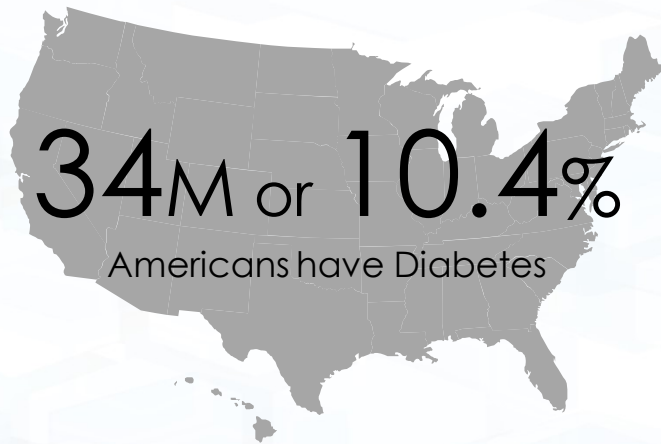


Biosimilar Insulins



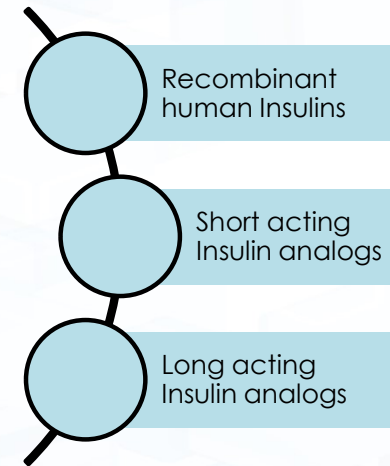
Diabetes a major disease in the US



Major therapies

- Oral drugs
- GLP-1s
- Insulins
- Rescue therapy

8
Million
use various forms
of Insulin

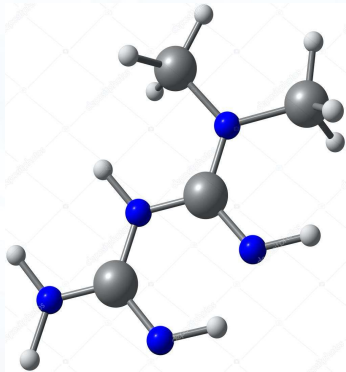


4%

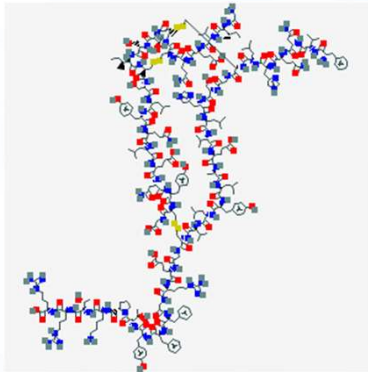
Average annual increase in Insulin
use from 2014 to 2019

Biopharmaceutics

Complex Molecules

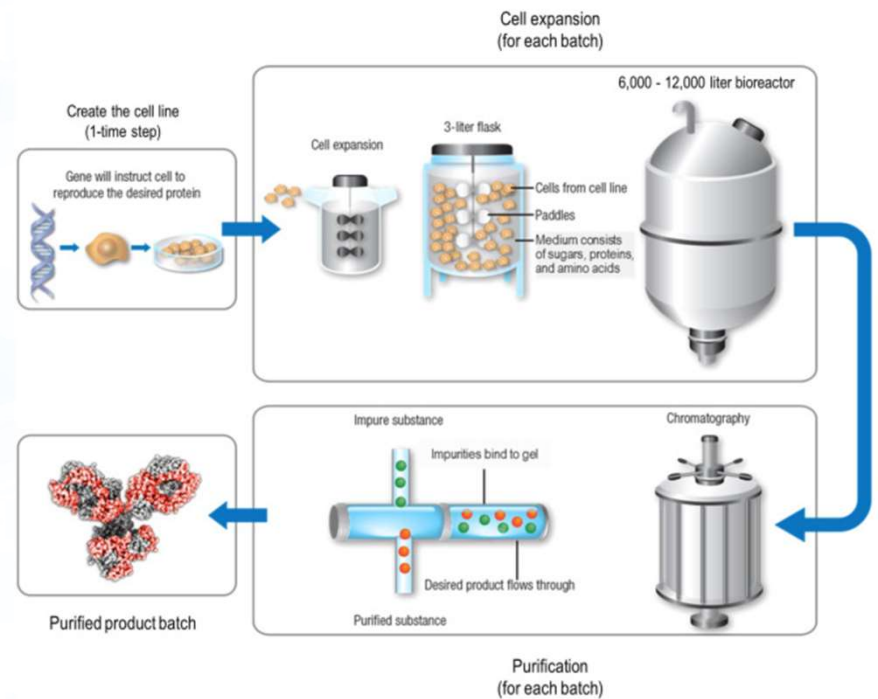


Meformin
 $C_4H_{11}N_5$
Average mass: 129.2 Da



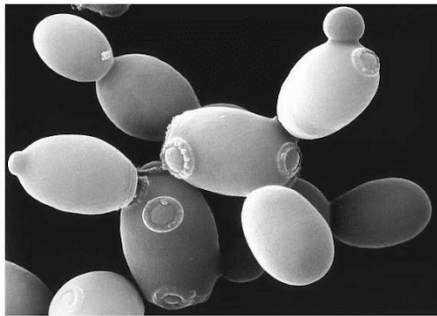
Insulin Glargine
 $C_{17}H_{19}N_3O_3S$
Average mass: 6063 Da

Product = Cell + Process + Place

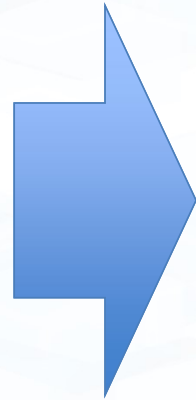


Insulin First Approved “Recombinant Biopharmaceutical” - 1982

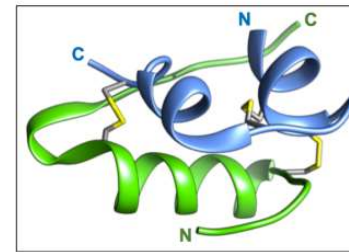
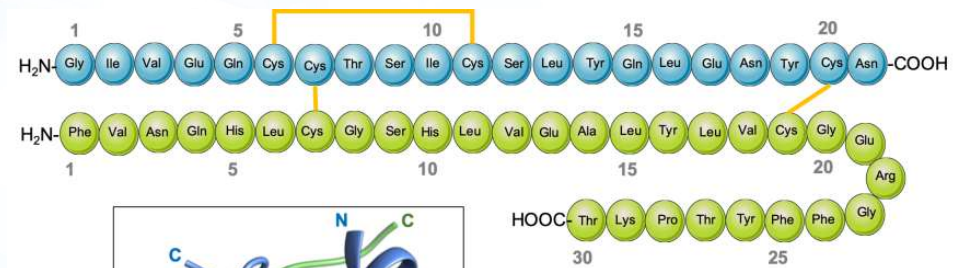
Eli Lilly – E. Coli
saccharomyces cerevisiae



Novo Nordisk – Yeast
Pichia pastoris

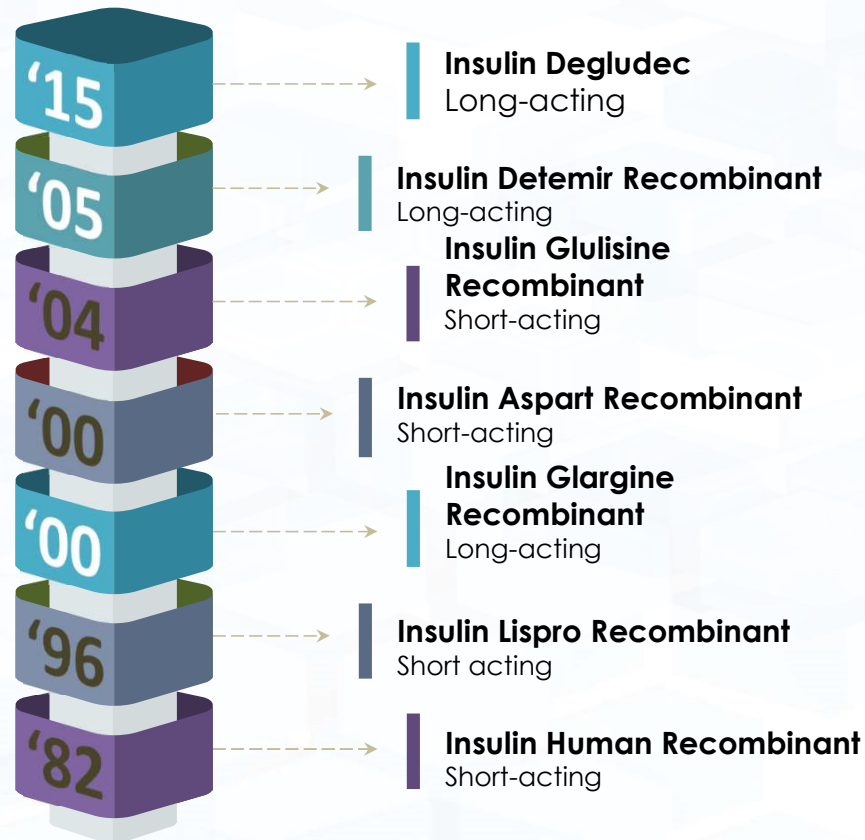


Recombinant Human Insulin
Humulin® and Novolin®



Physicians, Patients and
Payers see both as the
same product

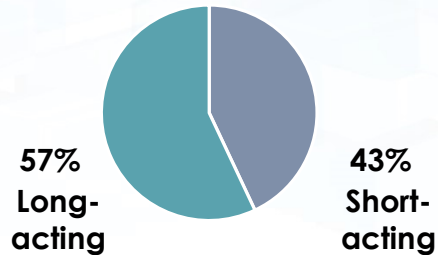
US Insulin History And Usage



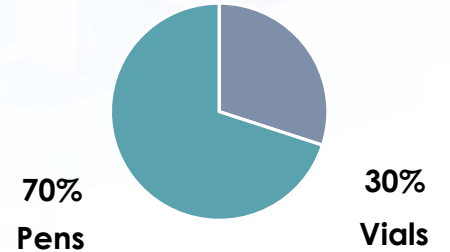
Few Players

Only insulin glargine has more than 2 competitors

Share of Insulin Units

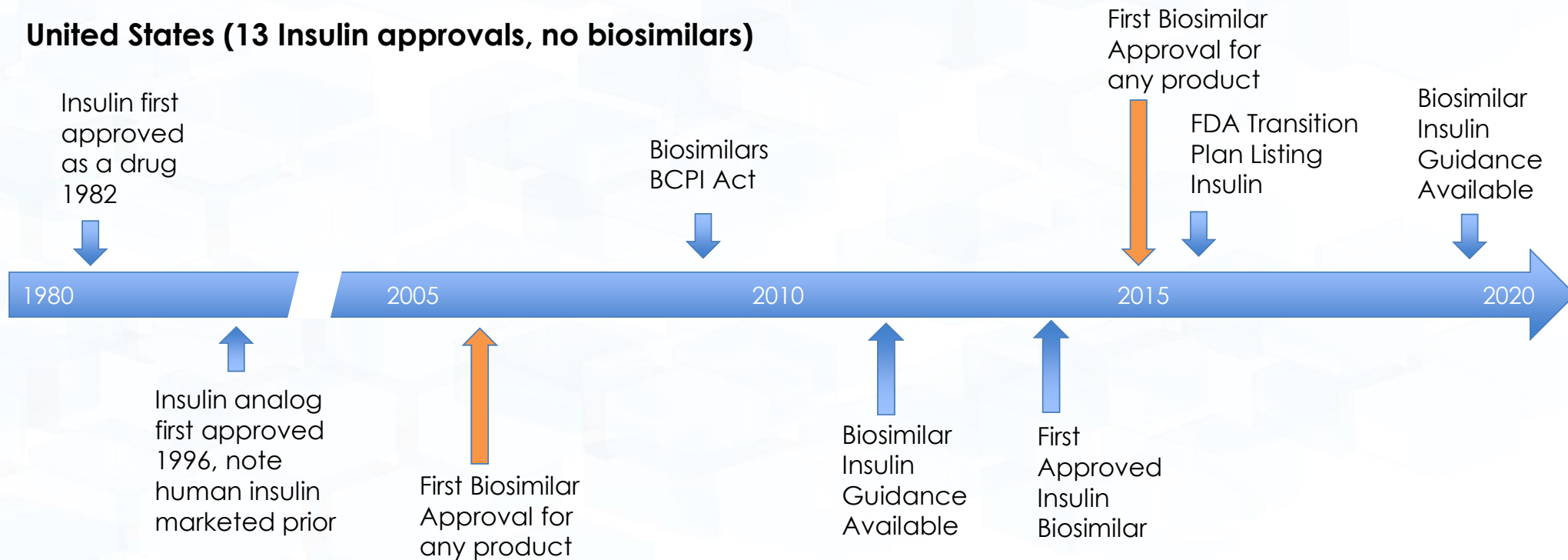


Share of Insulin Units



US vs European Insulin Evolution

United States (13 Insulin approvals, no biosimilars)



European Union (including UK) (14 insulin approvals, 3 biosimilars)



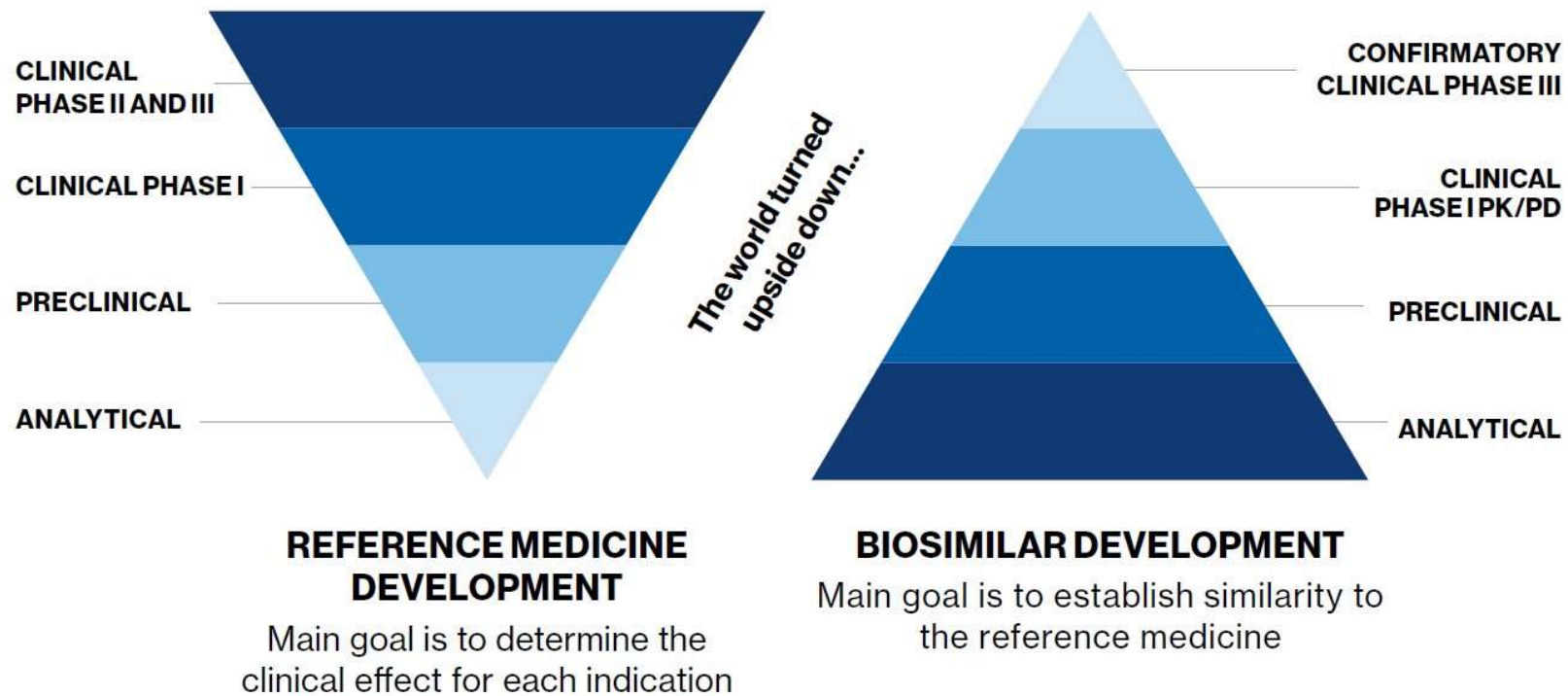
Migration From Drugs To Biopharma

- Regulated as a drug
- “Equivalent Insulins” require patient studies
- Branded products
- Orange Book Listed Patents



- Biosimilars now possible
- Analytical comparability and no clinically meaningful difference
- Option for “generic” like products
- Patent Dance Framework

Biosimilar Development – Show Differences Do Not Matter For Both Drug And Device/Pen



November 2019 FDA Insulin Draft Guidance

- Adequate information on the cell and manufacturing process
- Comprehensive and robust comparative analytical assessment between the Insulin biosimilar and the reference product
- Comparative study showing biosimilar insulin acts the same in the body as the reference product
- Scientific justification to show immunogenicity studies not required



No Need For Large Expensive Studies For Highly Similar Products