

# Trends in the commercial development of antibody therapeutics

Silvia Crescioli, Ph.D.

Independent consultant, The Antibody Society, Inc.

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BODY  
SOCI  
.ETY

# Agenda

- Definitions, data sources, objectives
- Trends in FIH studies for antibody therapeutics
- Current early stage pipeline
  - Antibodies for cancer and noncancer indications:
    - formats, targets and mechanism of action
- Overall trends in the clinical pipeline
  - Trends in first marketing approvals and success rates

# Definitions, Data sources, Objectives

# Definitions, inclusion/exclusion criteria

- **Antibody therapeutic:** Recombinant protein-based molecule with at least one antigen binding site derived from an antibody-gene that is evaluated as a therapeutic; excludes polyclonal antibodies from a natural source, antibody-encoding DNA, Fc only / Fc fusion proteins, and diagnostics
- **Commercial sponsor:** Public or private for-profit entity; excludes non-profit and government entities
- **Innovative:** Unique in composition of matter; excludes biosimilars
- **Clinical status:** Most advanced clinical study; excludes early-stage studies for molecules in Phase 2/3 or 3 studies or in reg.review, approved
- **First:** First; excludes second, third, etc.

# Sources of data

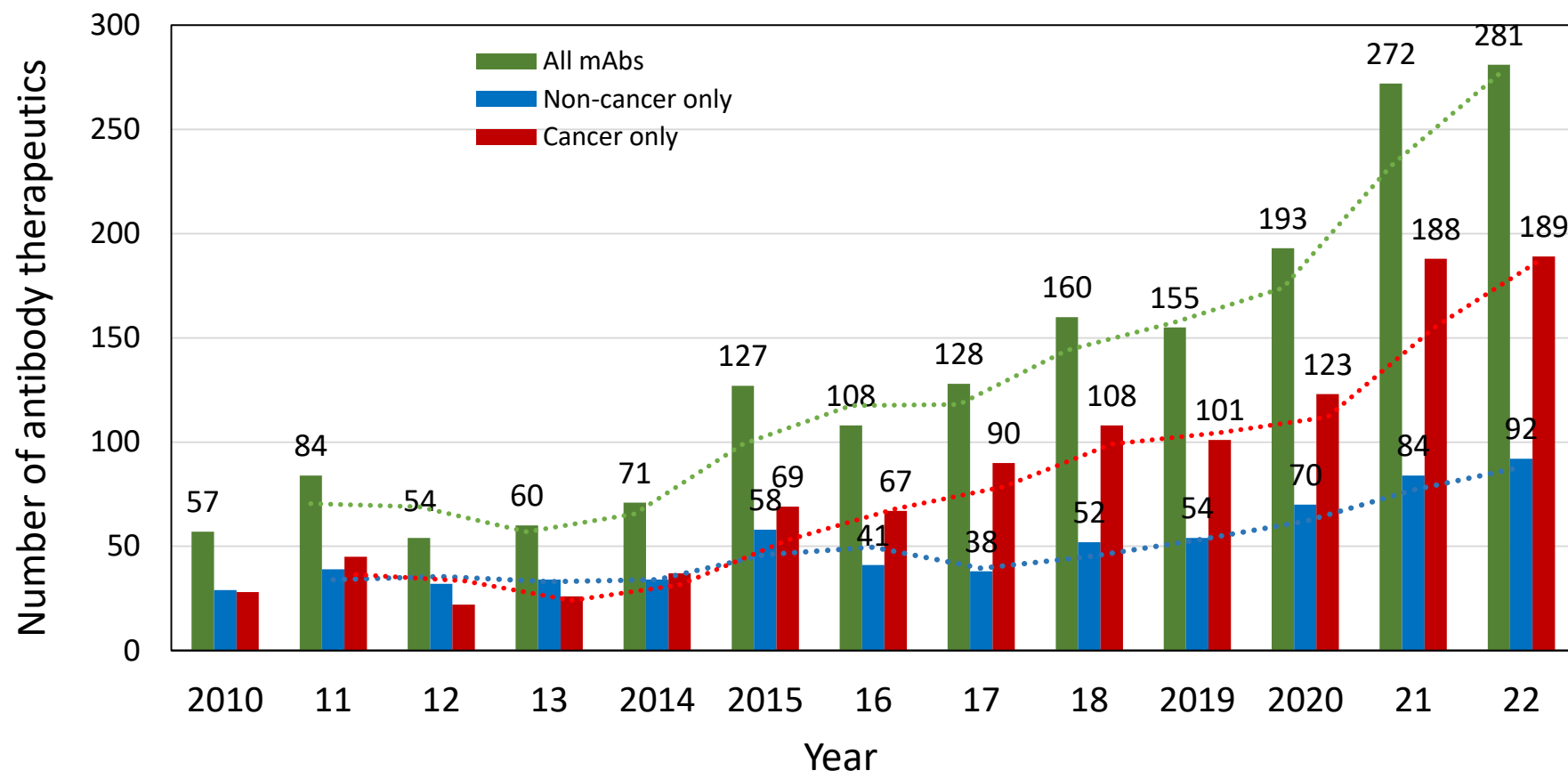
- Public disclosures from primary sources, including but not limited to:
  - Company press releases, presentations, meeting abstracts, quarterly and annual reports, etc.
  - Clinical trials registries, such as [clinicaltrials.gov](http://clinicaltrials.gov)
  - Regulatory agency documents from FDA, EMA, Health Canada, NMPA, etc.
  - WHO INN lists
- We cannot rely on secondary sources such as commercial databases because:
  - Our inclusion / exclusion criteria is specialized
  - Lags in data updates, esp. terminations, in databases
  - Introduction of errors that occur during data processing

# Objectives

- To determine trends in antibody therapeutic development over time
  - Overall, as well as focus on particular therapeutic areas, formats, or targets
- To determine clinical success rates for antibody therapeutics development, as conducted by the biopharmaceutical industry
  - Phase transition rates
  - Overall marketing approval rates
  - Phase transition and success rates will be featured in “Antibodies to watch in 2024”
- To assess innovation in the biopharmaceutical industry

# Trends in FIH studies

# Antibodies starting first clinical studies\*



\*Data available as of Q2 2023; 2020-22 totals include anti-SARS-CoV-2 antibodies (n=20, 16, 14 for 2020, 2021, 2022, respectively, representing 29%, 19% and 15% of non-cancer pipeline, respectively)

Totals include mAbs sponsored by commercial firms only; dotted lines are 2-yr moving average.

Source: The Antibody Society.



# Early-stage clinical pipeline

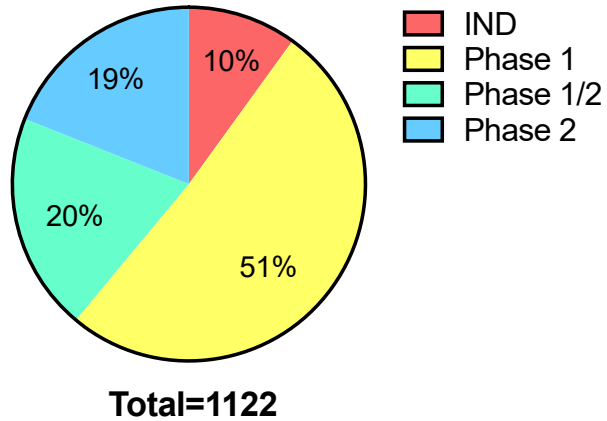
# Status of antibodies in early-stage clinical studies

Most advanced clinical phase

# Status of antibodies in early-stage clinical studies

## Most advanced clinical phase

### All molecules

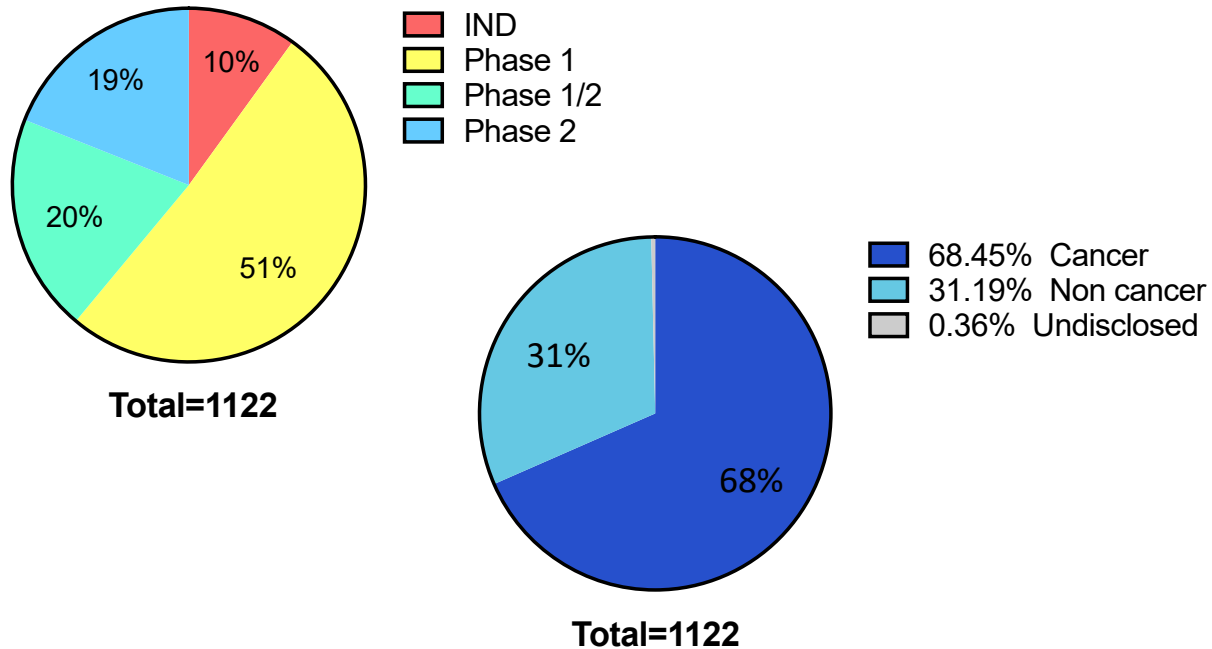


Data as of October 2, 2023. Early-stage excludes pivotal Phase 2 studies.  
TA could not be assigned for 4 molecules (undisclosed).

# Status of antibodies in early-stage clinical studies

## Most advanced clinical phase

### All molecules

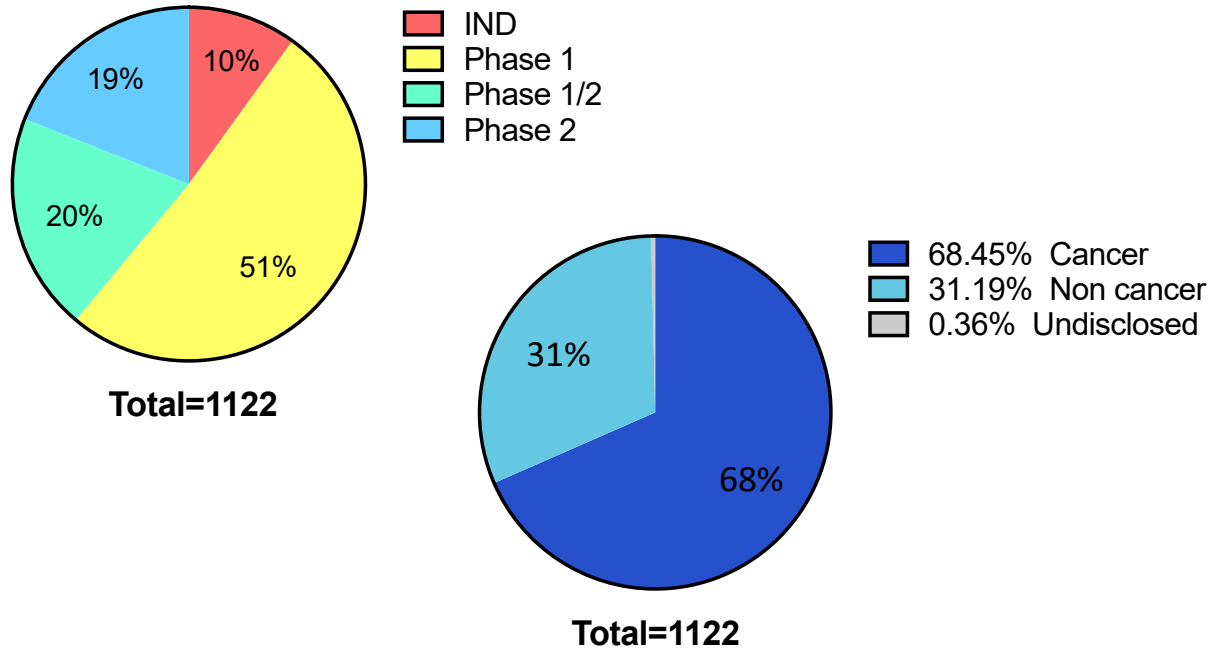


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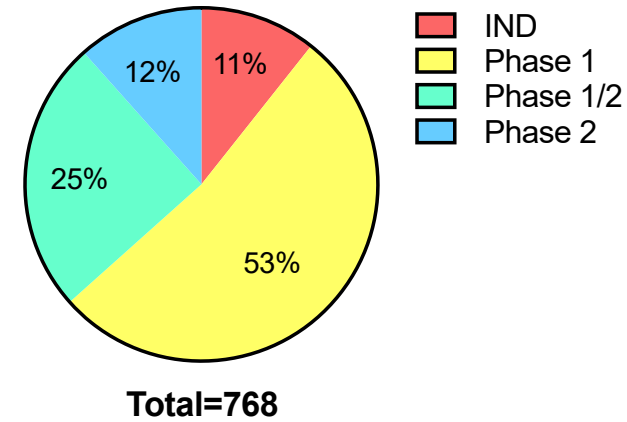
# Status of antibodies in early-stage clinical studies

## Most advanced clinical phase

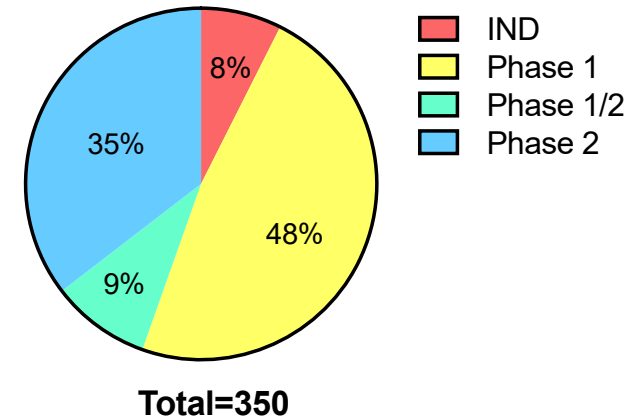
### All molecules



### Cancer



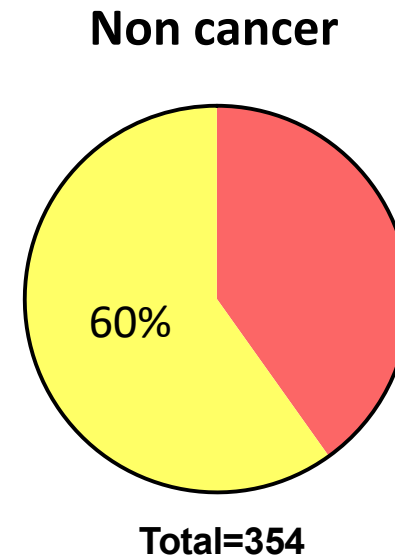
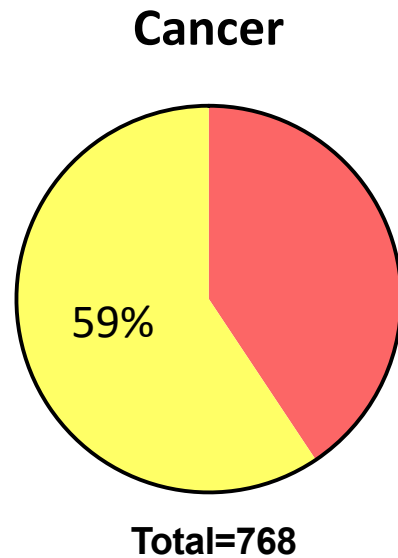
### Non-cancer





Data as of October 2, 2023. Early-stage excludes pivotal Phase 2 studies.  
TA could not be assigned for 4 molecules (undisclosed).

# Antibodies in early-stage clinical studies

Innovation: unique targets

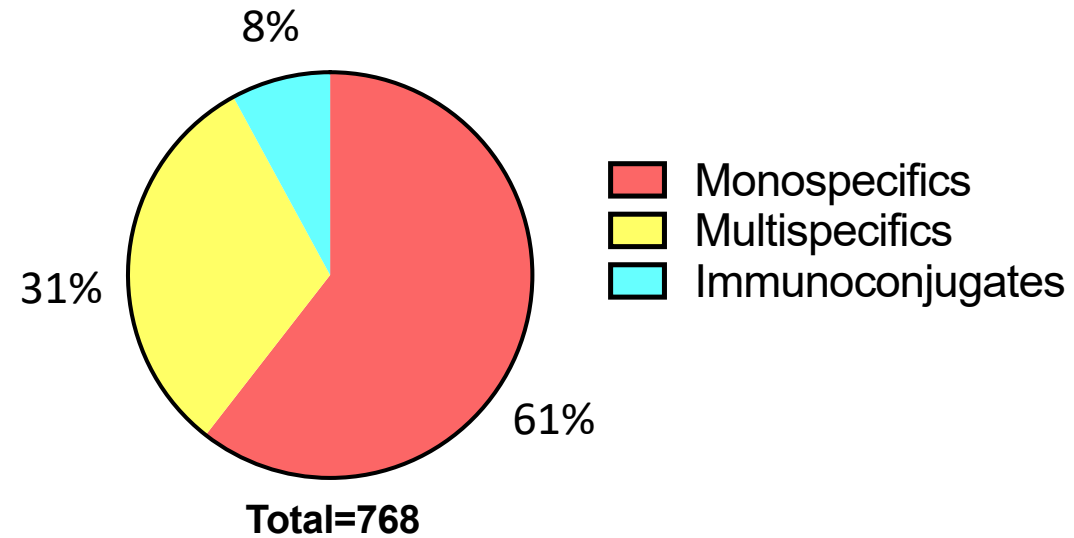


 Approved, in regulatory review, in late-stage studies  
 Unique

# Antibodies for cancer indication

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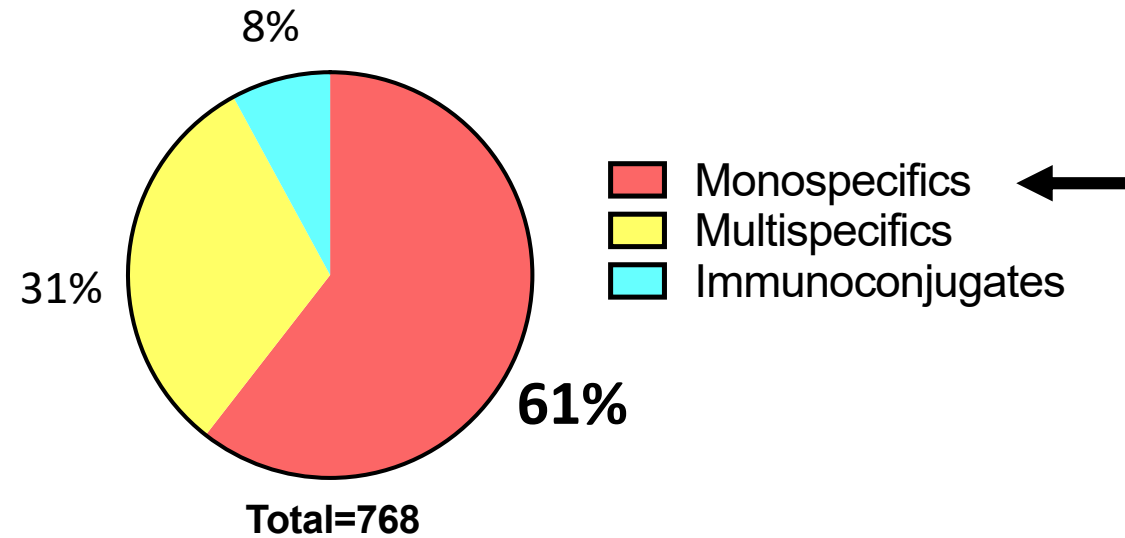
Format overview





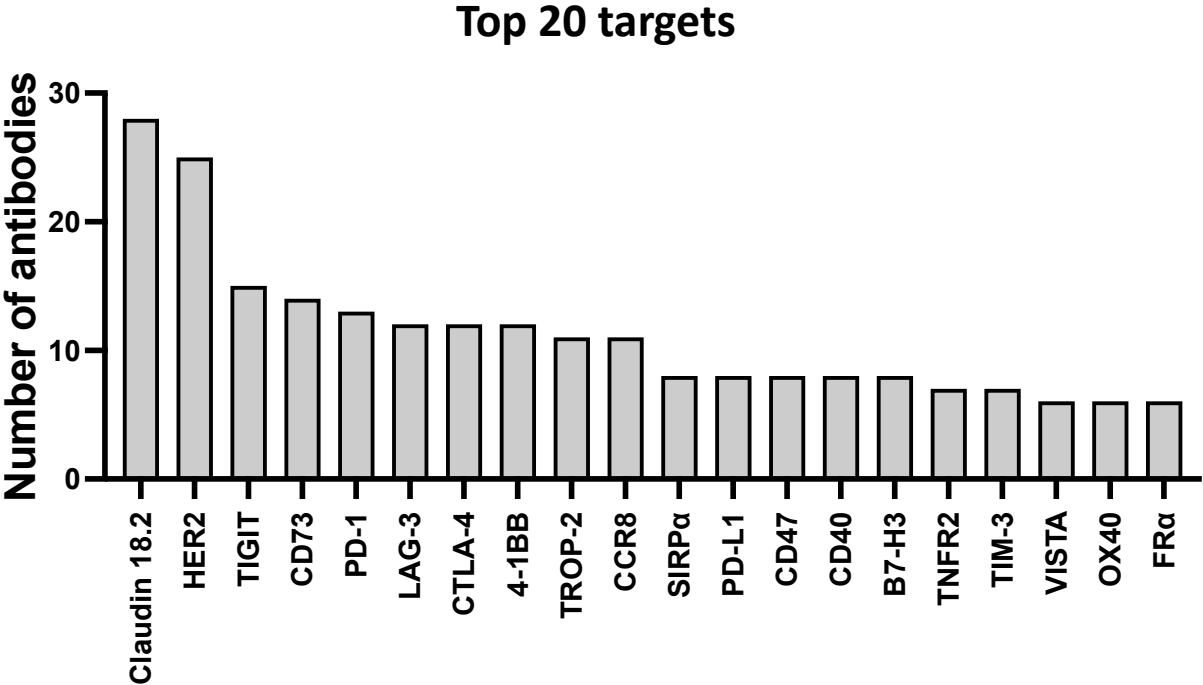
# Antibodies for cancer indication

Format overview



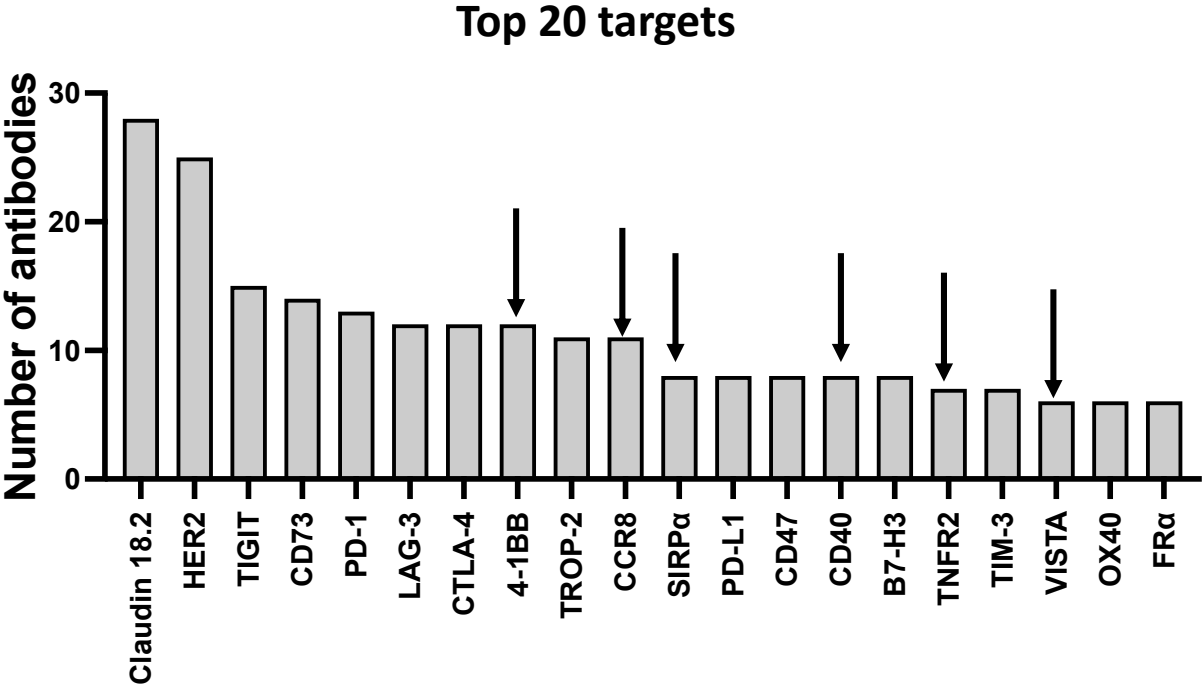
# Monospecific antibodies

Target overview



# Monospecific antibodies

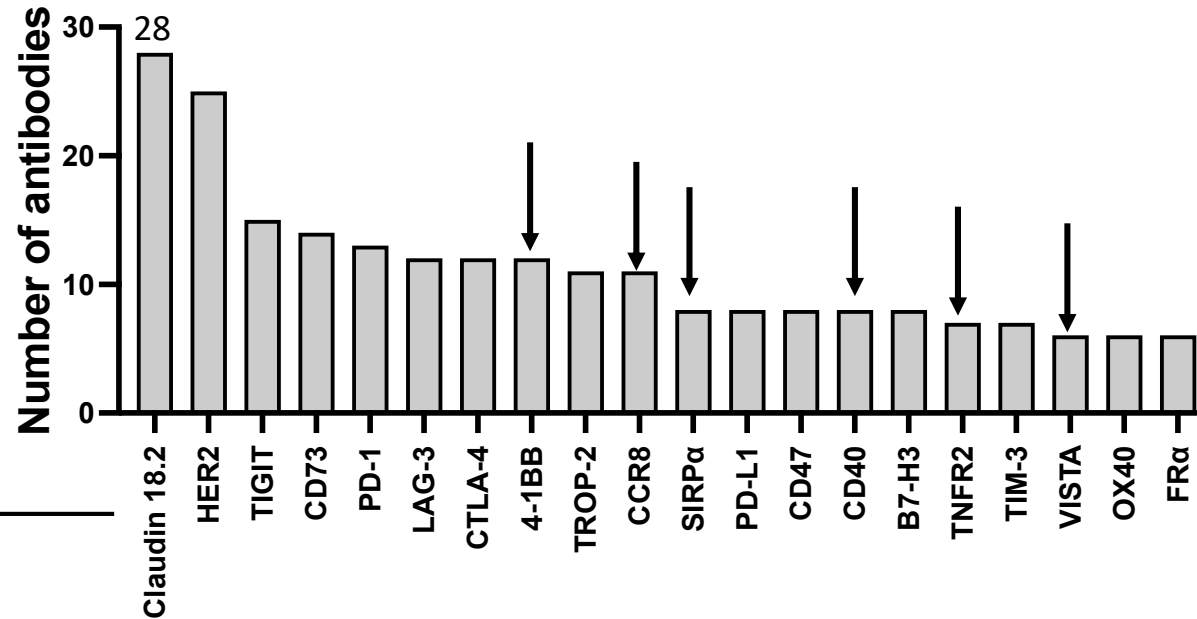
Target overview



# Monospecific antibodies

## Target overview

Top 20 targets

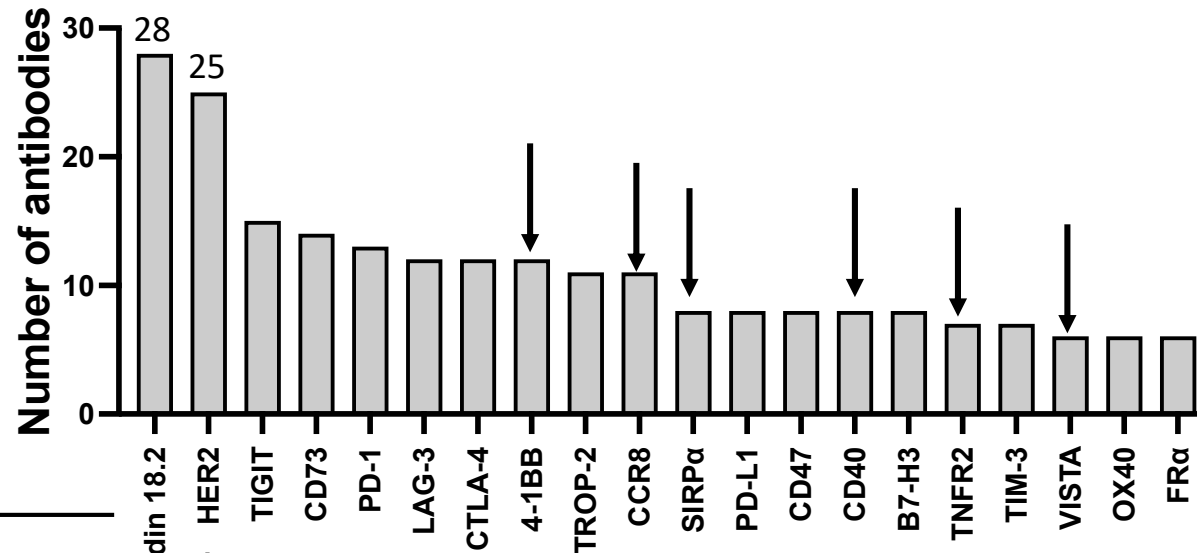


Claudin 18.2  
1 in regulatory  
review in Japan

# Monospecific antibodies

## Target overview

Top 20 targets

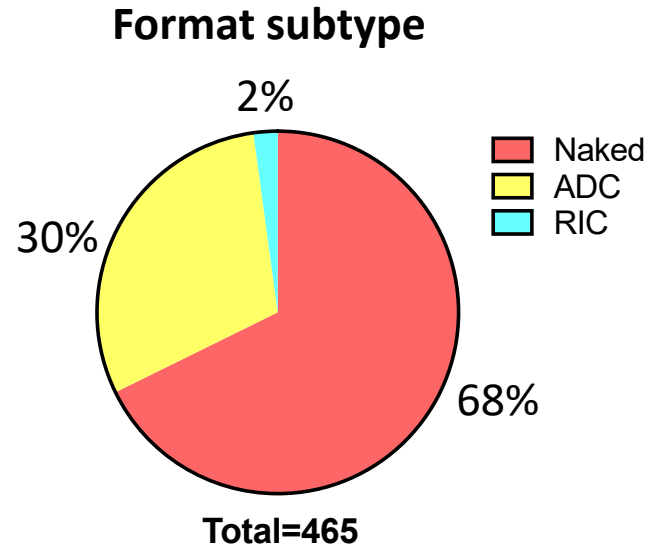


Claudin 18.2  
1 in regulatory  
review in Japan

HER2  
14 in late stage,  
regulatory review  
or approved

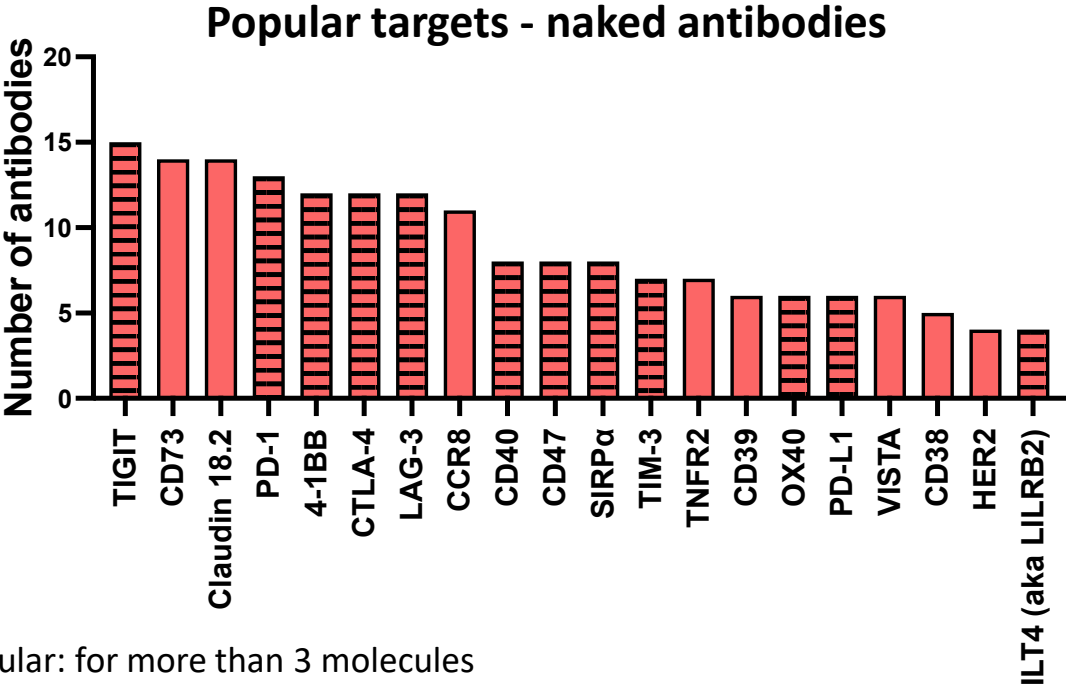
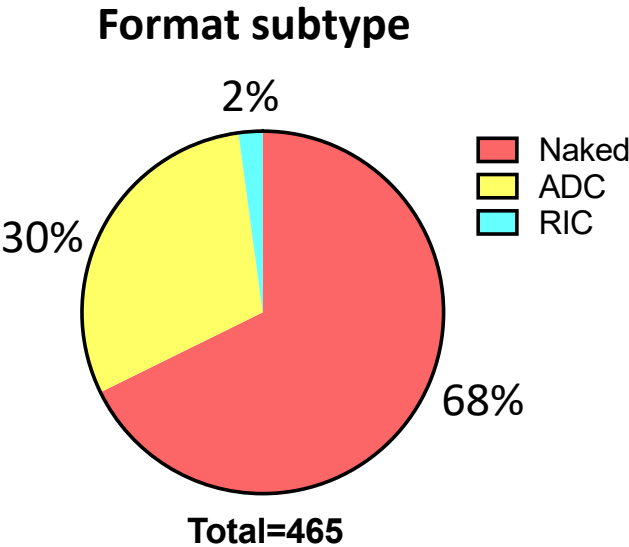
# Monospecific antibodies

Target overview  
by format subtype

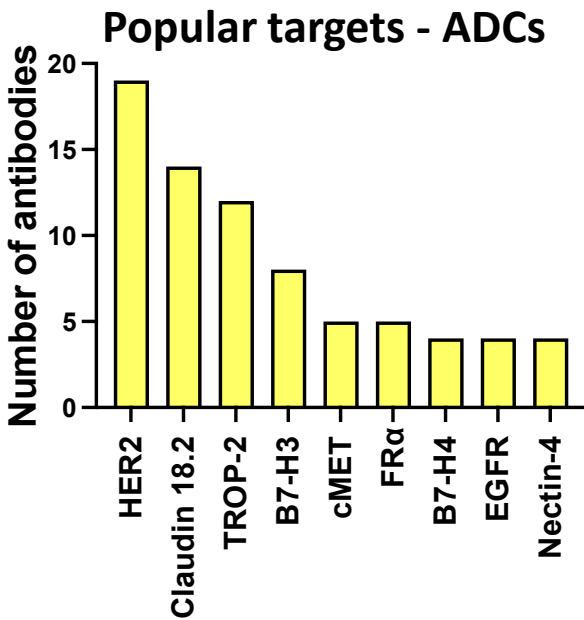


# Monospecific antibodies

Target overview  
by format subtype

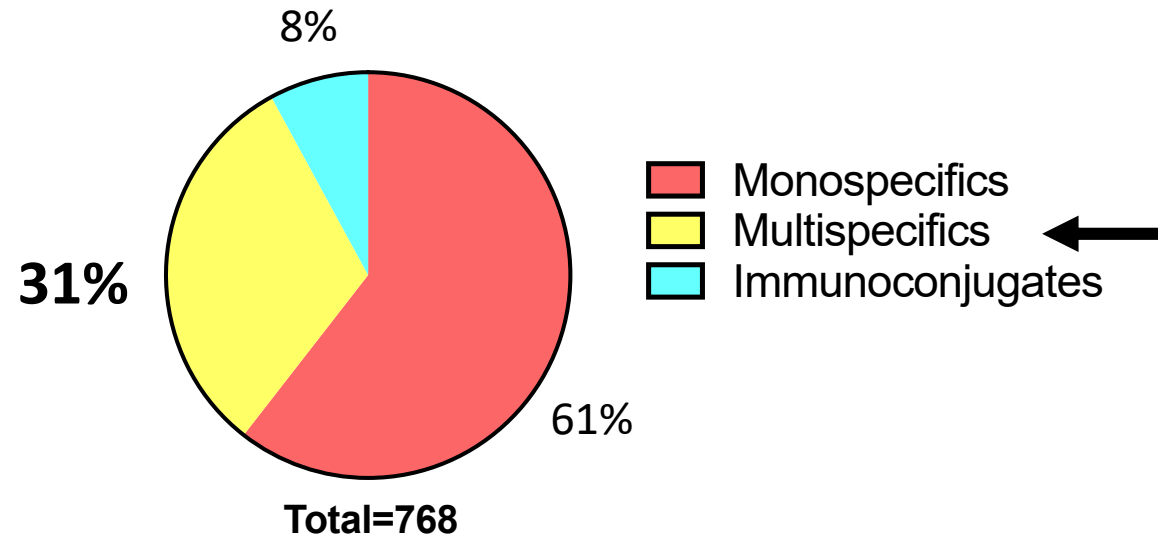


Popular: for more than 3 molecules



# Antibodies for cancer indication

Format overview





# Multispecific antibodies

Bispecifics, trispecifics, tetraspecifics

# Multispecific antibodies

Bispecifics, trispecifics, tetraspecifics

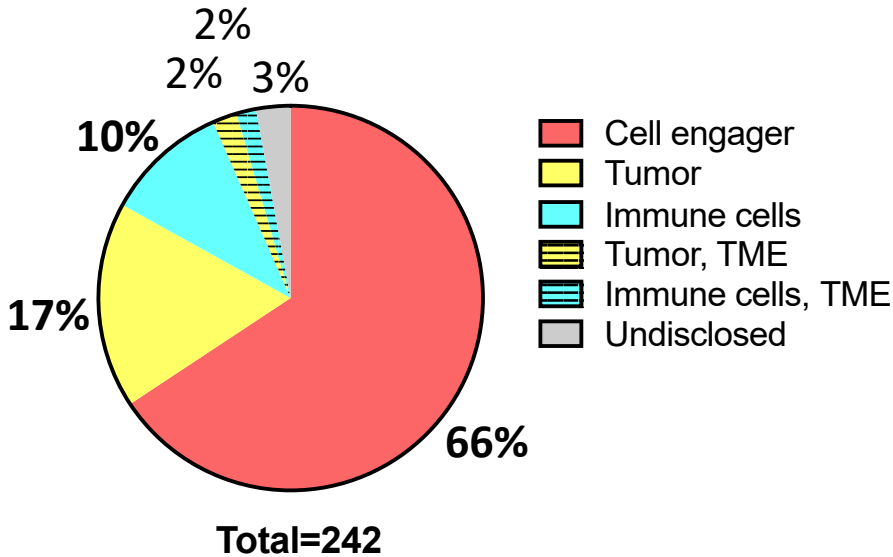


88%

# Multispecific antibodies

Bispecifics, trispecifics, tetraspecifics

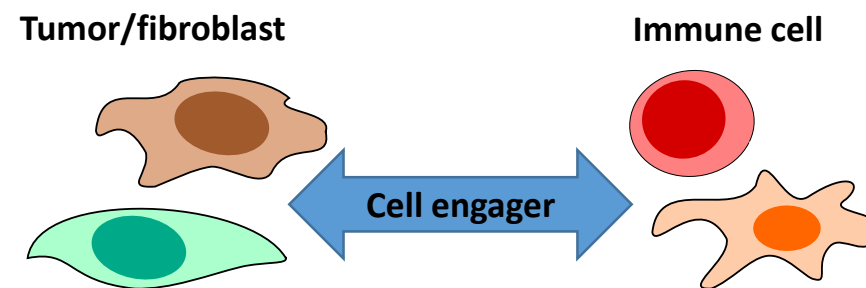
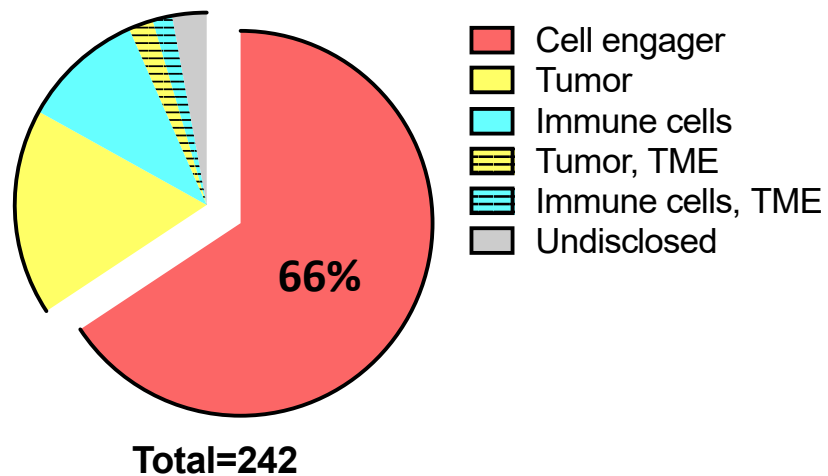
Type of target overview



## Cell engagers

## Multispecific antibodies

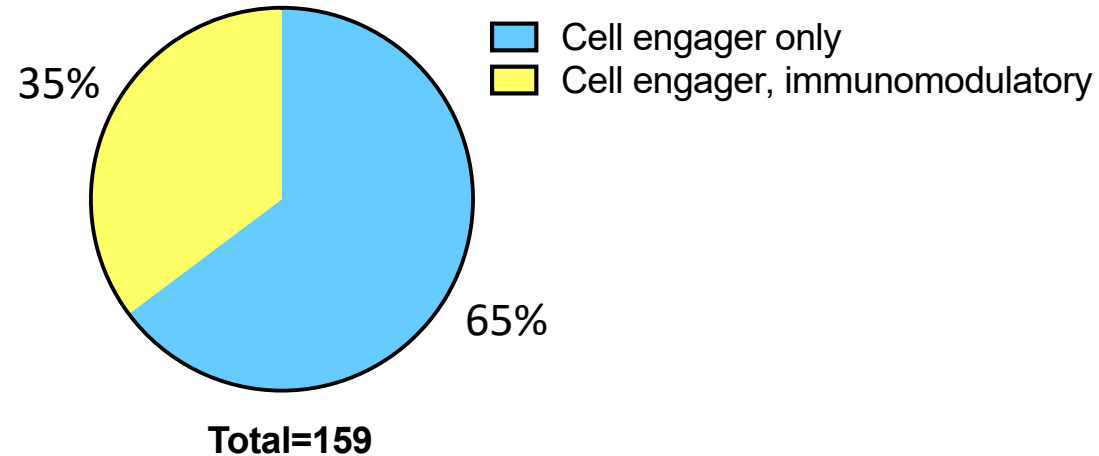
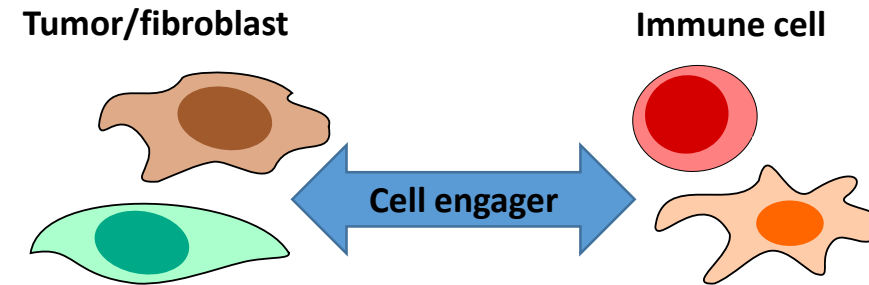
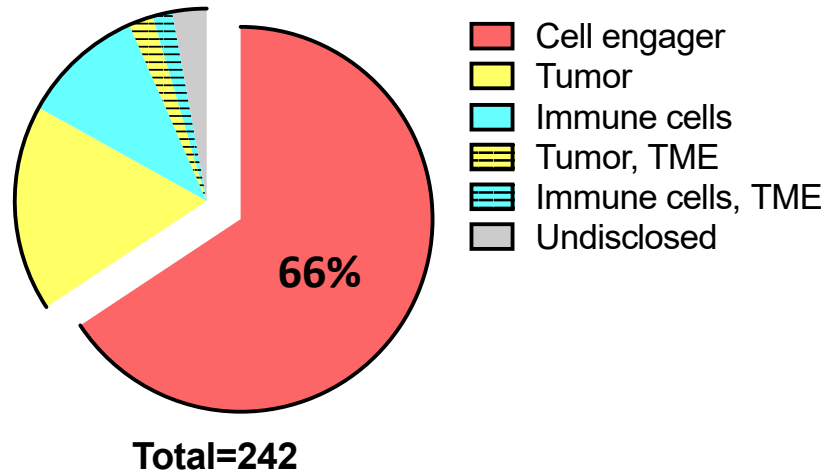
Bispecifics, trispecifics, quadrispecifics



**Cell engagers**

# Multispecific antibodies

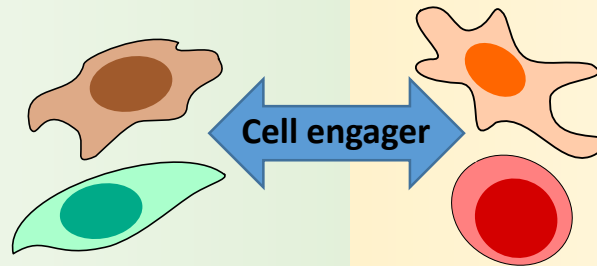
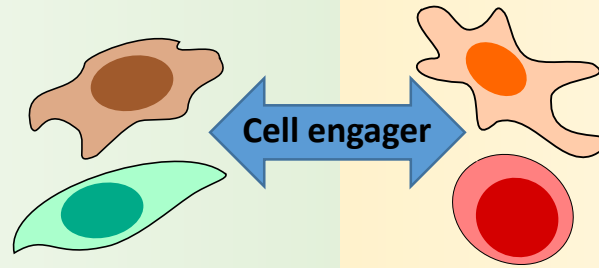
Bispecifics, trispecifics, quadrispecifics



# Multispecific antibodies

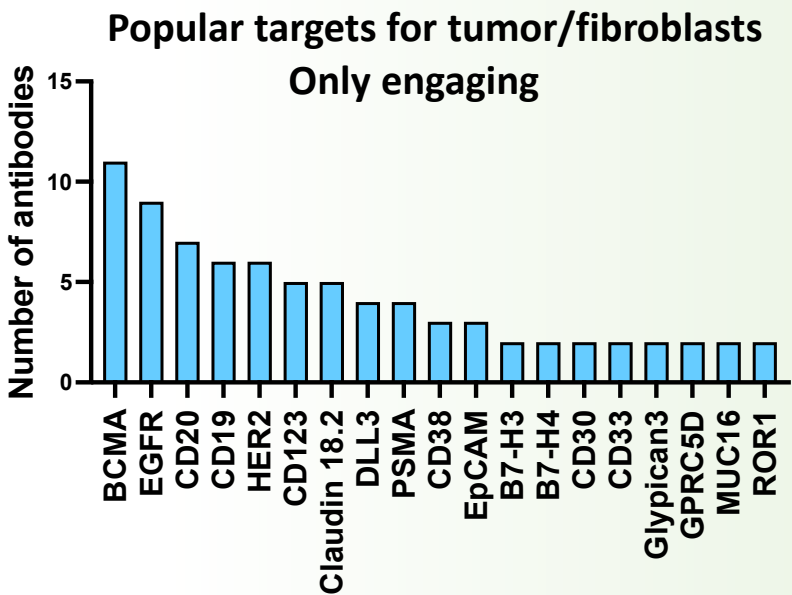
Tumor/fibroblast

Immune cell



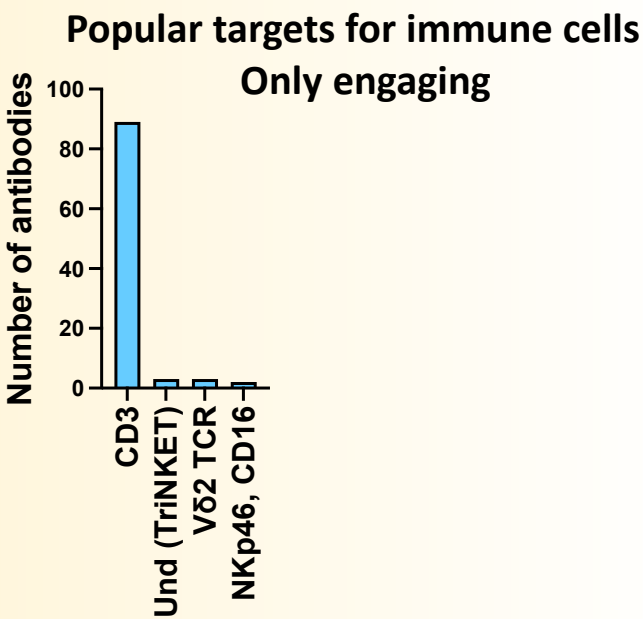
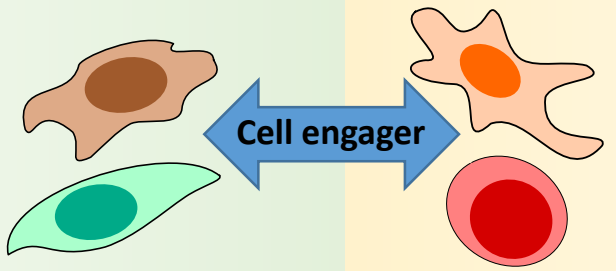
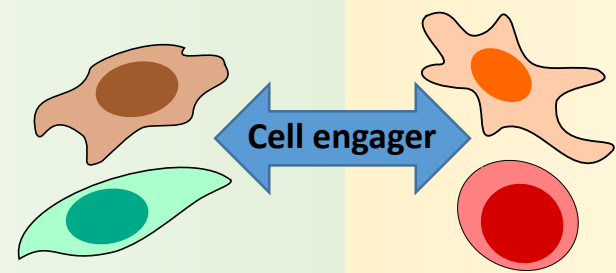
Cell engagers

# Multispecific antibodies



Tumor/fibroblast

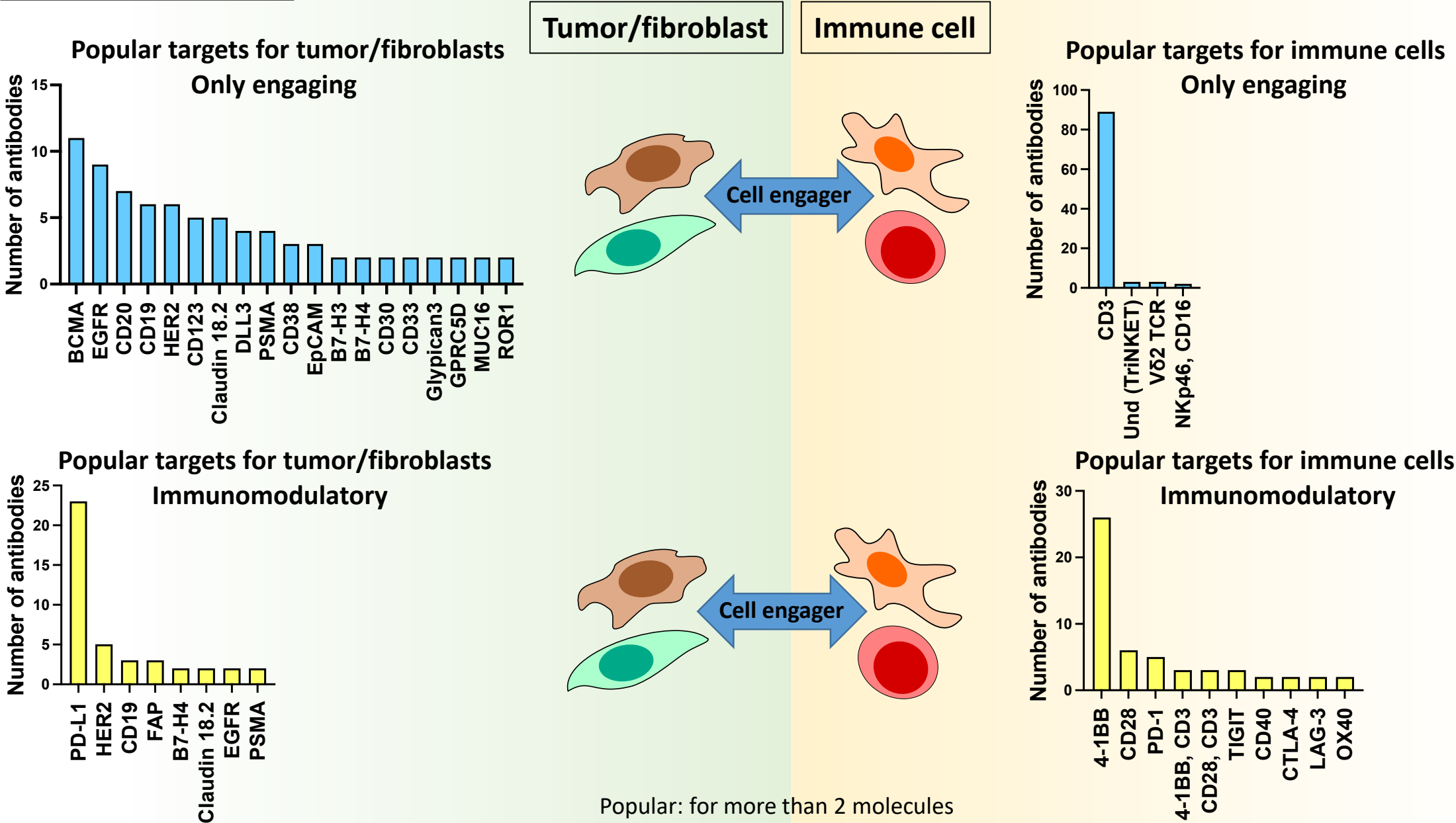
Immune cell



Popular: for more than 2 molecules

Cell engagers

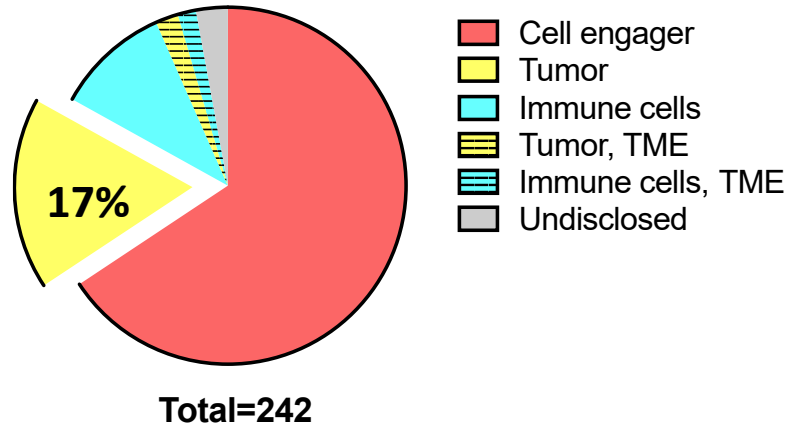
# Multispecific antibodies





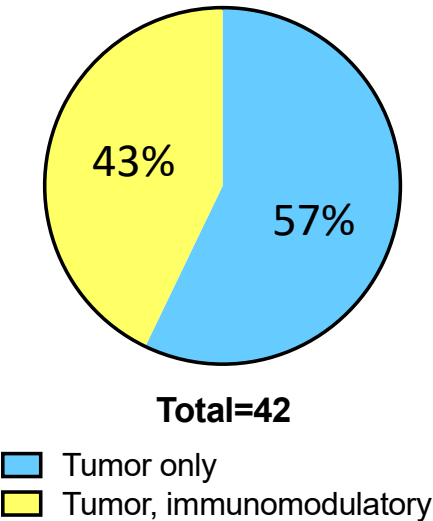
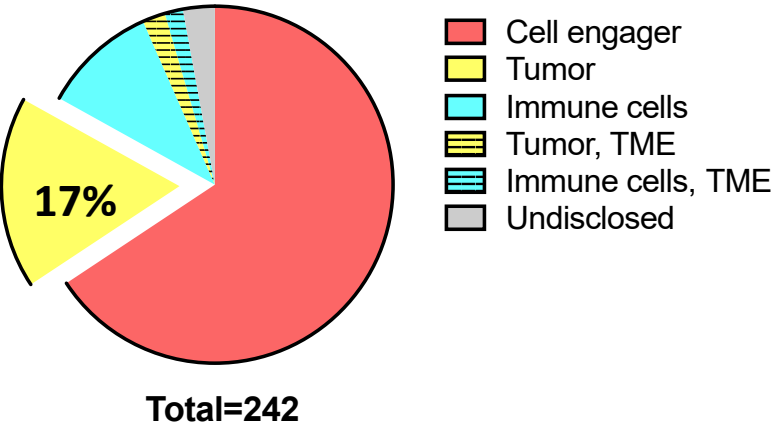
# Multispecific antibodies

## Targeting the tumor



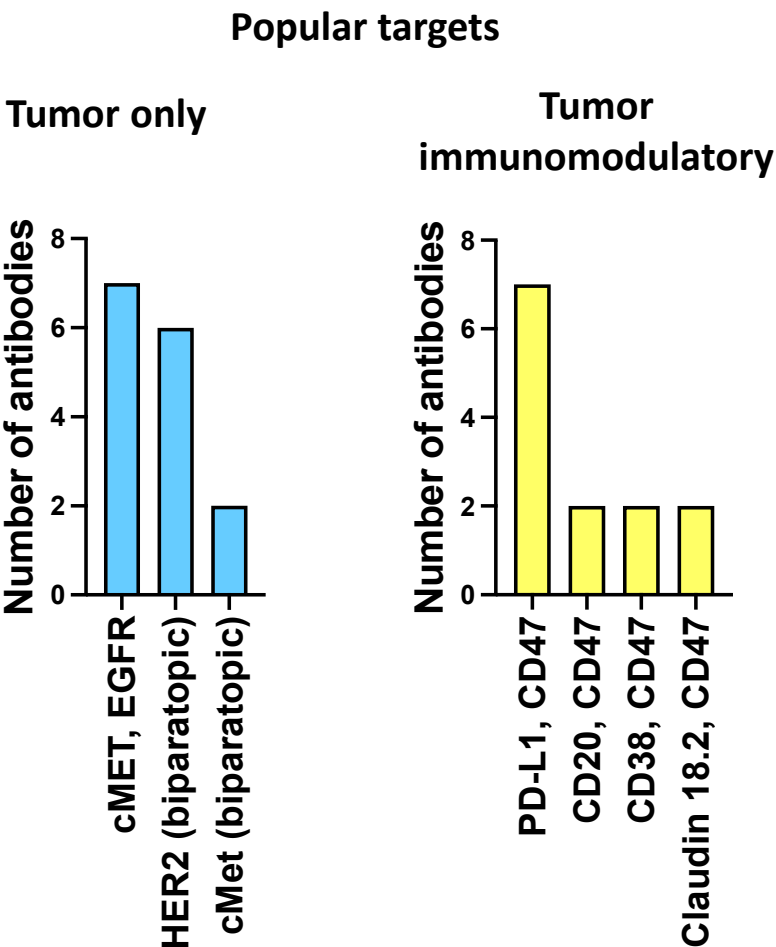
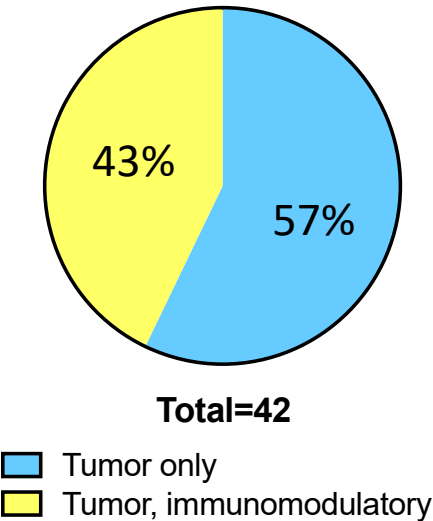
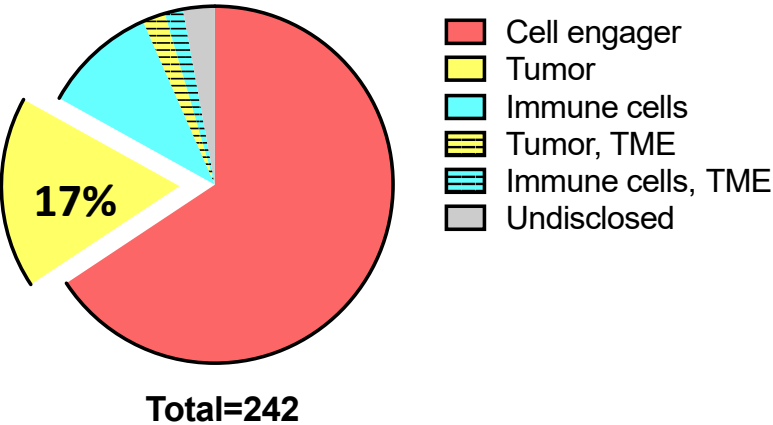
# Multispecific antibodies

Targeting the tumor



# Multispecific antibodies

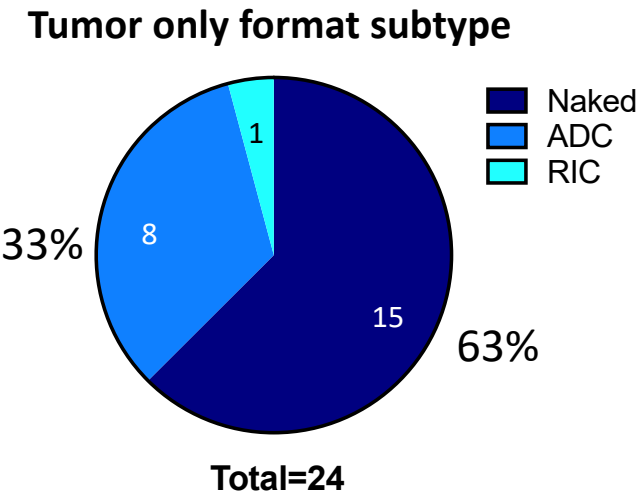
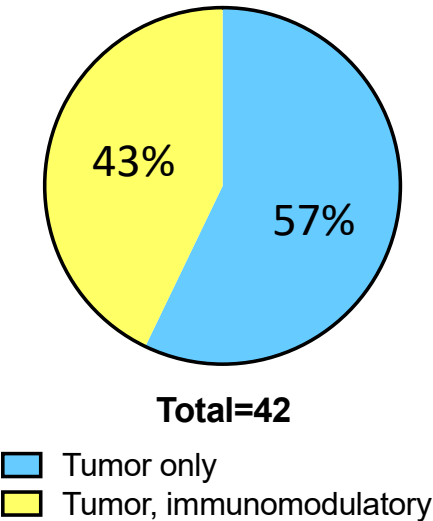
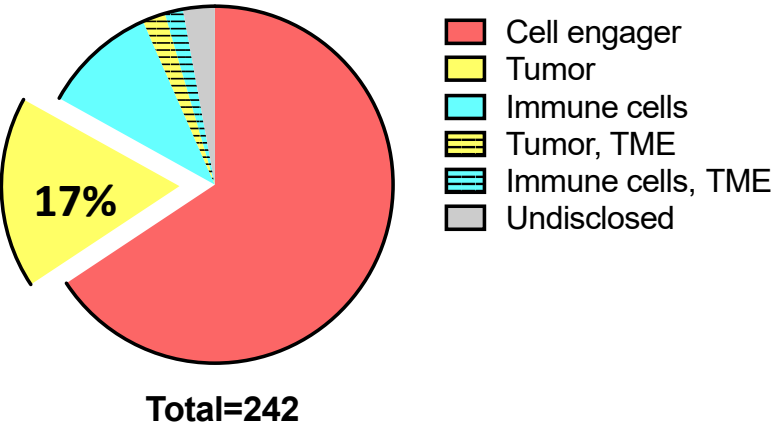
Targeting the tumor



Popular: for more than 2 molecules

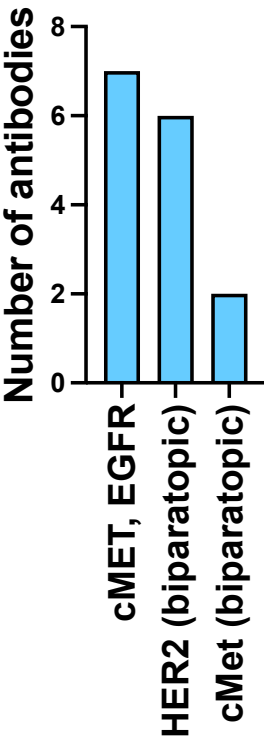
# Multispecific antibodies

Targeting the tumor

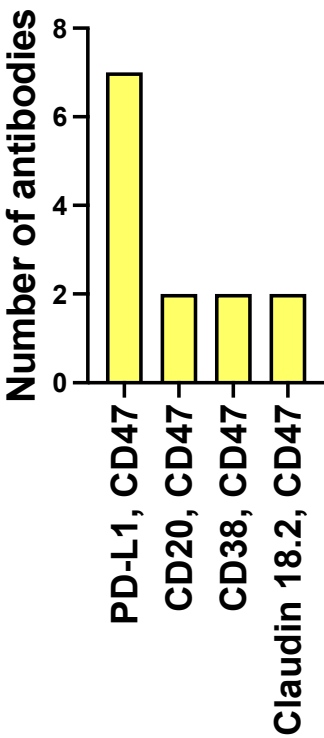


## Popular targets

### Tumor only



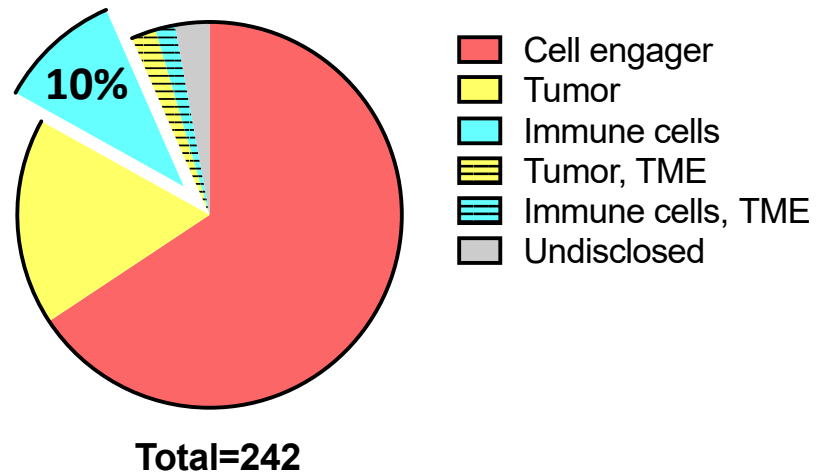
### Tumor immunomodulatory



Popular: for more than 2 molecules

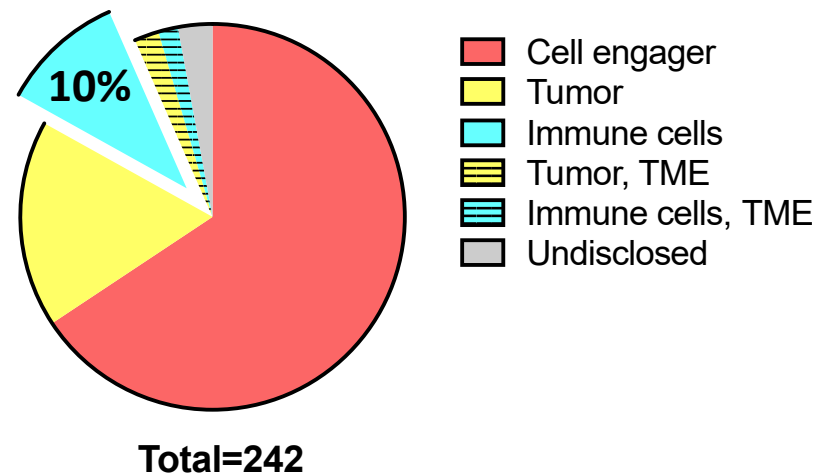
# Multispecific antibodies

Targeting immune cells

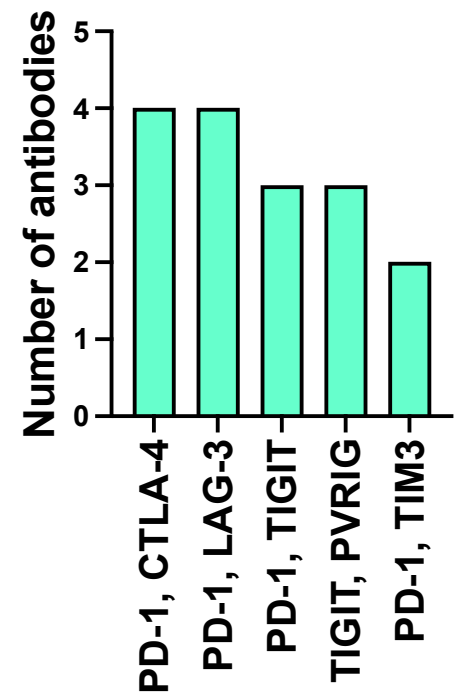


# Multispecific antibodies

Targeting immune cells



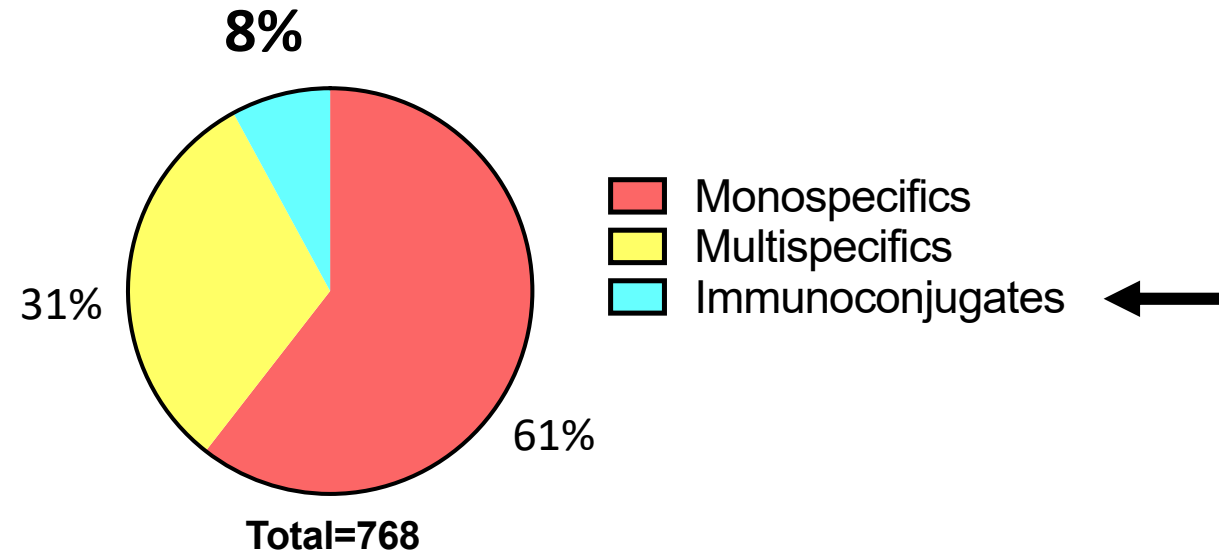
Popular targets



Popular: for more than 2 molecules

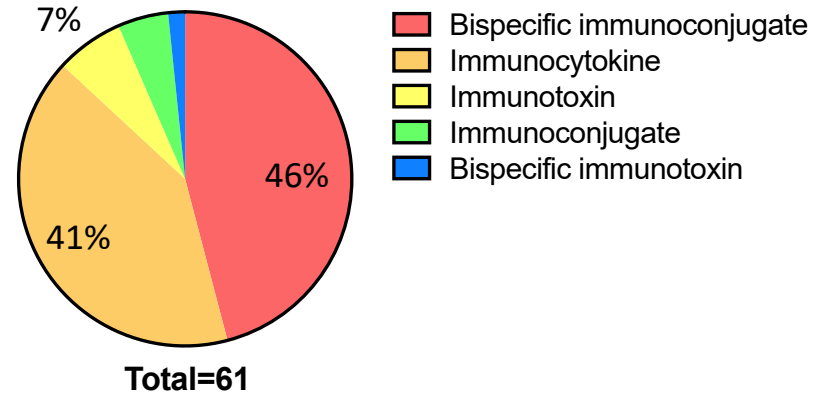
# Antibodies for cancer indication

Format overview



## Format and target overview

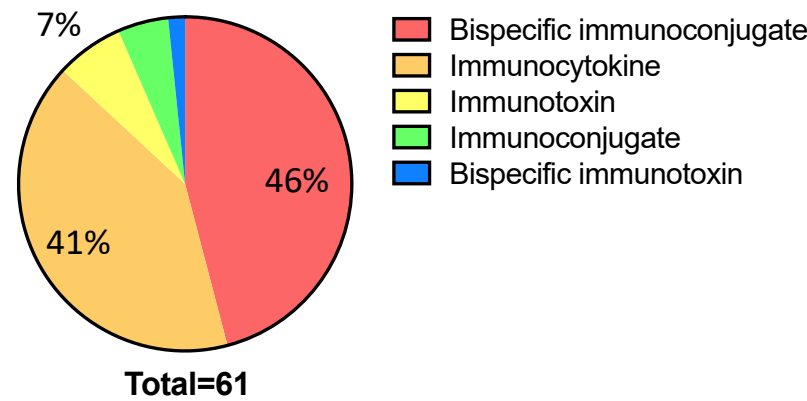
# Immunoconjugates



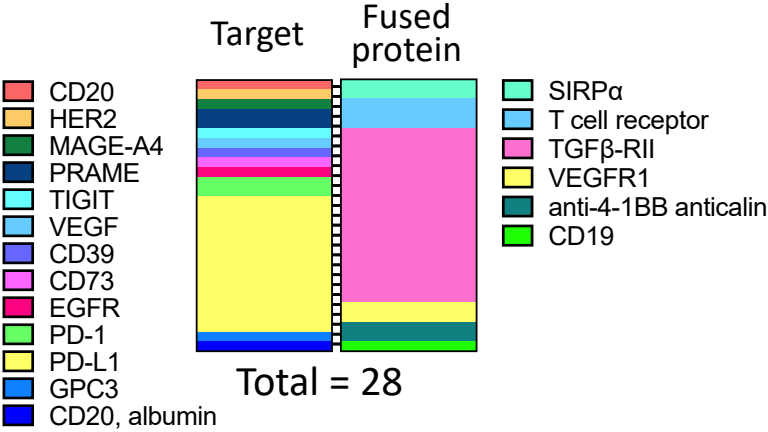


Format and target overview

# Immunoconjugates

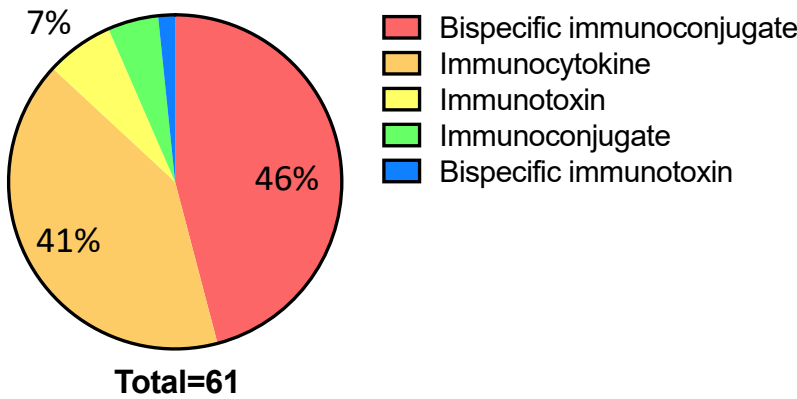


## Bispecific immunoconjugate

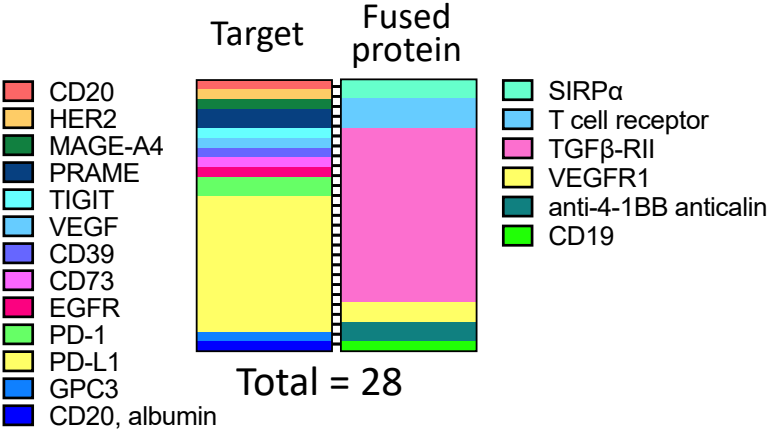


Format and target overview

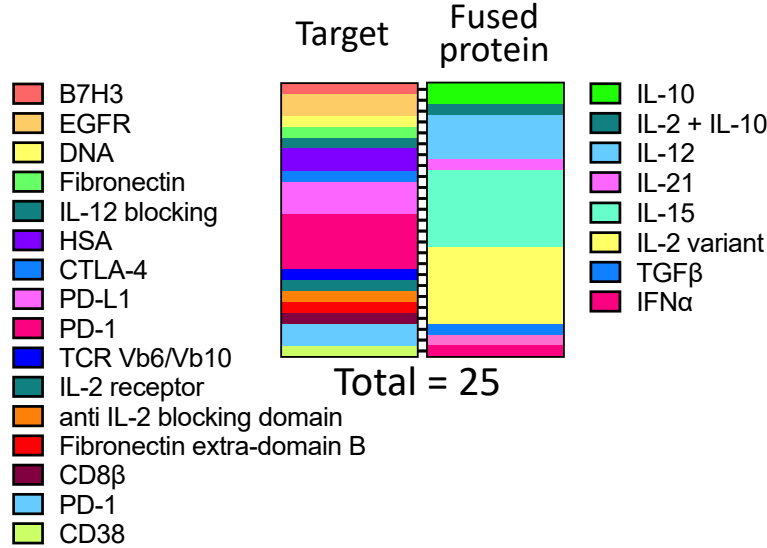
Immunoconjugates



Bispecific immunoconjugate

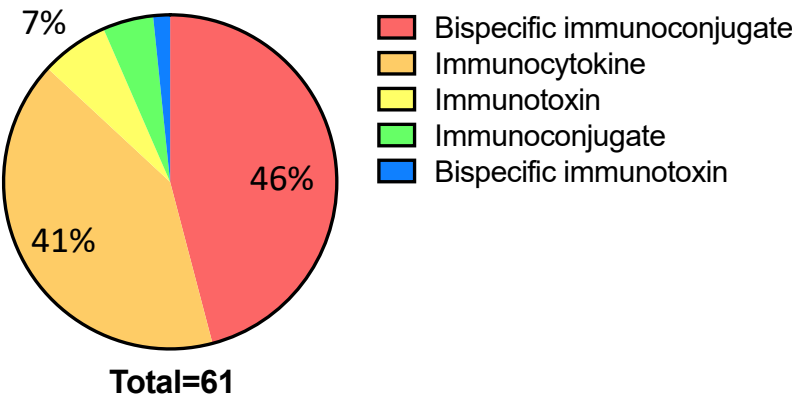


Immunocytokine

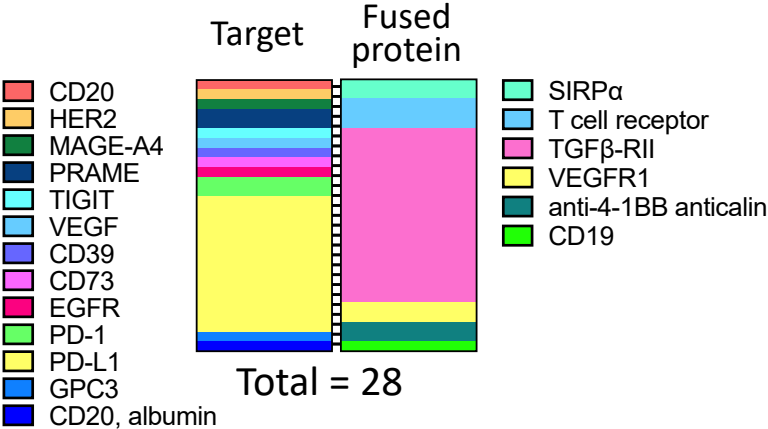


Format and target overview

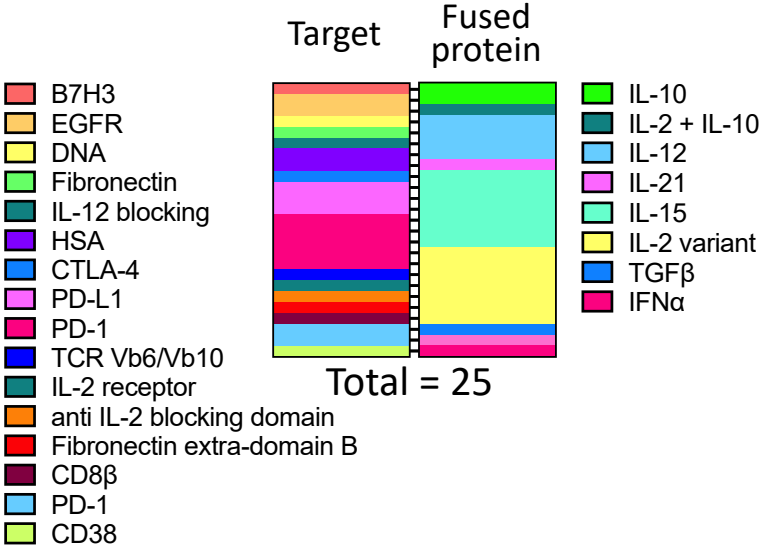
Immunoconjugates



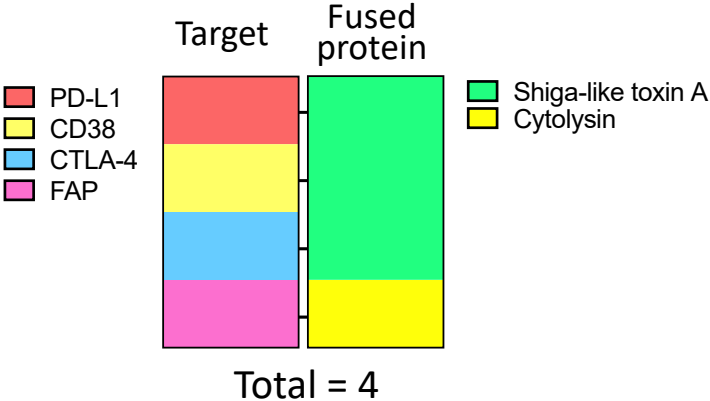
Bispecific immunoconjugate



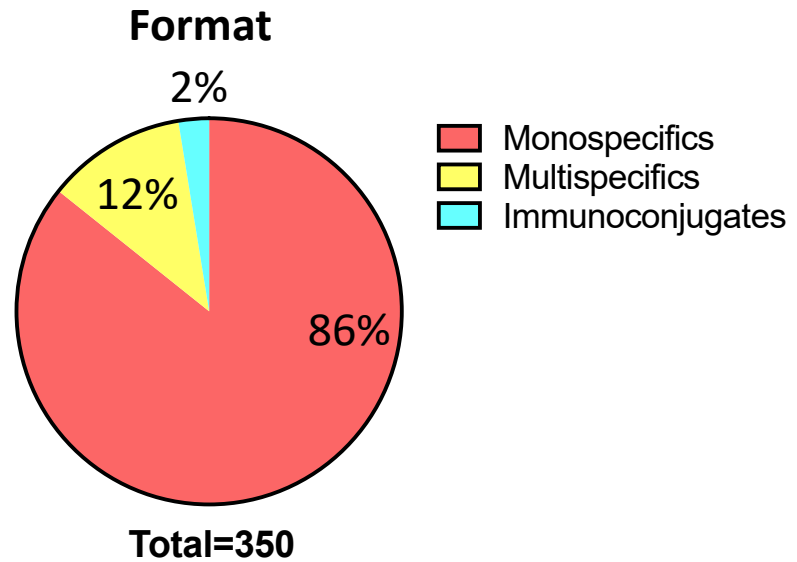
Immunocytokine



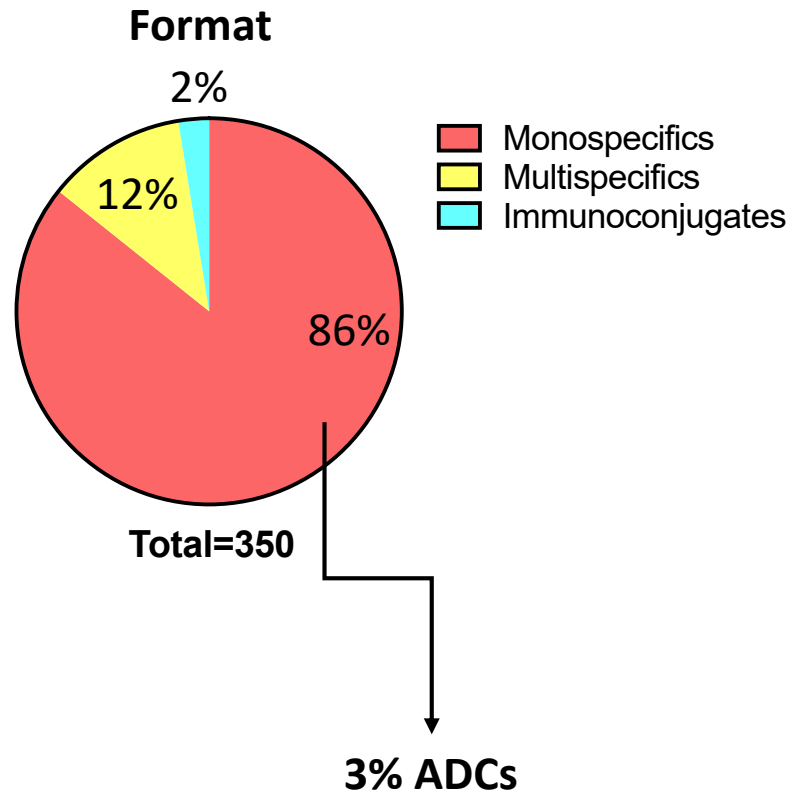
Immunotoxin



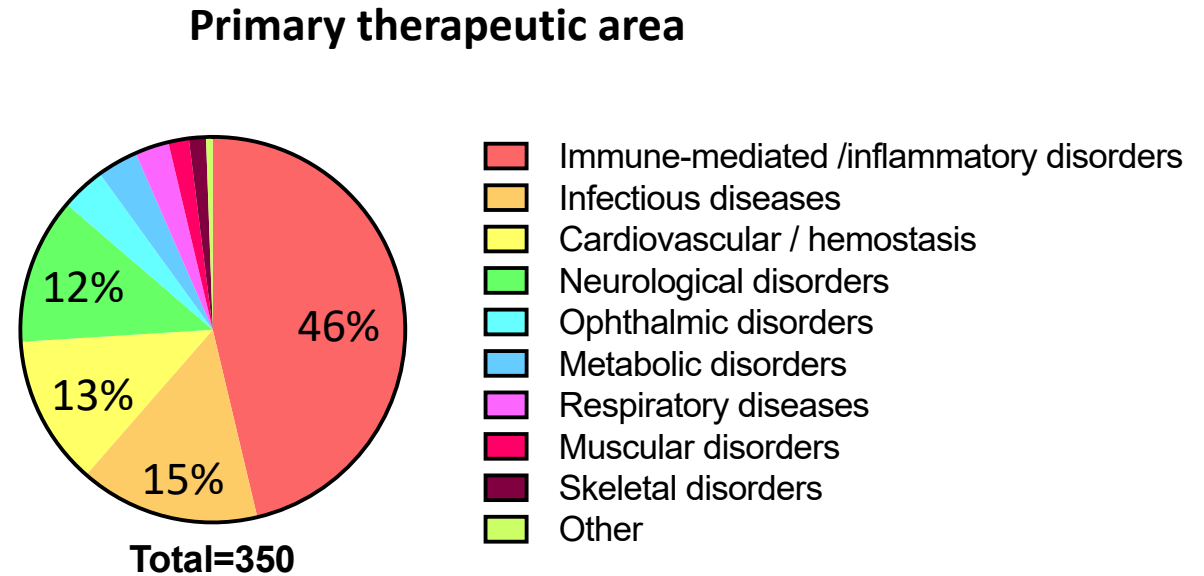
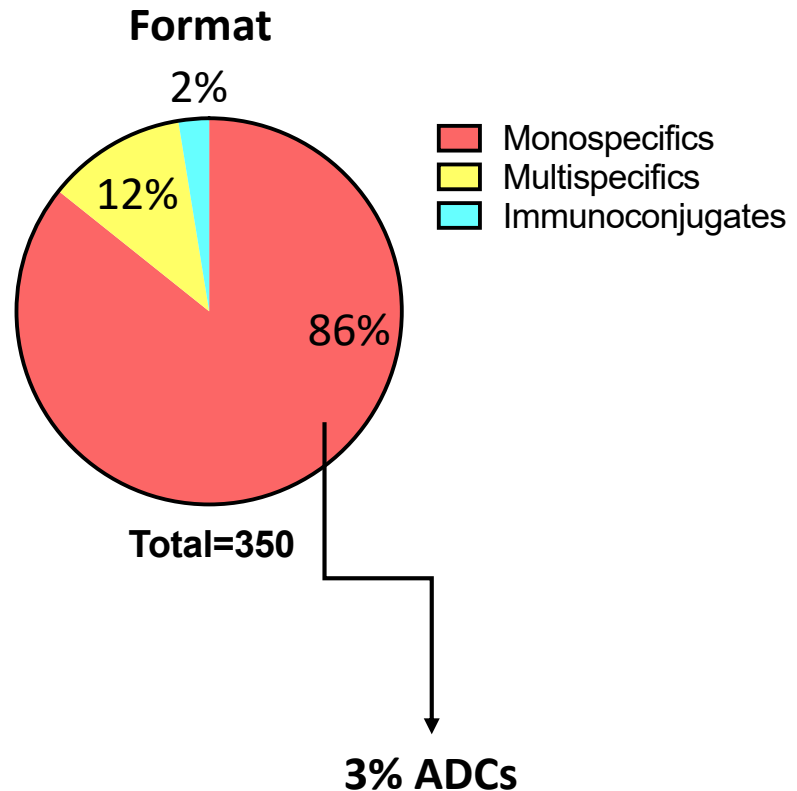
# Antibodies for non cancer indications



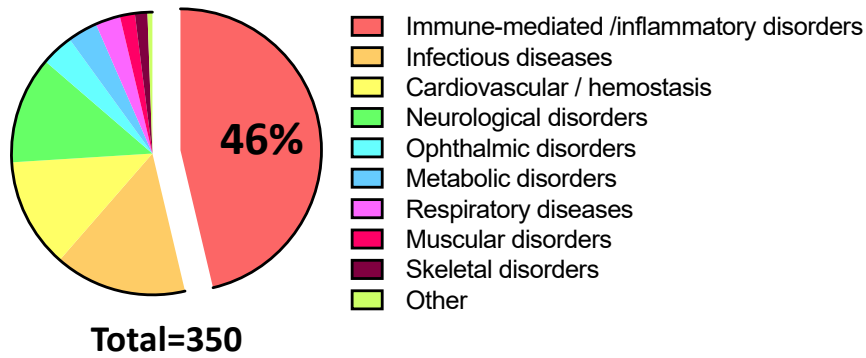
# Antibodies for non cancer indications



# Antibodies for non cancer indications

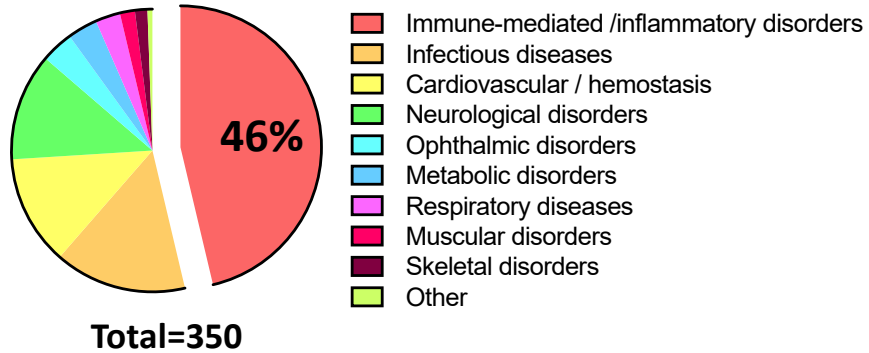


# Immune mediated / inflammatory disorders

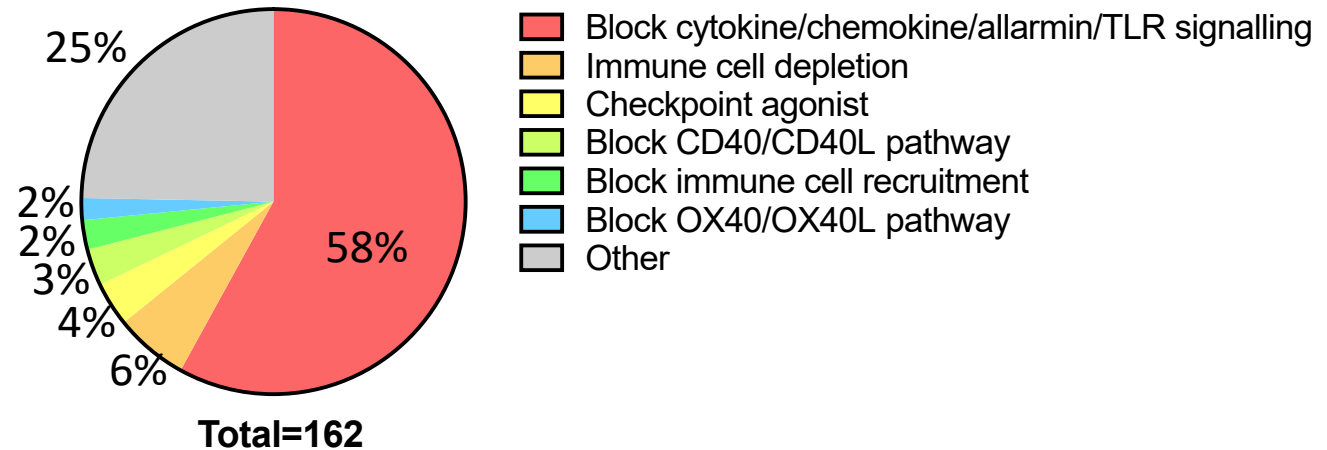


# Immune mediated / inflammatory disorders

## Mechanism of action overview

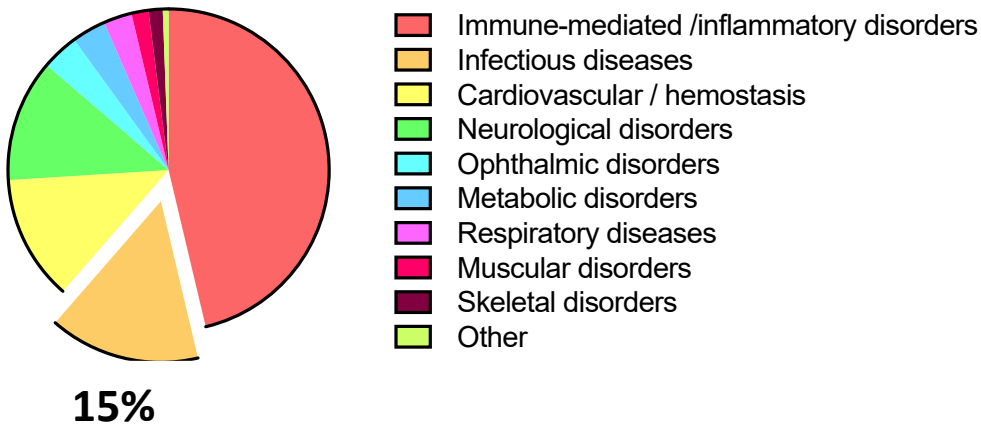


## Mechanism of action



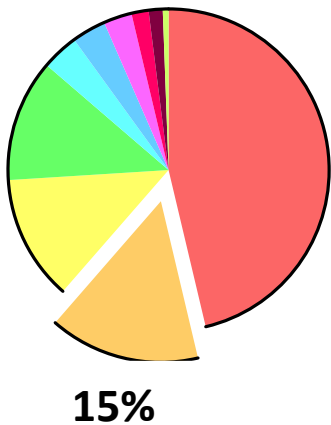


# Infectious diseases

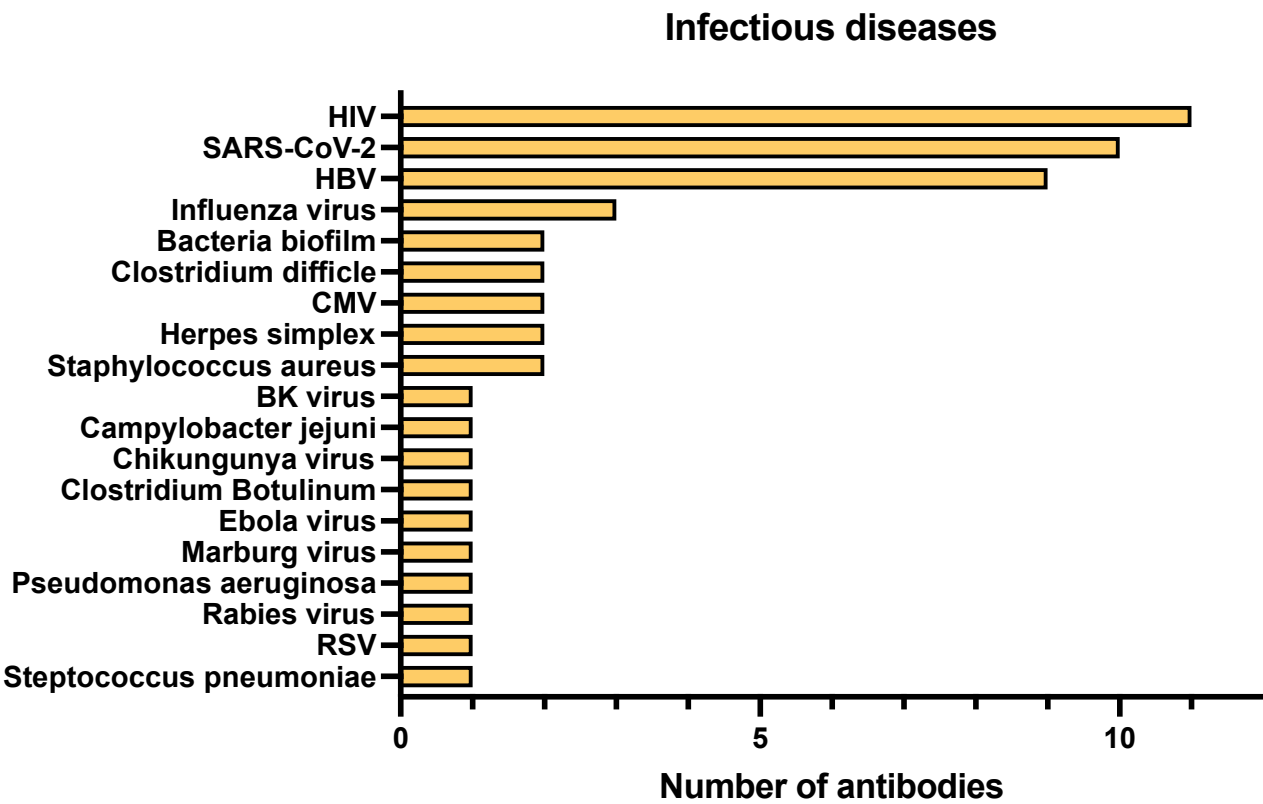


# Infectious diseases

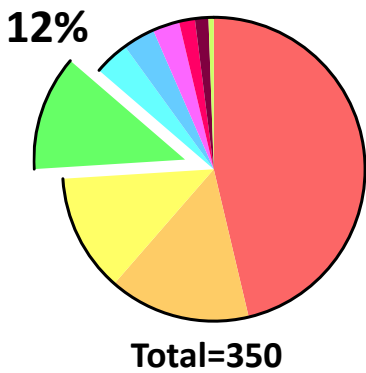
Target pathogen overview



- Immune-mediated /inflammatory disorders
- Infectious diseases
- Cardiovascular / hemostasis
- Neurological disorders
- Ophthalmic disorders
- Metabolic disorders
- Respiratory diseases
- Muscular disorders
- Skeletal disorders
- Other



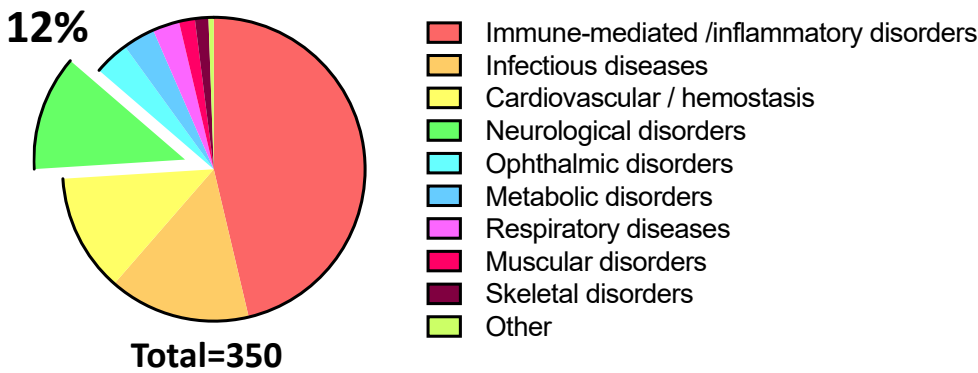
# Neurological disorders



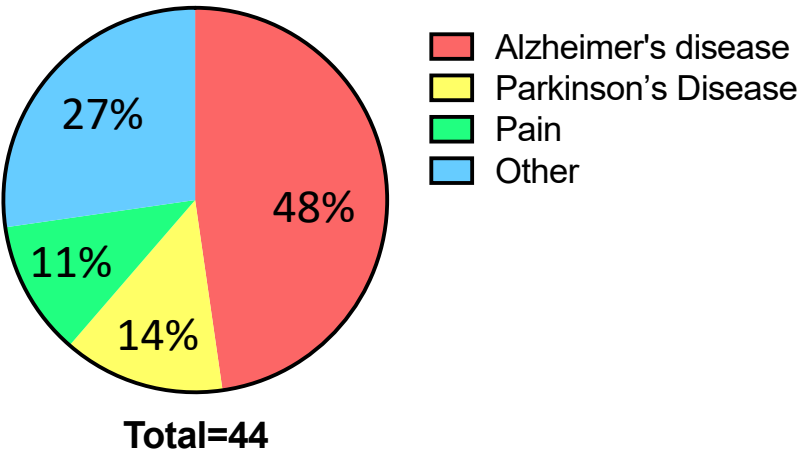
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- Infectious diseases
- Cardiovascular / hemostasis
- Neurological disorders
- Ophthalmic disorders
- Metabolic disorders
- Respiratory diseases
- Muscular disorders
- Skeletal disorders
- Other

# Neurological disorders

Target overview by indication

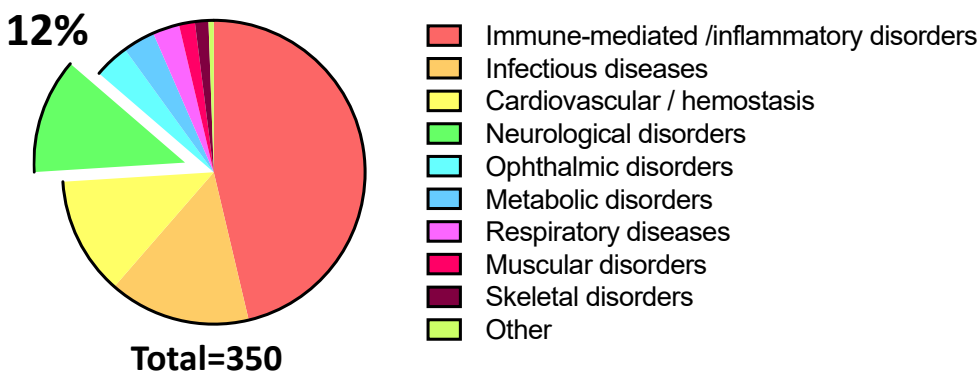


Primary indication

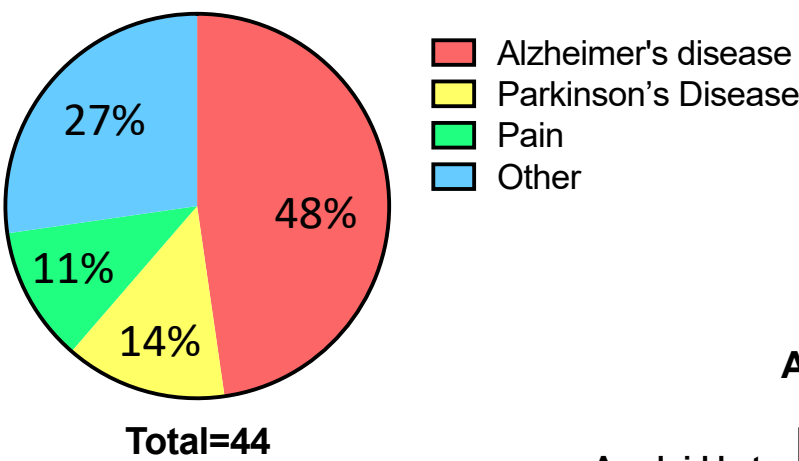


# Neurological disorders

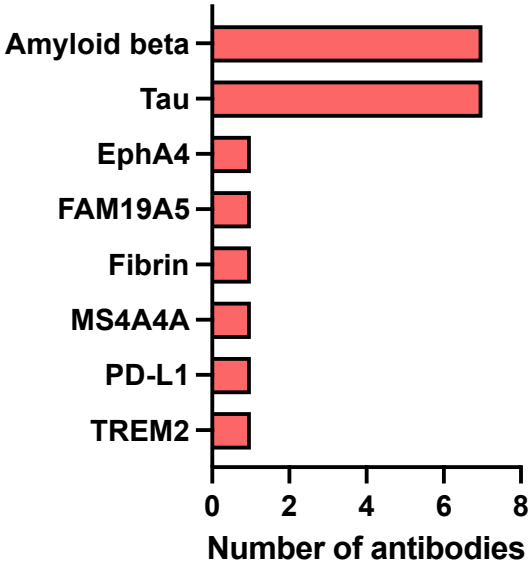
Target overview by indication



Primary indication

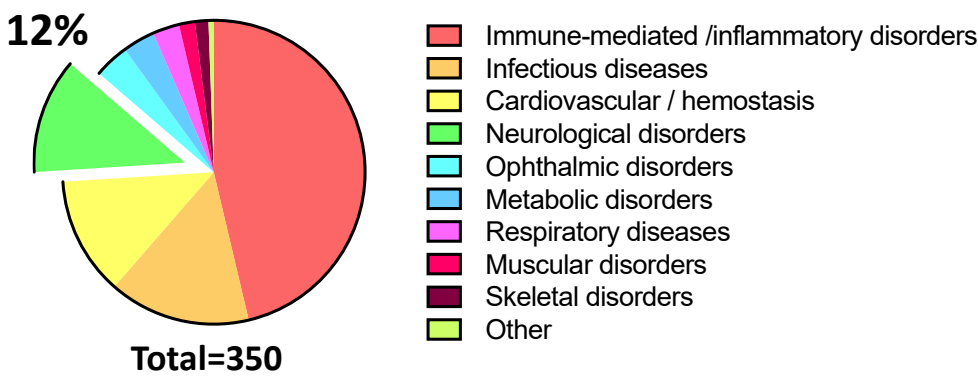


Alzheimer's disease

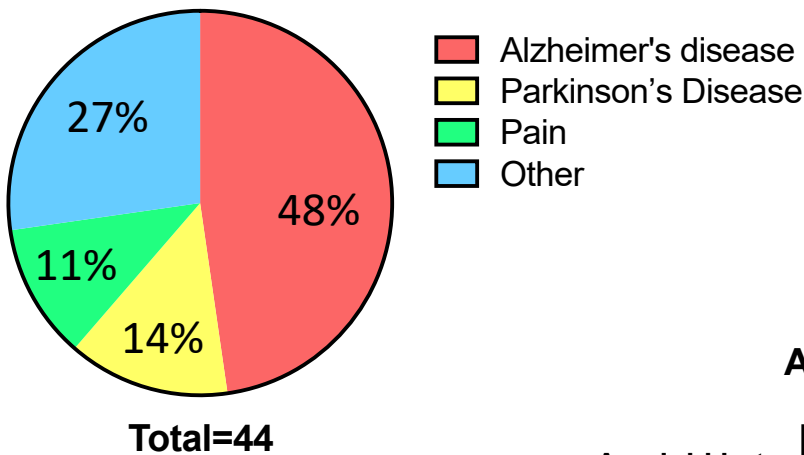


# Neurological disorders

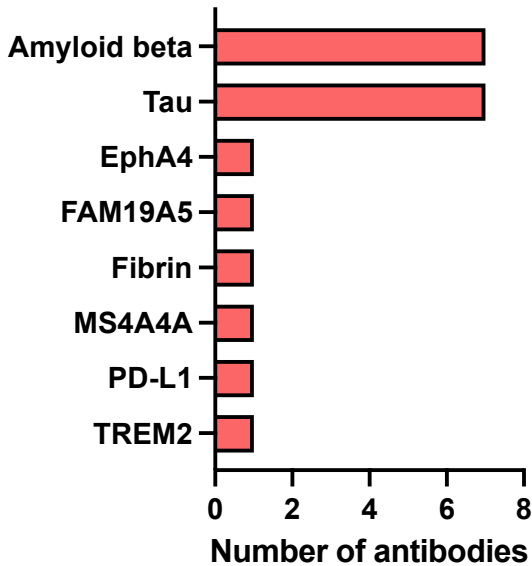
Target overview by indication



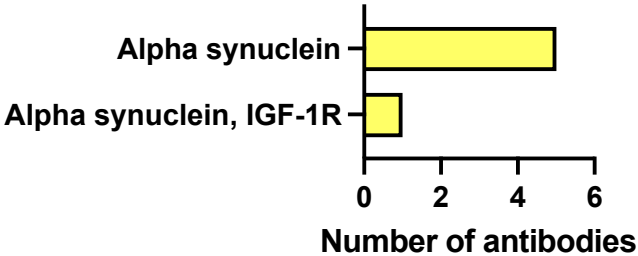
Primary indication



Alzheimer's disease

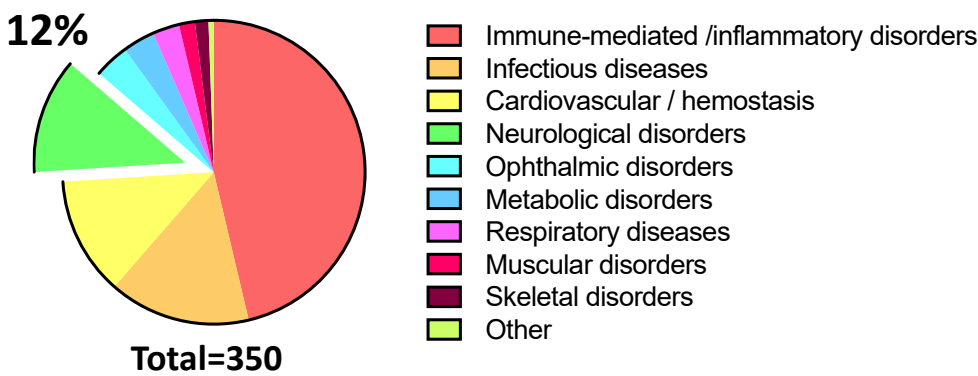


Parkinson disease

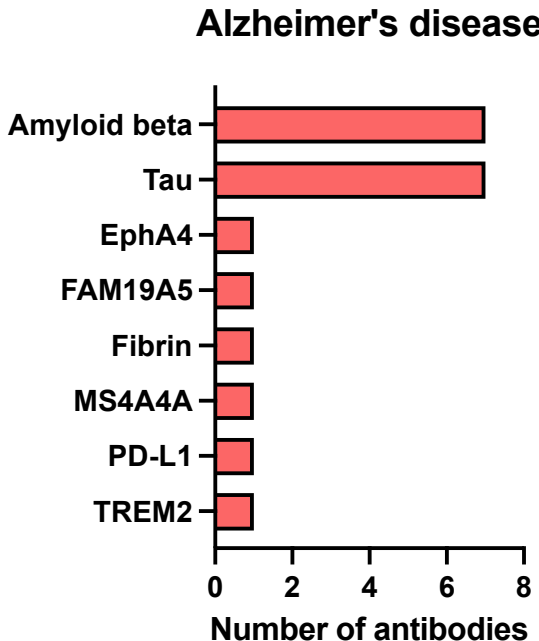
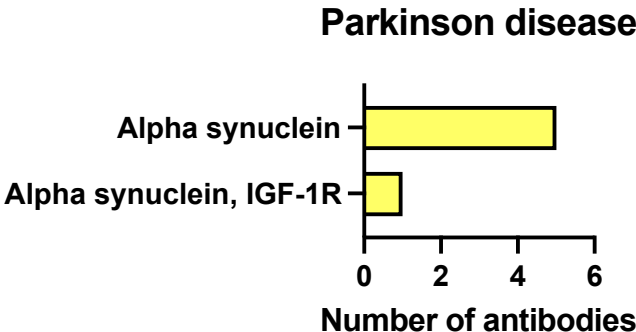
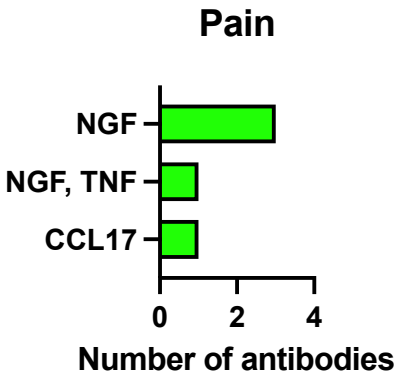
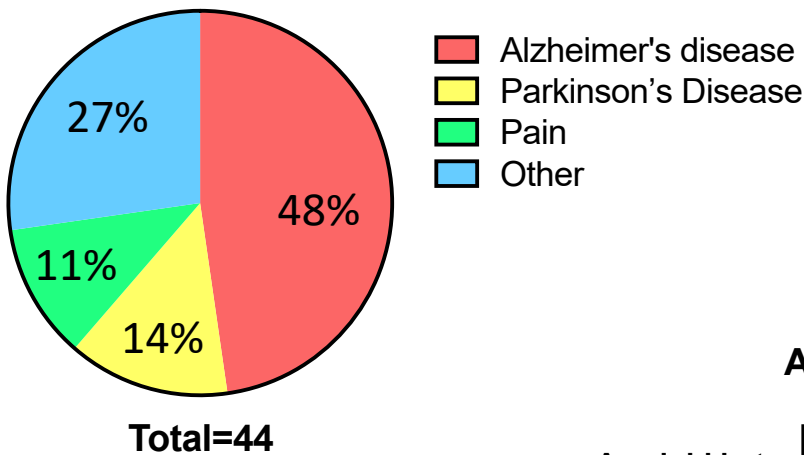


# Neurological disorders

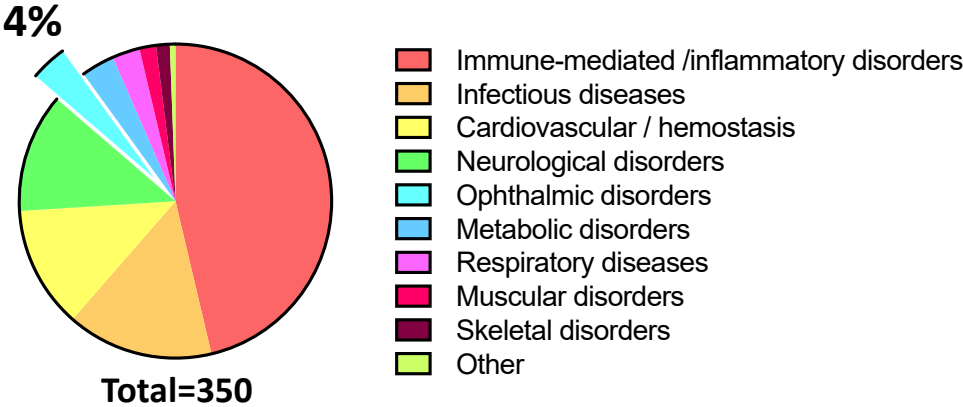
Target overview by indication



Primary indication



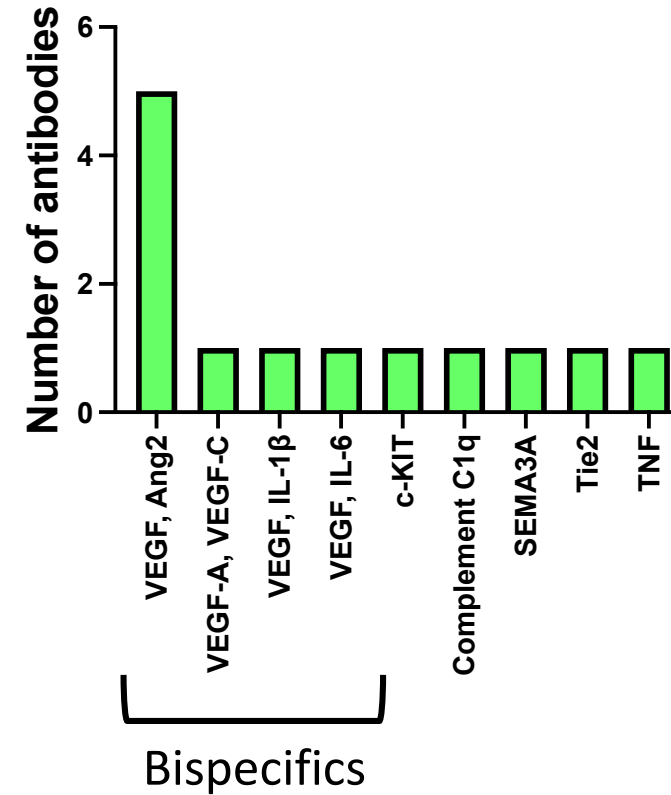
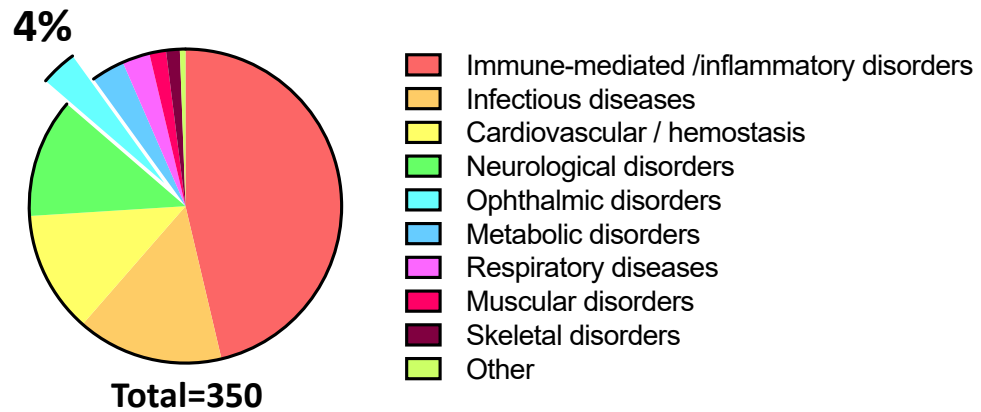
# Ophthalmic diseases



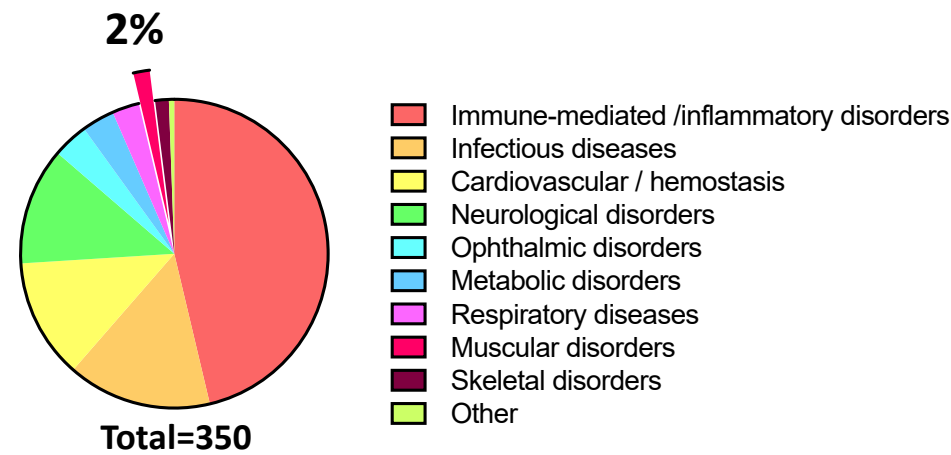


# Ophthalmic diseases

## Target and format overview

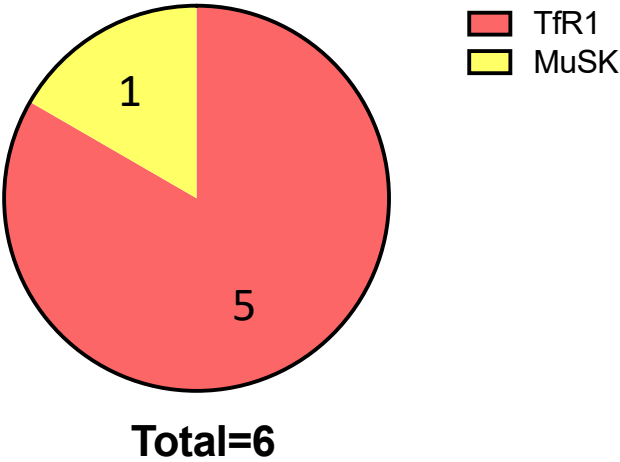
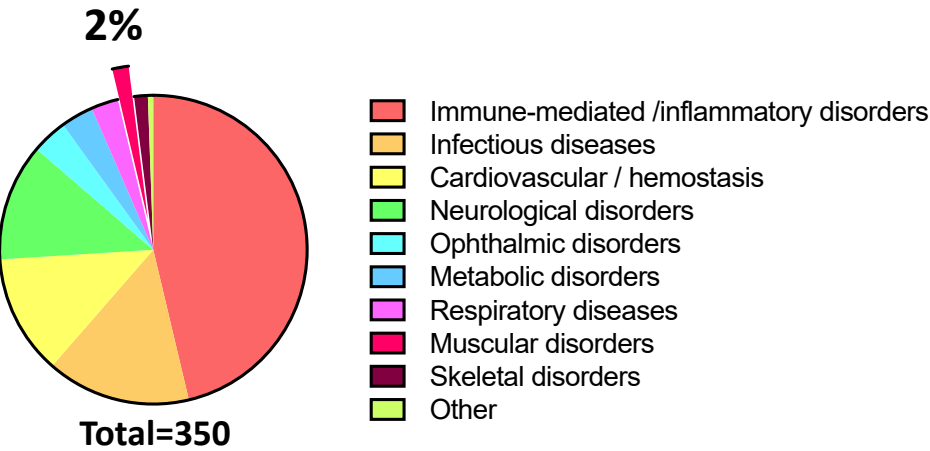


# Muscular disorders



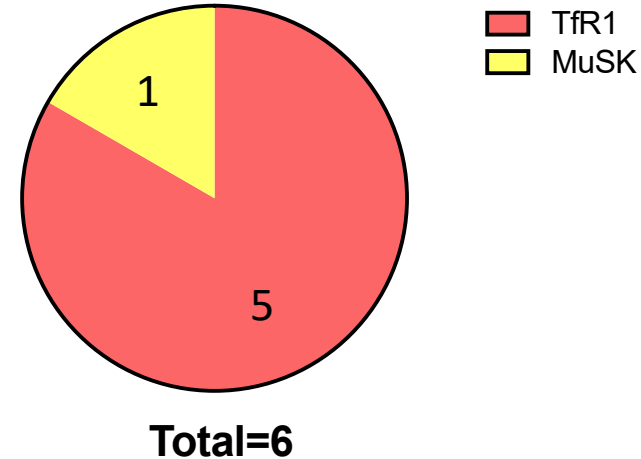
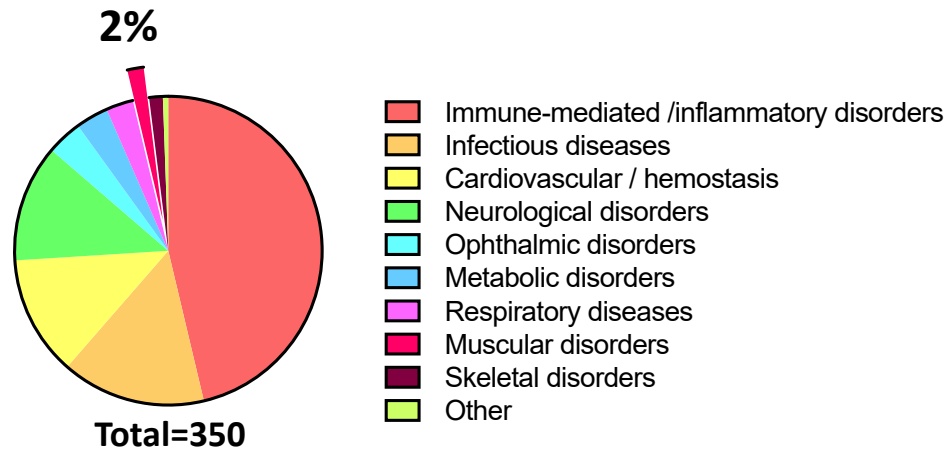
# Muscular disorders

Target and format overview



# Muscular disorders

## Target and format overview



### ADC/AOC targeting TfR1

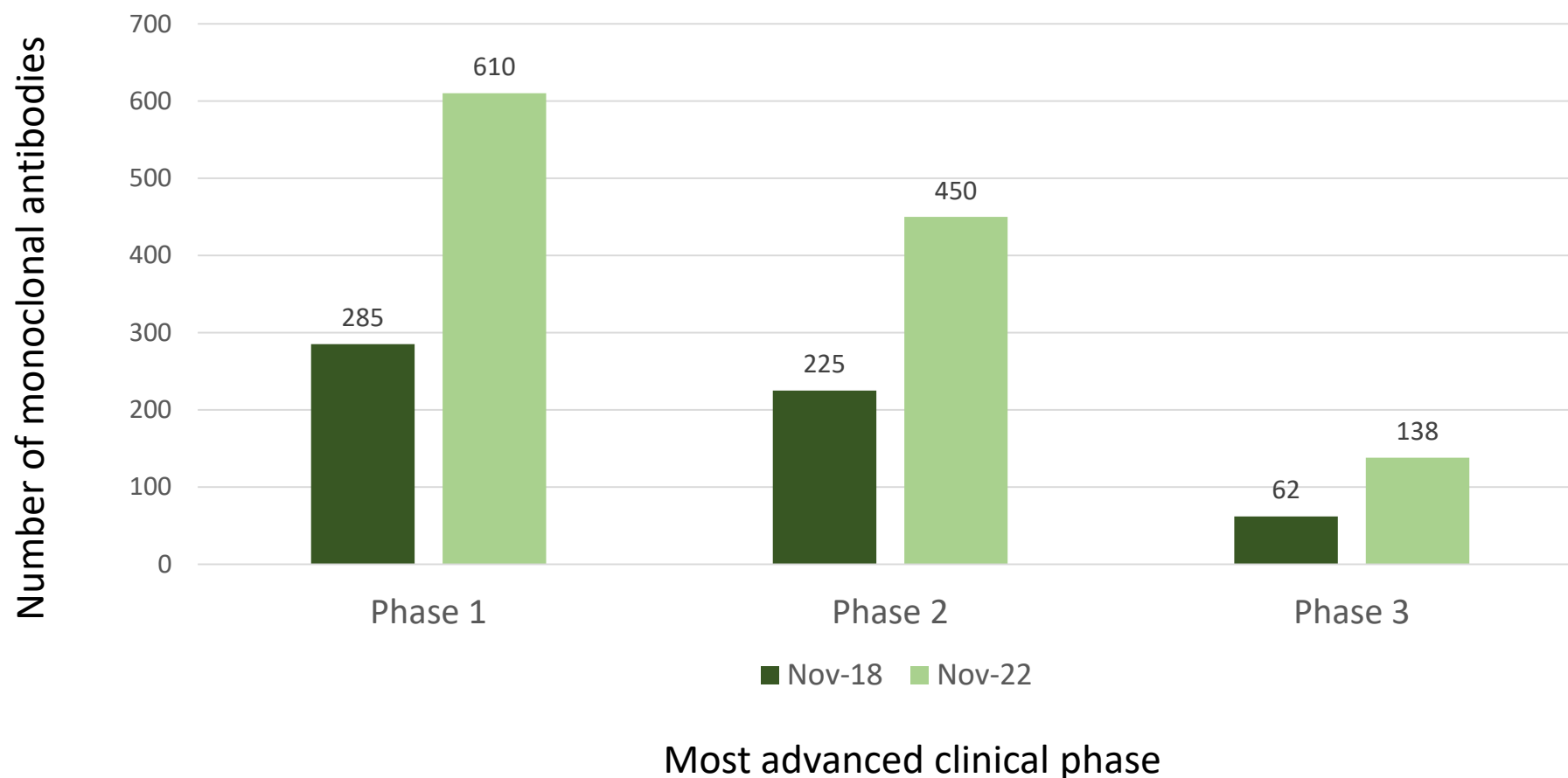
2 Myotonic dystrophy (siRNA/ASO targeting DMPK)

2 Duchenne muscular dystrophy (phosphorodiamidate morpholino oligomers (PMO) for exon skipping)

1 Facioscapulohumeral muscular dystrophy (siRNA targeting DUX4)

# Overall trends in the clinical pipeline

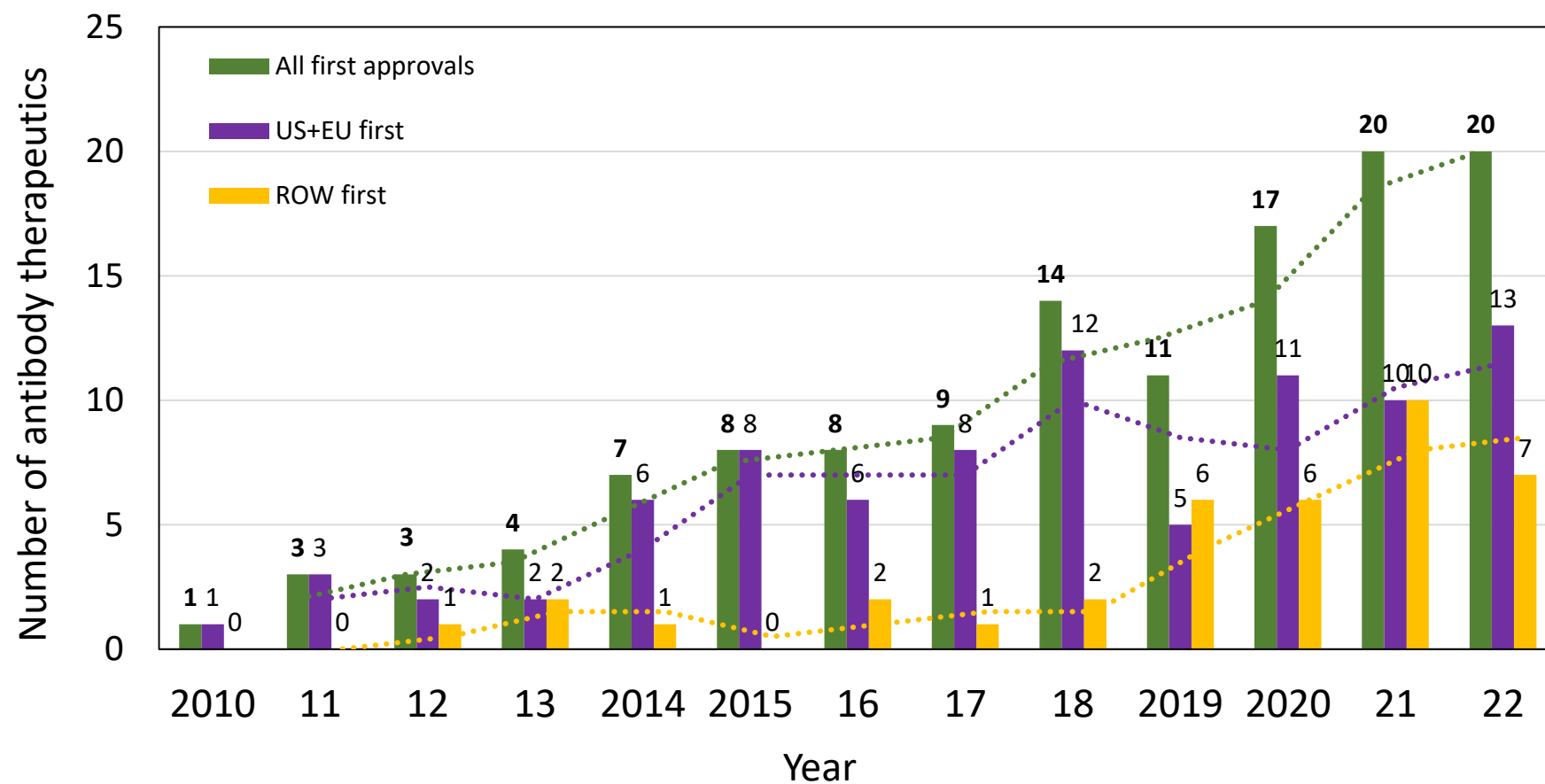
# Antibody therapeutics pipeline: 2018 vs 2022\*



\*Anti-SARS-CoV-2 antibodies excluded for historical comparison; molecules in Phase 1/2 and 2/3 studies incorporated as Phase 2 and Phase 3, respectively.  
2022 data as of Nov 1, 2022; 2018 data from "Antibodies to Watch in 2019", mAbs, 11 (2019). doi.org/10.1080/19420862.2018.1556465  
Percentage increase 2018 vs 2022 = 110%.

# Trends in first marketing approvals and success rates

# Annual first approvals: US+EU vs ROW



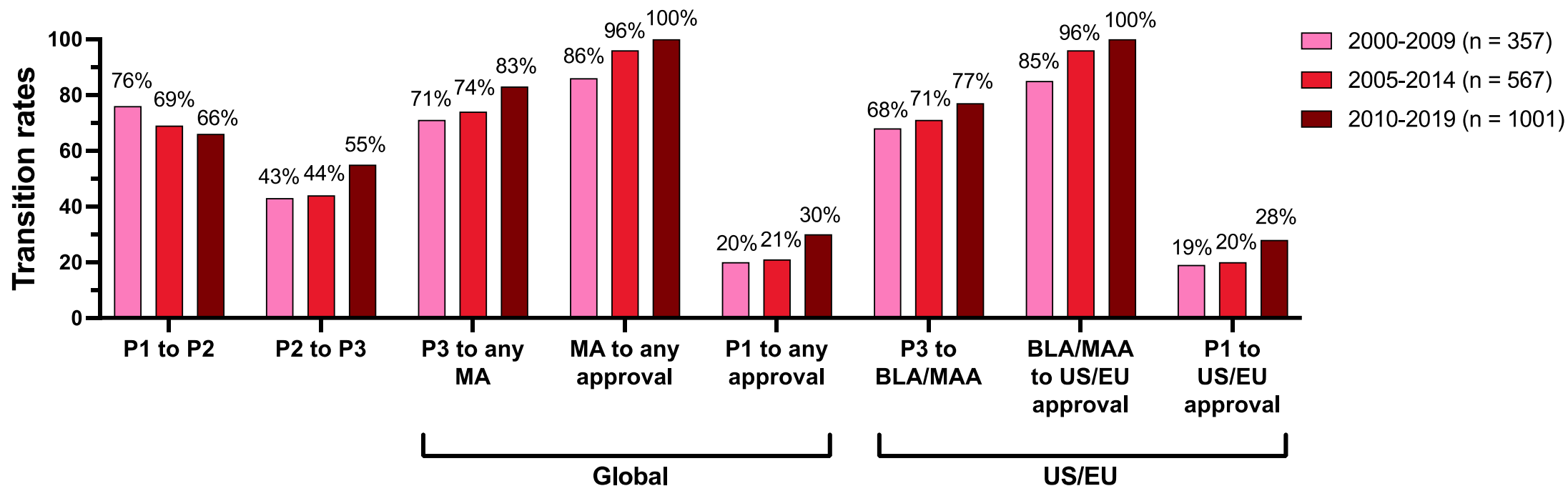
Tables of approved mAbs and antibodies in review available at [www.antibodysociety.org/antibody-therapeutics-product-data/](http://www.antibodysociety.org/antibody-therapeutics-product-data/).

Top 2 ROW countries contributing to totals in 2010-22: China and Japan.



# Phase transition and approval success rates

(antibody therapeutics which entered clinical studies in 2000-2019)



# Key messages

- Antibody therapeutics, particularly mAbs for cancer indications have entered clinical study in increasing numbers recently.
- For both cancer and non cancer, ~60% of the molecules is against novel targets, suggesting the biopharmaceutical industry is engaging in innovative R&D.
- Of mAbs for cancer indication:
  - The majority are monospecific, but ~1/3 are multispecific.
  - Most of the monospecifics are naked antibodies with immunomodulatory properties, and ~1/3 are ADCs.
  - Most of the multispecifics are cells engagers, of which ~1/3 have immunomodulatory properties.
- Of mAbs for non cancer indications:
  - The majority are monospecifics, only 12% are multispecifics.
  - The majority are for immune mediated / inflammatory disorders (66%), followed by infectious diseases (15%), cardiovascular / hemostasis (13%) and neurological disorders (12%).
- Trends show that antibody therapeutics are also entering late-stage clinical studies, and being granted marketing approvals world-wide, in increasing numbers recently.
- Phase transition and approval success rates increased globally and in US+EU, for antibodies which entered clinical studies after 2010 compared to those who entered in 2000-2009.

# Acknowledgements

- Dr. Janice M. Reichert (Chief Operating Officer, The Antibody Society, Inc., Editor-in-Chief, *mAbs*)
- The Antibody Society and their corporate sponsors

# Join The Antibody Society to keep up to date!

- The Antibody Society is a non-profit trade association
- Business intelligence focused on the commercial antibody therapeutic sector
  - Antibody News distributed via LinkedIn and email to members
    - Business deals, acquisitions, financing news
    - Regulatory agency designations, e.g., orphan drug, FT, PRIME
    - Antibodies entering first-in-human or more advanced clinical studies
    - Marketing application submissions and approvals in the US, EU and ROW
    - Withdrawals and terminations
  - Annual Antibodies to Watch article published in *mAbs*
  - Up-to-date data on late-stage pipeline, antibodies in regulatory review and approved can be downloaded from [antibodysociety.org](http://antibodysociety.org)
  - Complete clinical pipeline data provided to corporate sponsors

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# Thank you!

Email: [janice.reichert@antibodysociety.org](mailto:janice.reichert@antibodysociety.org)

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