



# How IP Shaped The Phage Display World

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# Phage Display: A Great Invention

- Searching on “phage display” produced:
  - 4,706 hits on PubMed
  - 35,100 hits on Google Scholar
  - 43 drug reports on THOMSON PHARMA®
- One marketed phage display antibody product:
  - HUMIRA®
- One stockpiled phage display antibody product:
  - ABTHRAX®
- Several more in clinical trials ....

# Phage Display Derived Antibodies In The Clinic

Name	INN Name	Target	Phase	Company
BENLYSTA®	belimumab	B-Lys	Pre-reg	HGSI/GSK/CAT
ABT-874	briakinumab	IL-12	III	Abbott/CAT
HGS-ETR1	mapatumumab	TRAIL-R1	II	HGSI/GSK/CAT
HGS-ETR2	lexatumumab	TRAIL-R2	II	HGSI/GSK/CAT
GC-1008	fresolimumab	TGF- $\beta$	II	Genzyme/CAT
CAT-354	tralokinumab	IL-13	II	CAT (MedImmune)
IMC-11F8	necitumumab	EGFR	III	ImClone/Dyax
IMC-1121b	ramucinumab	VEGFR-2	III	ImClone/Dyax
IMC-A12	cixutumumab	IGF-1R	II	ImClone/Dyax
MOR-103		GM-CSF	II	MorphoSys
R-1450	gantenenumab	$\beta$ -amyloid	I	MorphoSys/Roche

*Examples only; not an exhaustive list.*

*Based on information in Thie et al Curr. Pharm. Biotech. (2008) 9: 439-446*



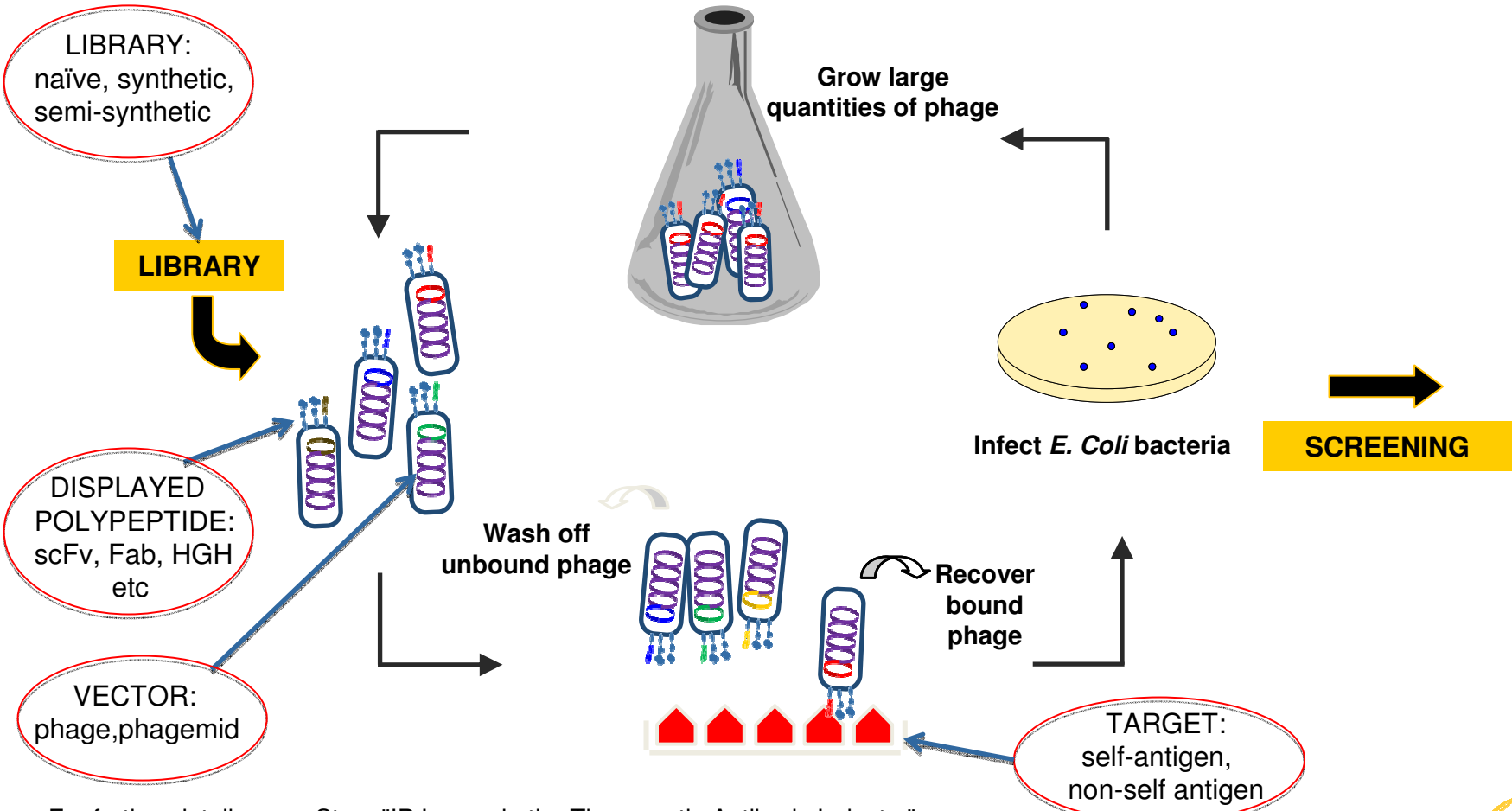
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# Challenges: Complexity And Uncertainty

- Multiple technical aspects and variations
- Multiple players
- Timing
- Geography
- Unpredictability
- Explaining it all

# Multiple Technical Aspects And Variations

Several "eureka" moments?



For further details, see: Storz "IP Issues in the Therapeutic Antibody Industry"  
Antibody Engineering Vol. 2. ed. Kontermann and Dubel, Springer-Verlag Berlin Heidelberg 2010

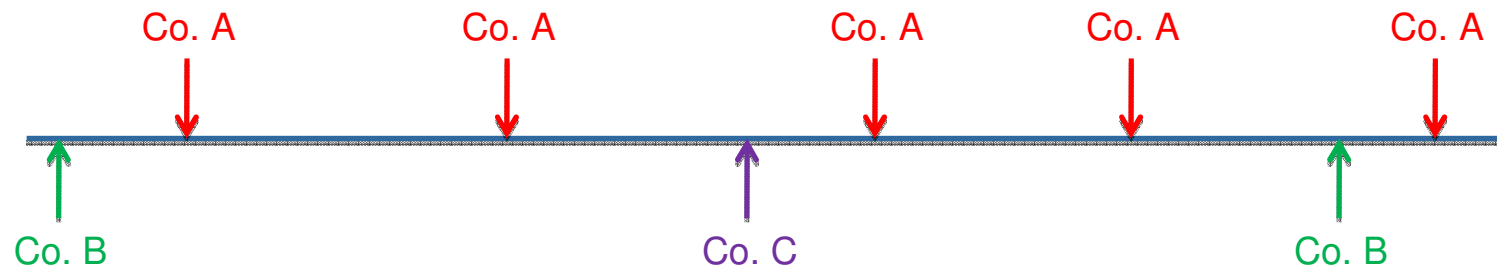
## Multiple Players, Including\* ...

- Affitech
- BioInvent
- BioSite
- CAT/MRC
- CBM (Micromet)
- Crucell
- Dyax
- Enzon
- Genentech
- MorphoSys
- Scripps/Stratagene
- XOMA

\*in alphabetical order

# Timing

- Several groups working in the field
- Several patent families with multiple filings in priority year



- In US, first-to-invent not first-to-file

# Geography

- US patent system differed from the rest of the world
- In the 1980's and early 1990's:
  - Inventors working outside US could not use notebooks to support date of invention
  - Continuation-in-part applications could be used to add data whilst maintaining patent term
  - Patents expired 20 years from filing or 17 years from issue whichever was the latest
- Resulted in a different phage display IP landscape in the US



# Unpredictability

- Matters of interpretation
- Hindsight
- The human factor
- The drama of European Patent Office opposition hearings



# Patents In The Spotlight

Financial Times  
July 2000

## Biotech group wins patent battle

By David Firm

Cambridge Antibody Technology yesterday won a big victory in a patent battle over its core technology, antibody production. The European Patent Office in Munich turned down a challenge to the "McCafferty" patent that protects CAT's technique for rapidly making "libraries" of thousands of antibodies. These are used as drugs or as the basis to develop drugs.

Three biotech companies, Dyax of the US, MorphoSys of Germany and BioInvent of Sweden had challenged the validity of the patent, which CAT says they are infringing. None of the companies was available for comment.

The decision significantly strengthens Cambridge Antibody's position but is unlikely to end the fight over the technology. MorphoSys and Cambridge Antibody are also fighting over another phage display patent held by the UK company.

Antibodies, with their ability to hunt down and bind to molecular targets in the body, form the basis of a new and fast growing class of highly specific "magic-bullet" drugs.

Cambridge Antibody has a leading position in the use of phage display, a technique that uses viruses in test tubes to mimic the human immune system's ability to generate almost limitless numbers of different antibodies from a set of basic molecular building blocks.

The company has deals worth up to £300m to develop drugs for pharmaceutical companies.

Cambridge Antibody's shares have risen from a low of 580p last year and peaked at £53 earlier this year, after the company struck a wide-ranging drug development deal with Human Genome Sciences, the US gene hunting company. Yesterday before the patent decision was announced, they closed at £29.87½.



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# Explaining It All: Disparate Audiences

- Partners and collaborators
- Analysts
- Investors
- Management and colleagues
- Judges and jurors
- Friends and family

# IP Shaping Of The Phage Display World

- Complexity and uncertainty probably put phage display at a disadvantage versus competitor technologies with simpler IP landscapes
- On the other hand it allowed multiple companies to claim they had a piece of the IP pie, enabling them to raise money, create jobs and develop antibody drugs



# Strategic Uses Of IP To Shape The Phage Display World

- **CAT**

- Licensed selectively
- Used its IP to reinforce its position as a leader in the field
- IP created uncertainty for competitors
- IP enabled a premium pricing strategy

- **XOMA**

- Licensed widely (>60 licensees)
- Used its IP to generate cash for product development
- Traded its IP in order to build its own phage display and antibody capabilities



# How Antibody Phage Display IP Shaped Me

- Joined CAT in June 1999, two months after the first MorphoSys lawsuit
- Early exposure to US litigation taught me valuable lessons
- Privileged to work in a field where patents really matter
- Learned from working with (and against) lots of great people
- Many patents are still out there...it's not over!