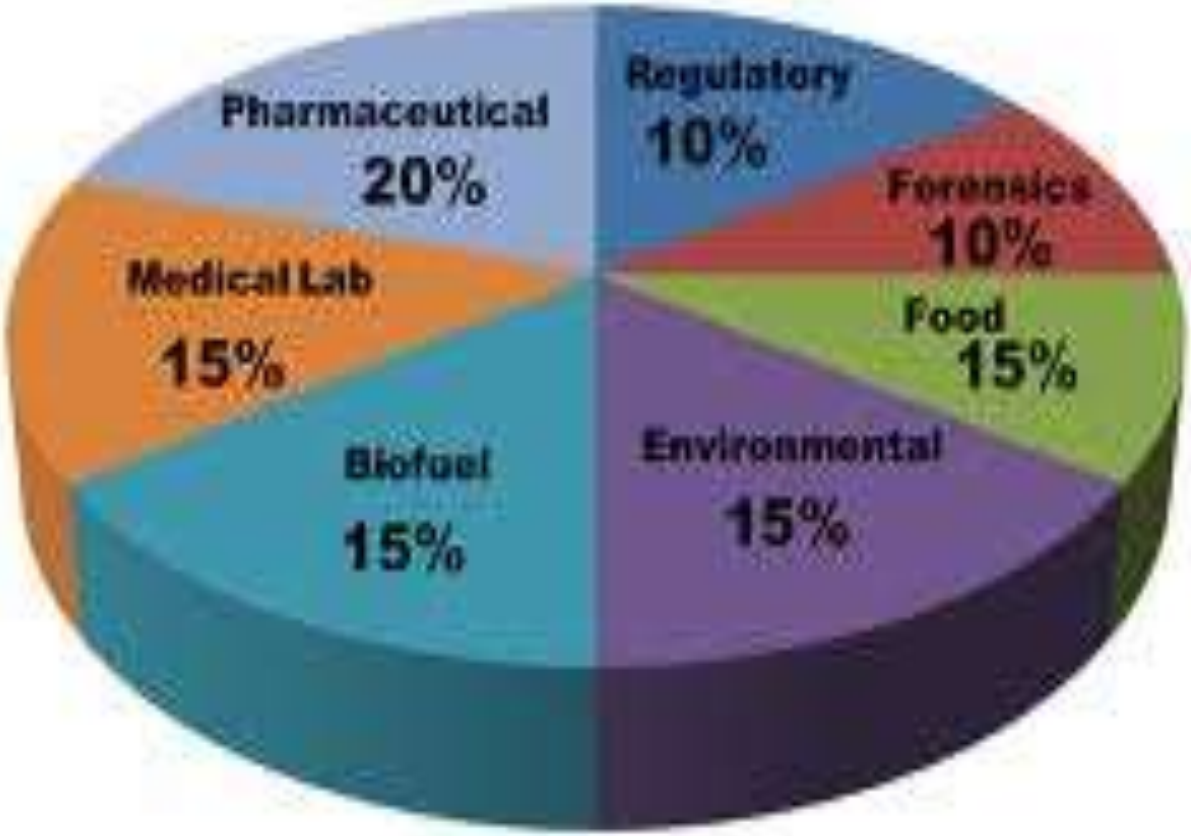
Origins of Biotechnology

- Although it seems like a new thing, biotechnology has actually been around for a while:
  - Domesticated plants and animals are the result of selective breeding
  - Using yeast to make bread rise
  - Using bacteria or yeast to ferment grapes into wine

Definition

Any technique that uses living organisms or substances from those organisms to make or modify a product, to improve plants or animals or to develop microorganisms for specific uses

Biotechnology Curriculum by Industry



Applications

- Green biotechnology (agricultural applications)
- Red biotechnology (medical applications)
- Blue biotechnology (aquatic applications)
- White biotechnology (industrial applications)

White biotechnology

- The use of biological methods to optimize industrial processes
- Applied by manufacturers of laundry detergents
- Includes research for new enzymes (proteins that remove oily and protein-based stains)
- Enzymes that work under extreme conditions (wash temperatures of 20°C or 90°C)
- This often entails modifying the enzymes of microorganisms for these processes

Green biotechnology:

- Use of biotechnological techniques in agriculture
- Vitamin A deficiency is a serious problem and can cause blindness at a young age if left untreated
- Golden rice was genetically modified to produce beta-carotene (a precursor of vitamin A that the body converts to vitamin A). A diet including golden rice can thus help to raise vitamin A levels

Biotechnology and medicine:

- Also called red biotechnology

- It includes:
  - Production of medicines and pharmaceutical products for treating or diagnosing disorders
  - Designing of organisms to manufacture antibiotics and vaccines
  - Engineering of genetic defects through genomic manipulation
  - Use in forensics through DNA profiling

Examples…

- Production of human insulin from non-human sources.
- Production of hormones like Interferons, Cytokinins, Steroids and human growth hormones.
- Gene therapy for prevention and control of diseases like hemophilia cystic fibrosis
- Development of vaccines and antibodies for rabies, HIV, etc.

Biotechnology and medicine

- Drug production
- Pharmacogenomics
- Gene therapy
- Genetic testing

Drug production

- It is the process in which pharmaceutical products are produced through application of biotechnological techniques
- Medicines are produced for:
  - Diagnosis
  - Cure treatments
  - Prevention of diseases

Drug production

- Producing medicines through:
- Isolating enzymes
- Genetically engineering enzymes

Drug production

- Recently, plants are being genetically modified to produce pharmaceutical products instead of their natural compounds

- For Example:

  A drug Elelyso for treating Gaucher is being produced by genetically engineering carrots

Drug production

- INSULIN:

  Human insulin is being produced using genetic engineering technique known as humulin and it is used for the treatment of diabetes that is low sugar level in the blood…..

Drug production

- INTERFERON:

  - Interferon interfere in transmission of viral genome from one cell to another and it also inhibits the cell division of abnormal cells.

  - Interferon produced using the recombinant DNA technology is used to treat cancer patients.

  - Interferon improved the quality of life of cancer patients…..

Drug production

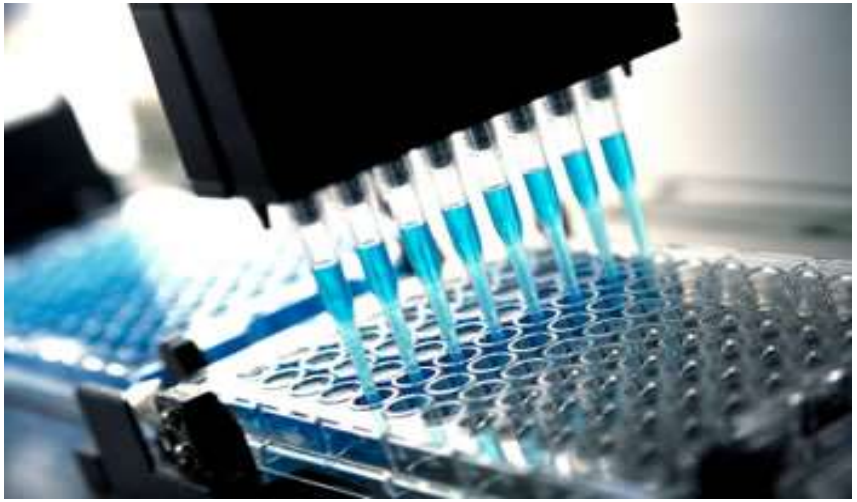
- HUMAN GROWTH HORMONE:

Since dwarfism is caused by growth hormone deficiency so it can be diagnose by HGH testing.

So HGH is used for the treatment of dwarfism due to hypo pituitary activity.

Pharmacogenomics

- Pharma = Drug or Medicine
- Genomics = The study of genes
- Studying response of genetic make up of an individual to a drug or pharmaceutical products



Use of Pharmacogenomics:

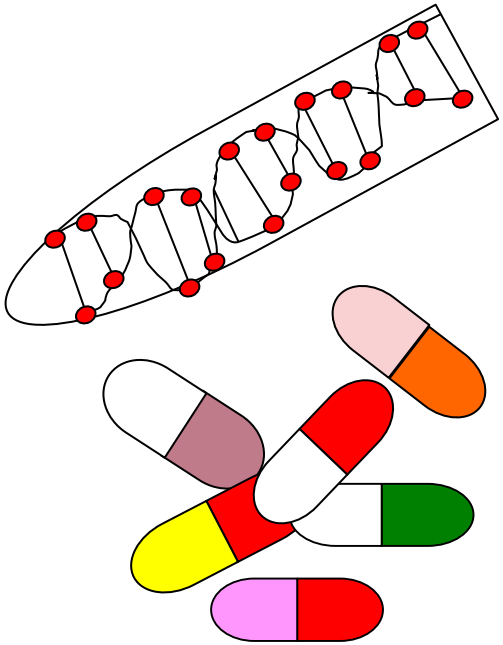
- ***"One-size-fits-all drugs"*** only work for about 60 percent of the population at best. And the other ***40 percent of the population increase their risks of adverse drug reaction*** because their genes do not do what is intended of them.

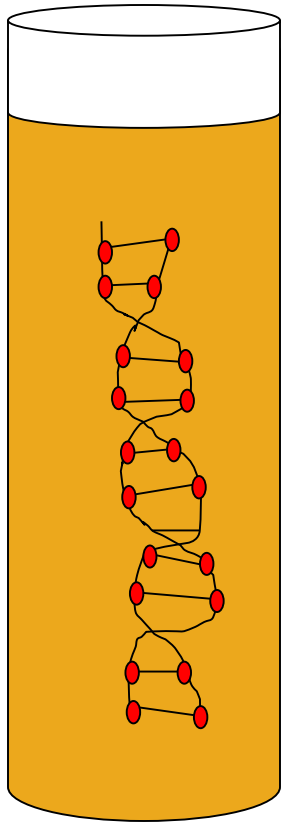
Impotance Of Pharmacogenomics

- Helps in the development of tailor made medicines
- Ensures more appropriate methods of determining drug dosages
- Improve process of drug discovery and approval
- Obtaining of better and safer vaccination
- Decrease in the overall cost of Health Care
- Advanced Screening for Disease

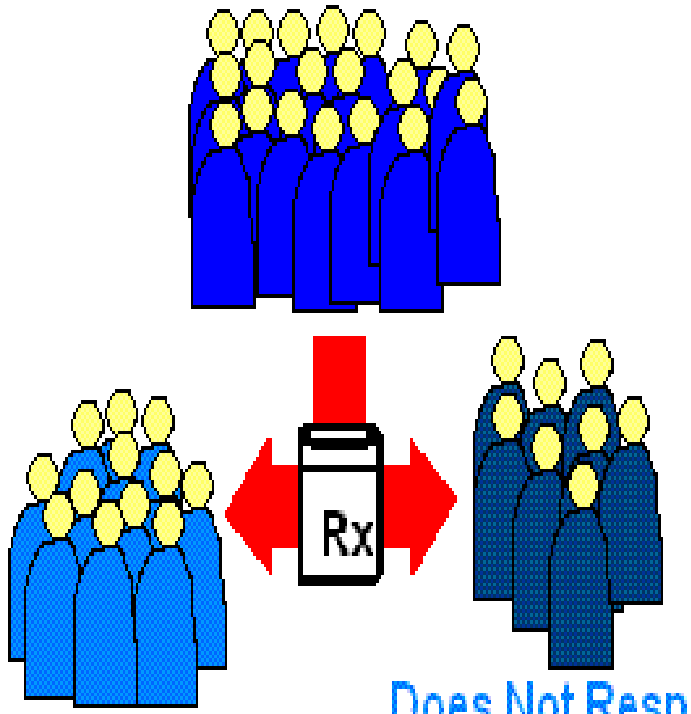
Phramacogenomic drugs

- Herceptin
- Gleevec
- Erbitux
- Tumoricide



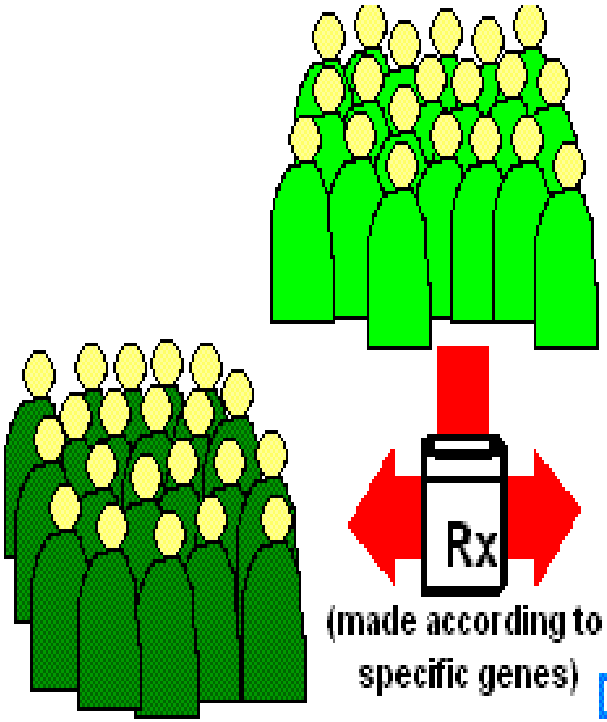


TODAY versus TOMORROW



Respond to Drugs:
30-60%

Does Not Respond To Drugs:
Everyone Else



(made according to specific genes)

Respond To Drugs:
100%

Does Not Respond To Drugs:
0%

Pharmacogenomics

Opinion:

- This sort of card would initially (~2025?) include mostly information related to drug metabolizing enzymes.
- Around ~2050 it might include an entire individual genome

Pharmacogenomics

Some barriers faced are:

- Complexity of finding gene variation that affect drug response
- Limited drug alternatives
- Disincentives for drug companies to make multiple pharmacogenomic products
- Educating healthcare providers

Gene therapy

- The process in which a faulty gene is removed or replaced with its healthy copy to restore the normal function of that gene

Gene therapy

- Replacing a mutated gene that causes disease with a healthy copy of the gene
- Inactivating or “knocking out” a mutated gene that is functioning improperly
- Introducing the new gene that help fight a disease

Gene therapy

- Some common ways are:
- Using fat droplets in nose sprays
- Using cold viruses that are modified to carry alleles ,go into the cell and affect them
- The direct injection of DNA(might include electroporation or biolistic method)

Gene therapy

The process of gene therapy is of two types:

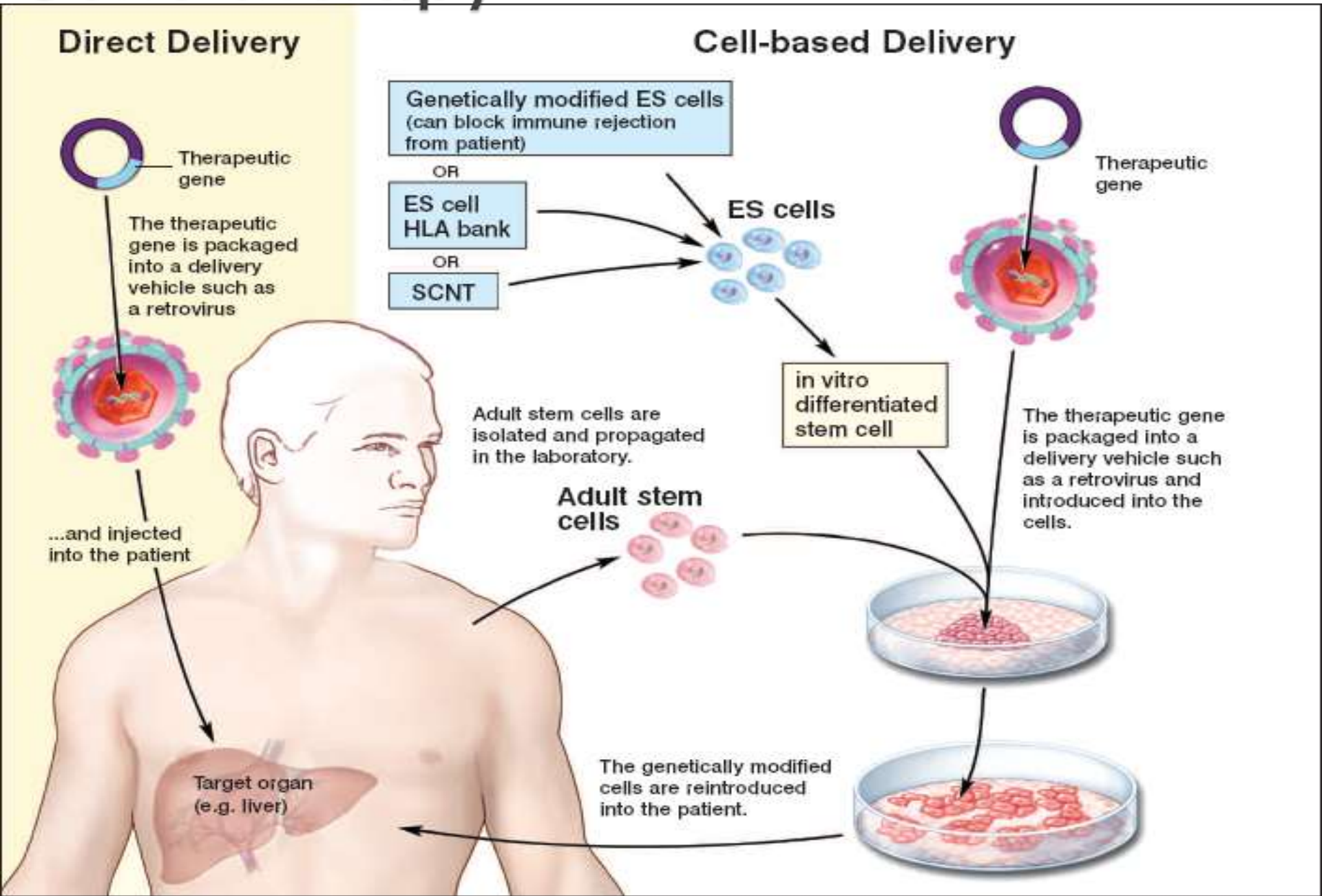
- Stem cell gene therapy:

  In this gene therapy is applied on a fully developed organism and the effects of gene therapy lasts only to the operated organism

- Germ line gene therapy:

  In this process gene therapy is done on a fertilized egg or an early embryo and the altered genome is followed in next generations.

Gene therapy



Genetic testing

- The examination of a patient's DNA molecule to determine his/her DNA sequence for mutated genes
- The genome of an individual is scaned for this purpose by a scientist

Genetic testing

- Forensic/identity testing
- Determining sex
- Conformational diagnosis of symptomatic individuals
- Newborn screening
- Prenatal diagnostic screening

Genetic testing

- Better drugs can be obtained by the knowledge of genetics
- Genetic testing can be used to detect the mutations regarding genetic disorders like cystic fibrosis, sickle cell anaemia, hutington diseases, etc.
- Tests are also being developed to detect various cancers

Questions

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FACULTY OF HEALTH SCIENCE,DEPARTEMENT OF PHARMACEUTICAL SCIENCE.

PHARMACEUTICAL BIOTECHNOLOGY

INTRODUTION:

Pharmaceutical biotechnology consist of the combination of two branches which Are "PHARMACEUTICAL SCIENCE" AND "BIOTECHNOLOGY".

DEFINATION:

PHARMACEUTICAL SCIENCE: Can simply be define as the branch of science that deals with the fomulation compounding and dispensing of drugs

BIOTECHNOLOGY:Can simply be define as the application of biological system,living organisms,or their derivatives in making or modifying products or processes for specific use.

THUS:

PHARMACEUTICAL BIOTECHNOLOGY :Can simply be define as the science that covers all technologies required for the production, manufacturing and registration of biological drugs.

The aim of this pharmaceutical biotechnology is to design, produce drugs that are adapted to each persons genetic make up,which can give the maximum therapeutic effect. Biotechnology plays an important role in pharmaceutical science most especially in the pharmaceutical industries by creation of genetically modified organisms that can be used in industrial production.

COMMON PHARMACEUTICAL BIOTECHNOLOGICAL PRODUCT

The common pharmaceutical biotechnology products that are made by the biotech pharmaceutical companies includes:

***Antibodies**

***Proteins**

***Recombinant DNA Products.**

ANTIBODIES

Antibodies: **Antibodies are proteins that are produced by white blood cells and are used by the immune system to identify bacteria, viruses, and other foreign substances and to fight them off. In the recent years, monoclonal antibodies are one of the most exciting developments in biotechnology pharmaceuticals.**

Example:

Actinin Alpha monoclonal Antibodies,Actin smooth muscle monoclonal antibodies e.t.c

PROTIENS

Proteins: Proteins made of amino acids are large, complex molecules that do most of the work in cells and are required for the structure, function, and regulation of the body's tissues and organs. Protein biotechnology is emerging as one of the key technologies of the future for understanding the development of many diseases like cancer or amyloid formation for better therapeutic intervention.

RECOMBINANT DNA PRODUCT

Recombinant DNA Products: Recombinant Deoxyribonucleic Acid is the genetically engineered DNA created by recombining fragments of DNA from different organisms. Some of the Recombinant DNA Products includes:

***Recombinant DNA Vaccines**

***Recombinant DNA Drugs**

***Recombinant DNA Enzymes**

*Recombinant DNA Growth Hormone

*Recombinant DNA Insulin

*Recombinant DNA Proteins

*Recombinant DNA Yeast

RECOMBINANT DNA VACCINE

A recombinant vaccine is a vaccine produced through recombinant DNA technology. This involves inserting the DNA encoding an antigen (such as a bacterial surface protein) that stimulates an immune response into bacterial or mammalian cells, expressing the antigen in these cells and then purifying it from them. Example Hepatitis B infection is controlled through the use of a recombinant hepatitis B vaccine,

RECOMBINANT DNA DRUGS

NAME OF DRUG	WHAT HUMAN PROTEIN IS FORMULATED AS THE DRUG	PHARMACODYNAMICS OF THE DRUG
1. Humulin Chart comparing Time Activity Profiles (go here)	rInsulin [FDA approval 1982]	Diabetes: Used by over 3.5 million people in the U.S. every day
2. Humatrope	rHuman growth hormone (hGH) (Somatropin) [FDA approval 8/96]	For Somatropin Deficiency Syndrome (SDS) in adults and GHD in children
4. Forteo	rParathyroid hormone, [FDA Approval Nov 26, 2002]	Treatment of osteoporosis in women and men

RECOMBINANT DNA PRODUCTS

R-DNA PRODUCT	EXAMPLE	FUNTION
R-DNA ENZYME	CHYMOSINE	Essential to the Nmanufacture of firm cheeses
R-DNA GROWTH HORMONE	PROTROPIN	Support growth and development
R-DNA INSULIN	HUMULIN	For the treatment of insulin-dependent diabetes
R-DNA PROTEIN	**Tissue plasminogen activato**	Involved in the breakdown of blood clots

ANY QUESTION

THANK YOU

PHARMACEUTICAL MANUFACTURING

What is pharmaceutical manufacturing

- it is the process of industrial scale synthesis of pharmaceutical drug by pharmaceutical companies.
- The process can be broken down into a series of unit operations such as milling, drying , compression ,and coating

What is a drug?

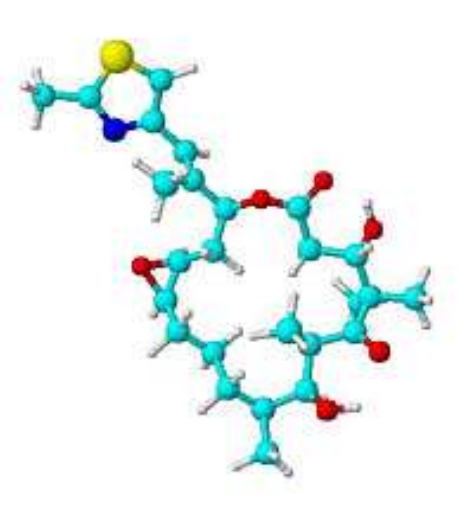
"A Chemical Substance that Interacts with a Living System and Produces a Biological Response"

Drug

A drug product consists of therapeutics (API) and excipients combined in a delivery system.

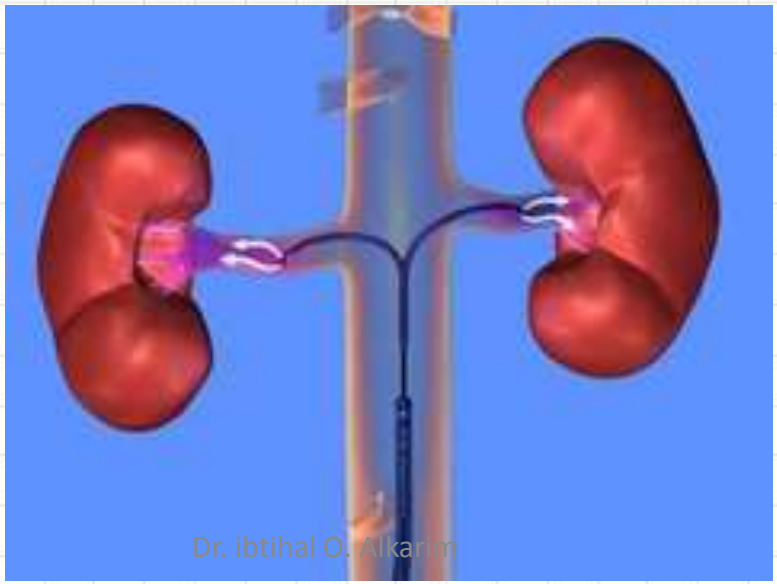
A drug product's success lies in its ability to deliver the drug at a certain rate in a certain environment in the body.

discovery



manufacturing

delivery

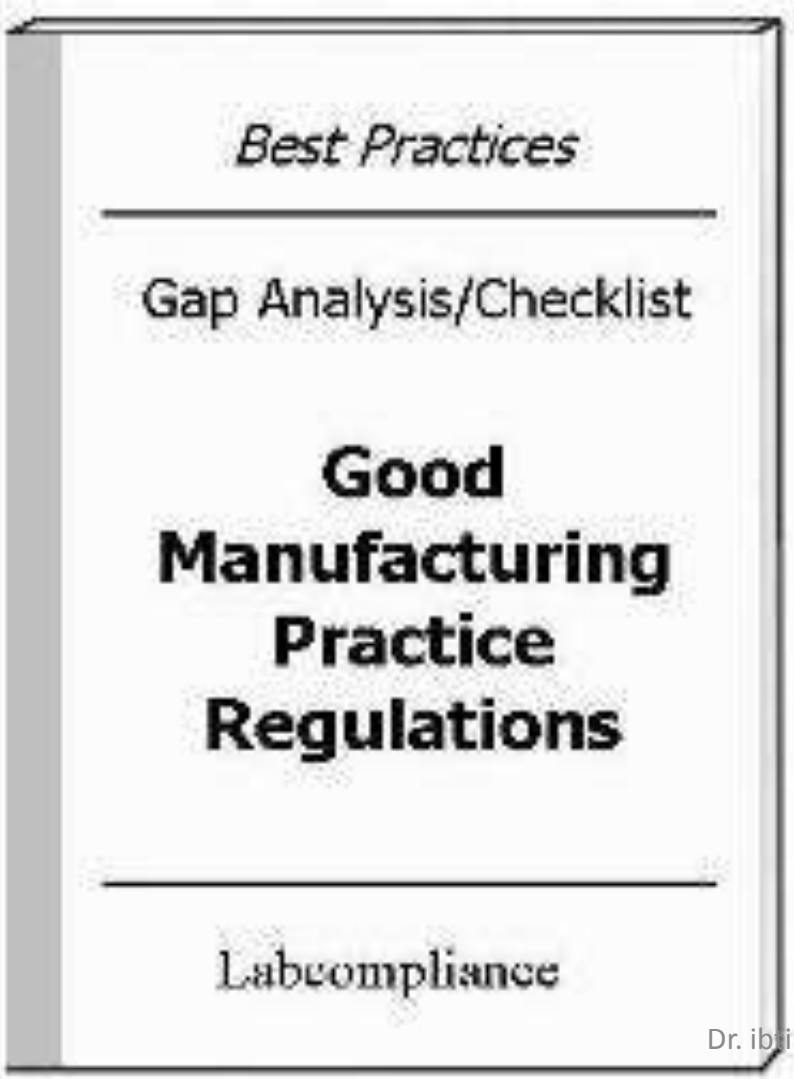


regulations

Regulations

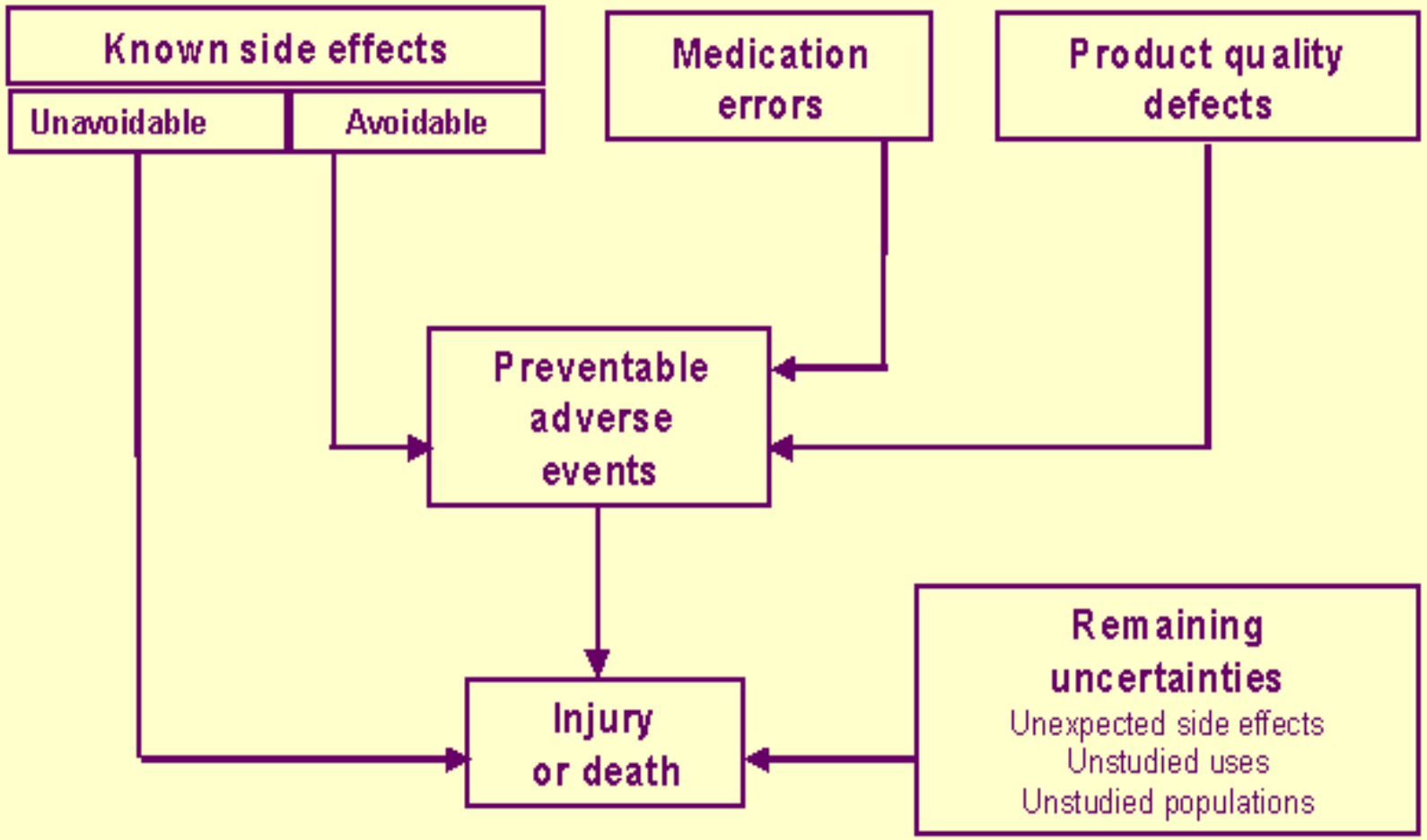
whether it's a new technology or a conventional technology. The role of regularity authorities is to ensure that the products are safe.

FDA: “ Our role is not really to make a judgment about whether they should be placed in the marketplace or not. . . . We are here as the gatekeeper to close the gate if a product is not going to be safe for consumers. . . . “



- GMP regulations address issues including record keeping, personnel qualifications, sanitation, cleanliness, equipment verification, process validation, and complaint handling.

Sources of Risk from Drug Products

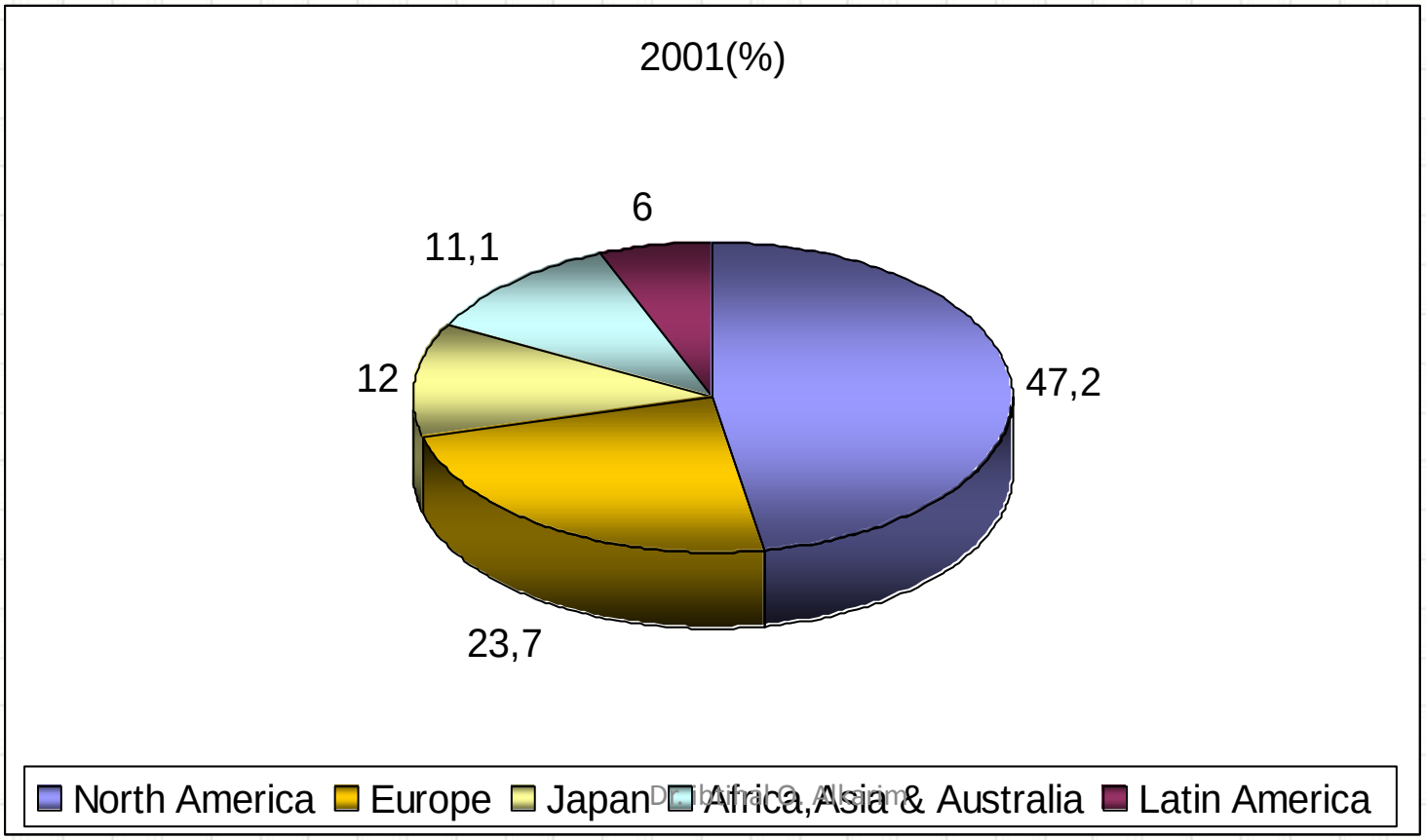


Pharmaceutical market

HISTORY OF PHARMACEUTICAL INDUSTRY

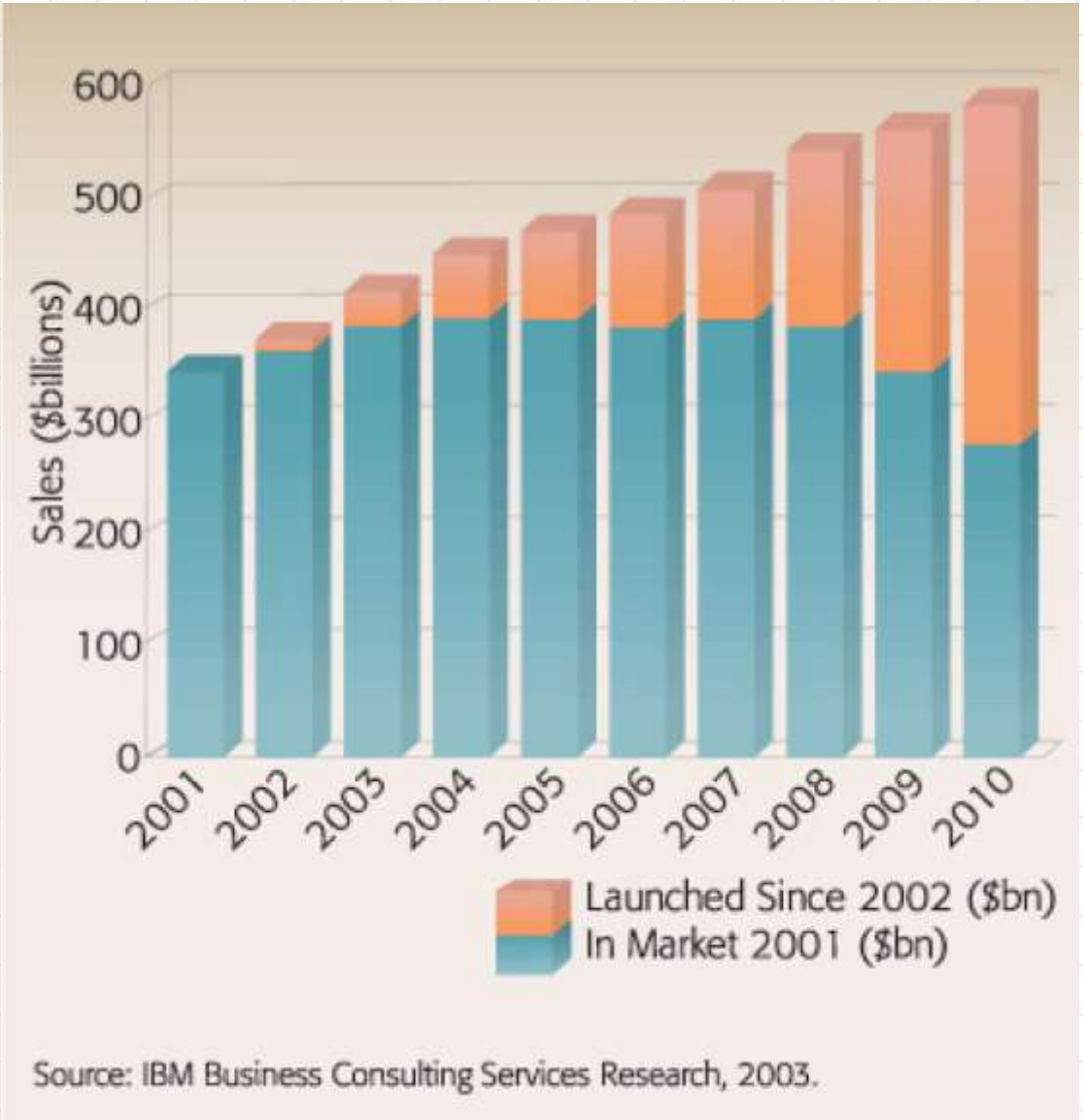
80% of the world pharmaceuticals production is generated by developed countries.

Graph 1: World Pharmaceuticals Market



World Pharmaceutical Market

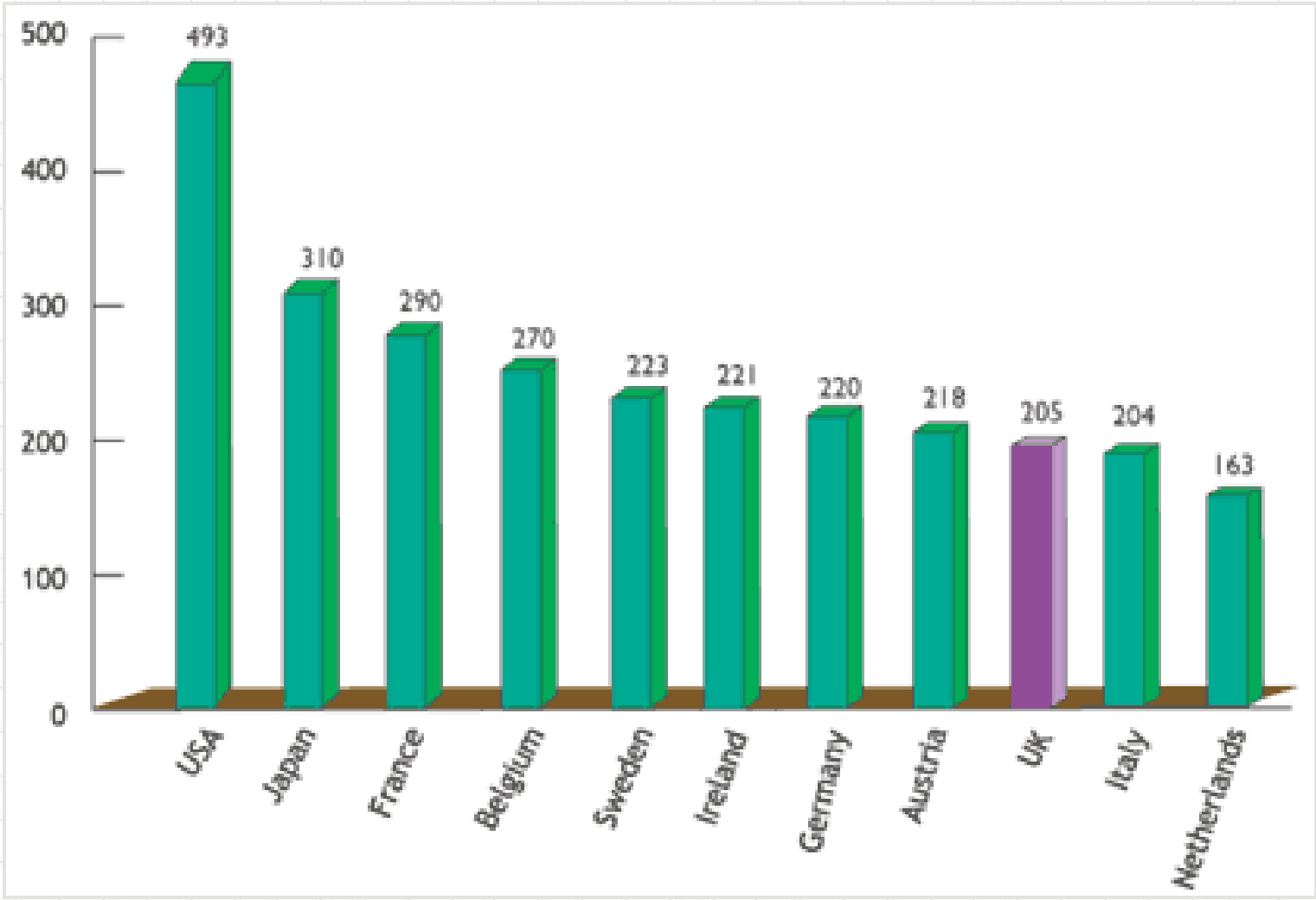
Growth of Pharmaceutical Industry in USA



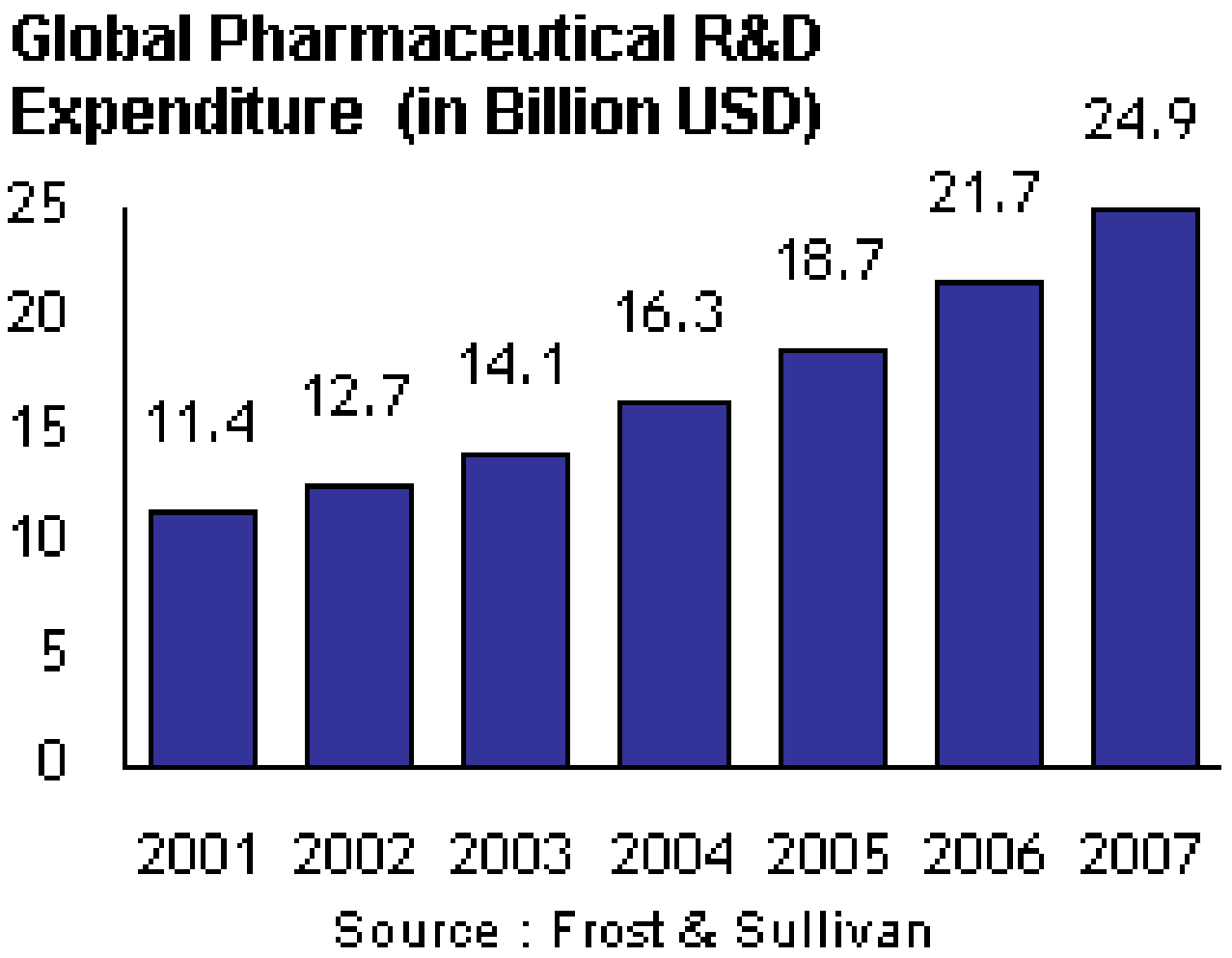
US Sales

Comparison of Annual Sales Per Person

ANNUAL SALES PER PERSON OF PHARMACEUTICALS (2004, £)



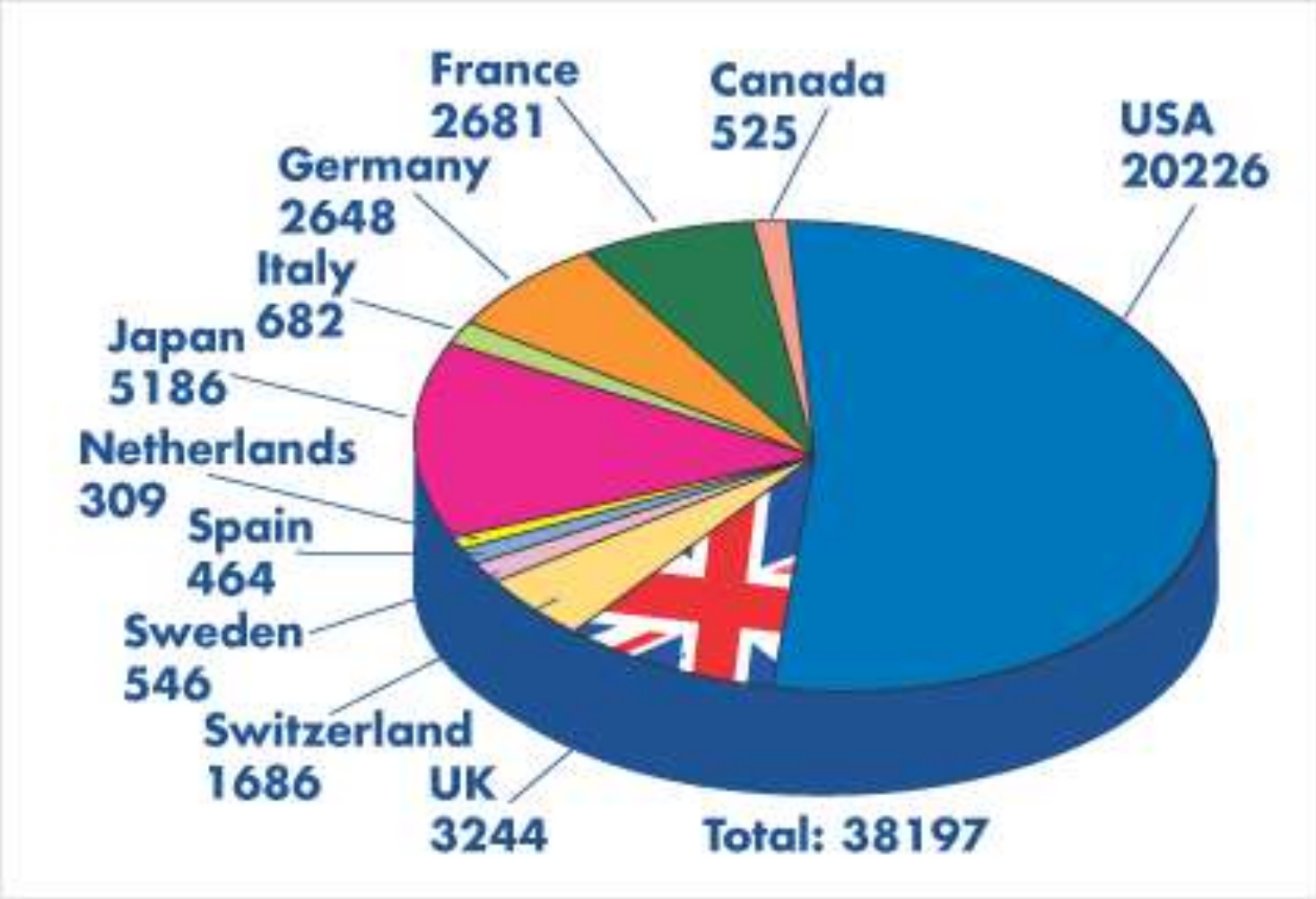
Growth of Pharmaceutical R&D Expenditure



http://www.pharmafocusasia.com/knowledge_bank/articles/images/graph1.gif

Comparison of Pharmaceutical R&D

WORLD VOLUME OF PHARMACEUTICAL R&D (2004 £m)



http://www.abpi.org.uk/publications/publication_details/annualReview2005/ar2005_leader.asp

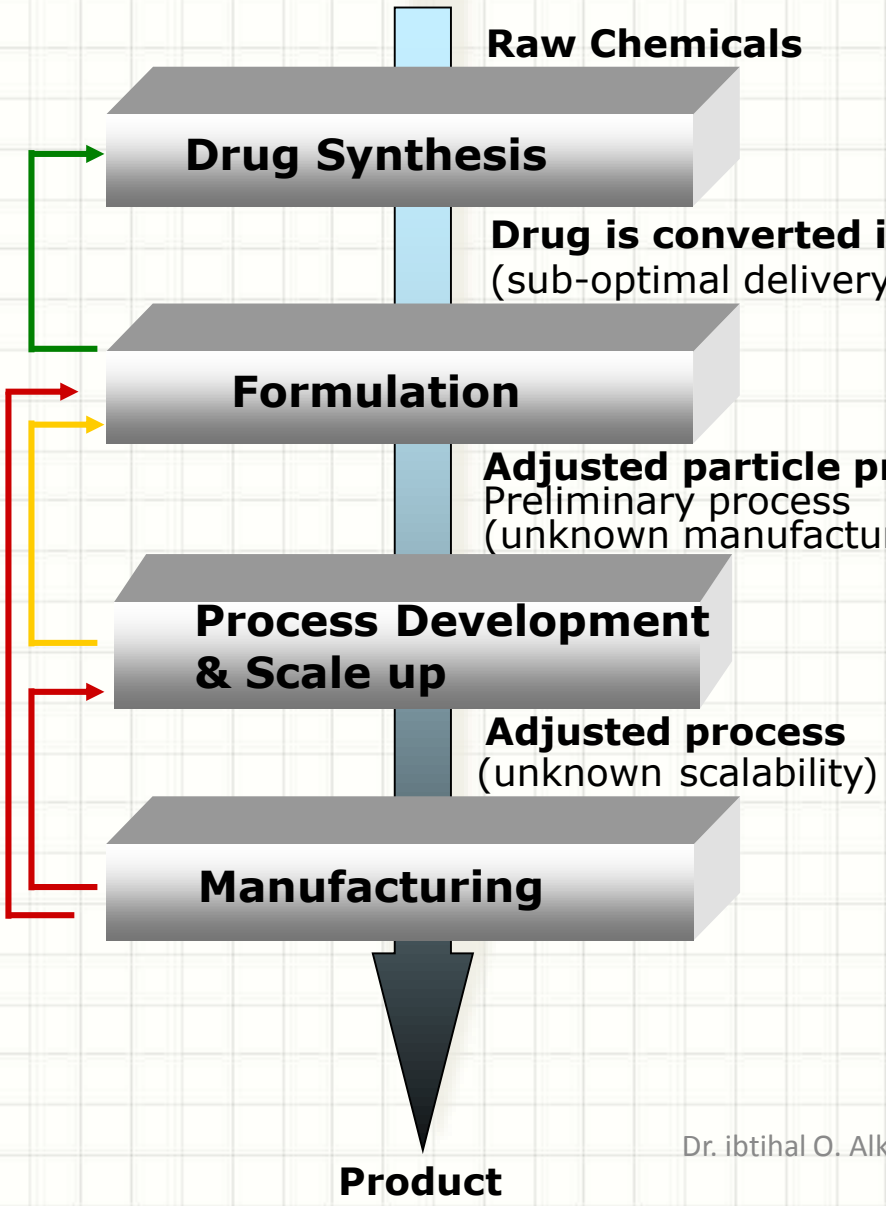
New drug discovery

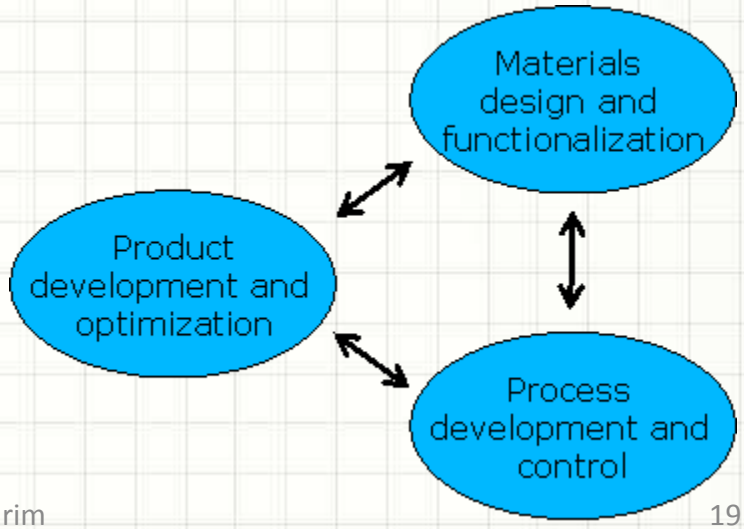
New Drug Discovery

http://www.nature.com/nbt/journal/v22/n10/thumbs/nbt1004-1215-F1.jpg

http://www.syagen.com/images/drug_discovery.jpg

Product/Process Development Paradigm





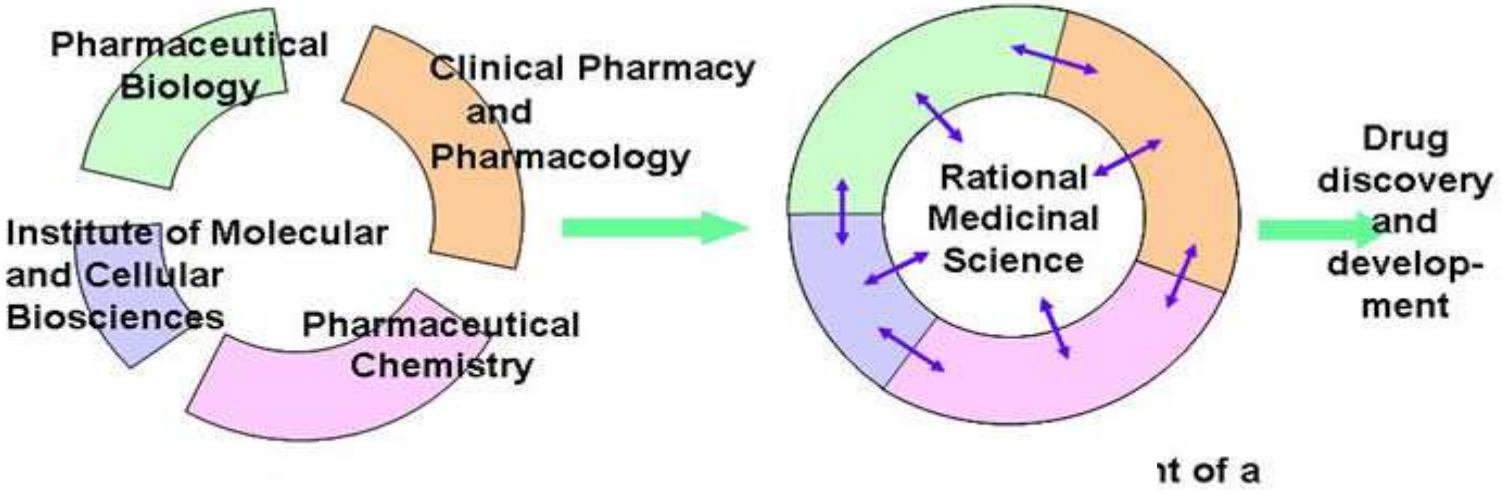
Pharmaceutical Engineering

- Around 15 years to bring a new drug to market
- Blockbuster drug - $1B annual sales
- Product development and scale-up
- Hiring of chemical engineers

Synthesis

Strategic approach to drug discovery and development in pharmaceutical sciences

http://www.u-tokyo.ac.jp/coe/images/pic_list03_004.JPG



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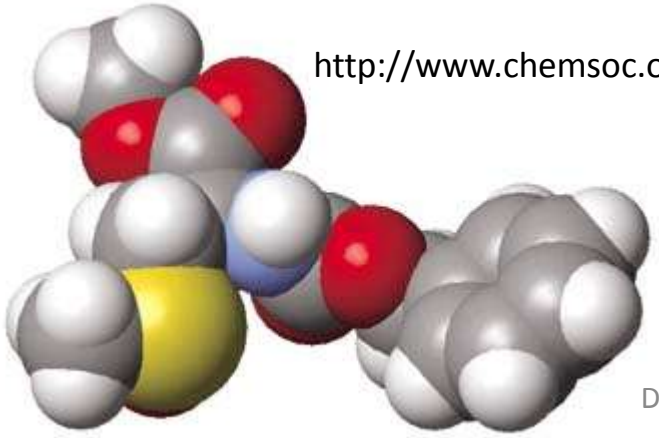
http://www.chemsoc.org/chembytes/ezine/images/1999/persp_apr99_2.jpg



Improvement in organic synthesis allow us to make larger and larger molecules.

Who discovers drugs? Doctors?

- Identify biological target - biology
- Prioritise/ validate target – pharmacology and chemistry
- Identify and optimise lead molecules – chemistry/pharmacology
- Preclinical studies – chemistry/pharmacology/ toxicology
- Formulation - pharmaceutical sciences
- Clinical evaluation – medicine
- Manufacture - chemical engineering

- For ***EACH*** **DRUG** approved, an average of 7500 compounds will have been made
- Of this 7500, *an average* of 21 will be tested for sub-acute toxicology, 6.5 will be tested in humans and 2.5 will reach Phase 3 – 1 then gets to market……
- Entire process takes *on average* 12 years
- Development costs do NOT include pre-launch marketing which can DOUBLE costs

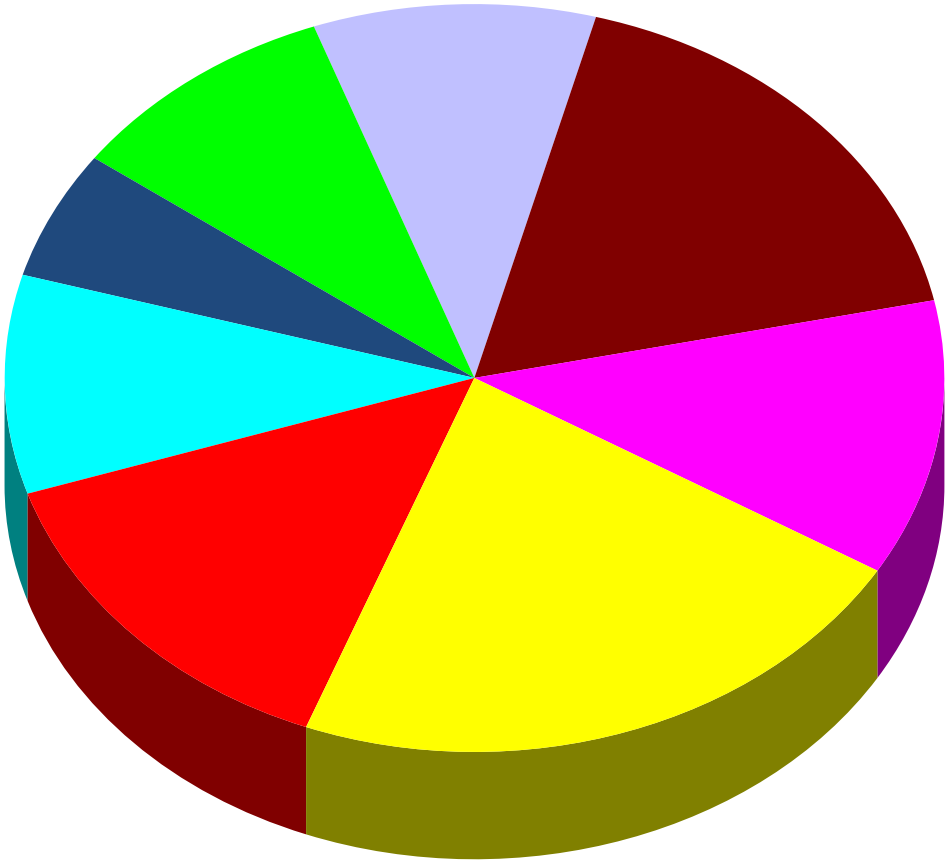
The “Pay Off”……to the companies

- Typical R&D budget: 33% R and 67%D
- R&D = 15 to 25 % of sales turnover
- Patent protection – 20 years from filing
- On average, 11yrs. of *productive* market life
- ✓ **Losec** – $2.7Bn in 1998; **Nexium** (single enantiomer) **$7.7Bn in 2008**
- ✓ **Lipitor** - $1Bn in 1998; **$13.8Bn in 2008**

The Companies in 2010

		Total Sales $billions
1	Johnson & Johnson	61.9
2	Pfizer	50.0
3	Roche	47.4
4	GSK	45.8
5	Novartis	44.3
6	Sanofi-Aventis	42.0
7	AstraZeneca	32.8
8	Abbott	30.8
9	Merck	27.4
10	Bayer	22.3

Major Therapeutic Targets



- CNS
- Metabolic
- Cardiovascular
- Anti-infectives
- Respiratory
- Gentio-urinary
- Musculoskeletal
- Oncology

Top 10 Therapies - sales in 2008 (US$Bn)

	2008 sales	% share
Oncology agents	45.8	6.4
Lipid regulators	34.2	4.8
Respiratory agents	30.7	4.3
Acid pump inhibitors	26.7	3.8
Antidiabetics	26.0	3.7
Antipsychotics	22.4	3.1
Angiotensin antagonists	21.6	3.0
Antidepressants	20.4	2.9
	US$227.8Bn	**32.1%**

Stages of pharmaceutical manufacturing

Dosage Forms

Tablets/Capsules

http://www.avmed.com/images/c_rx-capsule.jpg

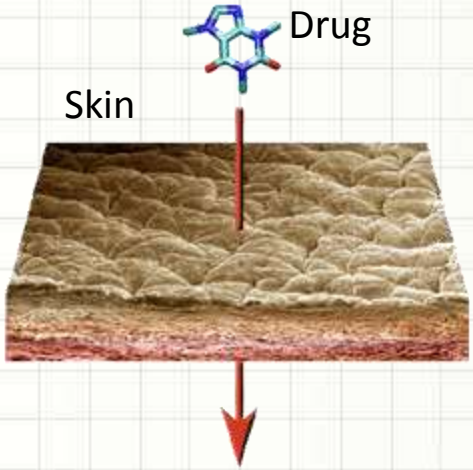
Injectables

http://www.indiamart.com/cscpharma/gifs/injectable.jpg

Inhalants

http://www.bath.ac.uk/pr/releases/images/vectura-inhale.gif

Transdermal products and implants



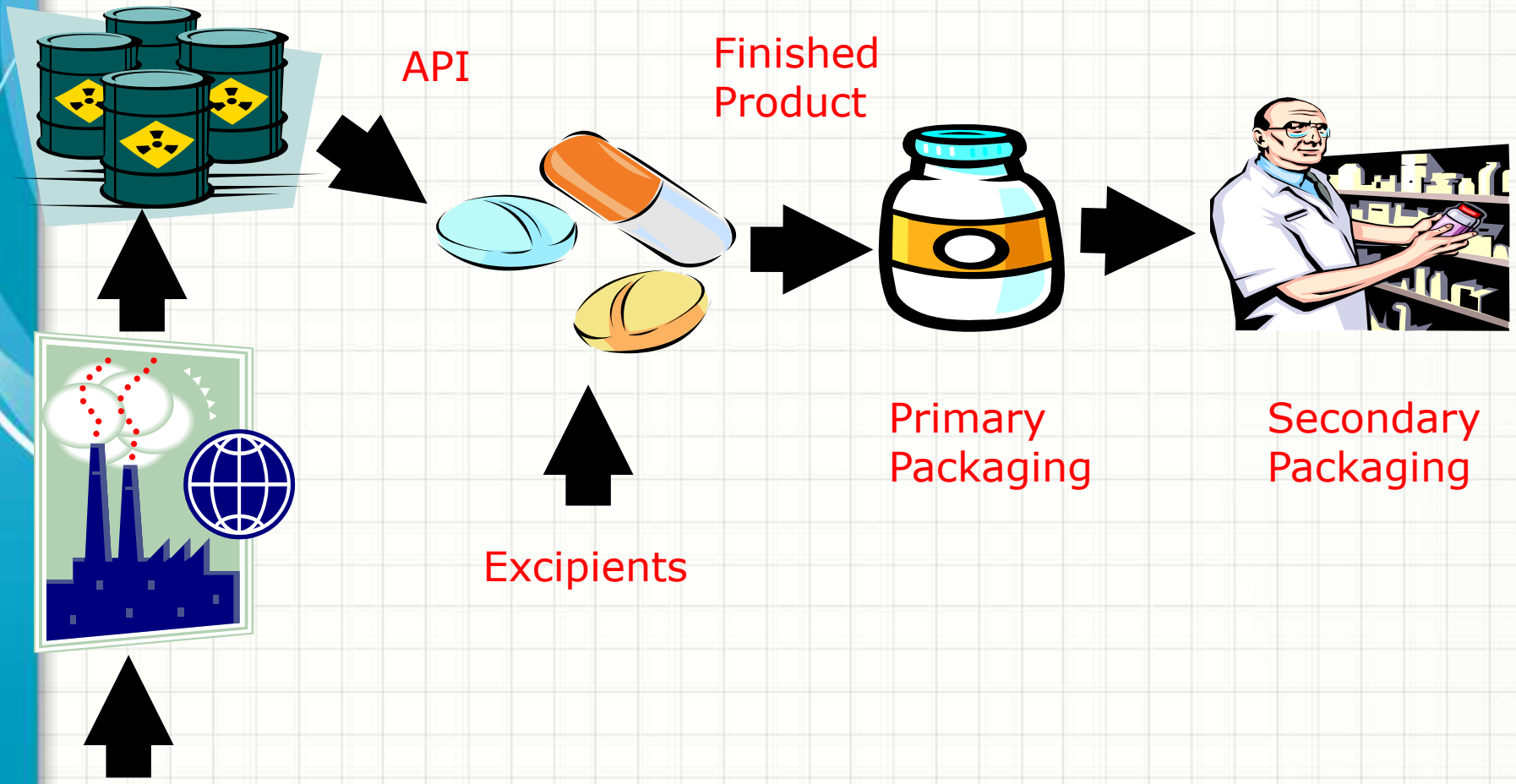
http://www.life-tech.com/pm/nb1app3.jpg

Solid dosage forms

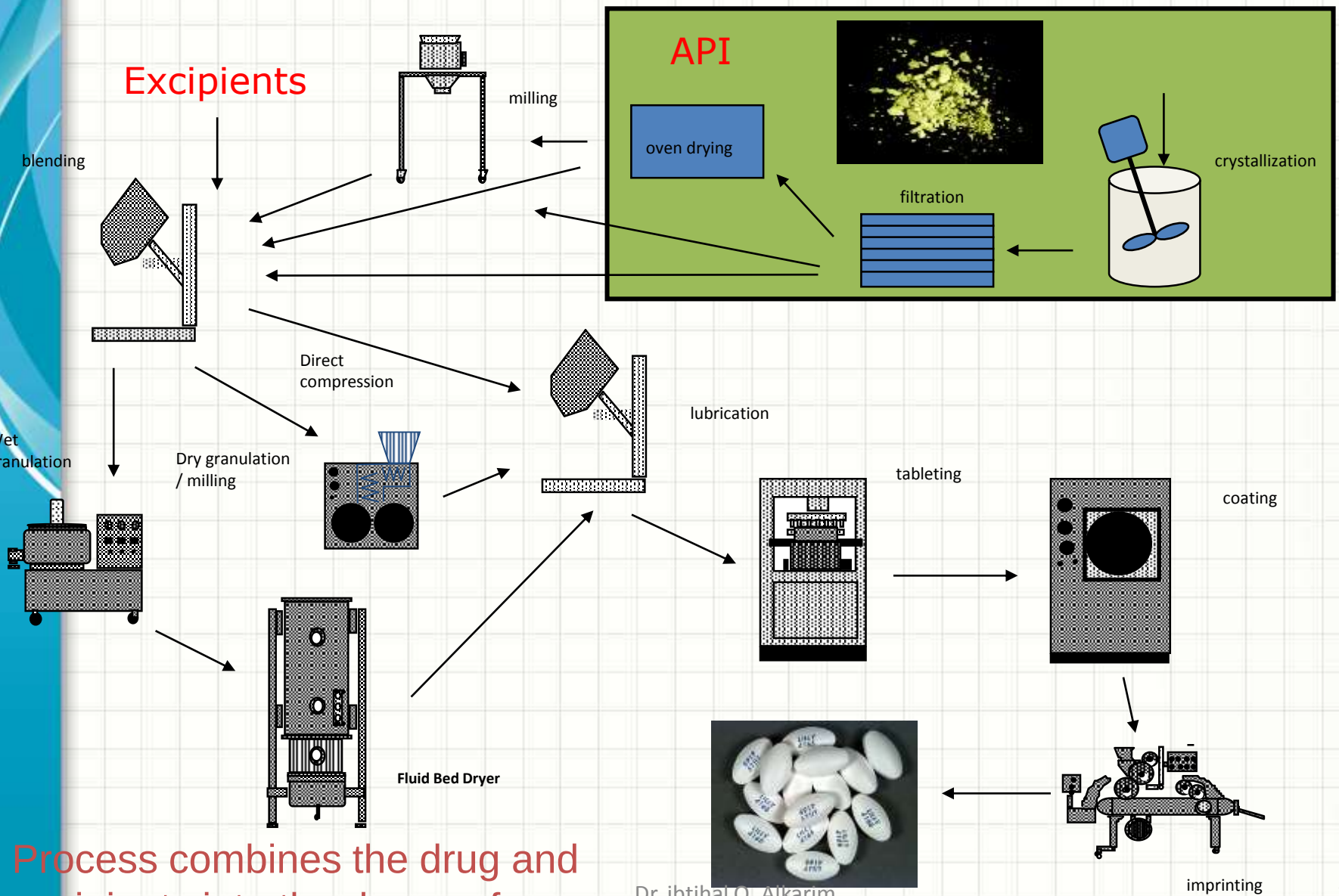
- Oral
  - Tablets
    - Lozenges
    - Chewable tablets
    - Effervescent tablets
    - Multi-layer tablets
    - Modified release
  - Capsules
    - Hard gelatin
    - Soft gelatin
  - Powders
- Inhaled
  - Aerosol
    - Metered dose inhalers
    - Dry powder inhalers

Singh, Naini (2002), Dosage Forms: Non-Parenteral, Encyclopedia of Pharmaceutical Technology

Stages of pharmaceutical manufacturing



Drug product manufacture



Process combines the drug and excipients into the dosage form

Solid dosage processing

- Dosage forms
  - Quality factors
- Excipients
- Particle properties
- Processing routes
- Unit operations

Quality factors for solid dosage forms

Functional quality factors
-Disintegrates to desired size quickly -The constituent particle size of the dosage form should dissolve and be absorbed in the GI tract at a pre-determined rate
Physical quality factors
-Must not break up on processing, packaging, transportation, dispensing or handling -Surface of tablet or capsule must be free of defects -Must be stable under anticipated environmental conditions -Have the same weight and composition for each tablet or capsule
Sensorial quality factors
-Easy and pleasant to swallow

Fung and Ng (2003), AIChE Journal, 49(5), 1193-1215

Product functions

- Product function
  - Product property: Content uniformity, dissolution, flow-ability, dust formation
  - Particle Properties: Particle size, particle shape, surface characteristics

Product property = F(particle properties, formulation)

Particle properties = F(process parameters, raw material/intermediate properties)

Process function

- Process parameters: Type of unit operation, operational parameters

excipients

Excipients

Excipients are substances, other than the active drug substance, or finished dosage form, that have been appropriately evaluated for safety and are included in drug delivery systems:

- To aid in the processing of the drug delivery system during its manufacture;
- To protect, support, or enhance stability, bioavailability or patient acceptability;
- To assist in product identification;
- To enhance any other attribute of the overall safety, effectiveness, or delivery of the drug during storage or use.

USP, General Information Chapter <1078>, Good Manufacturing Practices for Bulk Pharmaceutical Excipients

Excipient functions

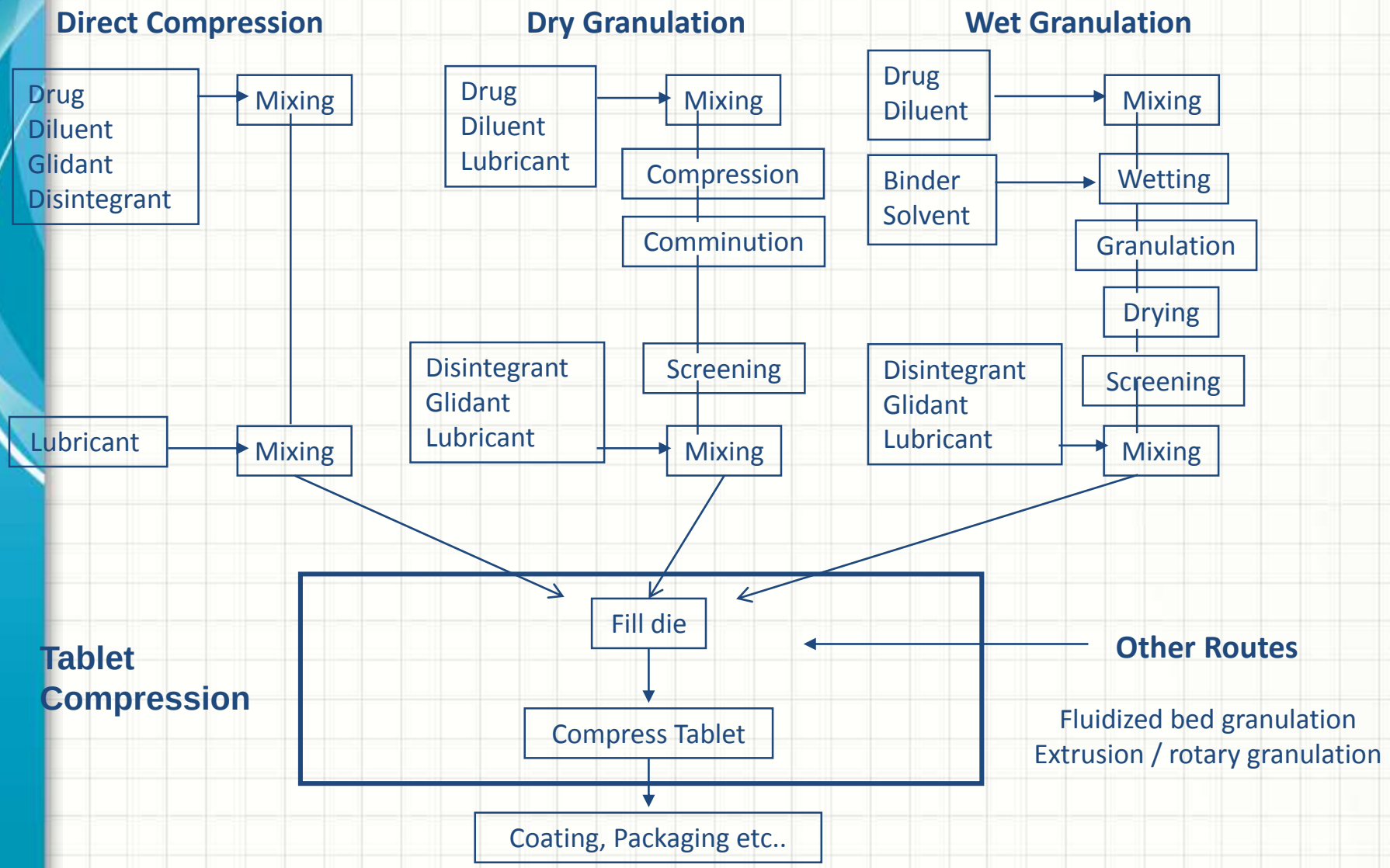
Component	Function	Examples
Fillers	Increase size and weight of final dosage form	Microcrystalline cellulose, sucrose
Binders	Promote particle aggregation	Pregelatinized starch, hydroxypropyl methylcellulose
Disintegrants	Promote break down of aggregates	Sodium starch glycolate
Flow Aids	Reduce interaction between particles	Talc
Lubricants	Reduce interactions between particles and surfaces of processing equipment	Magnesium stearate
Surfactants	Promotes wetting	Sodium lauryl sulfate, Polysorbate
Modified Release Agents	Influences the release of active	Hydroxypropyl methylcellulose, Surelease,

Hlinak (2005)

Processing routes

1. Wet granulation
2. Dry granulation
3. Direct compression

Processing routes



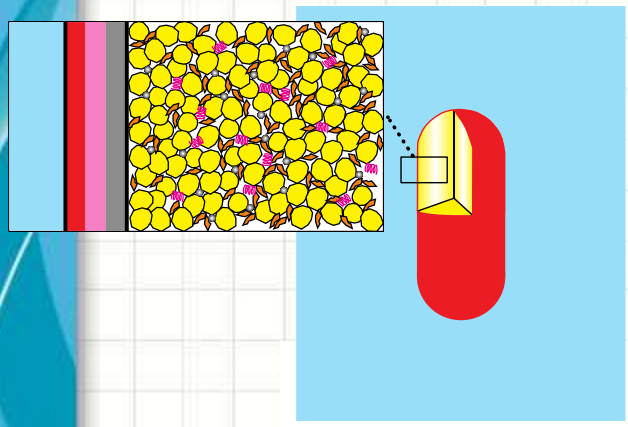
Unit operations

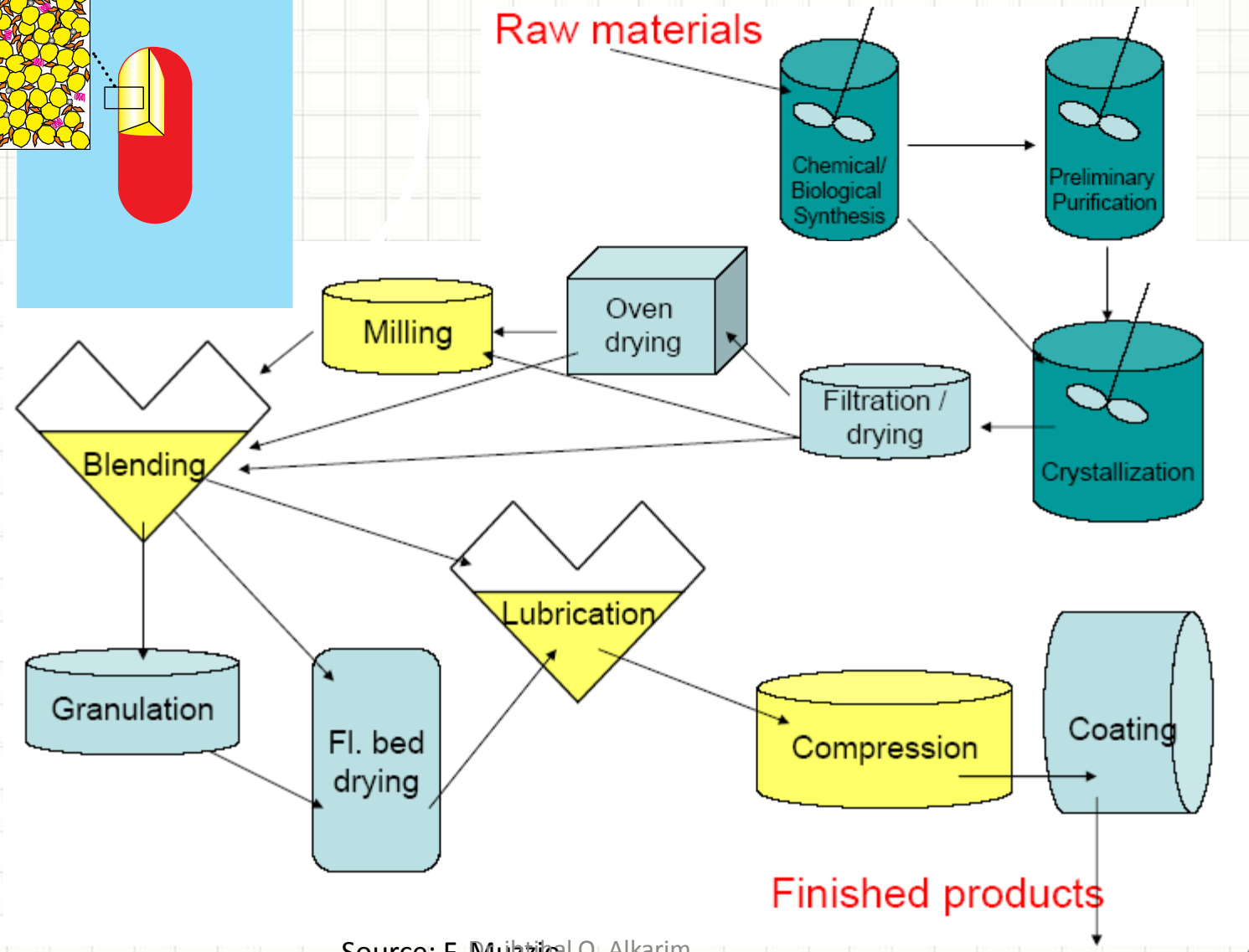
- Process function

Particle properties = F(process parameters, feed/intermediate properties)

  - Process parameters: Type of unit operation, operational parameters
- Type of unit operation
  - Size reduction (Milling)
  - Blending
  - Dry granulation (Roll compaction)
  - Wet granulation
  - Drying
  - Tablet compression
  - Coating

Flow Sheet for Tablet Manufacture





Source: F. Muzzio

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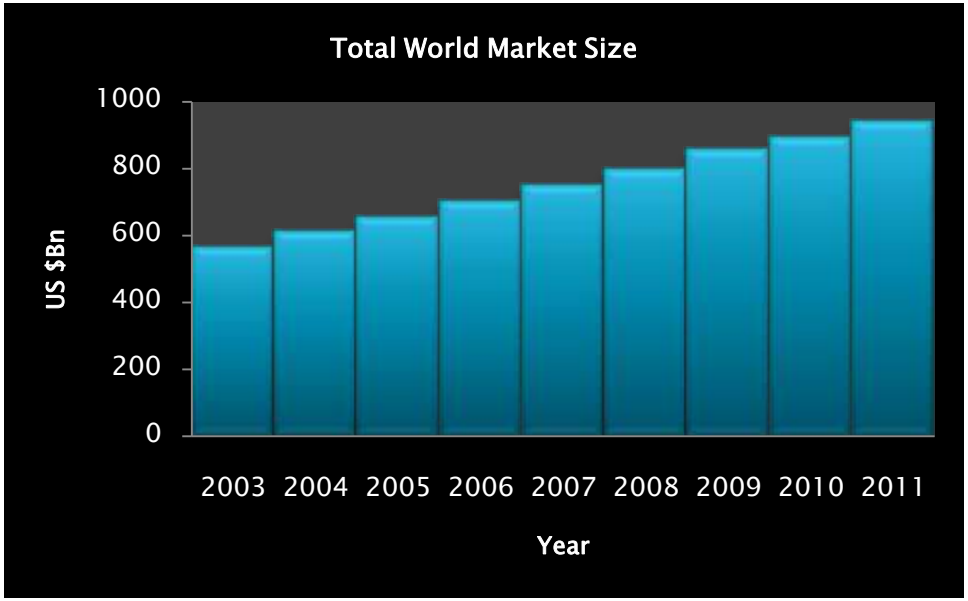
CONSULTING

Indian Pharmaceutical Industry

Industry background

- The global sales of medicines reached $942 billion in 2011, which was a 5.1% increase on the previous year.

This total is expected to reach $1.5 trillion by 2020, due to an increase in population of 7.6 billion people, 13% of which will be over 60.



Source: IMS Health Market Prognosis

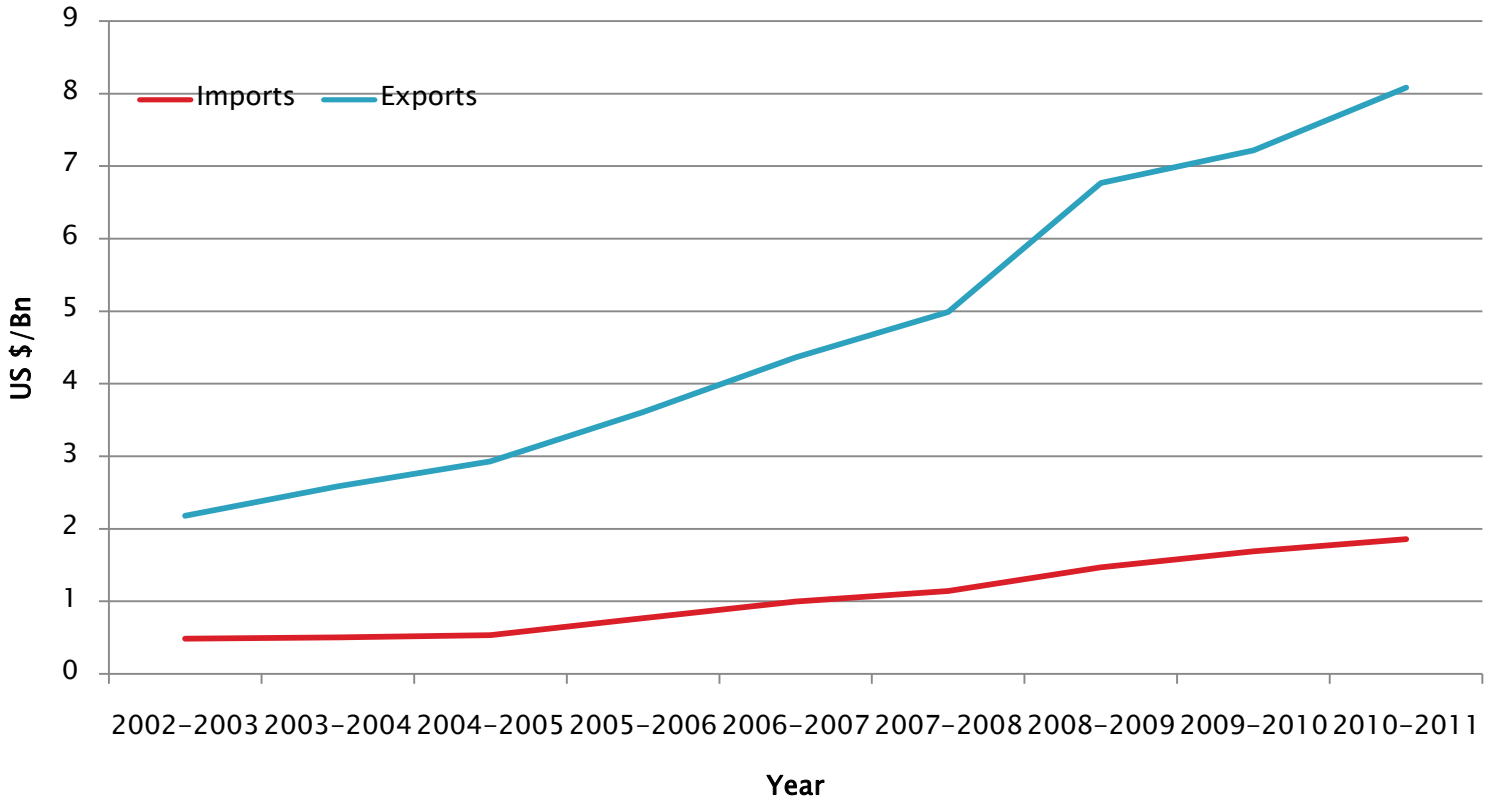
Issues for the Industry

- Between 2012-2018, the “patent cliff" will wipe an estimated $148 billion off pharmaceuticals industry revenues due to many drugs coming out of patents
- Rising cost of R&D, the cost of bringing a molecule to market globally is estimated to be from $800 million to $4 billion.
- On average, out of every 10,000 molecules been developed; only one or two are likely to reach the market.
- Increasing government pressure, with harsher price controls and taxes.
- European Medical Agency (EMA) and the US Food and Drug Administration (USFDA) are focusing on risk management; thereby putting pressures on profitability of pharmaceutical companies.

The Indian Pharmaceutical Industry

- The Indian pharmaceuticals industry has grown from a mere $0.3billion in 1980, to $12 billion in 2012.
- Branded generics dominate the market, making up 70-80% of it.
- The local companies enjoy a dominant position due to their development capabilities and early investment, as from 1970 to 2005, Indian law only recognized process patents and not product patents, which many companies took advantage of.
- The price of drugs is very low, due to intense competition. While India is 10th globally in terms of value, it is 3rd in term of volume of drugs produced.

Indian Pharmaceutical Companies Imports and Exports



Source: Ministry of Chemicals & Fertilizers, Department of

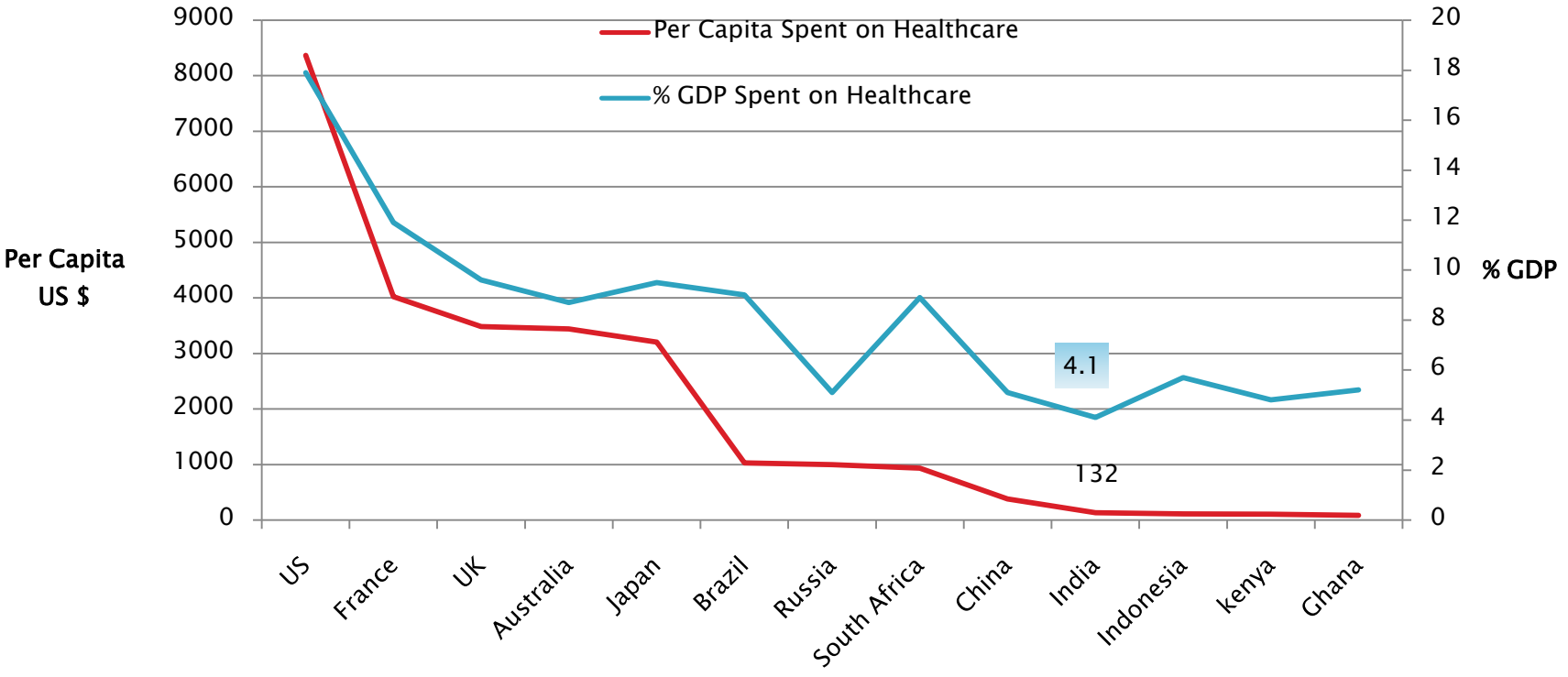
The Indian Set-Up

- The Indian pharmaceutical sector is highly fragmented, with more than 20 000 registered companies, with the top 250 companies controlling 70% of the market. These companies can currently meet about 70% of the countries demands for drugs; this is mainly through the Maharashtra and Gujarat regions, which account for 45% of the total number of pharmaceutical manufacturing units in India.

SWOT Analysis Of Indian Pharmaceutical Industry

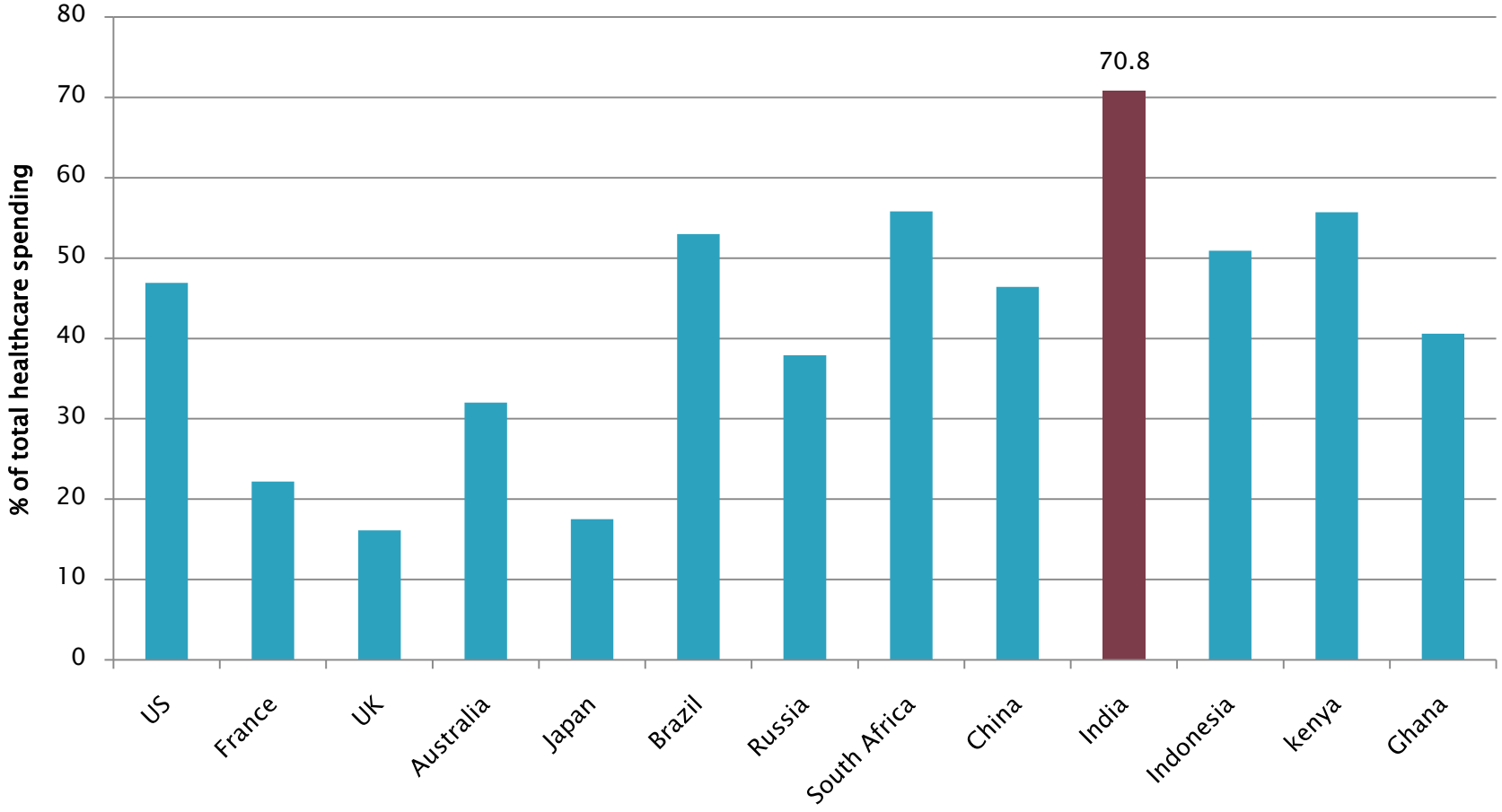
Strengths	Weaknesses	Opportunities	Threats
•Low cost of skilled manpower •Access to large pool of highly trained scientists •Strong marketing and distribution network •Proven track record in design of high technology manufacturing devices •Low cost of innovation, manufacturing and operations	•Stringent pricing regulations •Poor transport and medical infrastructure •Lack of data protection •Very competitive environment •Poor health insurance coverage •Production of low quality drugs tarnishes image of industry abroad •Low investment in innovative R&D	•Increase in per capita income •Global demand for generics rising •Increasing population with more sedentary lifestyle •Increasing health insurance sector •Significant investment from MNCs •Medical tourism •Cheap, diverse clinical trials •Global outsourcing hub due to low cost of skilled labor	•Other low cost countries affecting demand •Government regulations changing •Expanding of Drugs Price Control Order •Lack of investment in infrastructure •Wage inflation •R&D restricted by lack of animal testing and outdated patient office •Counterfeiting threat

Investment Comparison



Source: theguardian.com/news/datablog/2012/jun/30/healthcare-spending-world-country

Private Spending on Healthcare as a % of Total Spending



Growth Factors for Indian Market

- Population Growth
- Socio Economic Changes and Urbanization
- Increasing acceptability of modern medicine
- More affordably drugs
- More accessibility to drugs and medical care
- Cheap production cost
- Government regulations targeting growth and competitive market
- Contract R&D
- Medical Tourism

Key Players Locally

Company	Net Sales (30th July 2013 $Bn)	Employees
Cipla	1.39	20,000
Dr Reddy's Laboratories	1.14	16,300
Ranbaxy Labs	1.07	14,600
Aurobindo Pharma	0.92	8,635
Lupin Ltd	0.91	11,355
Sun Pharma	0.68	11,200
Novartis India	0.14	4,500 (115,000 Worldwide)

Sources: moneycontrol.com, drreddys.com, cipla.com, ranbaxy.com, lupinworld.com, novartis.in, aurobindo.com, sunpharma .com

International Players

Company	Net Sales (2012 $ Bn)	Employees
Johnson & Johnson (USA)	67.2	117,000
Pfizer (USA)	58.9	91,000
Novartis (Switzerland)	56.7	115,000
Roche (Switzerland)	47.8	80,000
Merck (USA)	47.3	86,000
Sanofi (French)	46.4	113,000
GlaxoSmithKline (UK)	39.9	97,000

Source: fiercepharma.com/special-reports/top-pharma-companies-2012-revenues

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Editorial Open Access

Overview on Pharmaceutical Formulation and Drug Design

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Definition

Pharmaceutical formulation

It is the processes in which different chemical substances i.e., active chemical substances will combined together to produce a medical compound i.e., medical drug.

Drug design

It is the process of producing or invention of novel and/ or new medical product, the design of this new product completely based on the knowledge of biological target. Moreover, this process sometimes known as or called rational drug design.

Background

For pharmaceutical formulation

This process involves production of drug which characterized by two things: first it must be a stable product, second it must be acceptable to the patient who will use it. Besides that in case of synthesis of an oral medication (tablet or capsule) it will contain a variety of ingredients besides the drug itself so it is an obligate matter to be sure that all of these ingredients must be incorporate with each other. Therefore it is very important to do a lot of formulation studies in order to detect the point of incorporation. Besides that formulation studies must focus on other factors like particle size, polymorphism, pH and solubility, in order to check whether these factors will effect on bioavailability of the drug or not.

For drug design

In case of drugs design, computer modeling techniques consider as a very important factor in this field. The phrase "drug design" precisely means design of small molecule that will bind tightly to the required target i.e., ligand. The target will refer either to a particular metabolic or signaling pathway that is specific to a disease condition or pathology or to the infectivity or survival of a microbial pathogen. But there are important points which need to optimized first before a ligand can consider safe and effective, these points are metabolic half-life, bioavailability and drug side effects.

Classifications for Pharmaceutical Formulation and Drug Design

Drug design

There are two major types or classifications of drug design. The first is called as ligand-based drug design and the second, structure-based drug design.

- Ligand-based drug design- In this branch or type of pharmaceutical formulation the design of the drug will be made or built depends on the knowledge of what binds to it.
- Structure-based- while this type drug design will depend on the information related with the three dimensional structure of the biological target these information will be gotten by using methods like X-ray or NMR.

Pharmaceutical formulation

There are two types or classifications for Pharmaceutical Formulation, these types are the following:

- Oral formulation- The most important characteristic for oral formulation it must be overcome the problems which associated with oral administration. The most critical problem is rate of drug solubility i.e., the active ingredient of the drug must be soluble in aqueous solution in a constant rate. This point can be controlled through some factors like particle size and crystal form. The oral formulation divided in two parts which are: A- Tablet form & B- Capsule form.
- Topical medication forms- This type include several parts as the following:
- Cream, B- Ointment, C- Gel, D- Paste, and E- Powder.

Conclusion

Therefore it is a very important point for the open access journals to encourage researchers to work hard in order to develop more drugs and treatments in order to get the best solubility and effectiveness.

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Analysing the Trade Aspects of Indian Pharmaceutical Industry

Presented by:
Sushant Mishra
Sushant_mishra1@yahoo.com

"The Indian pharmaceutical industry is a success story providing employment for millions and ensuring that essential drugs at affordable prices are available to the vast population of this sub-continent."

- Richard Gerster

Introduction

Indian Pharmaceutical Evolution

Phase I

Early Years

- Market share domination by foreign companies
- Relative absence of organized Indian companies

Phase II

Government Control

- Indian Patent Act – 1970
- Drug prices capped
- Local companies begin to make an impact

Phase III

Development Phase

- Process development
- Production infrastructure creation
- Export initiatives

Phase IV

Growth Phase

- Rapid expansion of domestic market
- International market development
- Research orientation

Phase V

Innovation and Research

- New IP law
- Discovery Research
- Convergence

1970 1980 1990 2000 2010

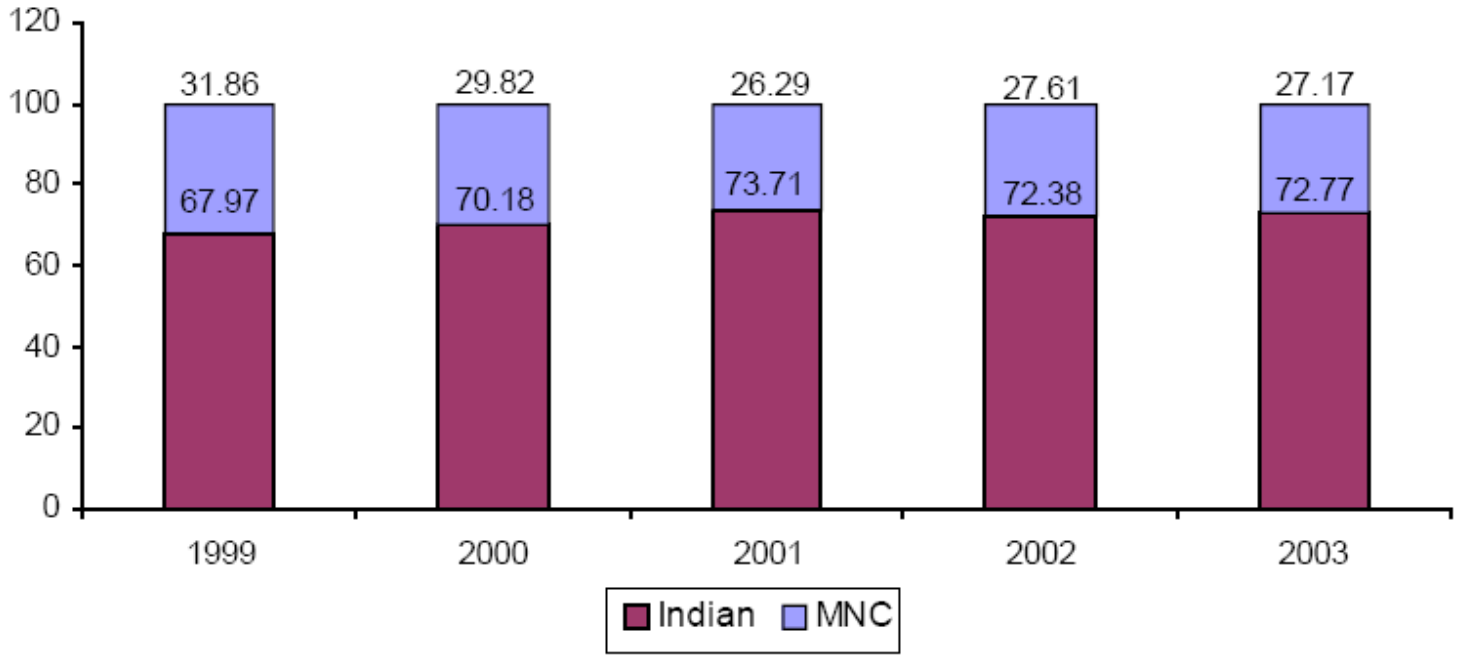
Global Pharmaceutical Market

- Estimated at $700 bn in 2007
- Growth Rate – 6% CAGR
- Expected to Reach - $937 bn in 2012
- Generic Drugs - $92 bn
- Generic Drug Market
  - Growth Rate – 11% CAGR
  - $155 bn by 2012

Indian Pharmaceutical Industry

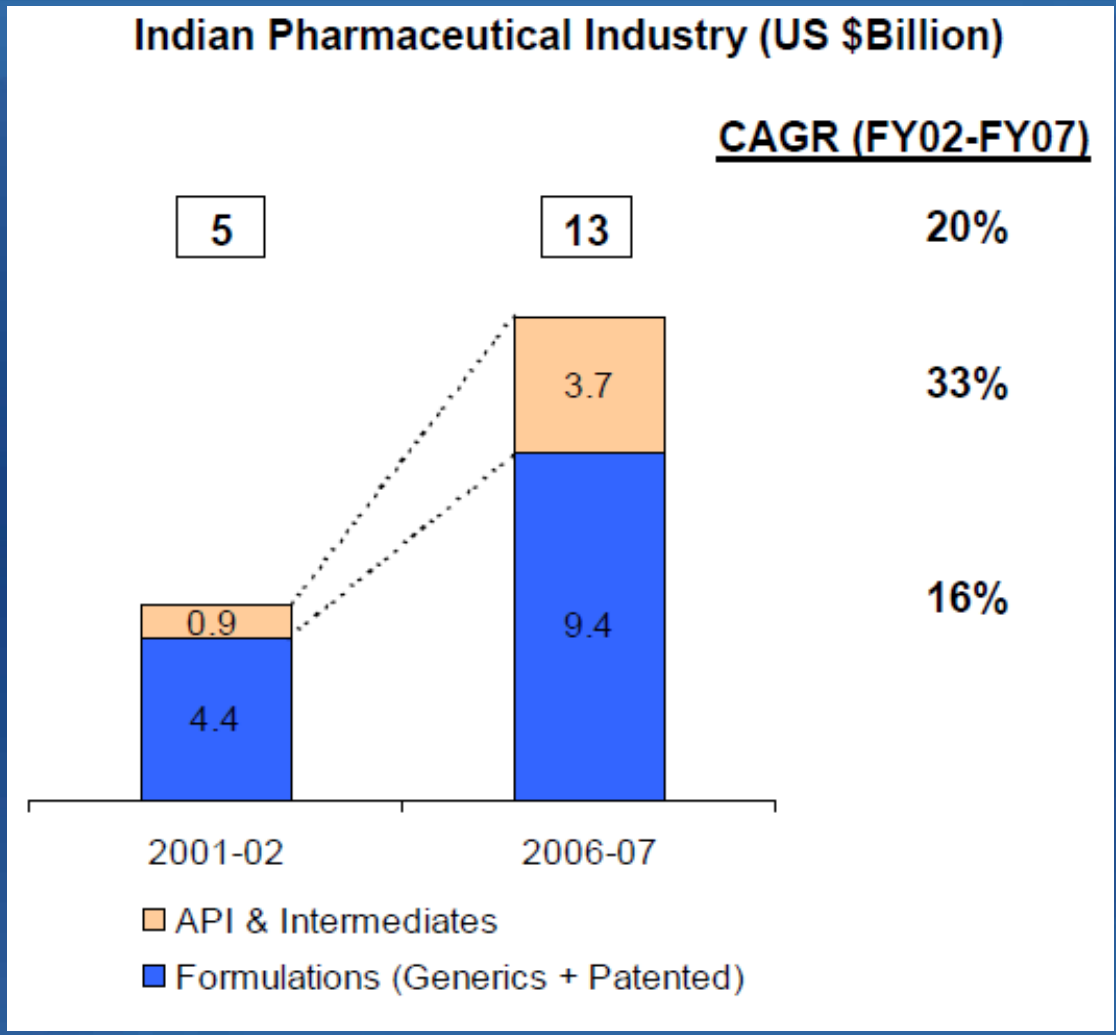
- Indian companies and subsidiaries of MNCs
- Indian companies manufacture
  - Generic Drugs
  - Intermediaries
  - Bulk drugs or APIs
- Meets 95% of domestic medical needs
- Other areas of recent focus include:
  - Drug Discovery and Development
  - Contract Research
  - Contract Manufacturing

MARKET SHARE – MNCs vs. DOMESTIC COMPANIES

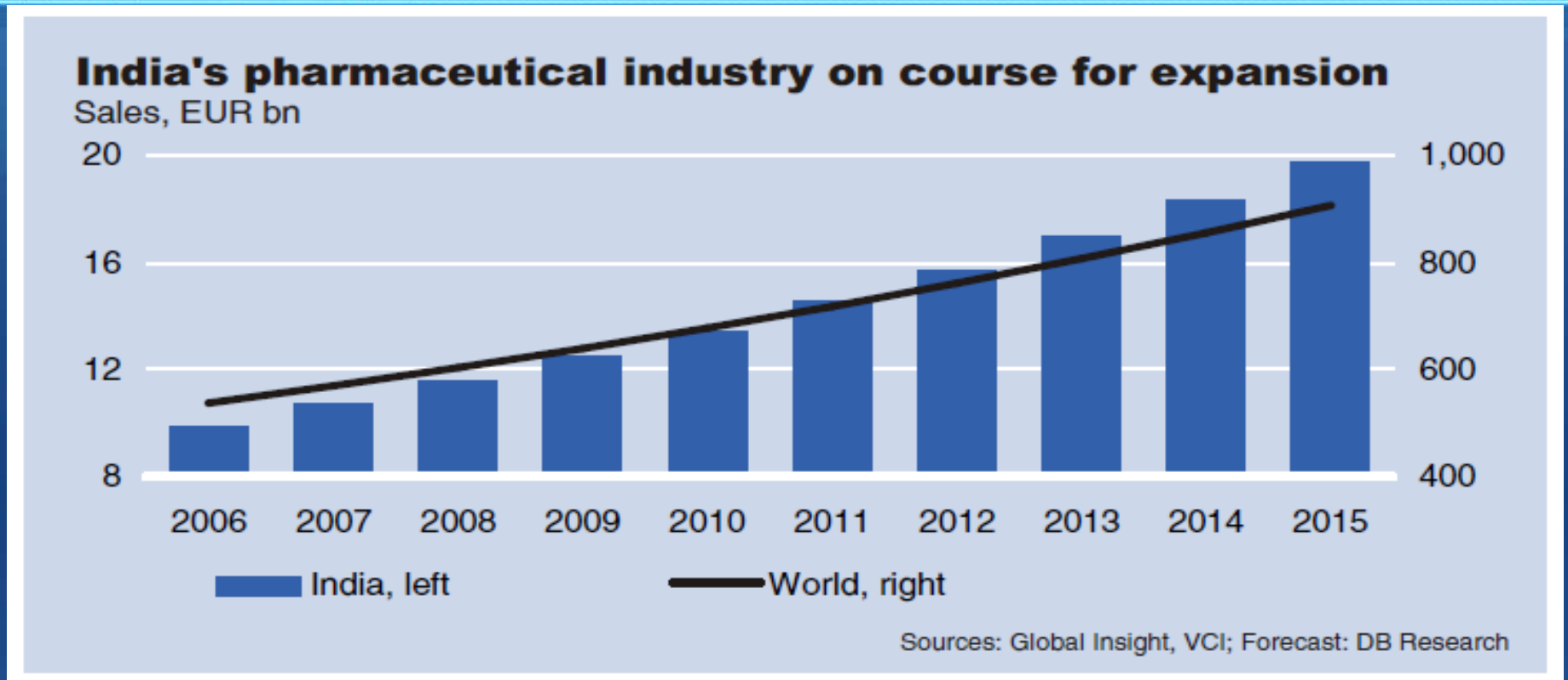


The Indian Pharmaceutical Industry

- Ranked 4th by Production Volume
- Ranked 13th by Domestic Consumption Value
- Growth expectation from $13 bn in 2007 to $34 bn in 2012

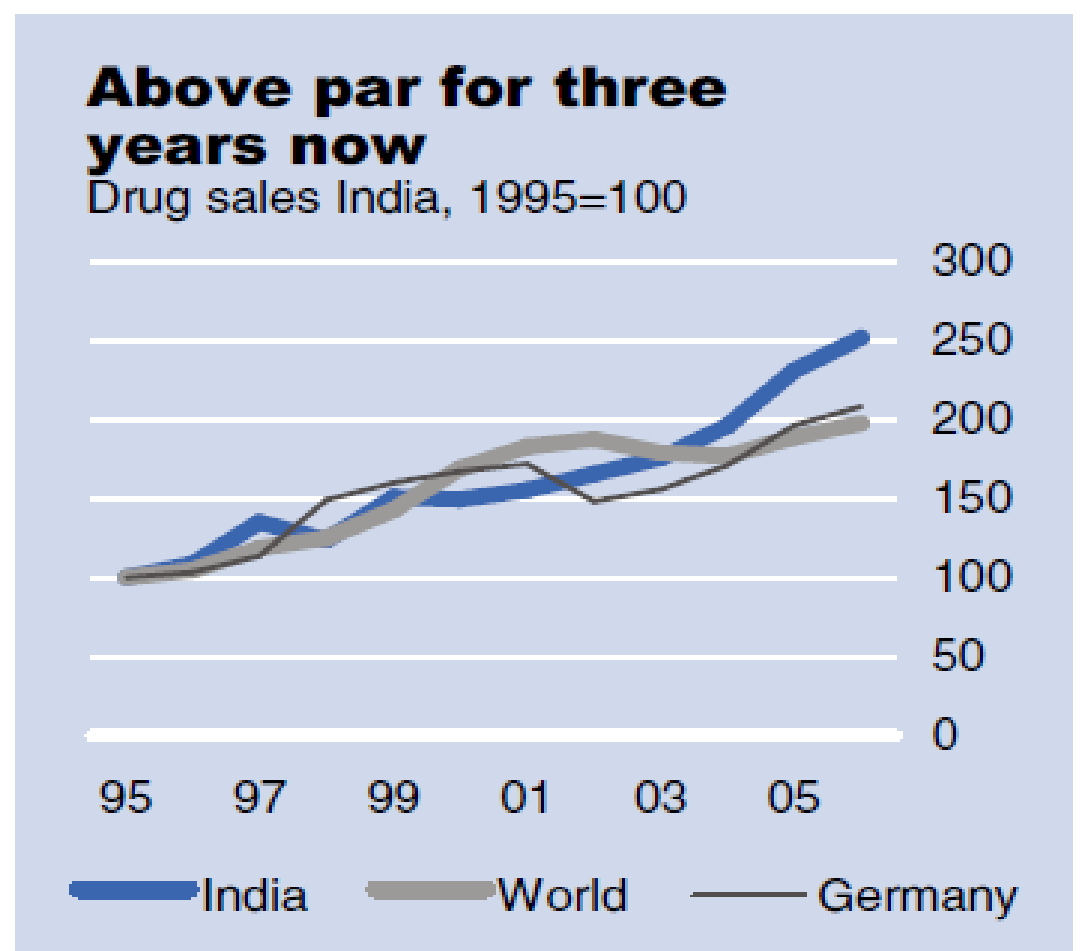


Growth Projections



- Growth at 8% p.a. till 2015 to just under EUR 20 bn
- World Growth Rate – 6% and Germany's – 5%
- Still India's share in World's Market in 2015 – Just over 2%

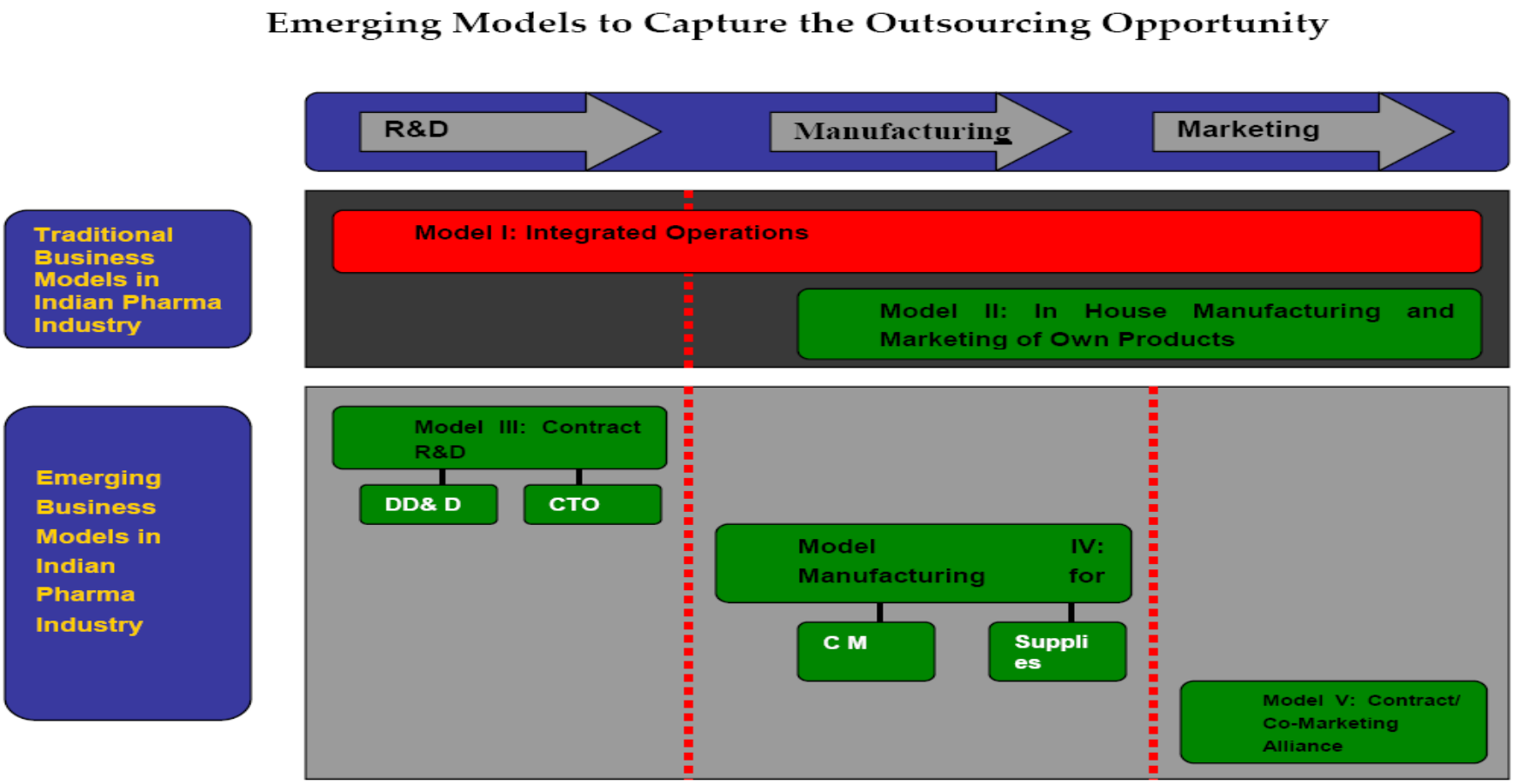
Drug Sales Growth



Factors for Immense Growth Potential

- Increasing health consciousness of people
- Affordability due to rising incomes of expanding middle class
- Health insurance facilities
- Large number of untreated and under-treated medical conditions
- Newer and better medicines

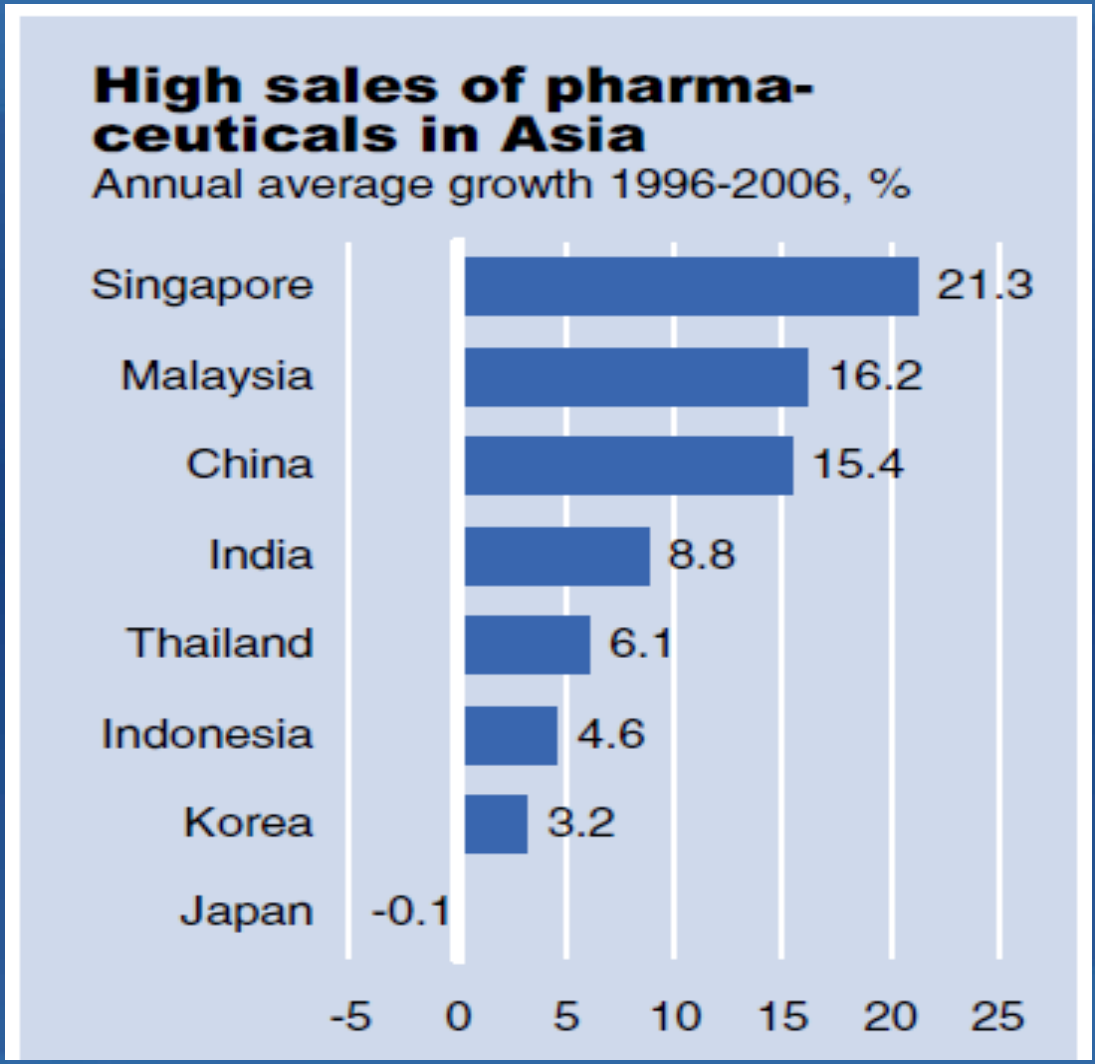
MODEL TO CAPTURE OUTSOURCING OPPORTUNITY



DD&D: Drug Discovery & Development
CTO: Clinical Trials Organization
CM: Contract Manufacturing

Source: E&Y

Growth Rate Comparision

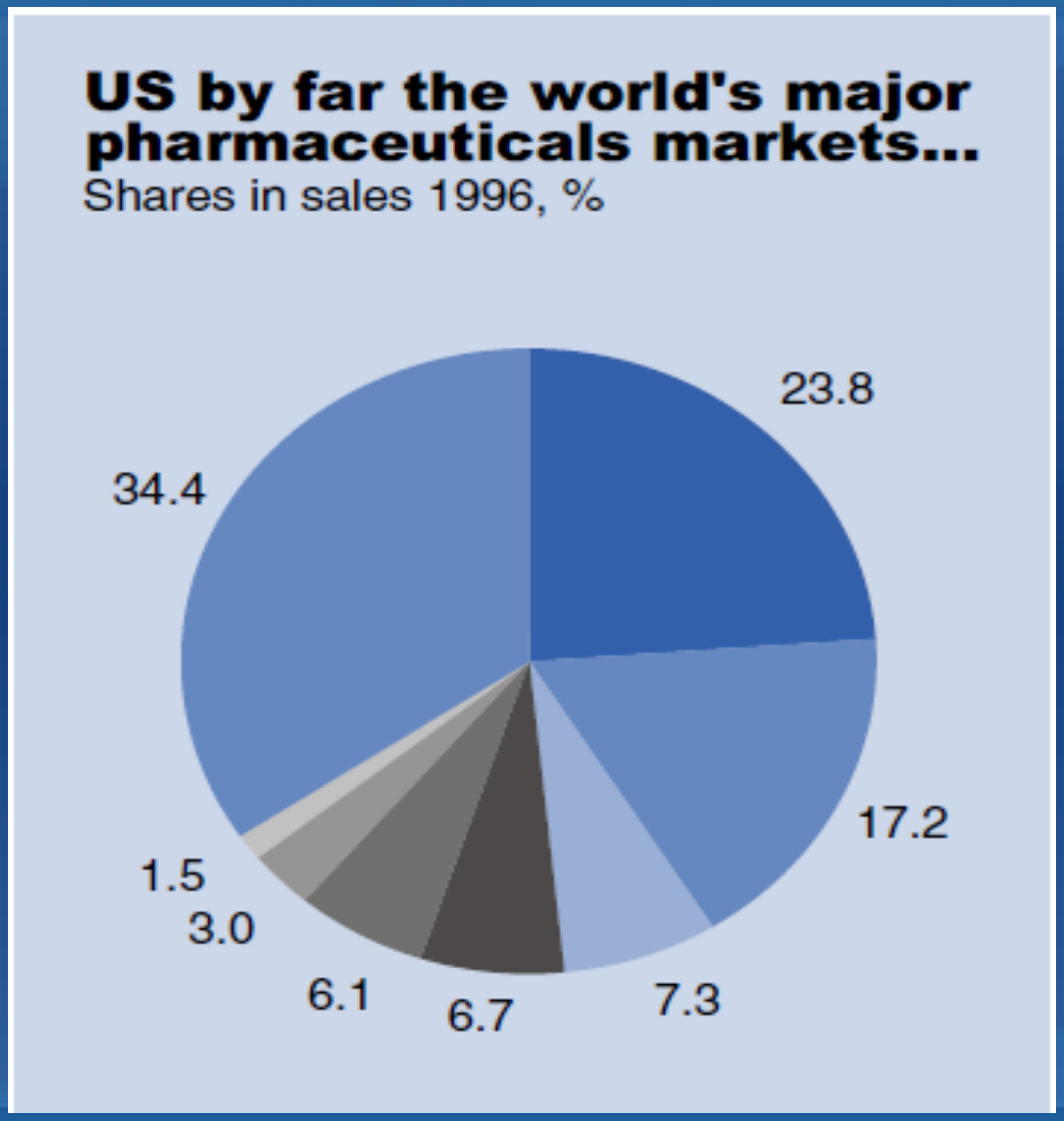


CII – Interlink Study

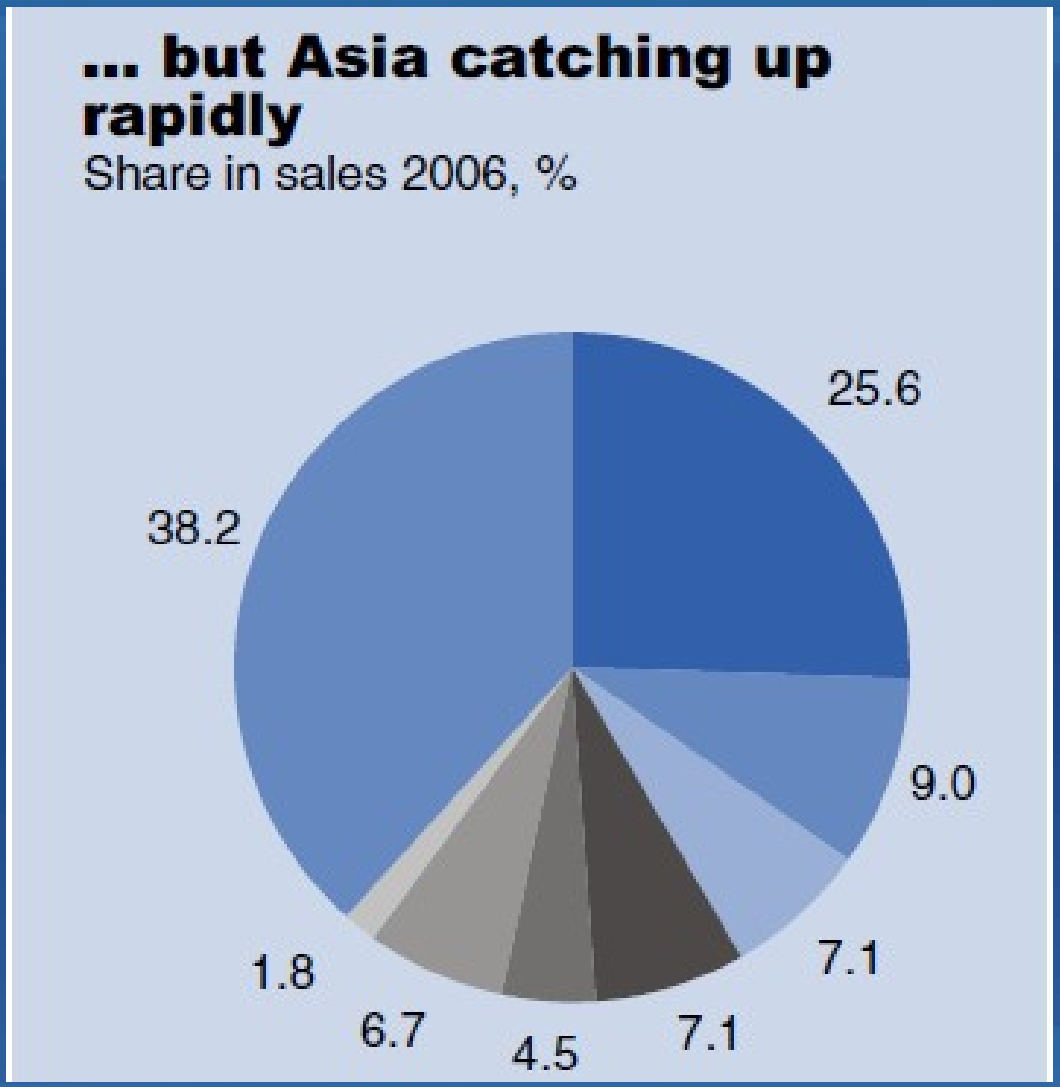
- As per CII - Interlink study, the following factors will contribute to incremental growth rate of the Indian pharma market in 2015:

2. Middle Class- 2%
3. Pricing- 1%
4. Rural Markets-2%
5. Marketing Efficiencies -1%
6. Health Insurance- 0.14%
7. Brands –0.5%

Market Share in 1996



Market Share in 2006



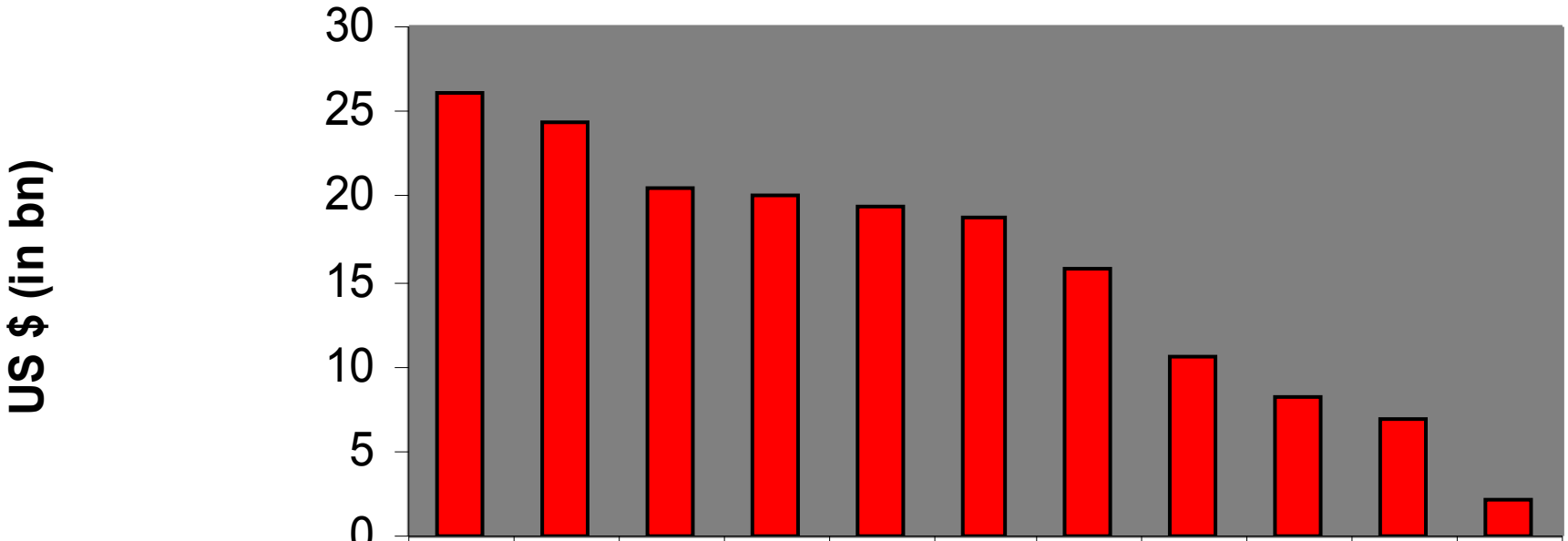
India's Comparison to the World

- US pharma sales - 14 times of India
- Japan – 5 times
- Germany – 4 times
- Western Industrial Countries – Per capita Pharma Sales – EUR 400 pa – 40 times of India
- China's Sales – EUR 36 bn - 4 times of India
- Korea's Sales – EUR 14 bn

Export Scenario

Global Pharma Export (2003)

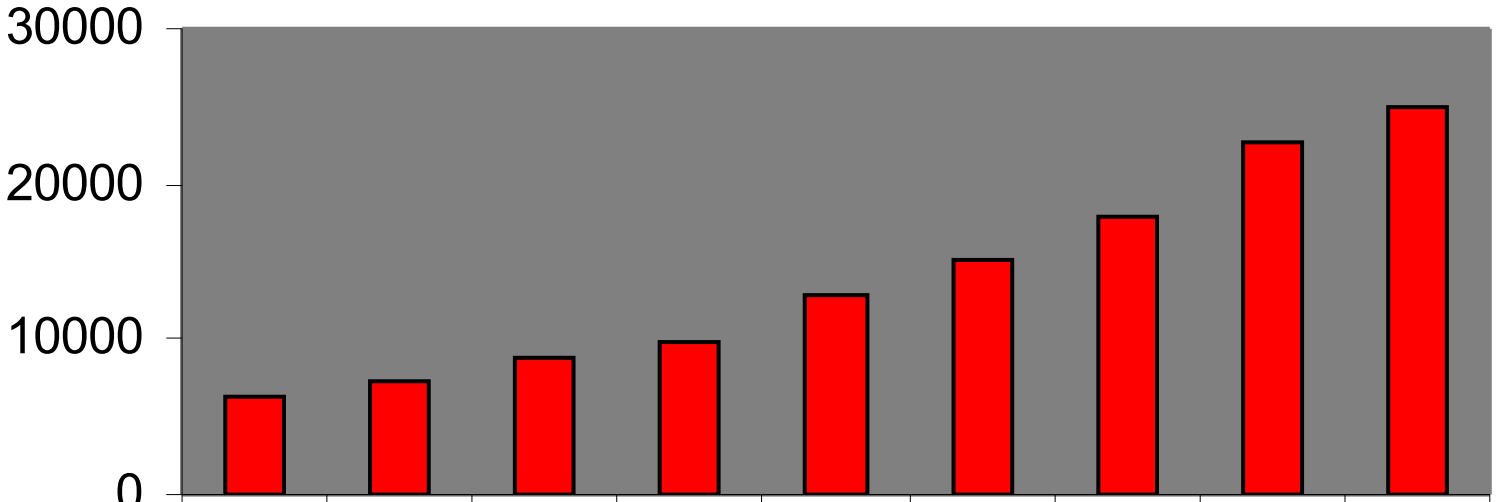
PHARMA EXPORT IN 2003



	Bel	Ger	US	UK	Swit	Fra	Irela	Italy	Net	Swe	Indi
US ($ IN BN)	26.2	24.5	20.5	20	19.5	18.7	15.8	10.6	8.11	6.82	2.17

Export Data

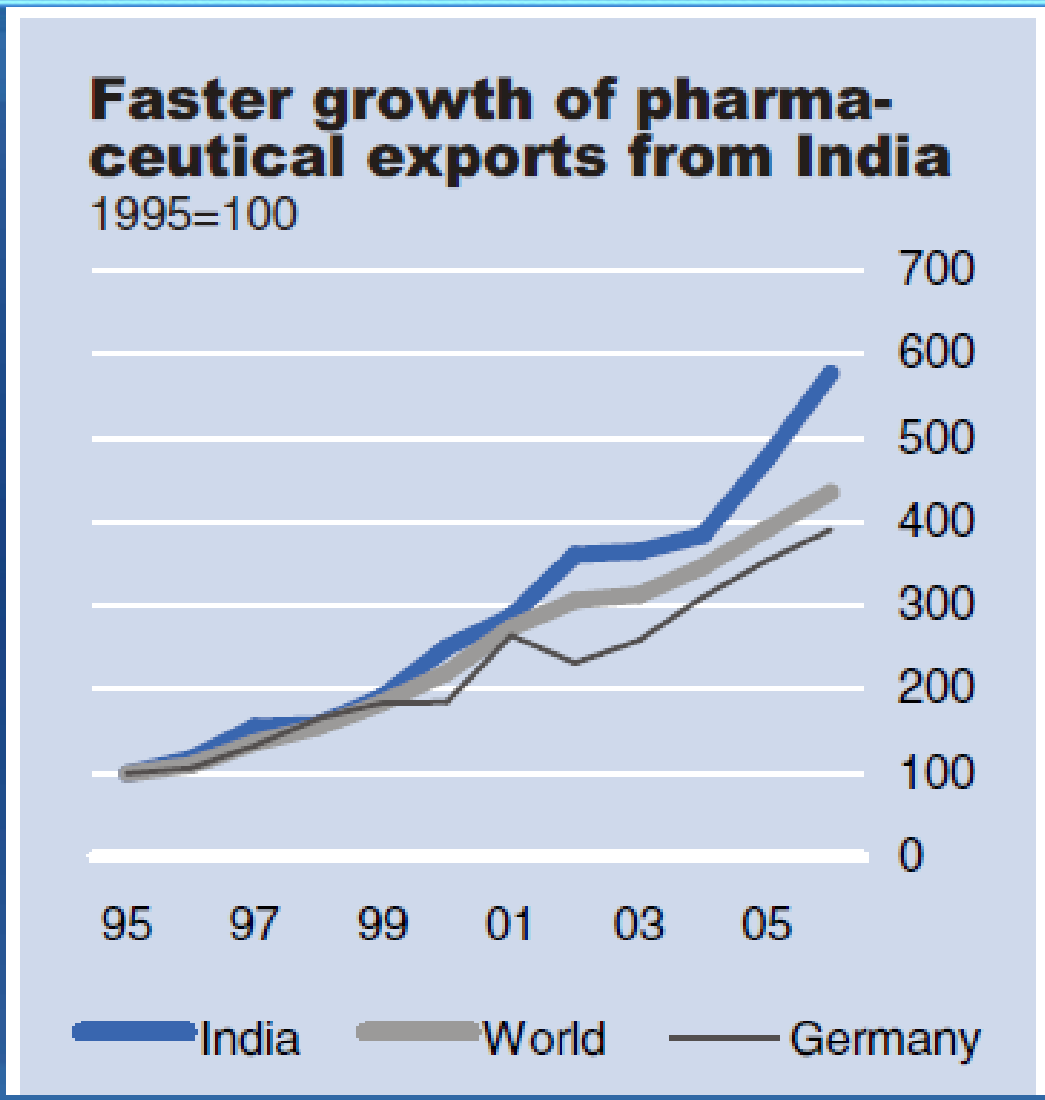
EXPORT (Rs. in Crores)



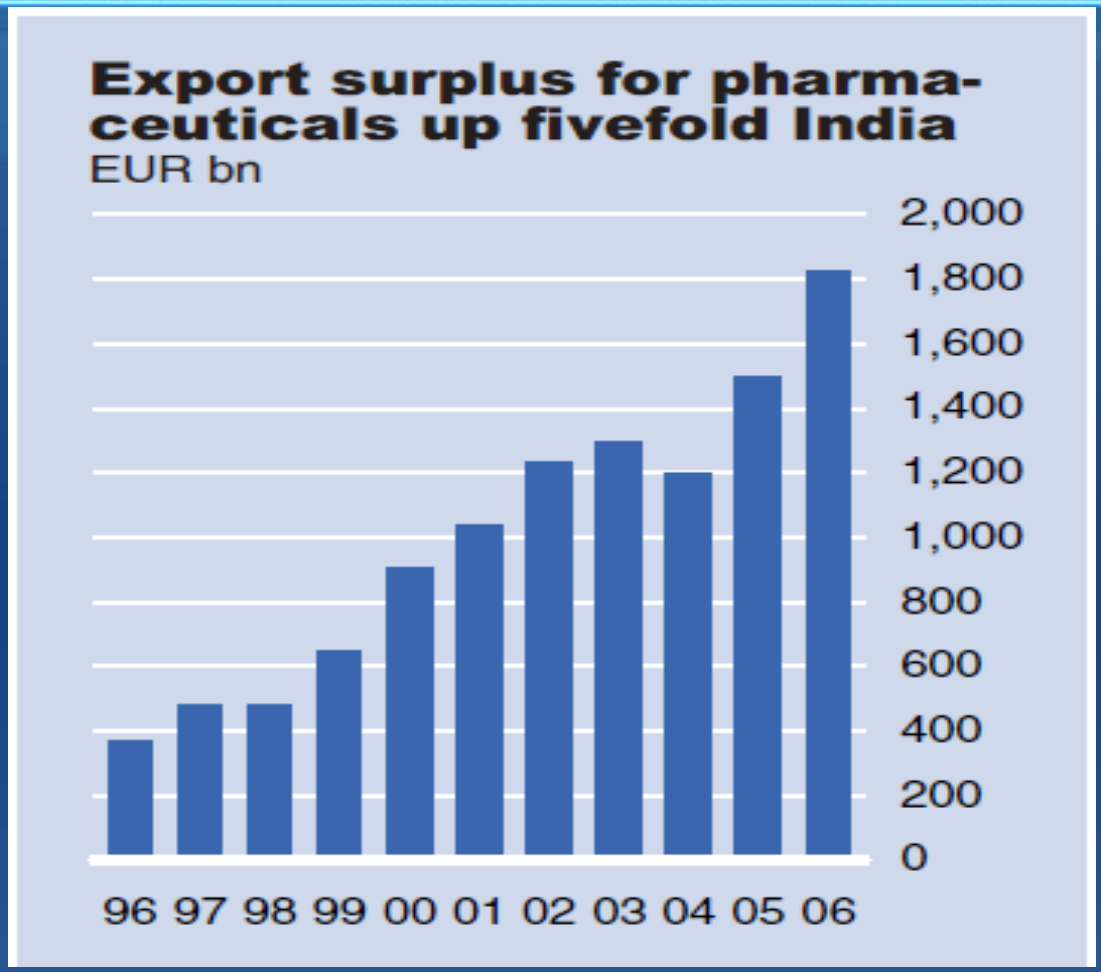
	1998-	1999-	2000-	2001-	2002-	2003-	2004-	2005-	2006-
EXPORT (Rs. in Crores)	6256	7230	8757	9751	12826	15213	17858	22579	24942

Growth in Exports

- Export Growth – 22% in 2006 – Twice of Global average
- Export Ratio – 32% in 2006



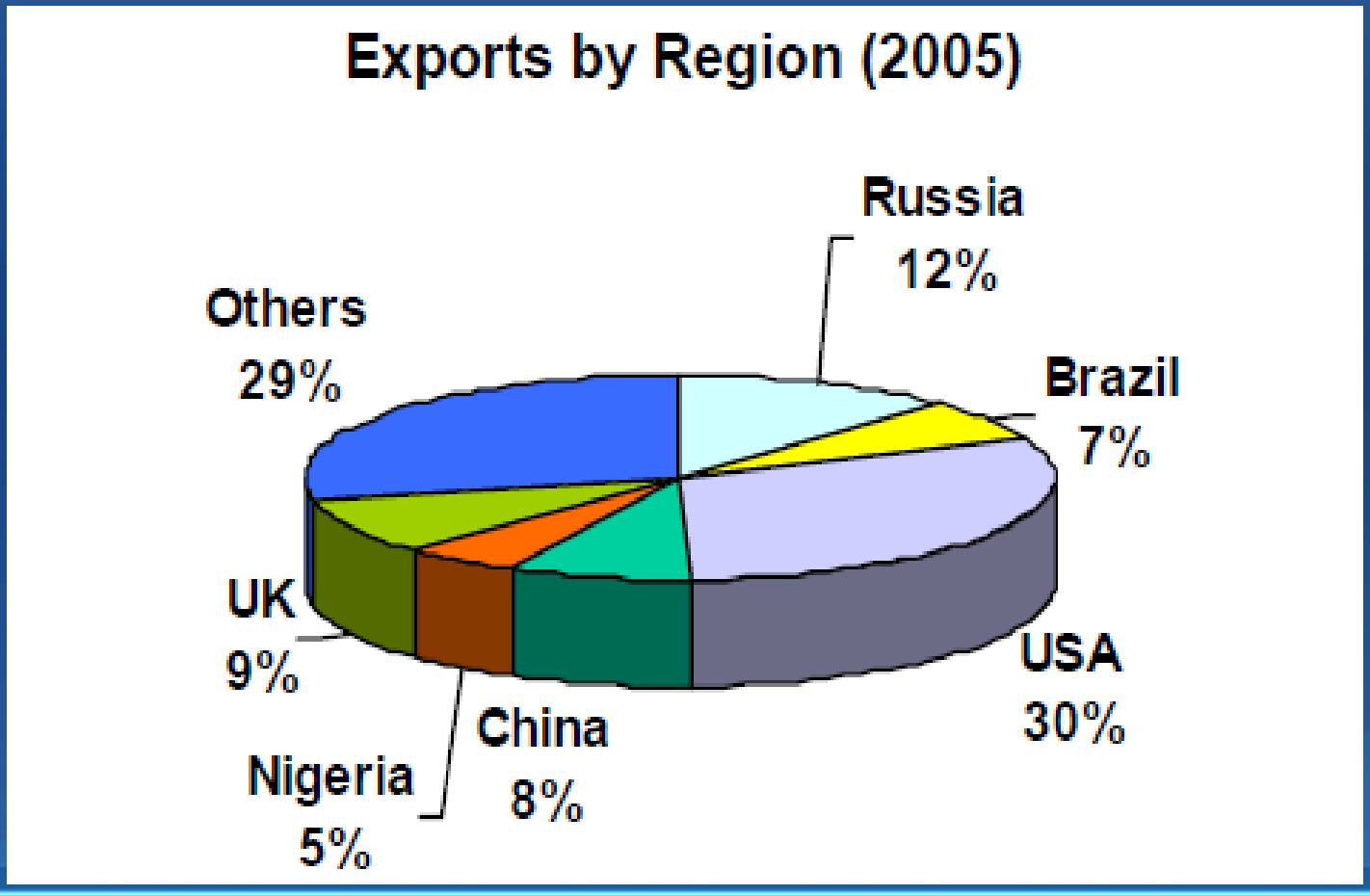
Export Surplus



Export Surplus has risen from EUR 370 mn in 1996 to around 1900 mn in 2006

Major Exporting Destinations

- India Exports to over 200 countries
- Primary markets - US, Russia, UK and China



Major Competitors

- Japan ($3.41bn)
- China ($3.12 bn)
- Austria ($2.99 bn)
- Canada ($2.50 bn)
- **India ($2.17 bn)**
- Australia ($ 1.54 bn)
- Mexico ($ 1.34 bn)
- Thailand
- Malaysia

TOP 10 COMPANIES BASED ON EXPORTS

RANK	NAME OF COMPANY	EXPORT (MARCH 06) IN RS.MN
1	RANBAXY	27041
2	CIPLA	15136
3	DR.REDDY'S	11967
4	AUROBINDO	8163
5	LUPIN	7611
6	ORCHID CHEMICALS & PHARMACEUTICALS	6210
7	PANACEA BIOTEC LTD.	4146
8	ATUL LTD.	4145
9	IPCA LABORATORIES	4062
10	MATRIX LABORATORIES LTD.	3960

Indian companies seeking overseas markets

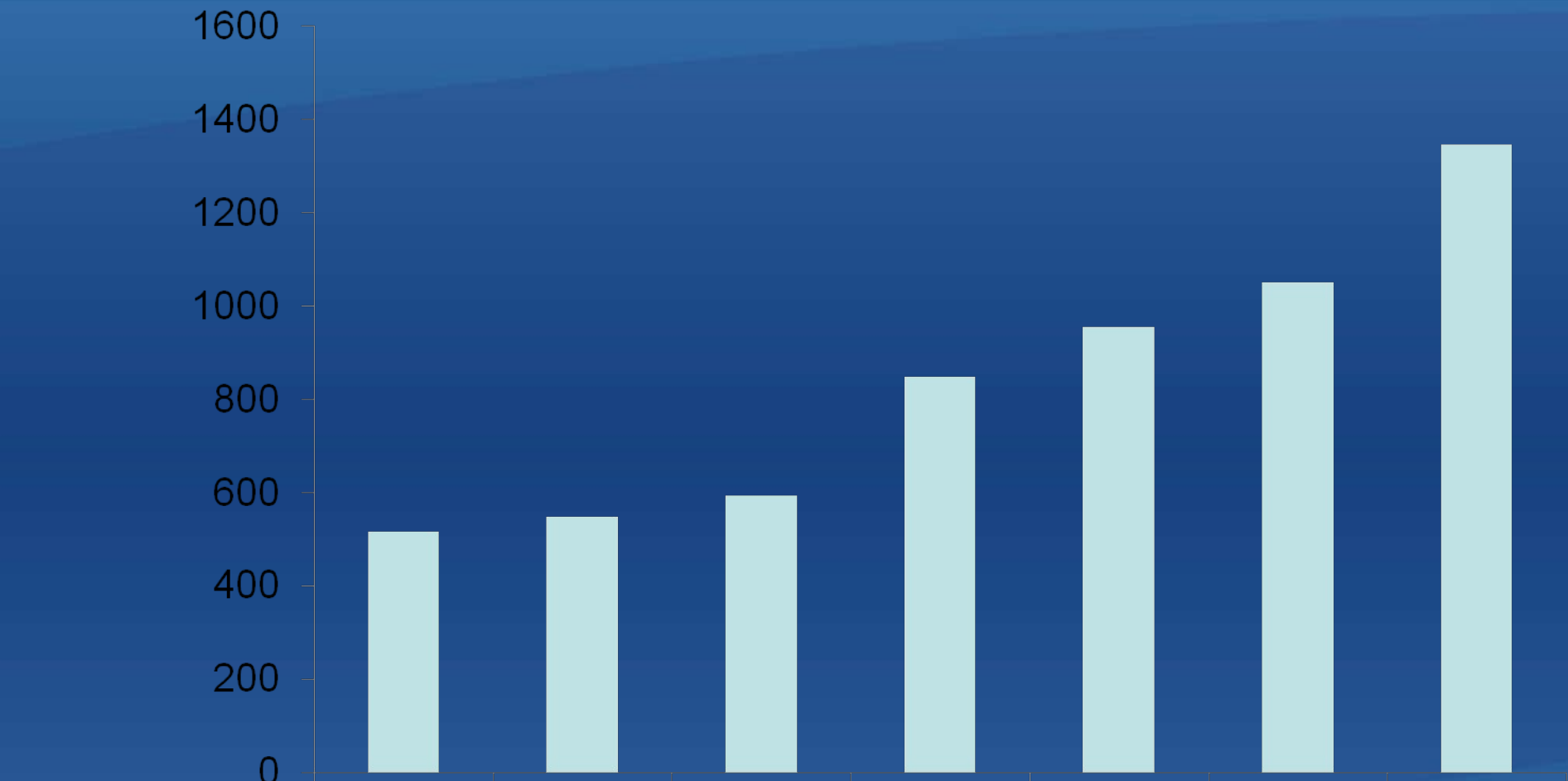
- Aggressive Growth Strategies
  - For building a global scale – Ranbaxy aims to be one of the Top 5
  - For market entry – acquiring local co or setting up subsidiaries
- Recent M&A activity – size of deals growing
  - **Ranbaxy going after acquisitions in US & Europe**
    - Acquired 3 companies in Europe in March/April 2006
      - Terapia (Romania) for US$ 324 million
    - Raising 1.5 billion to fund further acquisitions
  - Dr. Reddy's
    - Acquired Betapharm (Germany) for US$ 570 million in March 2006
  - Matrix (now part of Mylan)
    - Acquired Docpharma (Belgium) for US$ 263 million in 2005.

IMPORTS

- Its imports consist almost entirely of life-saving drugs and new generations of formulations that are under patent protection by innovator companies
- These include mainly:
  - Anti-cancer
  - Cardiovascular
  - Anti-hypertension drugs
- 'Life saving drugs' can be imported into India duty free
- Other pharmaceutical imports - base duty rate – 30%
- Effective duty rate - 56.8% in 2002
- United States – duty – 0%

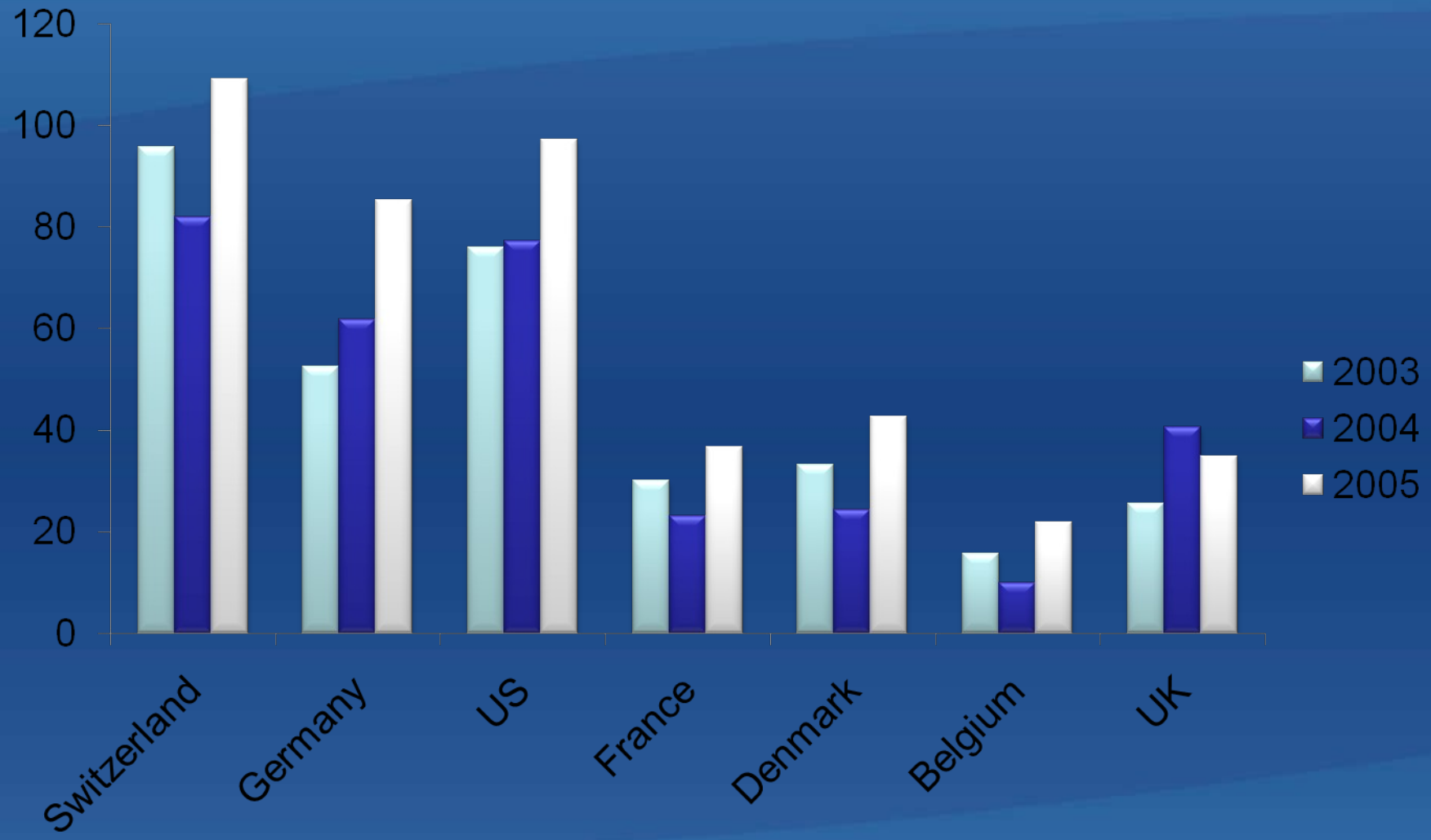
- **India’s leading import suppliers:**
  - **Switzerland (8%)**
  - **Germany (6 %)**
  - **US (7%)**
  - **France (3%)**

IMPORT DATA - 1999 to 2005



	1999	2000	2001	2002	2003	2004	2005
Value (in $ mn)	516.1	547.1	593.5	847.1	954.3	1050.2	1346.3

Import by Country (03-05)



FTP
and
Government Initiatives

GENERAL PROVISIONS

- Exports and Imports shall be free, except where regulated by FTP; free unless regulated or any other law in force.
- All imported goods shall also be subject to domestic Laws, Rules, Orders, Regulations, technical specifications, environmental and safety norms as applicable to domestically produced goods
- Any goods, export or import of which is restricted under ITC(HS) may be exported or imported only in accordance with an Authorization or in terms of a public notice issued in this regard.

PROMOTIONAL MEASURES

- Central Government aims to encourage manufacturers and exporters and Quality to attain internationally accepted standards of quality for their products.
- Central Government will assist in modernization an up gradation of test houses and laboratories to bring them at par with international standards.
- Exporters are eligible for STATUS CATEGORY

- A Status Holder shall be eligible for following facilities:

- i) Authorization and Customs clearances for both imports and exports on self-declaration basis

- ii) Fixation of Input-Output norms on priority within 60 days

- iii) 100% retention of foreign exchange in EEFC account

- iv) Enhancement in normal repatriation period from 180 days to 360 days;

Status Category	Export Performance FOB / FOR Value (Rupees in Crores)
Export House (EH)	20
Star Export House (SEH)	100
Trading House (TH)	500
Star Trading House (STH)	2500
Premier Trading House (PTH)	10000

EPCG

- Under this scheme the exporter is allowed to import capital goods use during Pre – production, Production and Post – production stage against payment of 5% customs duty subject to fulfillment of export obligation
- The export obligation is 8 times the duty saved
- The export obligation is 6 times in case of SSIs and agro units engaged in exports
- The period for fulfillment of export obligation is 8 years
- The period for fulfillment of export obligation is 12 years when:
  - EPCG authorization > 100 crores
  - Located in Agri export zone
  - Unit under revival plan of BIFR
  - Unit is a cottage or tiny sector unit

Duty Exemption Scheme

- The export enterprise is allowed to make duty free import of inputs which are directly used in the export product at the pre-shipment stage
- The details of the inputs are given in the Handbook of Procedures (Vol. II) in the form of Standard Input-Output norms (SION)

Duty Remission Scheme (DEPB)

- This scheme offers the facility for duty free import of inputs at the post shipment stage under **Duty Entitlement Passbook Scheme**
- It is valid for 24 months from the date of issuance
- This facility is provided by way of grant of import duty credit against the export product
- DEPB has been extended till 31st December of 2009

Other Provisions

- Import of Bonafide Trade Samples is allowed without limit except in case of vegetable seeds, bees and new drugs
- Export of Bonafide trade and technical samples of freely exportable item is allowed without any limit
- The exporter is allowed to replace damaged or defective good free of charge
- Exporter is allowed to import damaged goods for repair and later export them back without any license based clearance
- The exporter is allowed to trade goods from another country to a third country without license (if item is non restricted)
- Private bonded Warehouses for Export and Import

Pharmaceutical Export Promotion Council (Pharmaexcil)

- **Objectives** The objectives of the Council (Pharmexcil) are to extend all assistance to the pharmaceutical industry in India to explore their opportunities.
- Services Extended include:

  (a) Trade Enquiries received from foreign Embassies /Buyers

  (b) Market Development assistance as provided by Ministry of Commerce for business tours to foreign countries.

  (c) Arrange one to one Buyer/Seller Meets in India/Abroad.

  (d) Arrange Exhibitions in India and Abroad for market promotion.

  (e) Assist in Regulatory matters with domestic and Foreign Government agencies.

  (f) Provide financial assistance for Product Registration charges, Research and Development, Product showcasing etc. as per rules.

  (g) Arrange Conferences/Seminars in domestic and foreign countries - for market and technical up-gradation of information

Working Groups and Joint Working Groups

India-EU Joint Working Group

- Setup in 2006
- Co-Chairmanship of Joint Secretary (Pharma)
- D.G. Enterprises - counterpart from the EU side.
- The first meeting - 18th July 2006 at Brussels - the Terms of Reference for the JWG was finalized.
- Its 2nd meeting was held on 30th and 31st May 2007 at New Delhi

Working Groups and Joint Working Groups

Indo Tunisia Joint Working Group

- Constituted since 2004
- Three meetings have since been held.
- The Tunisian Government has given permission to 5 Indian Companies for registering their products in Tunisia

Working Groups and Joint Working Groups

Sub Group on Pharmaceuticals under the aegis of Indo-Russian Working Group on Trade and Economic Cooperation (IRWGTEC)

Provides inputs to IRWGTEC.

The issues discussed were various areas of cooperation like:

- Promotion of Trade and exports of pharmaceuticals to these countries
- Joint Venture Cooperation in manufacture as well as R&D
- Regulatory cooperation
- HRD and Training
- Exhibitions and Trade Fairs.

Working Groups and Joint Working Groups

Sub Group on Pharmaceuticals and Medical Devices

- High Technology Cooperation Group (HTCG) on Biotechnology and Life Sciences Working Group has recently been augmented by two subgroups covering Biotechnology, Pharmaceuticals & Medical Devices.
- The nodal point on the U.S side is Mr. Jeffrey Gren, Director of the Commerce Department (Office of Health & Consumer Goods).
- Joint Secretary (Pharma), from this Department has been nominated as the Nodal Officer for the Sub-Group on Pharmaceuticals and Medical Devices.
- The alternate officer will be the concerned Deputy Secretary (Pharma) in this Department.
- The last meeting of this group was held on 13th Dec. 2007.

Working Groups and Joint Working Groups

Working Group on Drugs and Pharmaceuticals

- Chairmanship of Secretary (C&PC)
- The Department of C&PC constituted three Sub Groups for different Terms of Reference (TOR) of Working Group.
- Report of the Working Group on Drugs and Pharmaceuticals for the eleventh five-year plan (2007-12) has already been submitted to the Steering Committee, Planning Commission on 1st December 2006.

- Some of the important measures for the welfare of common man and ensuring growth of the domestic Drugs and Pharmaceuticals Industry as envisaged in the Report include: -

  I. Creation of 5 new NIPER like institutions to generate requisite HR in this field.

  II. Interest subsidy to Pharma Industry for Schedule M compliance.

  III. Setting up 10 Pharma Parks to provide global environment to the Pharma industry.

  IV. Creation of District Drug Banks for BPL families.

  V. Provision for Price and availability of Cancer medicines Fund.

  VI. Measures for Pharma PSUs welfare including revival of sick PSUs.

  VII. Strengthening and up gradation of infrastructure at NPPA and NIPER and Pharmexcil.

Pharmaceutical Export Promotion Cell

- Objective - Boosting pharmaceutical exports and to act as a nodal center for all queries/issues regarding pharmaceutical exports.
- The Cell collects statistical data on export and import of pharmaceuticals in the country and provides commercially useful information for developing and increasing drugs and pharmaceutical exports.
- It is acting as nodal center for all queries and issues regarding Pharma exports.
- The Cell also undertakes promotional activities for acceleration of pharmaceutical exports and considers suggestions for modifications in EXIM POLICY from the industry.
- The Cell has also been entrusted with the organization of seminars and workshops on standards, quality control requirements of important countries so as to prepare the domestic companies for exporting their products.
- Database on the status of pharmaceutical industry in many countries is available in the cell for the benefit of Indian exporters.
- Events - GCC Africa and Latin America meets at Hyderabad and CIS meeting in Mumbai were organized.

Liberalisation

- 100% FDI allowed
- Industrial Licensing - abolished

BTPs in India

- Lucknow Biotech Park, UP
- TICEL Biotech Park, AP
- SP Biotech Park, MAH
- GENOME VALLEY
- ICICI Knowledge Park

Incentives to BTP

1. Taxation on biotechnology products
New biotechnology units will not be taxed for the first five years.

2. Fiscal incentives
All inputs as well as capital goods, including captive generation sets, during the implementation stage will be exempted from the payment of entry tax, which can be up to 7 years or during the construction period whichever is earlier.

3. Captive generation
Captive generation sets to be installed by biotech-industry will be eligible for exemption of electricity tax for a period of seven years.

4. Pollution control
Biotechnology units must fulfill the required norms regarding pollution control depending on its specific nature. The State Pollution Control Board will act as a facilitator in guiding these units to conform to the relevant rules and regulations. It will also act as a single window agency to co-ordinate the approval process.

Incentives to BTP

5. Uninterrupted power
These industries will be given top priority in sanction and servicing of power.

Biotechnology companies will be treated as industrial and not as commercial consumer and accordingly electricity tariff will be levied on such companies.

6. Relaxation in zonal regulations
For registered Biotechnology units within declared Biotechnology Park/Industries area, relaxation of FAR to the extent of 50% of the prevailing norms shall be given.

Incentives to BTP

7**. Simplified labour laws**
The labour laws will be simplified so as to enable employment of women during the evening hours.

8**. Concession for creating employment**
Expansion, diversification and modernization of existing small scale industries would get a concession on registration charges.

Incentives to BTP

The following consessions will be offered to the biotechnology park:

- Exemption on payment of entry tax on machinery/equipment/capital goods and construction materials, for a period of 7 years or till the date of completion of the project, whichever is earlier on the condition that each invoice should not be less than Rs.25 lakhs or Rs. 10.00 lakhs in case of construction materials.
- Up to 50% exemption from the payment of stamp duty and registration charges.
- In case of first lease as well as subsequent lease to biotechnology companies, concessions will be available for biotechnology parks certified by the Department of Science & Technology.

Special Initiatives

- The excise duty has been reduced from 16% to 8% in 2008
- Increased outlay for HIV treatment
- 20 more Biotech Parks to be set up
- Incentives under consideration
  - 30,000 crore relief package to help the pharma sector
  - Increased Grace period of upto 25 days for Foreign Exchange Payments
  - Reduced Interest Rates under DEPB

Quality Certifications and Practices

- WHO Certification
- US Food and Drug Administration (FDA)
- European Directorate for the Quality of Medicines (EDQM)
- USP (US Pharmacopeia)
- GMP (Good Manufacturing Practices)
- GLP (Good Lab Practices)
- HACCP (Hazard Analysis and Critical Control Point)
- DCGI Approval and Registration
- CTRI (Clinical Trials Registry in India)
- IPCC (Intergovernmental Panel on Climate Change)

TRIPS Impact Post 2005

- Product Patent Regime
- Process Patents - abolished
- IPR for 20 years instead of 14 years
- Phase gap in Clinical Trials abolished

RECOMMENDATIONS

- **Extension of deduction of 150% of R&D expenses: This** would encourage more and more companies to invest in R&D.
- **To rationalize Drug Price Control Order (DPCO). The objective of the price** control was to ensure adequate availability of quality medicines at affordable prices.
- **An academic –industrial relationship can be further explored,** on the lines of US model, where the universities are the sites of innovation and the industry commercializes the product. Property Rights (IPR) and get a share of the profits. Academic institutions will then become the engines of entrepreneurship.
- **Income tax exemptions should be given on clinical trials and contract research done outside the company and abroad:** This is because India is seen as an emerging center for outsourcing of clinical trials for the Pharmaceutical MNCs.

CONTD…

- **The problem of spurious drugs has to be tackled.**

- Most of the cases relating to spurious drugs remain undecided for years. Hence there is a strong need for setting up separate courts for speedy trials of such offences.

- Each state should set up accredited testing laboratories that are well equipped and adequately staffed. The staff should be trained well for drawing samples for test and monitoring the quality of drugs and cosmetics moving in the State.

LEVERAGING TRADITIONAL KNOW HOW

- **India should exploit its know-how in herbal medicines**
- Since these medicines do not come under the purview of the TRIPS regime and the research in new chemical entities involves millions of dollars of investment, the Indian companies should engage in R&D in herbal medicine
- The companies should try to exploit the Indian traditional knowledge in ayurveda and herbal cures and file as many patents for herbal medicine as they can
- For this the government should set up R&D laboratories undertaking research exclusively in the area of herbal medicines and support the companies in their research and patent filing

- **The government should encourage setting up of USFDA-compliant plants by providing tax holidays for a specified period** so that the Indian companies can exploit the opportunity arising out of patented drugs and take up marketing of generics in the developed countries like USA

India is poised to revolutionise biotechnology just as it did the IT industry.

-The Economic Times

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THANK YOU

Rx

SANJIBAN

Presented by

Sumit

ROADMAP

1. INTRODUCTION 2. HISTORY 3. COMPANY PROFILE
4. MODEL 5. GROWTH & LIBYSIM 6. TIMELINE
7. JOB PROSPECTIVE

INTRODUCTION

PHARMACY

Science dealing with collection, preparation, and standardization of DRUGS,
derives its name from the Greek root *PHARMAKON*, a drug

PHARMACEUTICAL

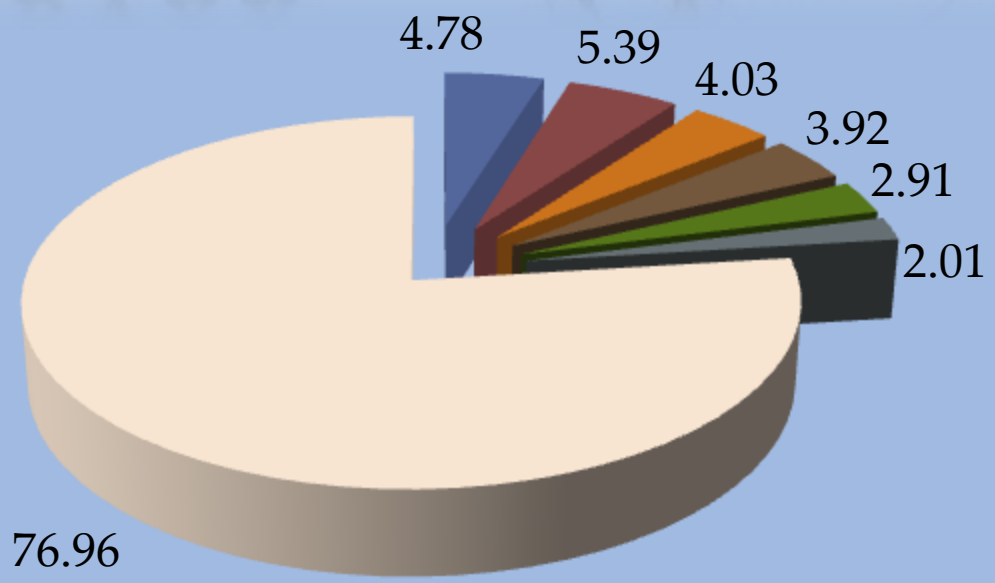
Relating to drugs used in medical treatment

PHARMA

a company that makes and sells pharmaceuticals

HISTORY

- Pharmacy began in Van Diemen's Land with the supply of medicines by military surgeons and dispensers
- As the number of free settlers grew, traders with ‘chemical knowledge' brought in shipments of medicines and chemicals
- The first was Michael Bates who, in 1825, established a business as 'PHARMACOPOLIST, Chemist and Druggist' in Launceston
- Hatton & Laws Chemists, one of the oldest pharmacy businesses still operating in Australia
- Chemists were licensed by laws enacted in 1837, 1840 and 1842
- Established the H.T. Gould & Co. Homeopathic Pharmacy in Hobart in 1881
- Formal separation of medicine and pharmacy came about when the Pharmacy Act was passed in 1908
- Most medicines were compounded mixtures of natural ingredients until the early 1900s, when the advent of patent medicines and manufactured tablets such as ASPIRIN AND PHENACETIN
- The synthesis of antibiotics and antipsychotics revolutionized drug treatment in the 1940s and 1950s
- In 1978 Pharmacy moved to the University of Tasmania, where it came to be ranked as one of the best pharmacy courses in Australia.


4.78
5.39
4.03
3.92
2.91
2.01
76.96
Ranbaxy
Cipla
GSK Pharmaceuticals
Piramal Healthcare
GlaxoSmithKline
Pfizer
Others

COMPANY PROFILE

Indian

Foreign

* Incorporated in 1961
* Ranked among the top
* 10 generics companies in the world
* Ground operations in 49 countries and manufacturing operations in 11 nations
* Exports contribute to around 80 per cent of the total revenues
* The company's net profit in first quarter of 2008 was US$ 39 million.

*Ranbaxy

Indian

Foreign

* Established in 1984
* Ranks among the top 15 generics players in the world
* First pharmaceutical company in Asia-Pacific (outside Japan) to be listed on NYSE
* Presence in 35 countries with operations in over 115 countries
* Generated revenues of US$ 1.5 billion in 2007
* Overseas business contributes to around 86 per cent of the total revenues
* Aspires to become a discovery led global pharmaceutical company and one of the top 10 generic companies in the world

*Dr. Reddy's Labs

Indian

Foreign

* Set up in 1935
* World's largest manufacturer of cost effective anti-retroviral drugs
* Cipla's products are bought by over 170 countries across all the continents
* Partnerships with nine companies for over 125 products
* Recorded a turnover of US$ 800 million in 2007
* Exports account for over 50 per cent of the overall sales
* Over 100 Drug Master File (DMF) registrations in the US and over 85 in Europe
* Presence across most of the therapeutic category

*CIPLA

Indian

Foreign

* Came into existence in 1988
* Fourth largest pharmaceutical company and is the leader in the CVS segment
* Has grown primarily on acquisitions, mergers and alliances in the last 15 years
* Merged with Global Bulk Drugs and Fine Chemicals (India) in 2003
* Acquired Pfizer's custom manufacturing plant located in Morpeth (UK)
* NPIL recorded a turnover of US$ 335 million
* Domestic market accounts for approximately 87 per cent of the company's annual sales
* TC presence: Anti-infectives, CVS, diabetes, dermatological, pain management, GI, respiratory, nutritional, CNS and urological

*Nicholas Piramal India Ltd.

Indian

Foreign

* Two manufacturing units in India, located at Nasik and Thane
* 2000-strong fieldworkers and a country wide network of over 4000 stockists
* Net sales of the pharmaceuticals business segment was US$ 326 million, which constitutes 92 per cent of the company's total sales
* It exported bulk drugs and formulations worth US$ 7.1 million
* Two R&D centers which are approved by the Department of Scientific and Industrial Research, Government of India
* TC presence: Anti-infectives, CVS, diabetes, dermatological, pain management, CNS, GI, nutritional, gynecological, respiratory, sera and immunoglobulin, hormones

*GlaxoSmithKline

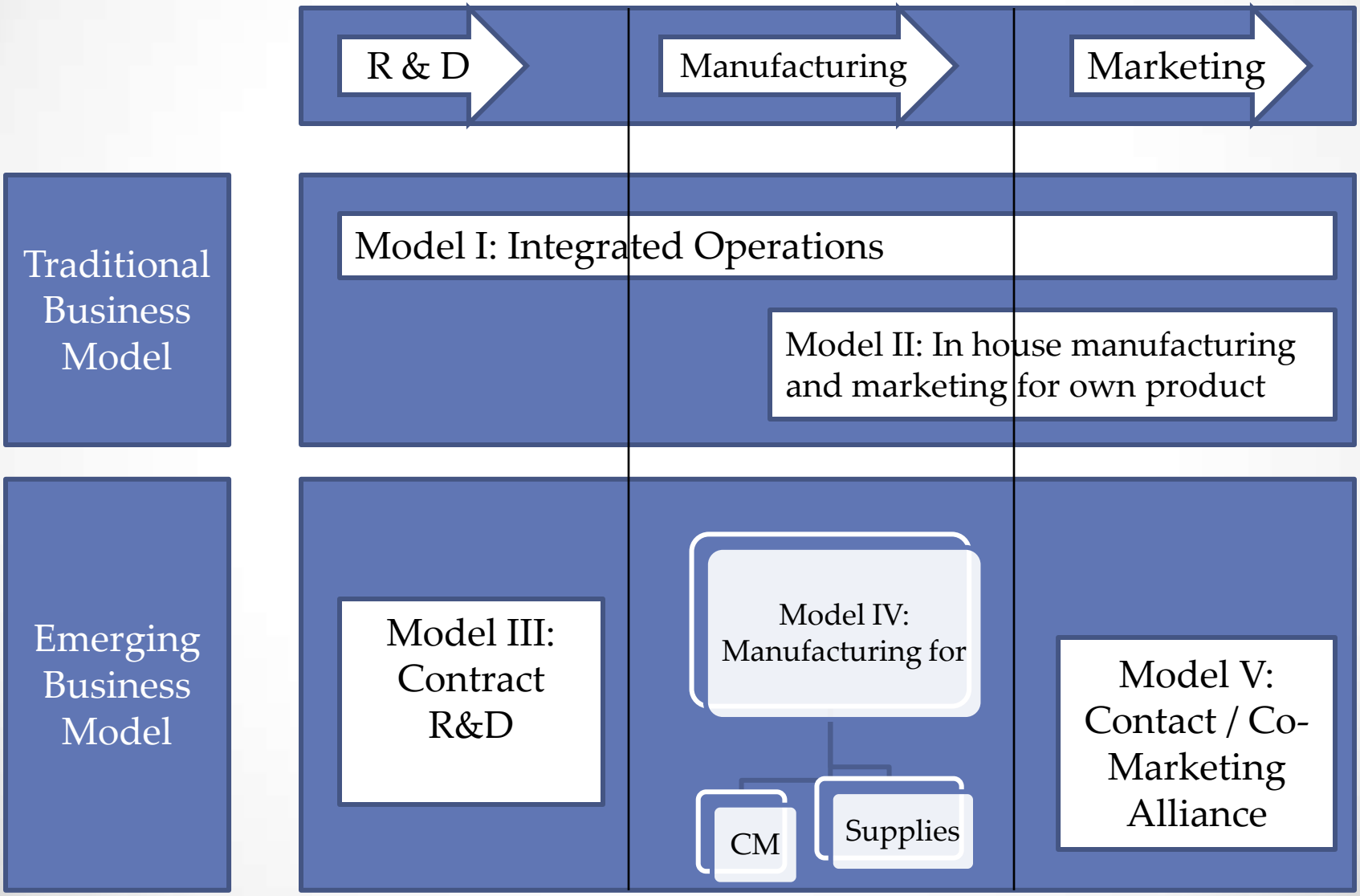
Indian

Foreign

Pfizer India

* Forayed in the Indian market in 1950
* Manufacturing facility at Thane, Maharashtra
* Launched five patented products since 2005 - Vfend, Viagra, Lyrica, Caduet and Macugen
* Seven of Pfizer's brands feature among the top 100 pharmaceutical brands
* Pfizer Limited (India) has a turnover of US$ 172 million (November 2006)
* Clinical research investments of US$ 15.75 million in India
* TC presence: Anti-infectives, CVS, dermatological, sera and immunoglobulin, pain management, diabetes, CNS, GI, nutritional, gynecological and respiratory

Business Model



PHARMACEUTICALS BRIEFING

Total per person spending in **HEALTH CARE** with **GDP** change

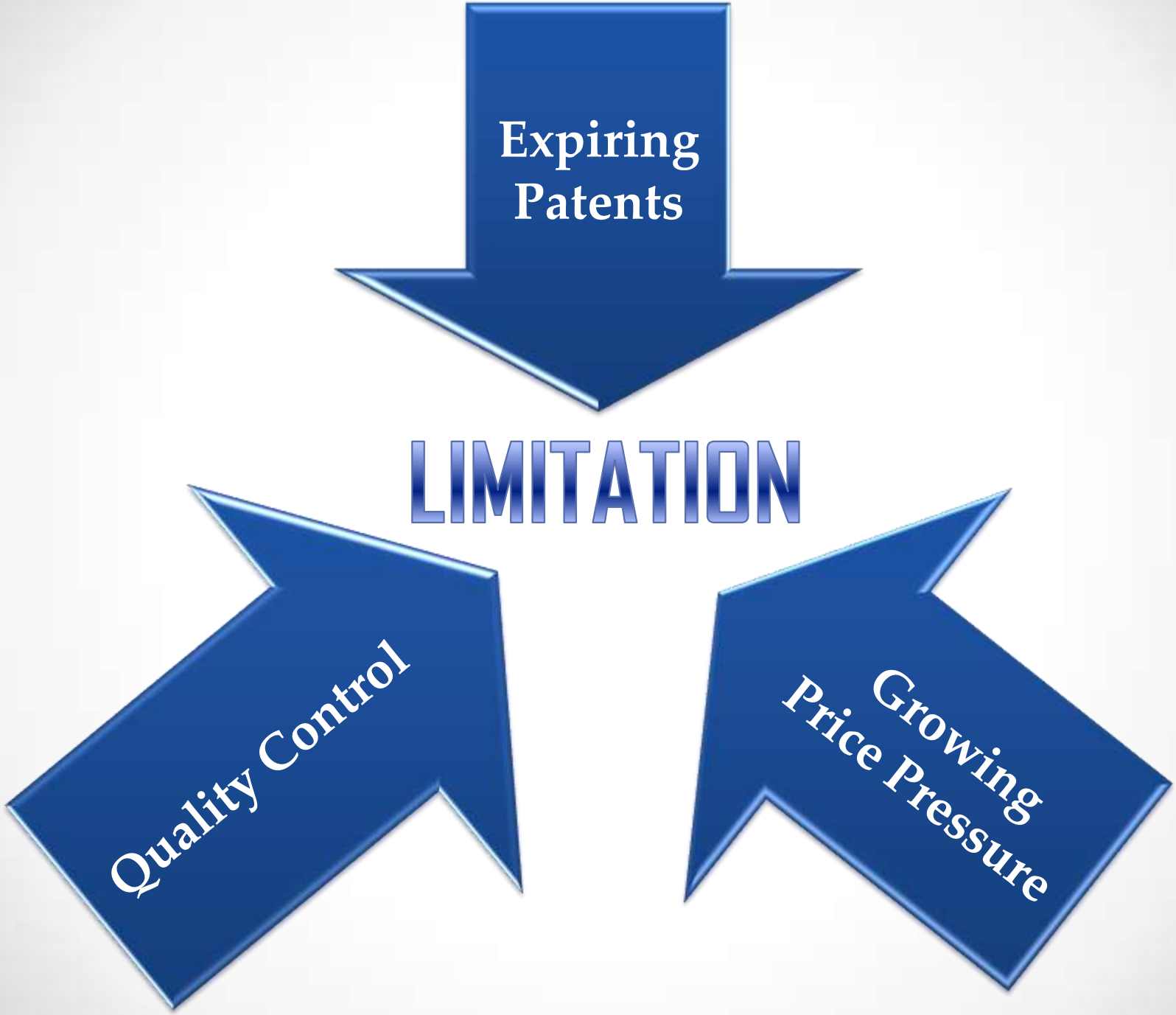
Market Size of US$ 10.04bn, with value wise growth of 20.4% over the previous year.

Present growth rate of 12%. Expected to grow by over 100% in the next 2years.

Present sale of medicines is US$ 9.61bn, which is expected to reach around US$ 19.22bn.

India's domestic pharmaceutical market stands at US$ 12bn in 2010, which is expected to grow to US$ 49bn by 2020.

New Patent law necessitated reorientation


Expiring Patents
LIMITATION
Quality Control
Growing Price Pressure

Rural market – opportunities at the bottom of the pyramid

- 65 per cent of the population resides in the rural areas with limited or no access to medicines and other healthcare facilities
- With a growth rate of 39 per cent in 2006, rural market has outstripped the growth in the urban region, across most of the therapeutic categories in both value and volume terms
- General physician driven segments such as anti-infectives, analgesics, etc. have registered high growth compared to the specialist-driven segments such as CNS
- Non-communicable diseases such as cancer,blindness, mental illness, hypertension, diabetes, HIV/AIDS, accidents and injuries are also on the rise

Lifestyle disease on the rise in rural areas

According to a study conducted by the George Institute for International Health in 45 villages in east and west Godavari districts of Andhra Pradesh, diseases of the cardiovascular system, such as heart attacks and stroke caused 32 per cent of deaths in this region

Policy And It's Impact

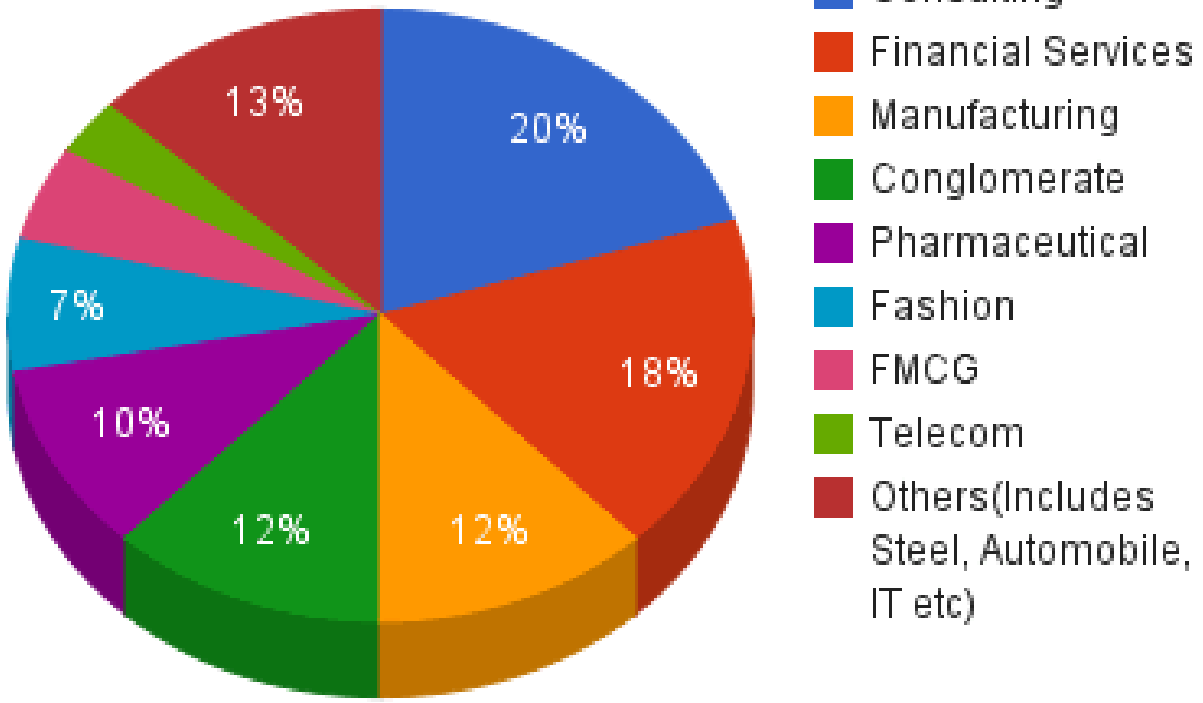
- **Indian Patents Act 1970** recognised **only process patents**
- Drug Pricing Control Order (DPCO) imposed Price ceilings
- Exodus of global innovator pharma companies from India
- Impetus for import substitution and increased domestic production

- Signing of **TRIPS Agreement** begins India;s transition to the WTO mandated product patent regime by 2005
- Increased focus on new drug discovery and development
- Increased export to regulated markets
- Return of global pharma majors

- **Indian Pharmaceutical Policy 2002** reduces number of drugs under price control and opens the market further to foreign investment
- MNCs scale up investments, explore new opportunities.
- Outsourcing & alliance trends accelerate

- India becomes **product patent compliant** from January 1, 2005
- MNCs ready patented products for India
- Explore IP intensive R&D and Mfg offshoring opportunities

1970 **1995** **2005**

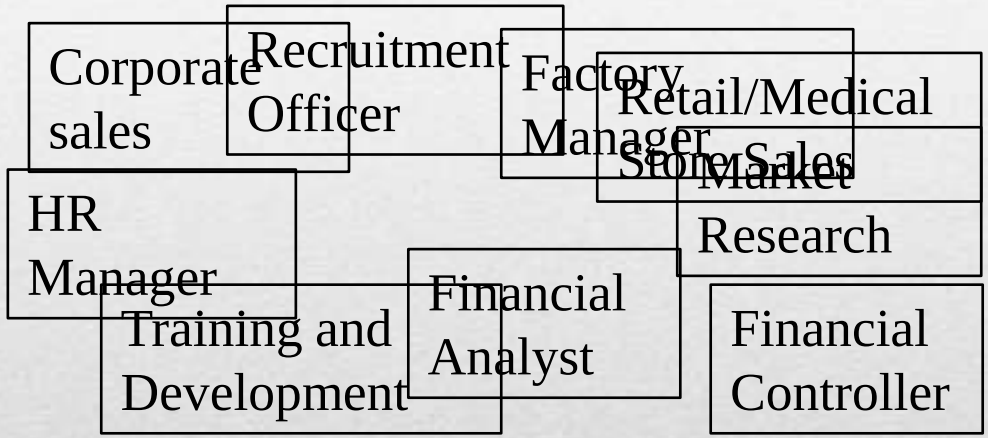


Job Prospective

Finance

Marketing

Human Resource



Job Profile

- Budget Analysts
- Investment Analysts
- Mergers and Acquisitions Analysts
- Money Market Analysts
- Ratings Analysts
- Risk Analysts
- Security Analysts
- Tax Analysts
- Stock Market Analysts
- Credit Analysts

Salary : 30,000 - 110,000+

Financial Analyst

Financial Controller

- Prepare financial reports and present findings and recommendations to senior management
- Interact with corporate finance group for reporting and financing needs
- Provide management information on the performance/ profitability of products, projects
- Responsible for overall annual planning process and quarterly forecasts
- Approve company expenditures budgets of operational costs and capital investments
- Prepare monthly analytical accounting reports, product costing reports, budget deviations

Sales

- **Create and execute an effective call plan**
- **Utilize reporting tools provided to achieve territorial goals**
- **Build business relationships with assigned customers**
- **Utilize your customer focused selling skills in your presentations**
- **Remain in compliance with Drivers Safety Guidelines, and your personal automobile insurance coverage requirement**

Market Researcher

- **Supporting creation, design, development, implementation and ongoing maintenance/ administration of various incentive compensation plans through compensation analysis, modeling and reporting**
- **Client data management, technical configuration, process definition, modeling and Incentive Compensation administration**
- **Perform changes to reports and data interfaces, and conduct ad hoc analyses**.

Factory Manager

- **Plan and manage all production activities to ensure the maximum quality with the ideal cost of production.**
- **Avail all production assets (equipment, machines, raw materials, etc.)**
- **Co-ordinate with the production, maintenance, inventory and purchasing departments**

HR Manager

- **Service Provider**
- **The Facilitator**
- **The Executive**
- **The Consultant**
- **The Auditor**
- **Employee Relations**

- **Consulting with other managers to identify training needs.**
- **Drawing up an overall training plan.**
- **Managing a training budget.**
- **Producing materials for in-house training.**
- **Working with training providers to develop suitable course content.**
- **Evaluating the success of both individual training and the overall program.**
- **Managing regular staff appraisals and reviews and making sure staff have opportunities for ongoing development.**

Training & Development Manager

Topic for SIP

Finance

- **Volatility analysis of Pharmaceutical Companies**

Marketing

- **Trend Analysis of Pharmaceutical with reference to B.S.E or N.S.E**

Human Resource

Topic for SIP

Finance

Marketing

Human Resource

- **Effect of Counter feting in Pharmaceutical Sector**
- **Comparison on sales between two companies in same product line**

Topic for SIP

Finance

Marketing

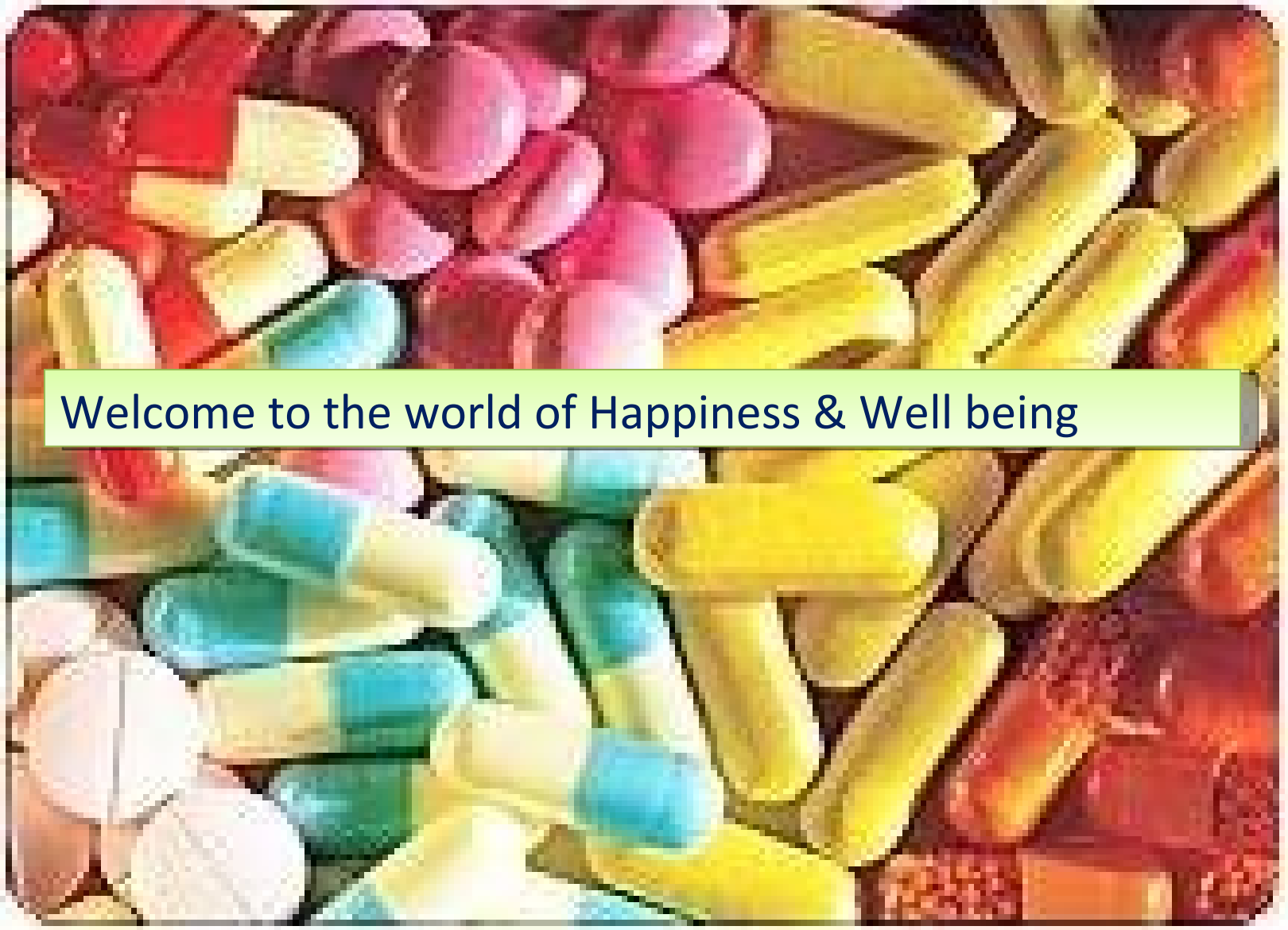
Human Resource

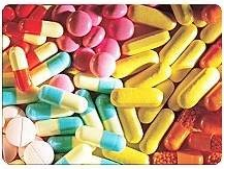
- **Training of Medical Representatives - an important tool for Brand Promotion**
- **Project on Factors effecting Job Satisfaction in Pharmaceutical company**

THANK YOU

QUESTIONS???

Pharmaceutical Industry an overview





Pharmaceutical Industry an overview

This is part of the lecture delivered by Shyamsunder Panchavati on 3rd September 2010. at Hyderabad.

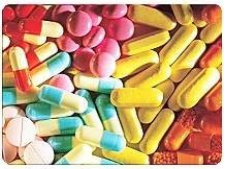
Title

Pharmaceutical Industry an overview

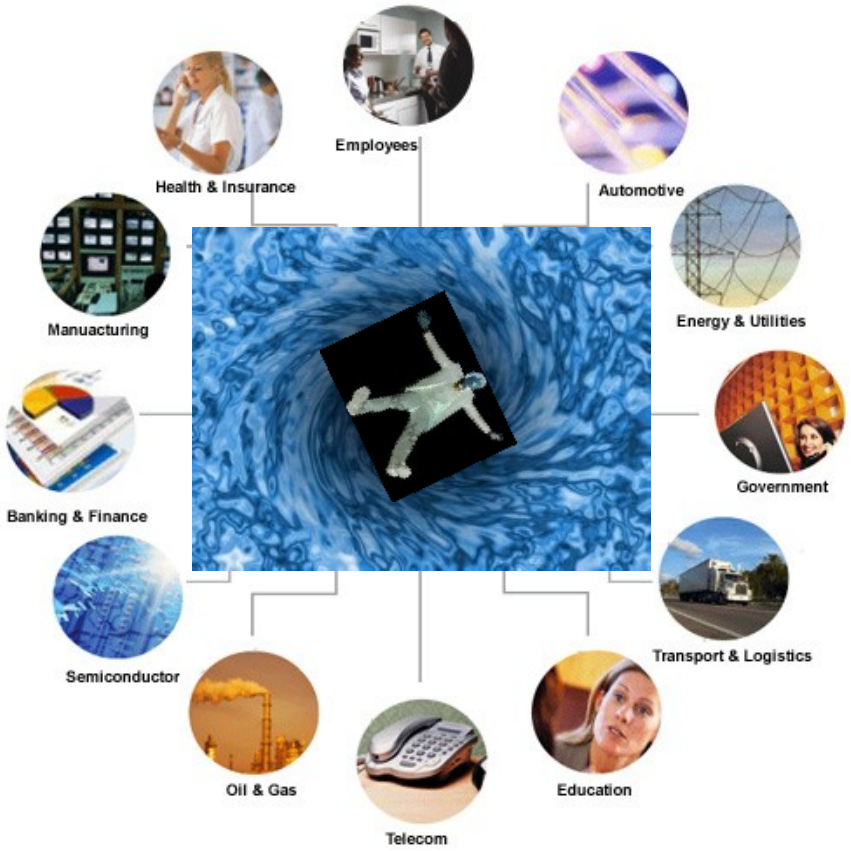
Abstract of the lecture available at

http://capacitybuildingdevelopment.blogspot.com/2010/09

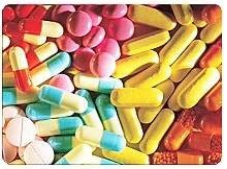
Human being lives in a whirlpool of Industries



Pharmaceutical Industry an overview

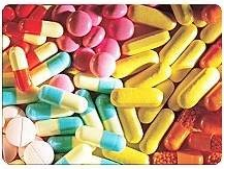


Human being lives in a whirlpool of Industries

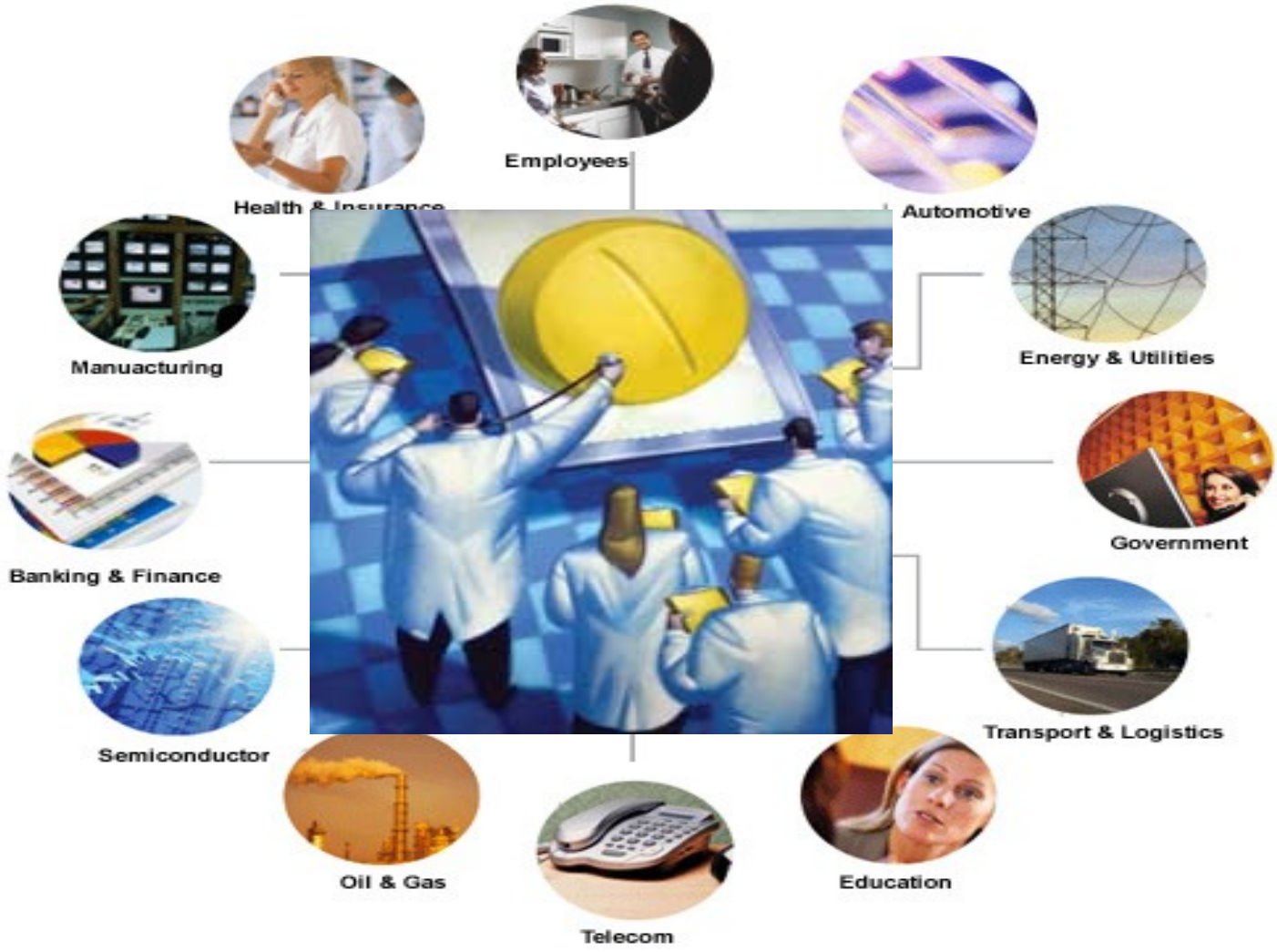


Pharmaceutical Industry an overview

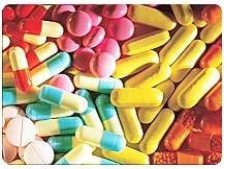
The Pedest[redacted]stry



Pharmaceutical Industry an overview



Pharmaceutical Industry the propeller for other Industries



Pharmaceutical Industry an overview

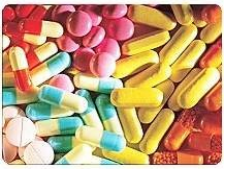
In around 1640 BC Dhanvantari wrote a treatise on Medicine, Pharmaceutics, & surgery.

AYURVEDA

SUSHRUTHA CHARAKA

During around 500 BC Buddhist Monks spread to the rest of the world

The History of Pharmaceutical Indus can be traced to 1600 BC



Pharmaceutical Industry an overview

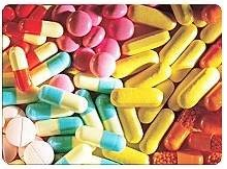
Modern day Allopathic Medication

More than 350 years old

Research & Development in later part of 19th Century and 20th Century

In 1930 Penicillin & Insulin were discovered.

Modern day Allopathic Medication



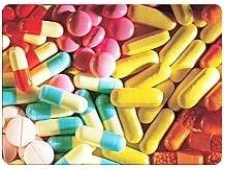
Pharmaceutical Industry an overview

In 1901 Acharya P.C. Ray started first Indian Pharmaceutical company

Till Independence Multinational were directly operating

In 1970s Product patent was replaced by process patent

Indian Pharmaceutical Scenario



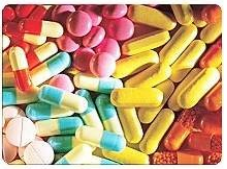
Pharmaceutical Industry an overview

!970s saw the emergence of Indian Pharmaceutical Industry

This led to the expansion of Bulk Drug Industry

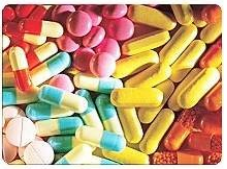
Various subsidies and infrastructural facilities enabled the expansion & spread of the Industry in various states.

Indian Pharmaceutical Scenario

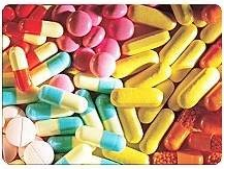


70s and 80 also saw the launch of new products in the Cardio Vascular, Neuro, Psycho-somatic, Gastro Renal, Anti Fungal and Anti Imflammatory segments.

New products like Co-Trimoxazole, Diltiazem, Diclofenac Sodium were some of the products launched.



70s and 80 also saw the, the beginning of exports to Asia, Africa,Europe,and Latin America of Bulk Drugs. More and more organization were able to get USFDA & WHO GMP certification.

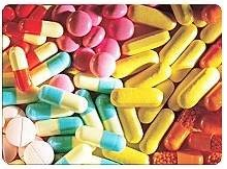


WTO & GATT

Resulting in more application for patent 35,218 Applications for patent were filed in the year 2008-09. 6040 from domestic, & 29,178 from foreign applicant

R&D being out sourced to India by MNCs

Indian Pharmaceutical Scenario



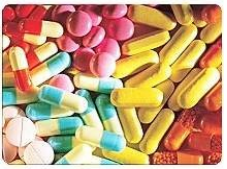
Pharmaceutical Industry an overview

Present Indian Market Size

$ 8 Billion

Rs. 400 Billion

Indian Pharmaceutical Scenario

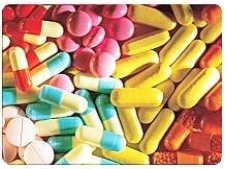


Pharmaceutical Industry an overview

Pharmaceutical Industry largest contributor after the Agriculture sector.

To the Indian economy. Still growing @ 10 to 11%

Indian Pharmaceutical Scenario

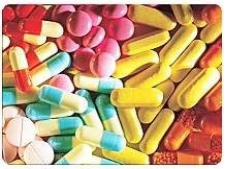


Pharmaceutical Industry an overview

Present global market size $ 825 Billion growing @ 4 to 6 %

India 3rd largest producer of Pharmaceuticals having 10% of the global share.

Indian Pharmaceutical Scenario



Pharmaceutical Industry an overview

Cardiovascular segment dominates the sales with 50%

Share

Anti Diabetic segment has a share of

22 %

Indian Pharmaceutical Scenario

Pharmaceutical Industry an overview

Top Ten Pharmaceutical Organizations in India

Ranbaxy

Dr Reddy's Laboratories

Cipla

Sun Pharma Industries

Lupin Labs

Aurobindo Pharma

GlaxoSmithKline Pharma

Cadila Healthcare

Aventis Pharma

Ipca Laboratories

Indian Pharmaceutical Scenario