Introduction

Biopharmaceutics – Study of the properties of "therapeutic substances" and their dosages / bioactivity relationships.

Taxol (very insoluble) * used to treat breast cancer, mixed with oil for solubility.
* Problem that cancer comes back DRUG Resistant.
* Most people don't survive second time.

Therapeutic Substances – Examples.

a) Prescription drugs ① "Small molecule" (generally molecule weight < 500.)
- Anything less than 500 can cross the blood brain barrier.

② "Peptides / proteins" – Proteases, amide bonds have short biological half life (does not last long).
– Have to keep taking it.

③ "Vaccines and conjugates"

b) Natural health products. (NHPs) ① Vitamins.
(Not as well regulated as pharmaceutical drugs.)
② Plant extracts.

c) Diagnostics ① information gathering. (eg. where tumors is and how they are connected).
↓
pills taking pics.

Pharmaceutical science – a group of interdisciplinary areas / fields of study involved in the design + synthesis, mode of action,
- need to know all the metabolites of the drug
cont.
delivery and use of drugs.

The pharmaceutical industry

Purpose?

- Supplying materials + techniques that deliver / (or promise to deliver) the thing that people desire most!! GOOD HEALTH.

Cure versus Prevention?

- Average life span in early 1900's = 50 years.
  but in 2015 = 80+ years.

Why? Higher standard of living.

a) better food and food supply (Pasteurized milk) + safe water
TB from drinking unpasteurized milk. (immune system cannot kill due to mucus)

b) workplace infrastructure (education)

c) Vaccines (prevention)

d) Drugs (cures)

↳ antibacterial, antihypertensive drugs

e) Diagnostics (+ improved medical procedures)

The "irony" is that healthcare spending by government does NOT correlate well with "wellness"

World-wide Pharmaceutical ~~industries~~ industry

The top 4 in 2012

① Pfizer (USA) $70.7 Billion 137 000 employees
② Johnson and Johnson (USA) $63.7 Billion. 119 000 employees.
③ Hoffman-La Roche (swiss) $43.9 Billion 78,600 employees.
④ Novartis (swiss) $41.5 Billion 98,200 employees.

The others.

⑤ Glaxo smith Kline . 40 B . 103 000 employees

⑨ Merck-Frost (USA) 24B 74,300 employees
⑫ Boehringer Ingelheim 17B (Germany) 43 000
⑬ Takeda Pharma (Japan) 16B 15000

(3) No

the osophageal valve weakens.

Acid reflux is treated by proton pump inhibitors.

Lipitore (Drug) → treat cholesterol.

The most prescribed Drugs (USA 2012) DOES not mean most $$

(1) Hydrocodone - 131.2 million prespenbtions. (Painkiller)
- Synthetic opiod from codeine.

(2) Generic Zocor (simvastatin) 94 M (cholesterol)
- hypolipidemic drug to ↓

(3) Lisinopril 87 M
- ACE inhibitor - used to lower BP (treat hypertension)

(4) Generic Synthroid - 70M
- synthetic thyroid hormone → regulates basal metabolic rate.

(5) Generic Norvasc - 57M
- Hypertension. (next gen Beta Blocker)

(6) Generic Prilosec - 54 M
- treat GERD. reflux disease.

(7) Azithromycin (Z-PAK) 52.6M
(Pfizer) - Antibiotic. All Bacteria

(8) Amoxicillin 52.3m Antibiotic.

(9) Generic Glucophage. 48 M.
- first line of treatment for Type II diabetes.

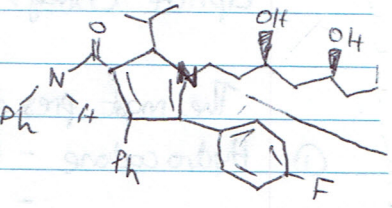
(10) Hydrochlorothiazide 48 M controls blood pressure

(4) PrepIOI.com/Seminars.

Top selling Drugs. (USA 2010)

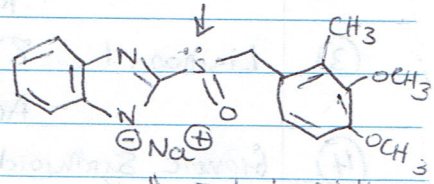
- Doesn't mean the most prescribed but just generate the most income.

(1) Lipitor $7.2 Billion - cholesterol lowering drug.



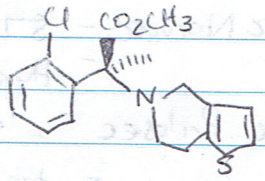
(2) Nexium 6.3$B - Proton pump inhibitor

has an enantiomer



→ to be soluble in H_2O. (Making it charged).

(3) Plavix 6.1$B - Blood thinner.



(4) Advair 4.7B - Used to treat asthma.

(5) Abilify 4.6B - Antipsychotic (Bipolar, Schizophrenia)

Compare Stats in 2012

(1) Humira (anti inflammatory) 9.8B
(2) Enbrel 8.4B - Psoriasis and rheumatoid arthritis. auto immune.
(3) Advair 8B
(4) Remicade (chimeric MAB against $TNF\alpha$
(5) Rituxan (Chimeric MAB to treat B-cell diffusion)
↳ tissue rejection

* Notice the change in orders → newer drugs to treat complex autoimmune conditions
- "recent change"
↳ to convince you & this look at top selling drugs in 2006.

Patented drugs

2006.

① Lipitor 14.4B
② Advair 6.1B
③ Plavix 6.1B
④ Nexium 5.2B
⑤ Abilify 1.9B

The Canadian Pharmaceutical industry

- This represents only 3% of the world pharmaceutical sales. (2010)
  ↳ we still make the top 10 in the world
- "Canadian Pharmas" = Research and Development companies make 78% of total sales.
  + Generic drug companies (22% sales)
- R+D companies are usually multinational → developing new drugs. (need lots $ 700M $)
- Generic companies manufacture drugs after the patents expire (~20 years)

Drug cost vs healthcare costs (Canada)

Year	Drug $	total healthcare $	% of drugs
2000	$15.1B	98B	15.3%
2005	23.2B	141B	16.5%
2010	30.1B	192.8B	16.0%

Thus, we do not have more drugs even though we spend increasing money on HC
So where is the $ going?

Theories?

① First world nations are much wealthier than other nations and can just pay more.
② Older + less healthy population.
③ We utilize more and more healthcare each year.