

Scale-Up of Chemical Engineering Process

Chapter 3: Review of Chemical and Bio Processes

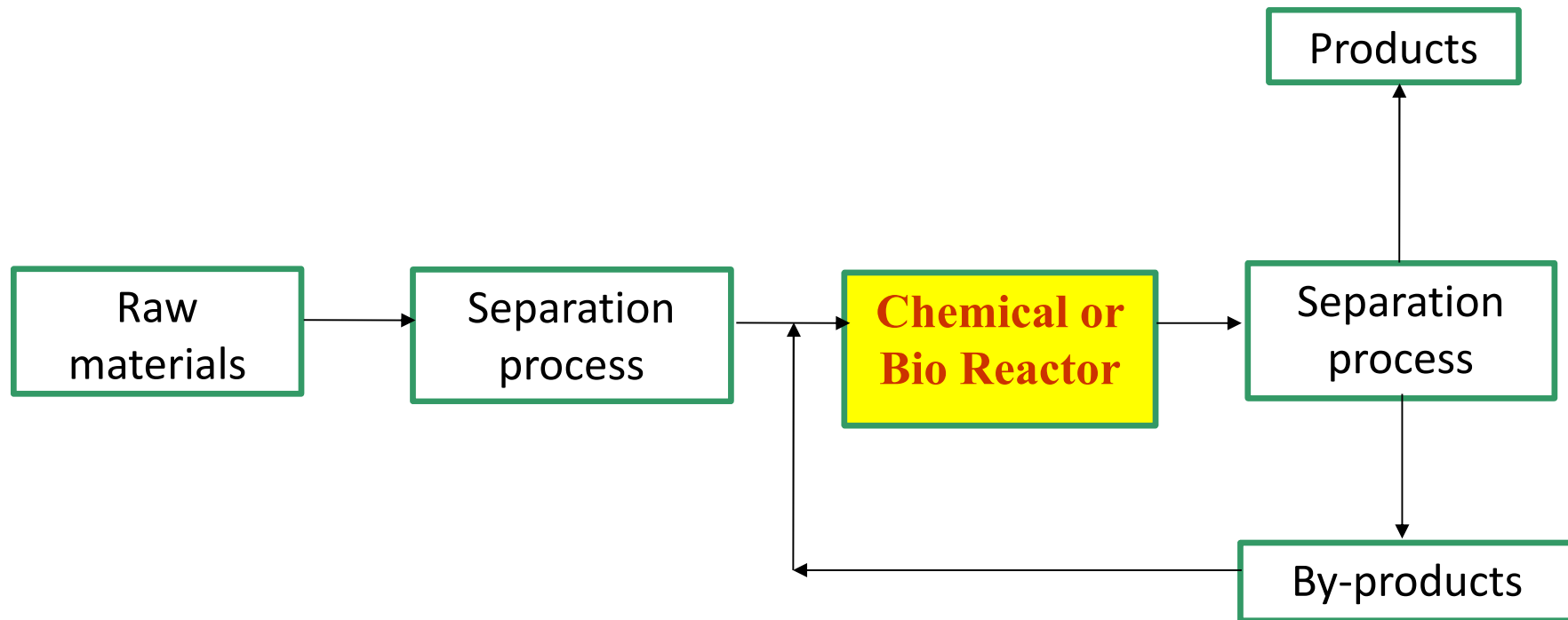
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Chemical and Bio Processes



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Structure of Chemical Industry

Consumer products

Plastics, electronic materials, fibers, solvents, detergents, insecticides, pharmaceuticals

Intermediates

Acetic acid, formaldehyde, urea, ethene oxide, acrylonitrile, acetaldehyde, terephthalic acid

Base Chemicals

Ethene, propene, butene, benzene, synthesis gas, ammonia, methanol, sulfuric acid, chlorine

Fuels

LPG, gasoline, diesel, kerosene

Raw materials

Oil, natural gas, coal, biomass, rock, salt, sulfur, air, water

Specialty Chemicals

Bulk Chemicals



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Fine Chemicals

- Identified according to specifications (what they are)
 - Advanced intermediates
 - Bulk drugs
 - Bulk pesticides
 - Active ingredients
 - Bulk vitamins
 - Flavour and fragrance



Specialty Chemicals

- Identified according to performance
 - Adhesives
 - Diagnostics
 - Disinfectants
 - Pesticides
 - Pharmaceuticals
 - Photographic chemicals
 - Dystuffs
 - Perfumes
 - Specialty polymers



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Differences in Process Development for Bulk and Specialty Chemicals

FEATURE	BULK CHEMICALS	SPECIALTY CHEMICALS
Product Life Cycle	Long (> 30 yrs)	Short (<10 yrs)
Focus on R&D	Driven by cost & environment; Process Improvement	Product Improvement
Competing Processes	One route usually the best	Competitors may use variety of routes
Patent Protection	On process or technologies	On chemistry; often to block competitors
Technology	Usually continuous	Batch and continuous
Scale-up	Pilot plants and simulation tools	Rule of thumbs

(Source : Chemical Process Technology by Moulijn etc. 2001)



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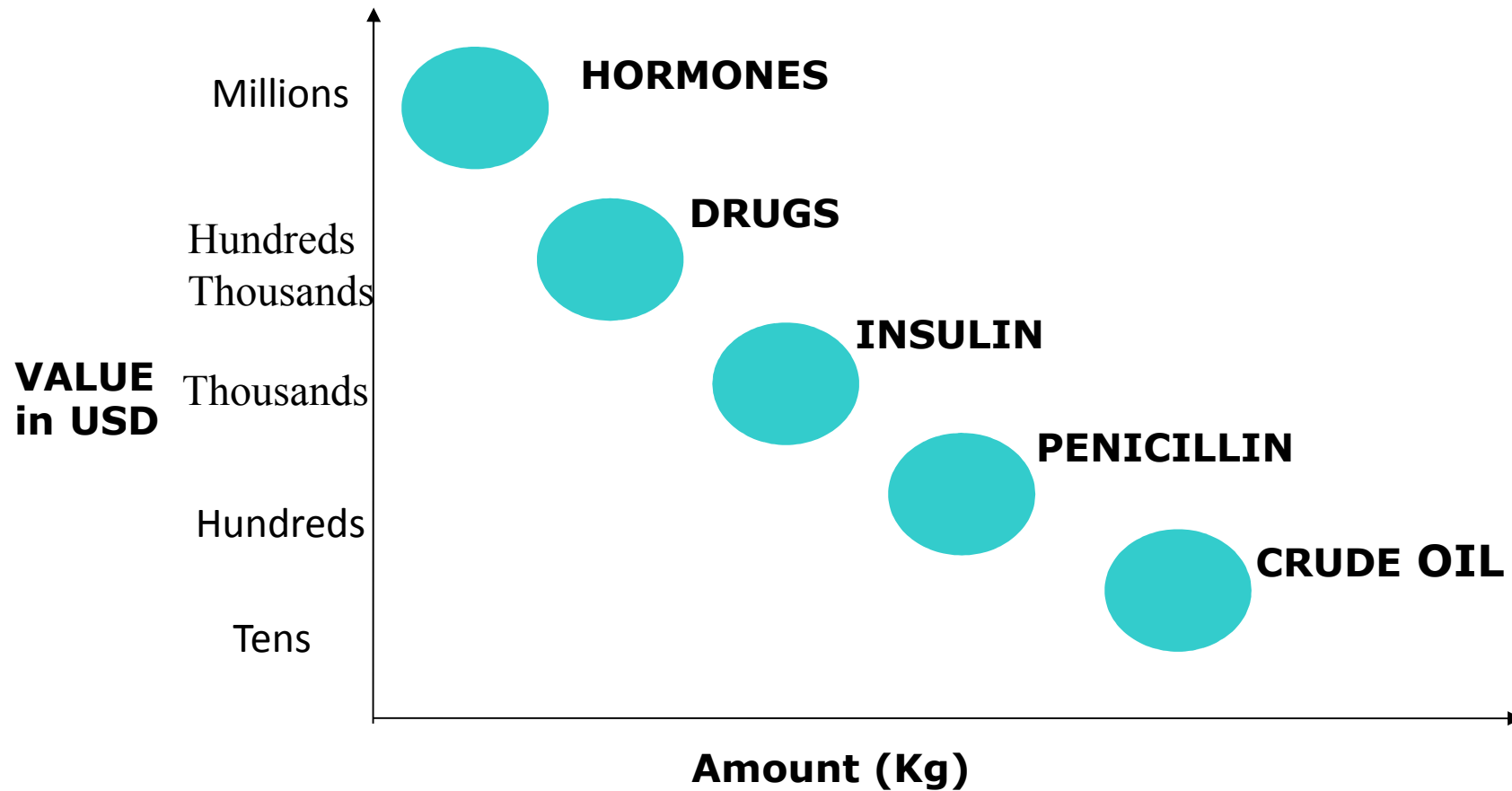
Production and By-product Formation

INDUSTRY SEGMENT	PRODUCTION (mt/yr)	BY-PRODUCT (kg by-product/kg product)
Oil Refining	1 millions to 100 millions	0.01 - 0.1
Bulk Chemicals	10,000 to 1 million	< 1-5
Fine Chemicals	100 to 10,000	5 - 50
Pharmaceuticals	10 to 100	25 - 100

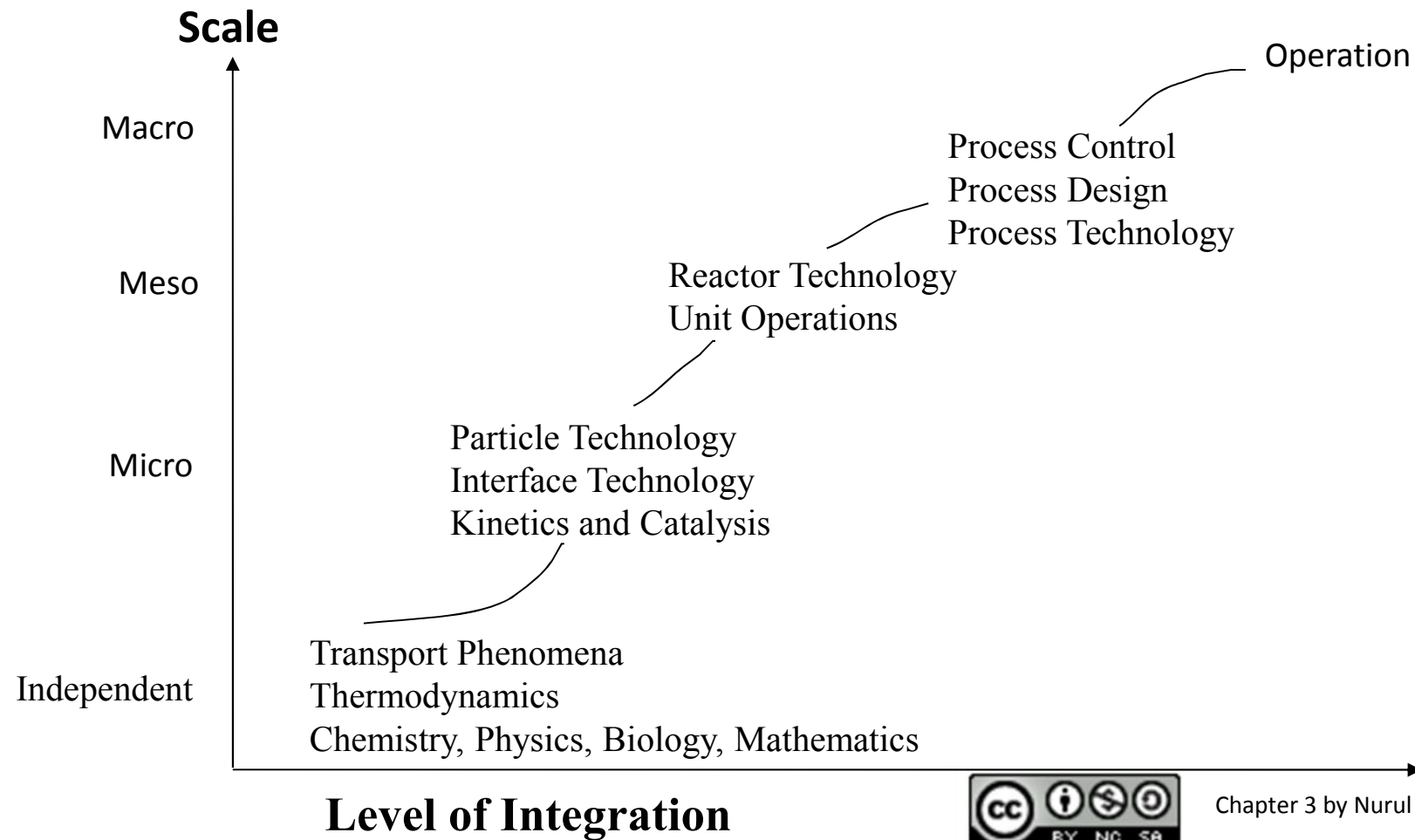


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Comparison of Values Vs Amount of Production



Chemical Process Technology



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