

Biopharmaceutical - Regeneron Case Study

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DRAFT



REGENERON
SCIENCE TO MEDICINE®



Biopharma overview

Regeneron - Executive summary

Regeneron - Pipeline

Regeneron - Enabling technology

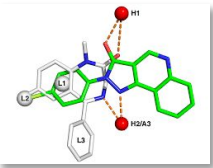
Regeneron - Valuation

Comparing biopharmaceuticals and traditional pharmaceuticals: key metrics

■ Deep dive to follow

Definitions

The primary difference between **biopharmaceuticals** and **traditional pharmaceuticals** is the method by which the drugs are produced...



Traditional:
manufactured through a series of chemical synthesis

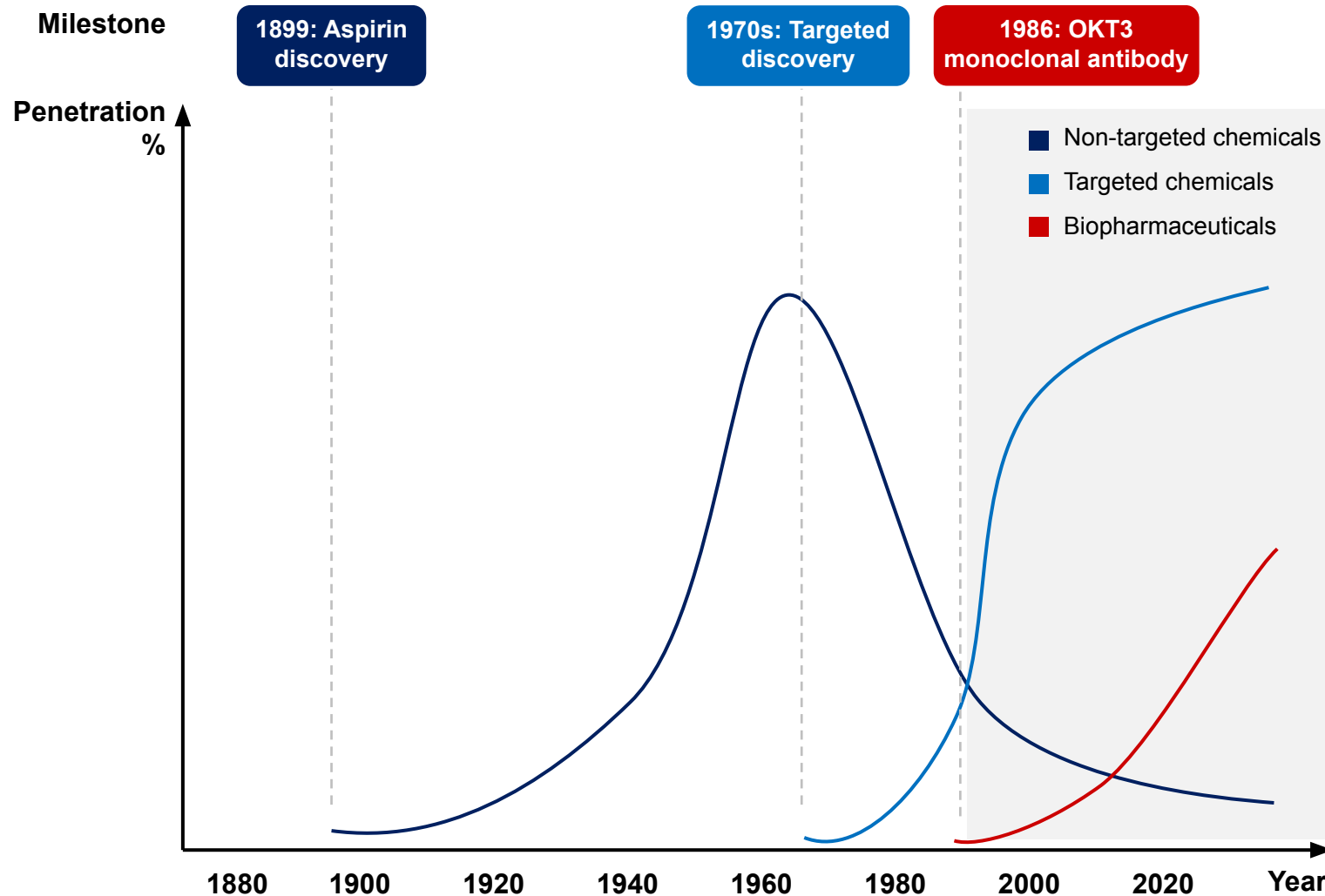


Biopharma:
manufactured in living organisms such as bacteria, yeast and mammalian cells

Pharmaceutical VS Biopharmaceuticals, in terms of market maturity and ramp-up outlook, together with development and production challenge

		Pharmaceutical	vs.	Biopharmaceutical
Internal	R&D	<ul style="list-style-type: none"> Cost of launch: ~1300 Mn USD for brand name Timeframe: 10-15 yrs 	+	<ul style="list-style-type: none"> Cost of launch: ~2600 Mn USD per drug Timeframe: ≥ 10 yrs
	Production	<ul style="list-style-type: none"> Lower complexity with standardized production process 	+	<ul style="list-style-type: none"> Higher complexity with less predictable yield rate
External	Maturity	<ul style="list-style-type: none"> Since 1899 Matured market with well-defined technology 	+	<ul style="list-style-type: none"> Since 1982 Emerging market with lurking uncertainties
	Ramp-up	Steady	-	Acceleration

Comparing biopharmaceuticals and traditional pharmaceuticals: timeline

















The biopharmaceutical segment is catching up with its pharmaceutical counterpart with noticeable momentum...

	Pharmaceutical	Biopharmac eutical
Volume, 22' Bn USD	1,107	369
Volume, 25' Bn USD	1,199	513
CAGR %	3.5	12

Treatment areas driving the majority growth for biopharma

 High competition, High demand
  Low competition, Low demand

Treatment Area	Market size, 22' Bn USD	22-30 CAGR, %	Competition	Demand for innovative drugs
Oncology	286.04	8.2%		
Rare disease	119.6	12.8%		
Neuro	78.73	5.3%		
Cardio	63.96	3.8%		
Autoimmune	54.8	12.9%		
Gastro	37.93	7.9%		
ENT	21.1	5.5%		

 **Opportunity to be captured in various TAs...**

For large TAs (e.g. oncology, neuro, cardio)...

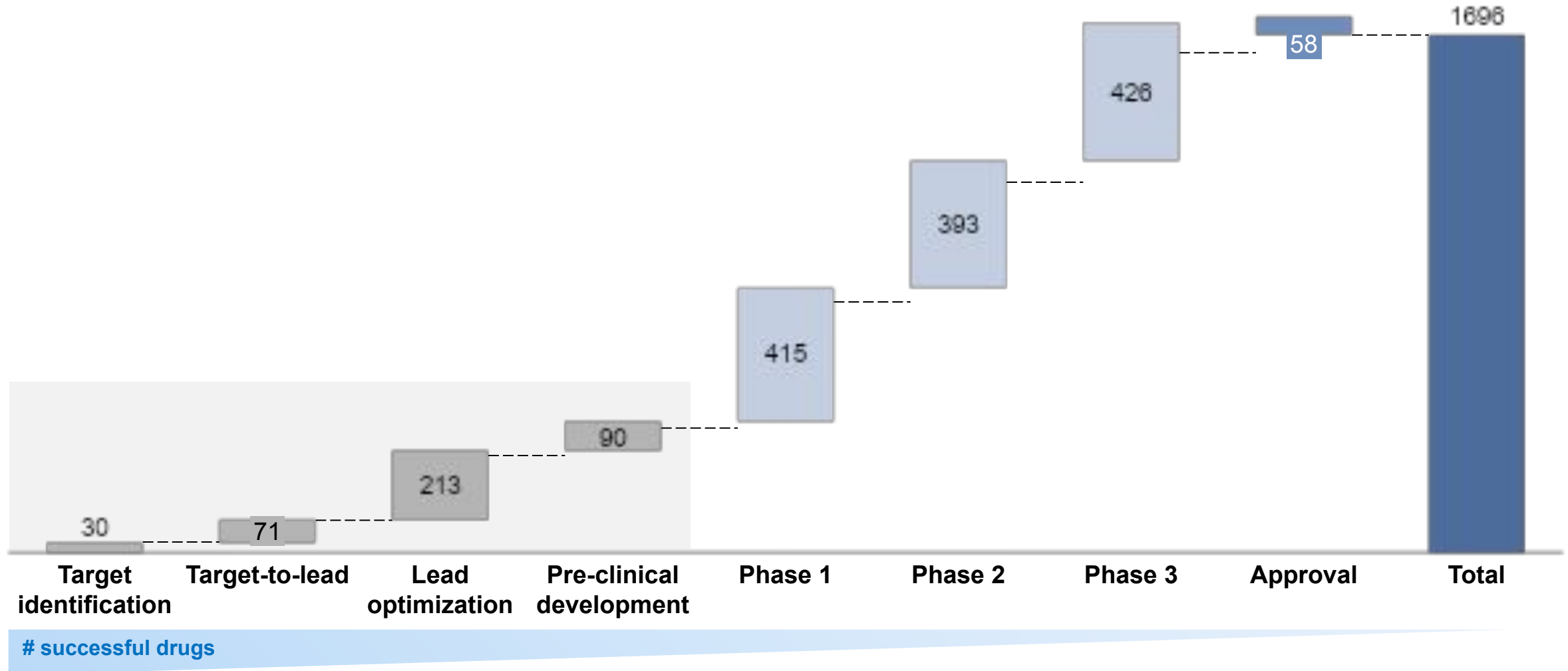
- Opportunities for innovative drugs for overhaul

For small TAs (e.g. rare disease, autoimmune, ENT)...

- Opportunities for fulfilling unmet needs

From 0 to 1: how much does one drug cost?

Development Phase and Costs Breakdown (\$, Mn, approx.)





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Executive Summary

What to expect from this document ...

1. **Value proposition:** a leading biotechnology company that invents medicines for serious diseases, covering key TAs in oncology, autoimmune, cardio and rare diseases.
2. **Key enabling lever:** a bank of proprietary tools to help the process of translating science into medicine, in a way that accelerating and improving the traditional drug development process
3. **Valuation:** Current medium valuation at 85,220.6 Mn USD

... and what is not covered in this document, for the next steps

1. **Market deep dive:** industry research and interviews to follow, aiming to understand the key success factors in the biopharmaceutical companies
2. **Competition deep dive:** based on the KSF derived, start benchmarking analysis on Regeneron and its major competitors, aiming to evaluate their value propositions and Regeneron's position
3. **Current valuation cross check, with a different approach**



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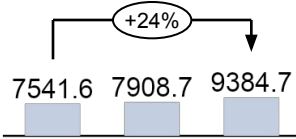

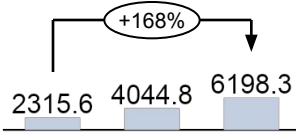

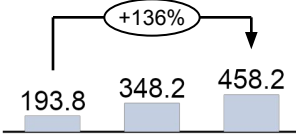

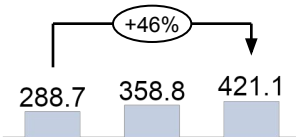

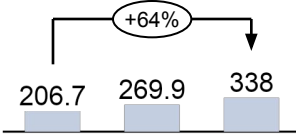
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Expansionary pipeline strategy to sustain growth

Not exhaustive

Commercialized product			
Product	Indication	TA	2019-21 Sales, \$Mn
★  EYLEA® (aflibercept) Injection	• Neovascular age related macular Degeneration	Ophthalmology	
★  DUPIXENT (dupilumab)	• Atopic dermatitis	Immunology & Inflammation	
 LIBTAYO® (cemiplimab-rwlc) Injection 350 mg	• Non-small cell lung cancer/basal cell carcinoma	Solid Organ Oncology	
 Praluent® (alirocumab) Injection 75mg/mL, 150mg/mL	• Heterozygous Familial hypercholesterolemia	General Medicine	
 KEVZARA® sarilumab	• Rheumatoid arthritis ("RA")	Immunology & Inflammation	

★ Best sellers

1. Further discussion on the next page

Pipeline

























35+ biological products are in the clinical trial stage, covering multiple TAs¹...

Pipeline Strategy:

- Research and Develop new compound
- Extend indication of marketed products (e.g. EYLEA for Retinopathy of prematurity)
- Develop new concentrations of marketed products (e.g. from 2 mg aflibercept to 8 mg in EYLEA)

Treatment area mapping

Commercialized product Product in pipeline High attractiveness and feasibility Low attractiveness and feasibility

Treatment Area	Attractiveness	Feasibility	Products from Regeneron	
Oncology			 Libtayo	 REGN4018 REGN5668
Rare disease			 Evkeeza	 REGN1979 REGN5459
Neuro				 REGN475
Cardio			 EYLEA Praluent	 REGN5381
Autoimmune			 Kevzara Dupixent	 REGN3500 REGN6490
Gastro			 ZALTRAP	
ENT			Untapped market	



TA Strategy

Products are scattered in the most attractive and lucrative market

Should develop new products in the pipeline to enter the market like Neuro and Gastro



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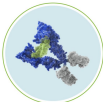



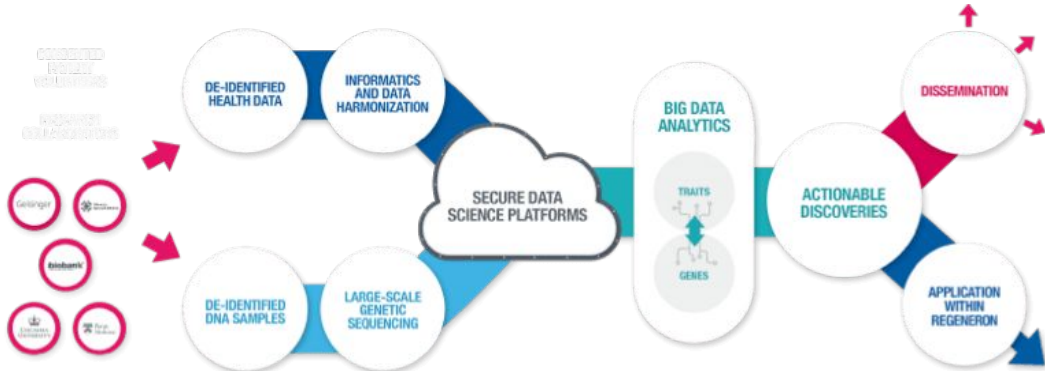

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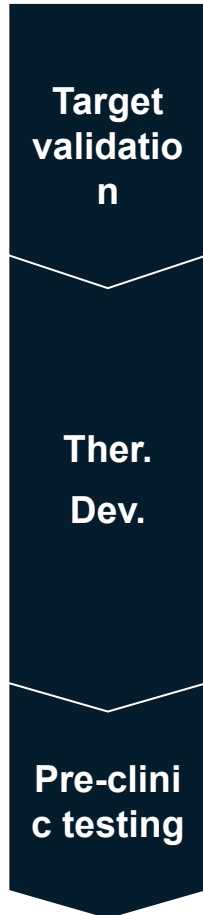
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Regeneron's proprietary tools to optimize and speed up development

Tool	Function	Target identification	Target validation	Therapeutic Dev.	Pre-clinical testing
Trap (2000)	<p>Create high-affinity blockers for a variety of signaling proteins, reducing the harmful effects</p>  <ul style="list-style-type: none"> Successful applications: EYLEA, ARCALYST, ZIV 	Not applicable.			
VelociSuite (2008)	<p>Platforms speeding up the drug discovery process at each step</p>		 VelociGene VelociMouse	 VelociImmuneV elociHum	 VelociMab
Regeneron Genetics (2014)	<p>Use big data to analyze patient information, increasing probability of clinical trials success</p> <ul style="list-style-type: none"> Over 750k cases in the database from Geisinger, UK biobank, etc. 				

What differentiates VelociSuite?



Traditional Platforms

Artificially replaces the gene of interest in mouse stem cells with human counterparts. Sometimes needs to breed multiple generations to ensure the progress.

Generates antibodies in regular mice and take them out. Cannot ensure effectiveness and safety in human.

Takes a long time from mouse immunization to clinical trials.

VelociSuite

VelociGene & VelociMouse:

Automated technology that uses bacterial artificial chromosome vectors, which can directly insert or delete genes in embryonic stem cells. No need to breed. Mouse Lego.

VelociImmune:

Humanizes mice's immune system with VelociGene. Guarantees effectiveness of antibodies from the mice.

VelociHum:

Optimizes mice to be more suitable in testing therapeutics against immune cells and studying human tumor models.

VelociMab:

Labels the VelociImmune mice's antibody-producing cells to speed up the screening process for best candidates.



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Valuation

Data as of Dec 2nd, 2022		Market Data			Financial Data				Valuation Multiples			
		Price	Market Cap	EV	Revenue	EBITDA	EBIT	Net Income	EV / Revenue	EV / EBITDA	EV / EBIT	P / E
Company Name	Company Ticker	(\$Share)	(\$M)	(\$M)	(\$M)	(\$M)	(\$M)	(\$M)	x	x	x	x
Biogen Inc.	NasdaqGS:BIIB	298.9	43,042.0	43,895.9	10,363.2	3,490.6	2,957.3	2,864.7	4.24x	12.58x	14.84x	15.02x
Gilead Sciences	NasdaqGS:GILD	89.03	111,665.3	129,344.3	27,136.0	12,775.0	10,665.0	3,334.0	4.77x	10.12x	12.13x	33.49x
Vertex Pharma	NasdaqGS:VRTX	321.37	82,492.9	73,546.8	8,700.6	3,353.1	3,209.4	3,273.2	8.45x	21.93x	22.92x	25.20x
Amgen Inc.	NasdaqGS:AMGN	285.51	152,342.2	179,568.2	26,330.0	13,425.0	10,221.0	6,835.0	6.82x	13.38x	17.57x	22.29x
Sanofi	NasdaqGS:SNY	89.93	112,782.5	128,186.7	46,501.0	13,807.5	11,149.2	6,409.0	2.76x	9.28x	11.50x	17.60x
Mean									5.41x	13.46x	15.79x	22.72x
Median									4.77x	12.58x	14.84x	22.29x
Maximum									8.45x	21.93x	22.92x	33.49x
Minimum									2.76x	9.28x	11.50x	15.02x
Regeneron Pharma	NasdaqGS:REGN	766.39	81,851.9	71,562.7	13,710.2	6,772.7	6,456.9	5,370.3	5.22x	10.57x	11.08x	15.24x





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