



sanofi



## L'essor des produits issus de la biotechnologie dans les médicaments et les vaccins

*4èmes Rencontres académie-industrie du CNC*

*Les usines du vivant : Génération et  
Transformation de matériaux et de principes  
actifs*

Paul Baduel

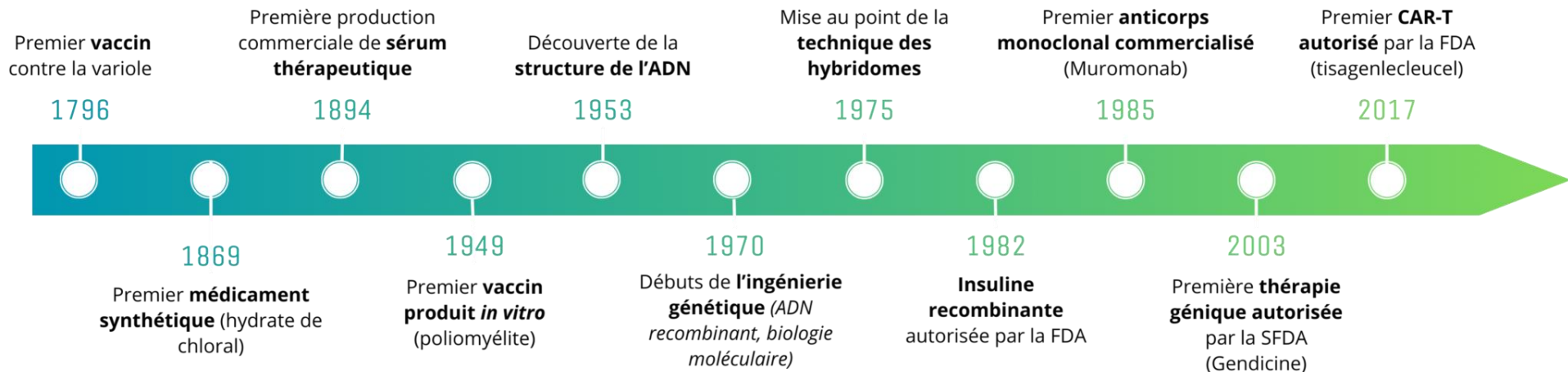


05/12/2024

# Les produits biologiques en pharmacie

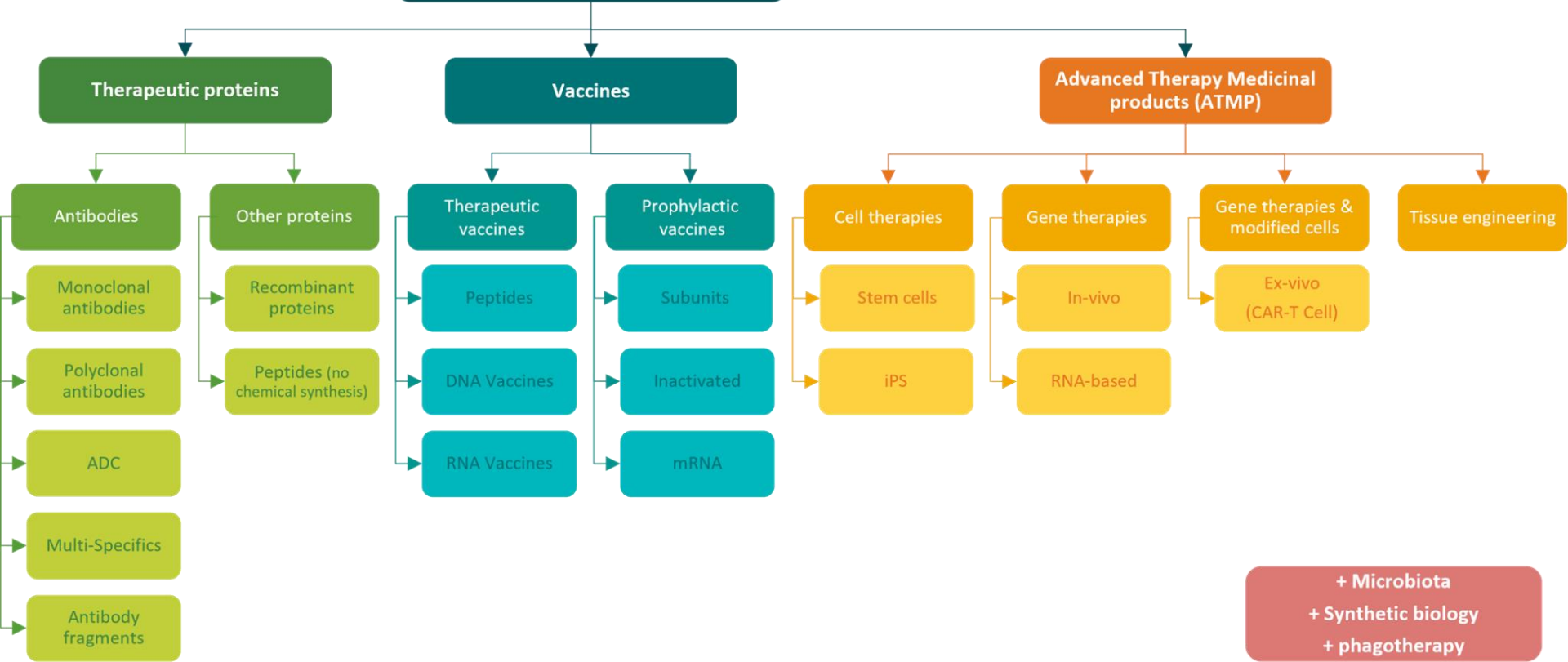
*De quoi parle-t-on ?*





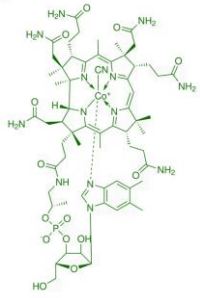
# BIOTHERAPIES

BLA : Biological License Application

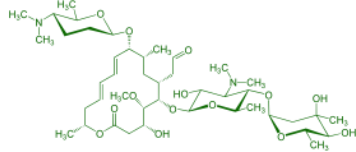


+ Microbiota  
+ Synthetic biology  
+ phagotherapy

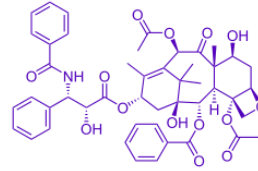
NDA : New Drug Application



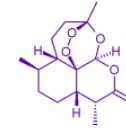
Vitamin B12



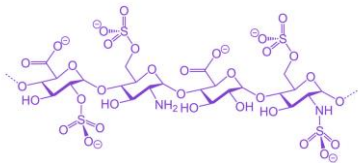
Spiramycin



Paclitaxel



Artemisinin

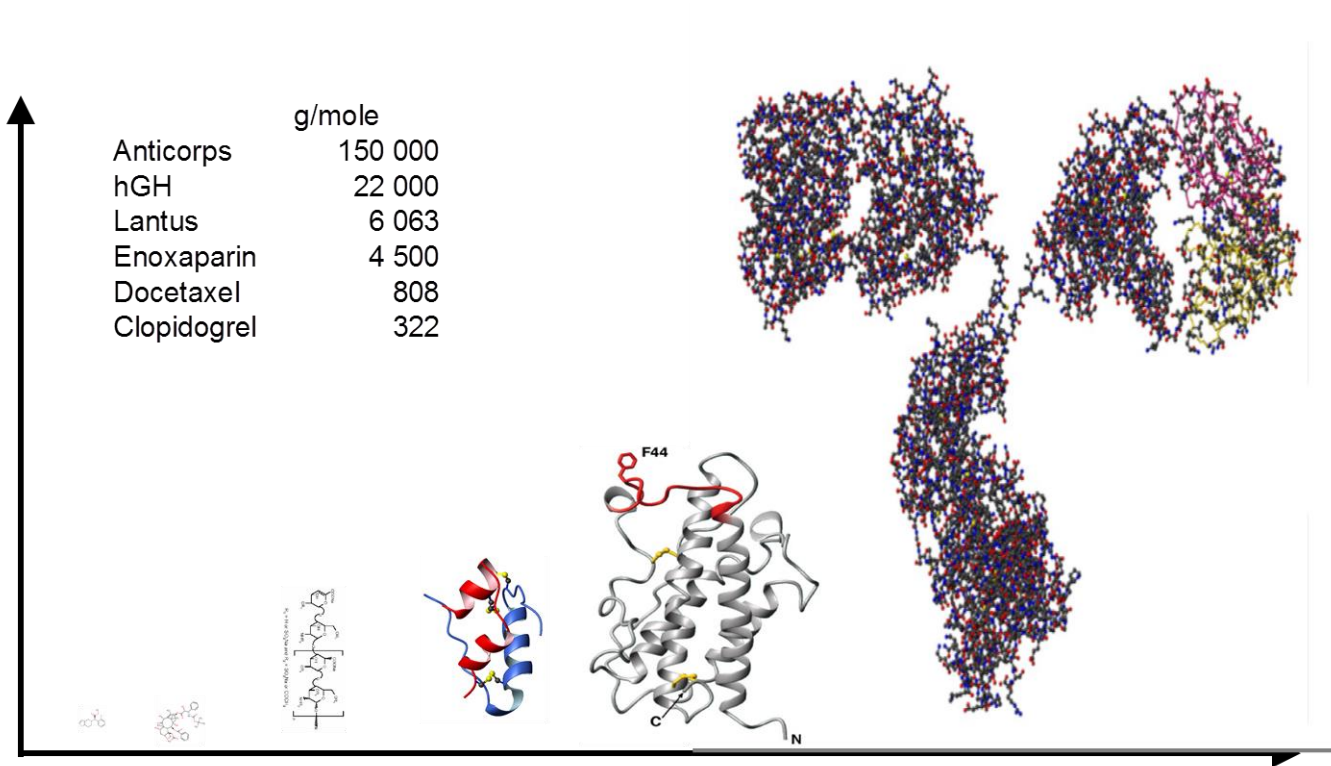


Heparin

**De nombreux produits sont à la frontière de la chimie et de la biologie**

- Produits d'hémisynthèse
- ARNs
- Peptides
- Biologie Synthétique

# Structure de quelques produits biologiques



# L'essor des biothérapies



# Les 10 premiers pharmaceutiques mondiaux (*valeur*)

<b>2000</b>		<b>Synthesis</b>
Prilosec (IPP)	AZ	C
Lipitor (cholesterol)	Pfizer	F + C
Prevacid (IPP)	Takeda	C
Prozac (antidepressant)	Eli Lilly	C
Zocor (cholesterol)	Merck	F + C
Celebrex (AINS)	Pfizer	C
Zoloft (antidepressant)	Pfizer	C
Paxil (antidepressant)	GSK	C
Claritin (Allergies)	Schering P	C
Glucophage (diabetes)	BMS	C

Biothérapies 0%

<b>2010</b>		
Lipitor (cholesterol)	Pfizer	F + C
Plavix (anticoagulant)	Sanofi	C
Advair (asthma/COPD)	GSK	F + C
Remicade (arthritis)	Merck	mAb
Enbrel (arthritis)	Pfizer	mAb
Humira (arthritis)	Abbott	mAb
Avastin (cancer)	Roche	mAb
Rituxan (cancer)	Roche	mAb
Diovan (hypertension)	Novartis	C
Crestor (cholesterol)	AZ	C

Biothérapies 45%

<b>2023</b>		
Keytruda (oncology)	Merck	mAb
Comirnaty (Vaccine)	Pfizer	mRNA
Humira (Immuno-suppressor)	Abbott	mAb
Ozempic (Weight loss)	Novo Nordisk	peptide
Eylea (AMD)	Bayer	mAb
Eliquis (oral anti Xa)	Pfizer BMS	C
Biktarvy (antiviral)	Gilead	C
Dupixent (Immuno-modulator)	Sanofi	mAb
Stelara (Crohn)	J&J	mAb
Darzalex (oncology)	J&J	mAb

Biothérapies 85%

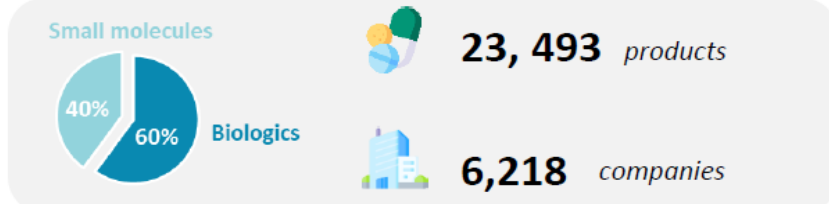


# L'essor des Biothérapies

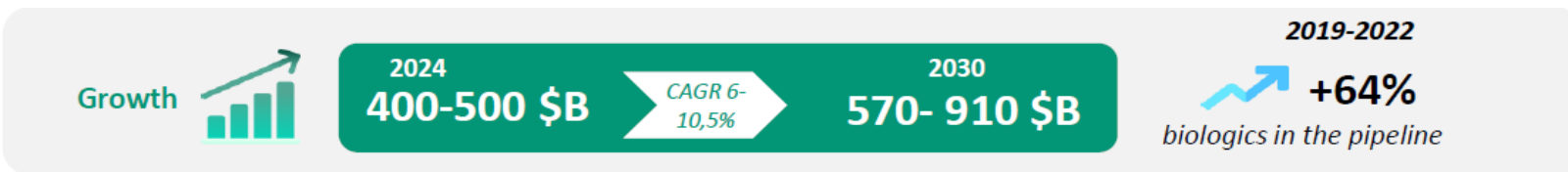
## Market



## Pipeline



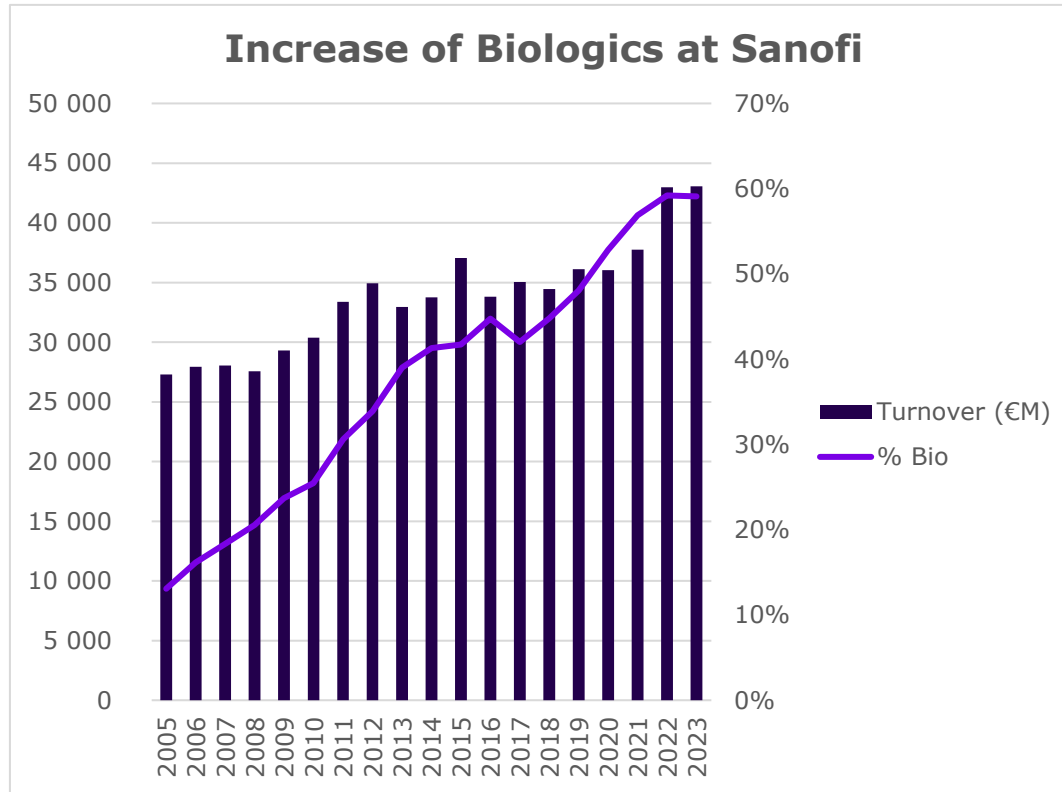
## Trends and Projections



Source Mabdesign, Global Data



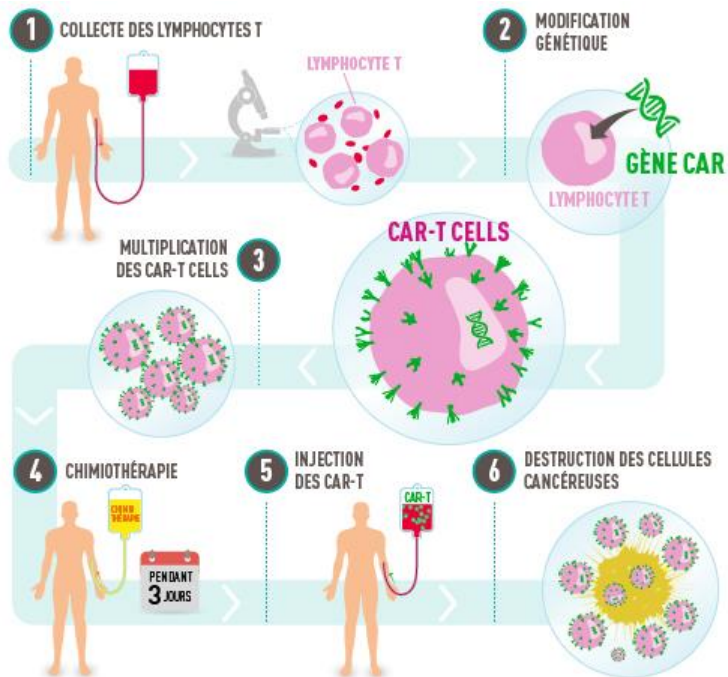
# Sanofi, un exemple représentatif



**Des produits plus complexes qui  
ciblent des besoins médicaux non  
satisfaits**

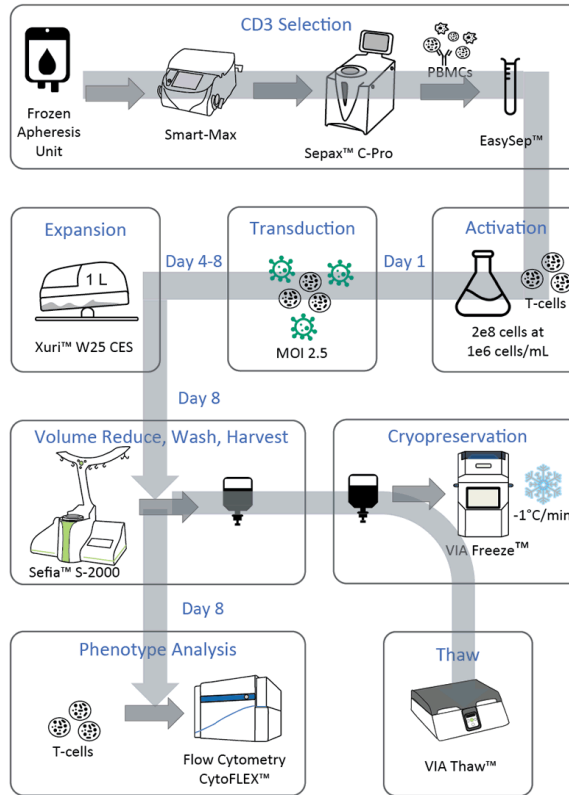


# Exemple des CAR-T Cells



**GUSTAVE/ROUSSY**  
CANCER CAMPUS  
GRAND PARIS

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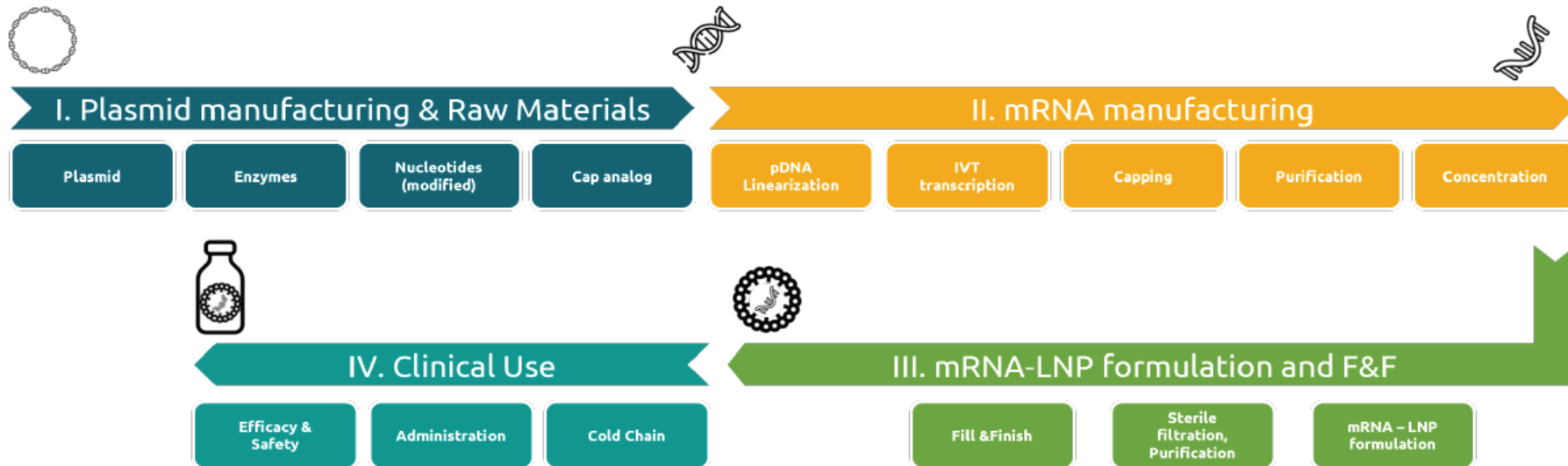


cytiva

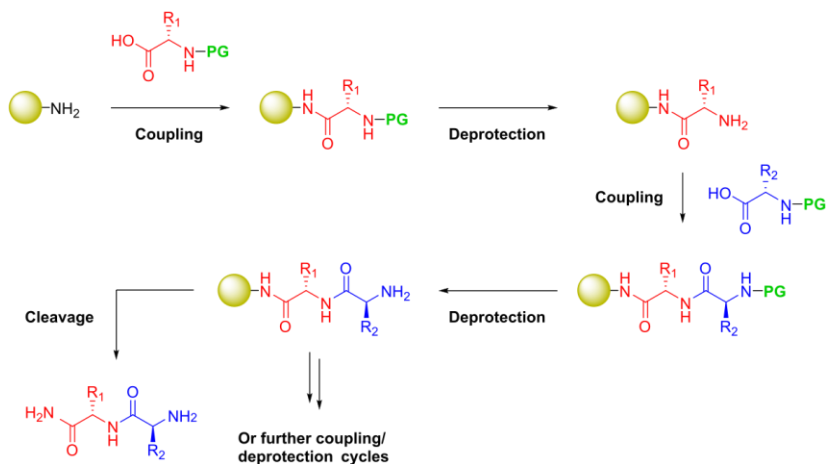
**Chimie ou Biologie**



# La synthèse des mRNA

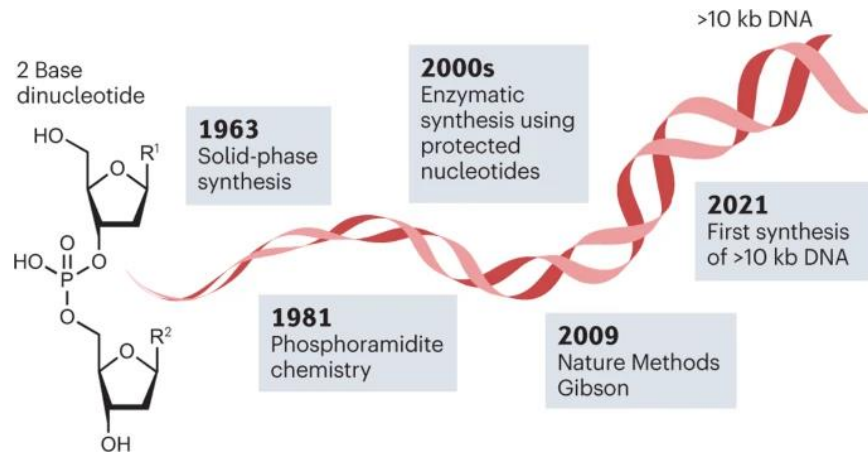


## Synthèse peptidique en phase solide



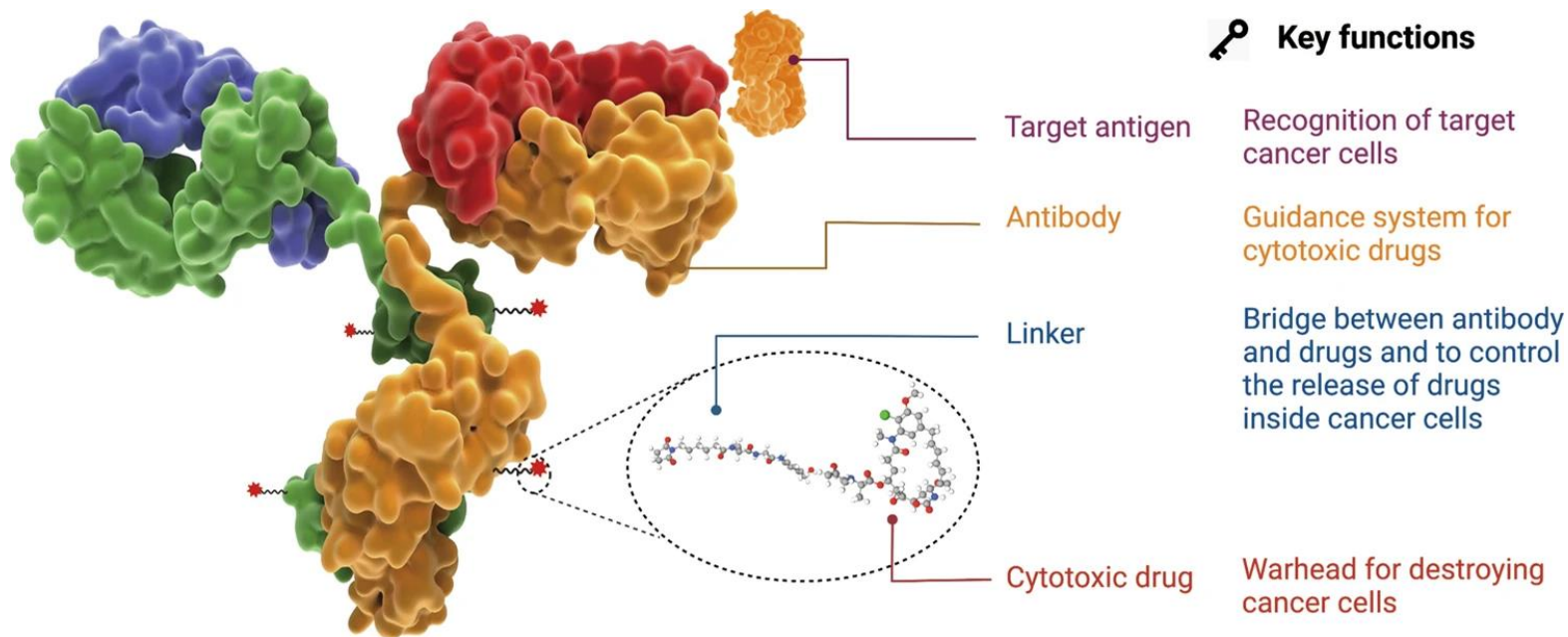
From Elizabeth Denton

## Synthèse d'ADN



Hoose, A., Vellacott, R., Storch, M. *et al.* DNA synthesis technologies to close the gene writing gap. *Nat Rev Chem* 7, 144–161 (2023). <https://doi.org/10.1038/s41570-022-00456-9>

## ADCs became 1st line therapy for some cancer



Fu, Z., Li, S., Han, S. *et al.* Antibody drug conjugate: the “biological missile” for targeted cancer therapy. *Sig Transduct Target Ther* **7**, 93 (2022). <https://doi.org/10.1038/s41392-022-00947-7>



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Merci  
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