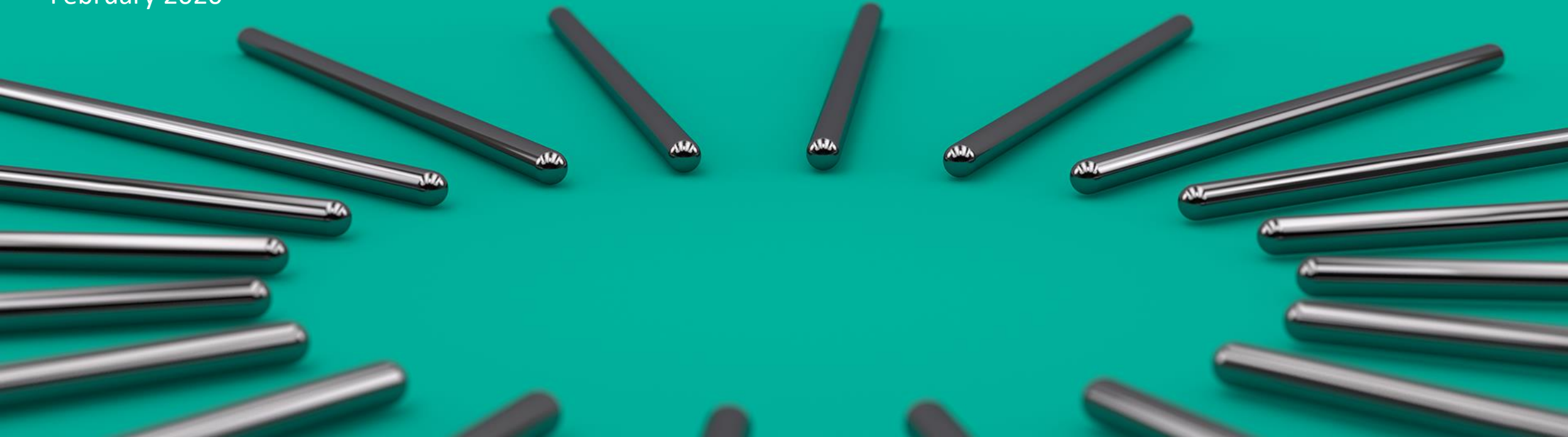


Global Patent Trends in Biologics Innovation

An analysis of global patent filings featuring biosequences

Dr Caroline Peel and guest speaker Dr Rose Hughes (Patent Attorney)

February 2020



Agenda

Themes for Discussion

- Top Technology Trends in Biotechnology from Biosequence Patents
- Opportunities and Challenges in Biologics and Patenting Biologics
- Changing Business Models in Biotechnology Innovation
- AI strategies in Therapeutic Research and Discovery and the Resultant Patents
- China Dominates the Patent Landscape: Quality of Biotechnology Innovation and Challenges of Patent Enforcement

Dr Rose Hughes

AstraZeneca

European Patent Attorney



Rose Hughes is a European Patent Attorney with both private practice and in-house experience. She is currently a patent attorney at AstraZeneca in Cambridge, specialising in biologics and large-molecule pharmaceuticals. Rose is a regular contributor to one of Europe's leading intellectual property blogs, IPKat, where she covers updates to UK and European patent case law. She has an academic background in immunology and infectious disease and holds a PhD from University College London.

Top Technology Trends in Biosequence Patents

Analysis of patent filings from 2008-2019 indicate the following leading biosequence technology areas



Testing and Diagnostics

- Genetic testing for disease susceptibility
- Hybridisation assays
- Large-scale bioinformatic screening
- Immune assays
- Detection of microorganisms



Anticancer Therapies

- Biologics
- Antibody therapies
- Chimeric and humanised antibodies
- Chimeric antigen receptor T-cell therapies



Recombinant DNA technology

- Genetic engineering including Genetically Engineered Organisms
- Development of gene therapy vectors
- Vaccines
- CRISPR Cas9 applications

Top 20 Applicants

Timeline of activity for major patent applicants sorted for volume

Patent Applicants (Top 20)	2008 - 2019	Total Inventions (DWPI Patent Families)	% Filed in the last 5 years
Chinese Academy of Sciences		4144	50.5%
Inspection and Quarantine technology centre		3978	57.8%
Academy of Military Medical Sciences		1352	45.2%
Zhejiang University		1140	57.5%
university of Jiangnan		1137	69.3%
China Agricultural University		1022	51.6%
Rural Development Administration		977	35.4%
University of Huazhong agricultural		962	55.5%
United States Health & Human services		918	30.8%
Roche		902	33.8%
University of California		848	42.1%
University of Nanjing Agricultural		831	55.2%
Shanghai Jiao Tong University		829	51.7%
Fudan University		693	51.1%
Pioneer Hi-Bred International		657	16.7%
Sun-Yat Sen University (China)		647	59.7%
University of South China Agricultural		646	68.9%
Seoul National University		640	38.0%
French National Institute of Health and Med. Res. (Inserm)		618	44.7%
Monsanto		563	23.1%

Changing Business Models and Emergence of Innovation Hubs

Open Business Models

- Open Business Models: Division of Innovation Labour through Intermediate Innovation Markets
- Public Funding for Early-Stage Biomedical Research and Emergence of Innovation Hubs
 - United States: NIH America's Seed Funding
 - United Kingdom: "Strategy for UK Life Sciences"
 - Australia: Medical Research Fund
- Build, Buy, Acquire or Licence

OECD: "It is particularly important for government funded research to continue to provide the early seeds of innovation. The shortening of private-sector product and R&D cycles carries the risk of under investment in scientific research and long-term technologies with broad applications."

Top 5 UK Assignees

Immatics Biotechnologies GmbH

University College London

UCB SA

Oxford University Innovation

GlaxoSmithKline Biologicals

Top 5 Australian Assignees

University of Queensland

Monash university

University of Sydney

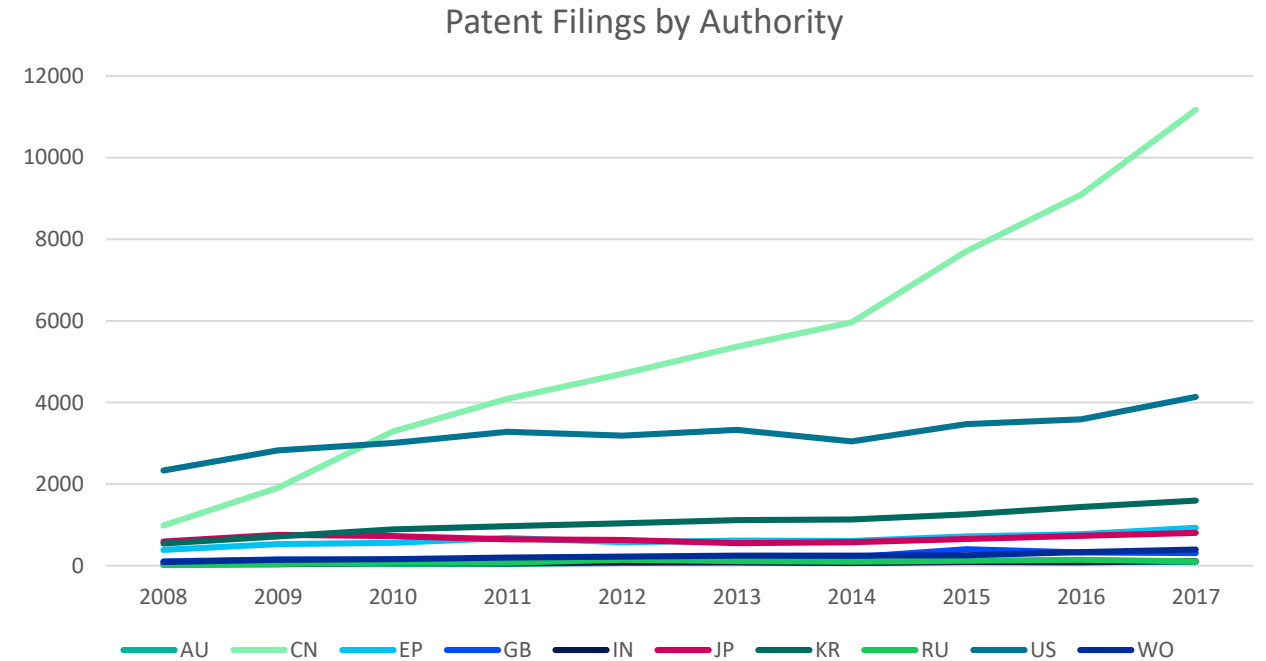
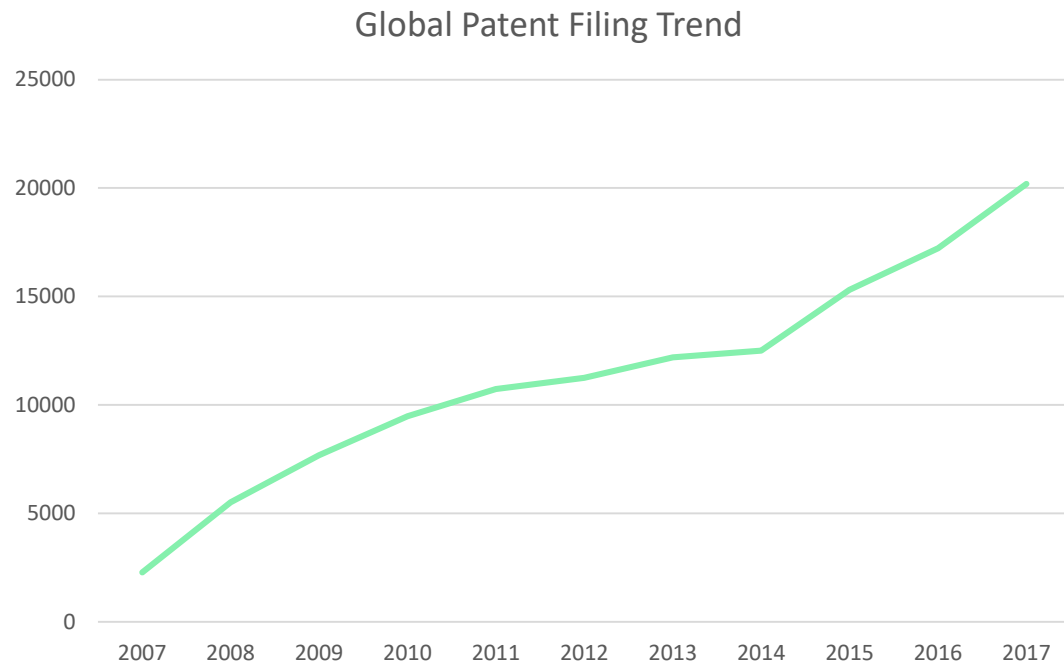
Commonwealth Scientific and Industrial
Research Organisation

Genentech Inc

Global Patent Activity for Biosequences

Timeline of Patent Activity

- Timeline of Patent Activity (number of inventions/patent families) and source country patent activity by filing year based on the earliest priority date within the family

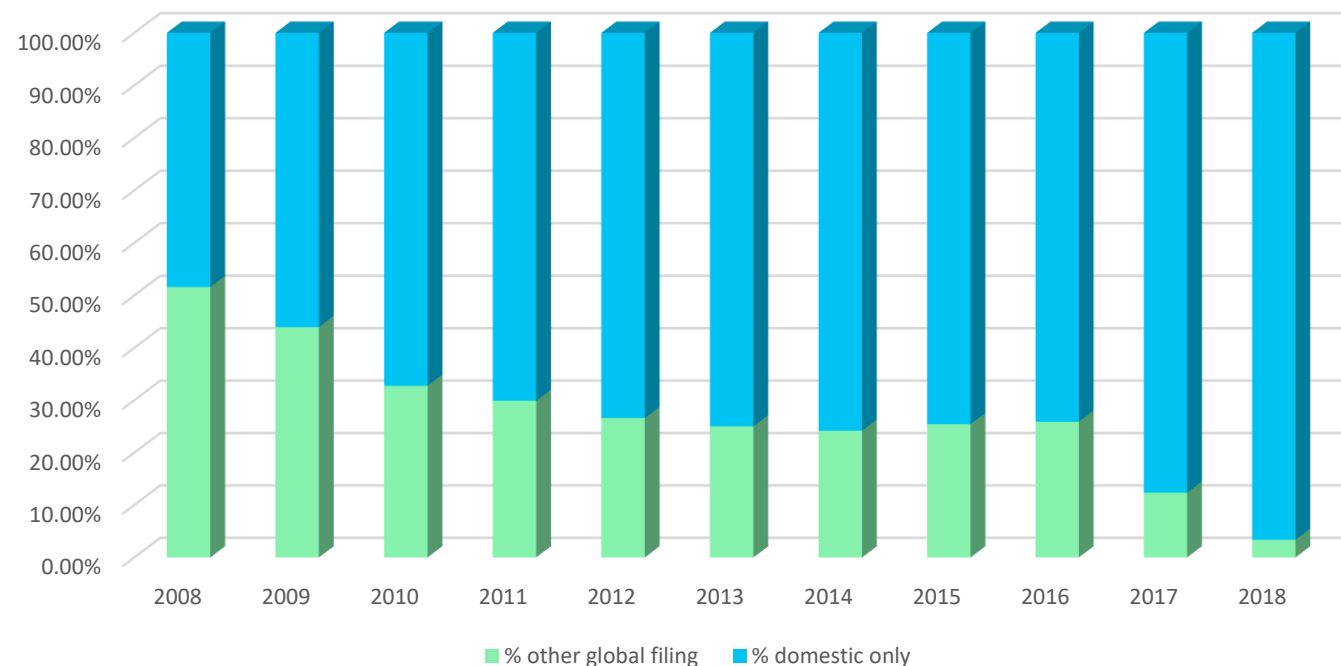


Proportion of Chinese Global Biotechnology Filings

Proportion of domestic only versus patents with another global filing

- 2017/2018 data may be impacted by late filing of PCT applications in China where filings from outside China will file their Chinese patents up to 18 months later in the process

Proportion of Chinese Domestic Only Biosequence Patent Filings



Top 5 Chinese Assignees

CHINESE ACADEMY OF SCIENCE

INSPECTION & QUARANTINE TECHNOLOGY CENT

ACADEMY OF MILITARY MEDICAL SCIENCES

ZHEJIANG UNIVERSITY

UNIV JIANGNAN

Question & Answers

Thank you

Presenters:

Dr Rose Hughes (European Patent Attorney - AstraZeneca)

Dr Caroline Peel (Head of Content Operations for IP –
Clarivate Analytics)

Data Analysis Presented:

Derwent GENESEQ

Derwent World Patent Index

Derwent Data Analyzer

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