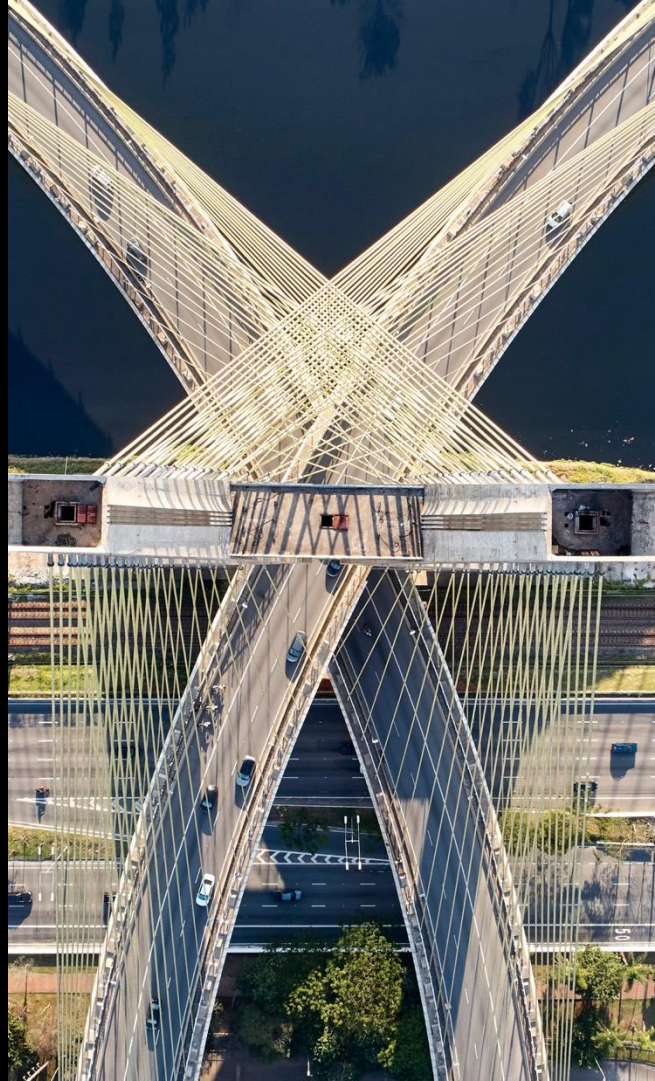
LexisNexis®

Staying relevant with Blockbuster Technologies

Insights through Patent Analytics

February 16th, 2021



Housekeeping

- This webinar is being recorded, you will receive a link to access it, in a follow-up e-mail.
- If you have questions during the presentation, please send us via the *Question Tab*
- You can download the slides from the system

Today’s speakers

Kae Gruner
Acella Pharmaceuticals, LLC

Dr Sarbani Chattopadhyay
LexisNexis PatentSight

Gene Quinn
IPWatchdog

The expensive and risky path of Drug development: An Overview

Probability of Success[2] by Clinical Trial Phase and Therapeutic Area

	P1 to P2	P2 to P3	P3 to Approval	Overall
Oncology	57.6	32.7	35.5	3.4
Metabolic/Endocrinology	76.2	59.7	51.6	19.6
Cardiovascular	73.3	65.7	62.2	25.5
Central Nervous System	73.2	51.9	51.1	15.0
Autoimmune/Inflammation	69.8	45.7	63.7	15.1
Genitourinary	68.7	57.1	66.5	21.6
Infectious Disease	70.1	58.3	75.3	25.2
Ophthalmology	87.1	60.7	74.9	32.6
Vaccines (Infectious Disease)	76.8	58.2	85.4	33.4
Overall	66.4	48.6	59.0	13.8
Overall (Excluding Oncology)	73.0	55.7	63.6	20.9

Source: Chi Heem Wong, Kien Wei Siah, Andrew W Lo. "Estimation of clinical trial success rates and related parameters." *Biostatistics* 20(2): April 2019, Pages 273-286. Published online: 31 January 2018. DOI: 10.1093/biostatistics/kxx069

Notes

(1) The same drug can go through multiple clinical trials.

(2) Typically, the overall probability of success is calculated by multiplying the probability of success for transitioning from Phase 1 to Phase 2, Phase 2 to Phase 3, and Phase 3 to Approval.

Cost To Develop One New Drug is $2.6 Billion (2013)

2013 study by **Tufts Center for the Study of Drug Development**: published in the **Journal of Health Economics**.

Journal of Health Economics 47 (2016) 20–33

Contents lists available at ScienceDirect

Journal of Health Economics

journal homepage: www.elsevier.com/locate/econbase

Innovation in the pharmaceutical industry: New estimates of R&D costs☆

Joseph A. DiMasi[a,*], Henry G. Grabowski[b], Ronald W. Hansen[c]

[a] Tufts Center for the Study of Drug Development, Tufts University, United States
[b] Department of Economics, Duke University, United States
[c] Simon Business School, University of Rochester, United States

ARTICLE INFO

Article history:
Received 15 August 2014
Received in revised form 28 January 2016
Accepted 29 January 2016
Available online 12 February 2016

JEL classification:
L65
O31

Keywords:

ABSTRACT

The research and development costs of 106 randomly selected new drugs were obtained from a survey of 10 pharmaceutical firms. These data were used to estimate the average pre-tax cost of new drug and biologics development. The costs of compounds abandoned during testing were linked to the costs of compounds that obtained marketing approval. The estimated average out-of-pocket cost per approved new compound is $1395 million (2013 dollars). Capitalizing out-of-pocket costs to the point of marketing approval at a real discount rate of 10.5% yields a total pre-approval cost estimate of $2558 million (2013 dollars). When compared to the results of the previous study in this series, total capitalized costs were shown to have increased at an annual rate of 8.5% above general price inflation. Adding an estimate of post-approval R&D costs increases the cost estimate to $2870 million (2013 dollars).

AbbVie Humira

The New York Times

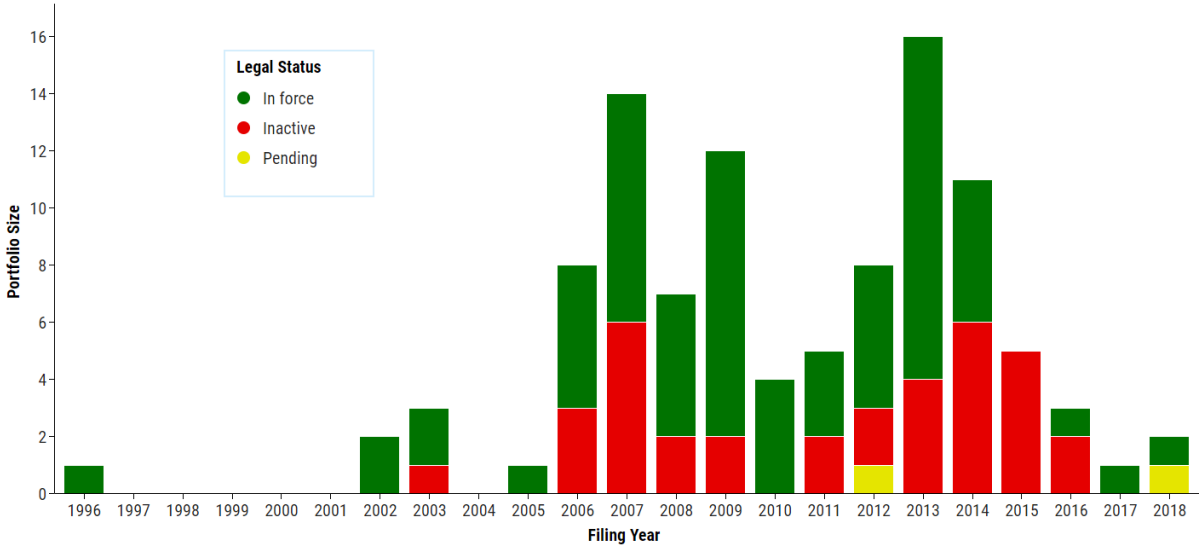
Humira is the best-selling prescription drug in the world. You may have seen the commercials.

Because of Humira, a woman with rheumatoid arthritis can wash her puppy in the bathtub, another with colitis can stroll happily through a fair packed with food vendors, while a third suffering from psoriasis can go to the gym without hiding her neck.

AbbVie's Humira on Pace to Become Biggest Seller by 2024

Humira, AbbVie Inc.'s (NYSE:ABBV) flagship drug, is projected to supplant the popular heart treatment Lipitor as the best-selling drug of all time, reaching cumulative sales of $240 billion in 2024. This according to Evaluate, which provides commercial intelligence for the pharmaceutical and medical device industries.

Filing statistics of AbbVie patents related to Humira

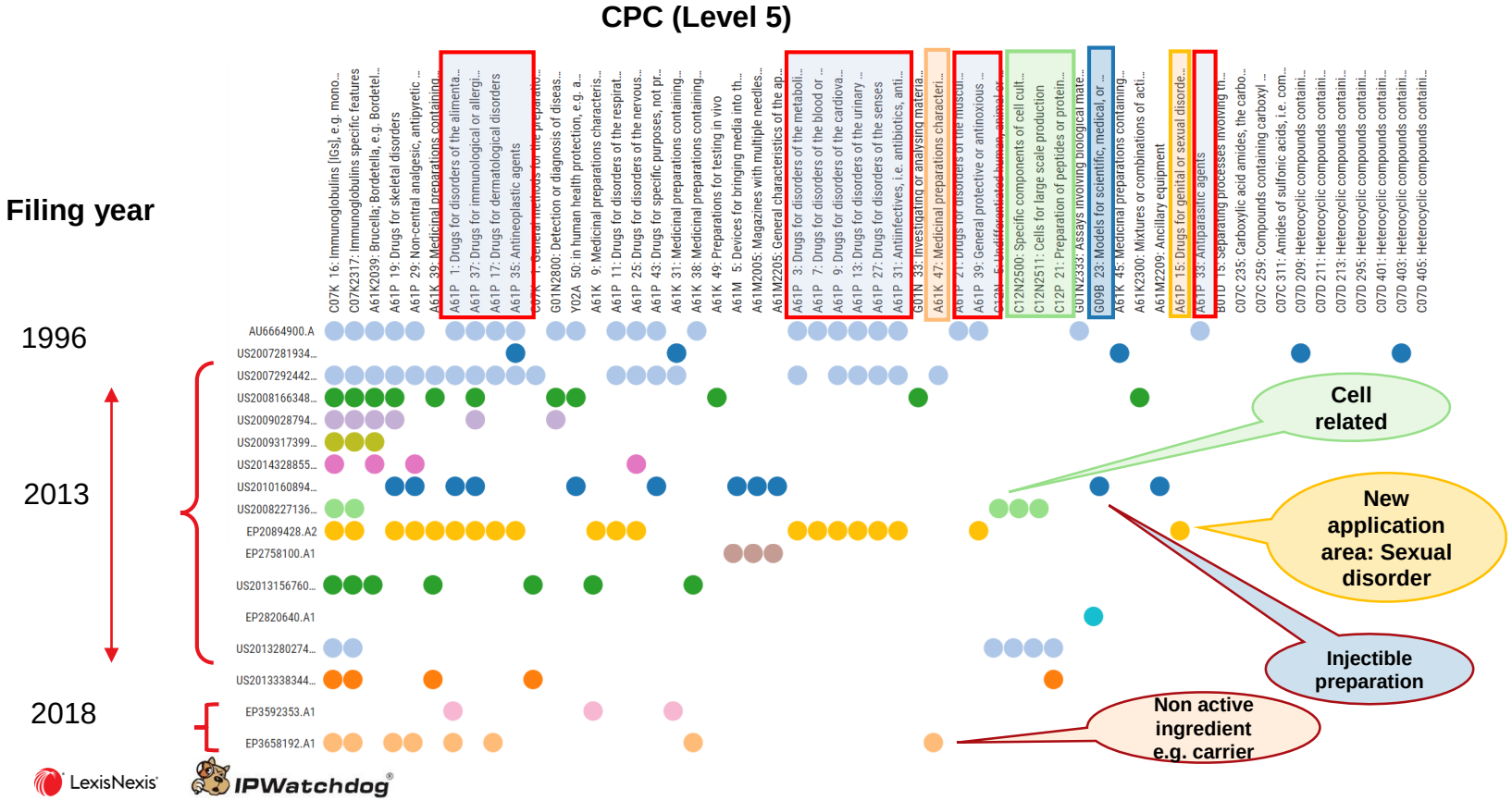


- 1996 filed AbbVie patent still in force because the patent family has family members filed in recent years claiming priority to the 1996 filed patent.

- Newly filed patents e.g., in 2017 and 2018 are either granted or pending thus allowing some aspects of the drug gaining protection for another 20 years from date of filing.

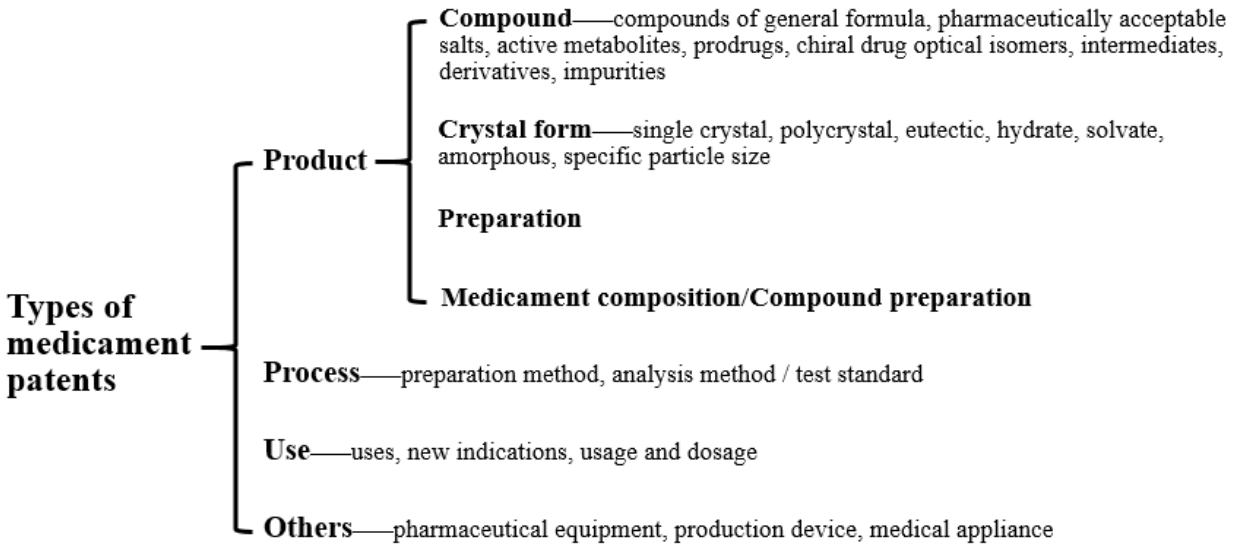
LexisNexis IPWatchdog

Technology Focus of Selected AbbVie Humira patents filed along the years



LexisNexis IPWatchdog

Types of Patent claims: Pharmaceuticals



https://www.borsamip.com/Articles/_747.html

Types of Patent claims: Pharmaceuticals

Molecules
- Pharmacologic compound or active metabolite
- Protein, DNA, or antibody

Processes
- Manufacturing process
- Purification method
- Diagnostic processes

Compositions/formulations
- New compositions of two or more ingredients
- New formulations (e.g., extended release, gel, patch)

Other
- Diagnostic tests
- R&D-technology
- Targets/biomarkers
- Devices such as inhalers

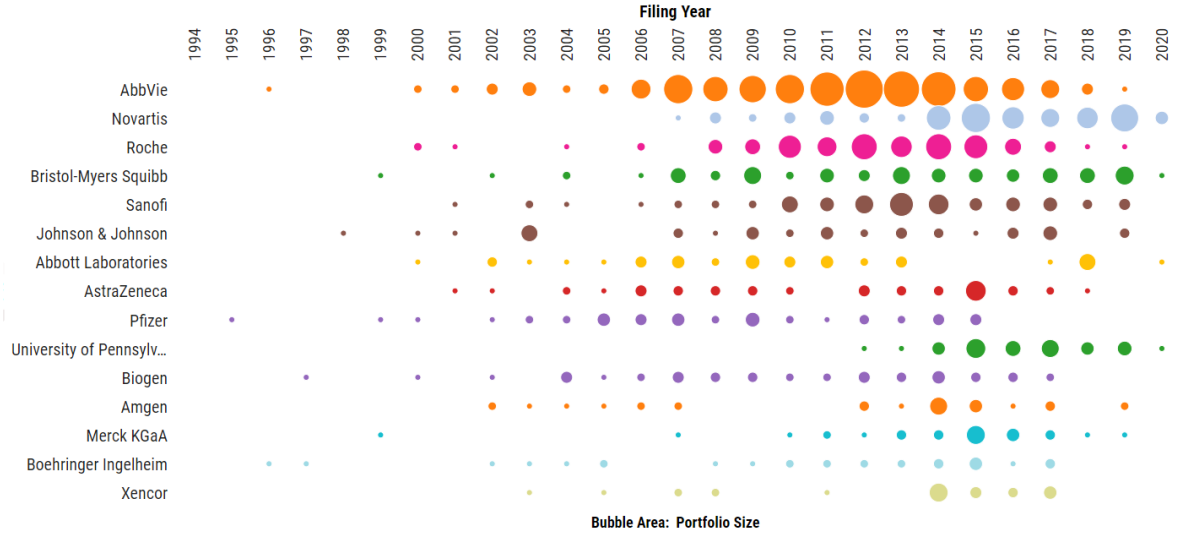
Specific forms of molecules
- Enantiomers/Isomers
- Polymorphs
- Salts, Esters
- Prodrugs

New Uses/Indications
- compounds for use to treat disease
- methods of treatments
- new patient sub-groups
- dosage regimen

* A patent grants the right to exclude; right to market comes from other authorities (e.g., EMA)

NOVARTIS

Filling statistics of companies citing AbbVie Humira patents

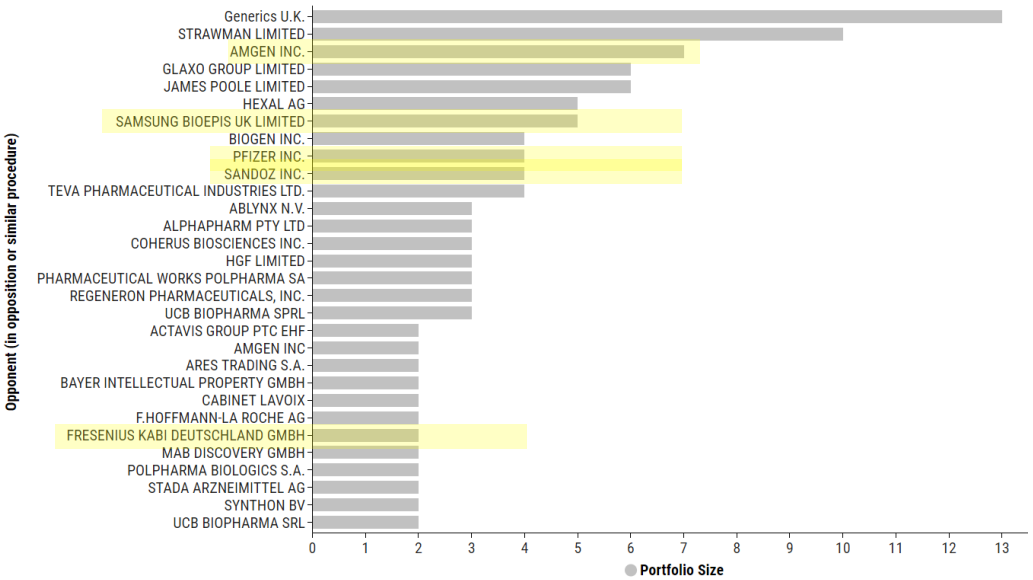


The earliest filed AbbVie patents related to Humira filed in 1996 was expected to expire in 2016. Increased filing activity around 2016 is seen for citing companies. Amgen, Boehringer Ingelheim and Pfizer are among the top citing companeis

AbbVie itself filed patents citing earlier Humira patents, recently i.e., it is actually building on its already existing Humira patents.

LexisNexis IPWatchdog

Companies involved in Opposition against AbbVie Humira patents



- Generic companies like Generics UK, Teva Pharmaceuticals have opposed the AbbVie Humira patents.
- Pfizer, Amgen, Sandoz and Fresenius Kabi are among the Top Opponents for AbbVie Humira patents

News

AbbVie inks Humira patent deal No. 7, delaying Pfizer's U.S. biosim launch until late 2023

December 3, 2018

On Friday, Pfizer announced that it has signed an agreement with AbbVie that resolves all intellectual property disputes related to Pfizer's PF-06410293, a proposed biosimilar adalimumab referencing Humira.

Mylan, Samsung Bioepis, Sandoz, Fresenius Kabi, and Momenta have also settled their patent litigation in exchange for launch dates in 2023. The only biosimilar developer not to settle is Boehringer Ingelheim (BI), sponsor of the already approved Cyltezo. Last week, BI told The Center for Biosimilars® that "Our focus is on bringing Cyltezo (adalimumab-abdm) to the US market and we are committed to making it available to US patients as soon as possible, and certainly before 2023."

AbbVie Humira

The New York Times

Humira is the best-selling prescription drug in the world. You may have seen the commercials.

Because of Humira, a woman with rheumatoid arthritis can wash her puppy in the bathtub, another with colitis can stroll happily through a fair packed with food vendors, while a third suffering from psoriasis can go to the gym without hiding her neck.

AbbVie's Humira on Pace to Become Biggest Seller by 2024

Humira, AbbVie Inc.'s (NYSE:ABBV) flagship drug, is projected to supplant the popular heart treatment Lipitor as the best-selling drug of all time, reaching cumulative sales of $240 billion in 2024. This according to Evaluate, which provides commercial intelligence for the pharmaceutical and medical device industries.

Hatch-Waxman Act & BPCIA

	HATCH-WAXMAN ACT	BPCIA
Patents identified	Orange Book listing of patents (no process patents), certified against by generic applicant (Para. IV certification)	No patent listing, but private exchange of patent information ("patent dance"), which is optional
Application types	ANDA or § 505(b)(2) "paper NDA"	Biosimilar license application/biosimilar interchangeable license application
FDA stay	Automatic 30-month stay of FDA approval upon filing suit	No automatic stay of FDA approval
Sponsor exclusivity	Five-year marketing exclusivity for new active moiety commencing on FDA approval	Twelve-year marketing exclusivity for new biological structures commencing on FDA approval: ▪ But if application is filed by same Sponsor or manufacturer of the Sponsor's product (or a licensor, predecessor-in-interest or a related party), the changed biological structure must also result in: – A change in indications, route of administration, dosing schedule, dosing form, delivery system, delivery device or strength, or – A change in safety, purity, or potency
Sponsor exclusivity	Three-year marketing exclusivity for new indication or dosage form	No additional exclusivity for same biological structure

	HATCH-WAXMAN ACT	BPCIA
Generic exclusivity	ANDA—First to file and to certify under Para. IV (challenging Orange Book patents) receives 180 days of market exclusivity against later-filed ANDAs ▪ Can be forfeited under various conditions ▪ § 505(b)(2)—no 180-day exclusivity	No exclusivity for biosimilar. First interchangeable biosimilar receives exclusivity against any subsequent interchangeable license application for any condition of use in the Sponsor's product until the earlier of: ▪ One year after commercial marketing by first biosimilar; ▪ Eighteen months after court decision (appellate court, if appealed) on all patents or dismissal of action against first biosimilar; or ▪ Forty-two months after first biosimilar approval if litigation is still pending, or 18 months after first biosimilar approval if no suit is filed (i.e., where first biosimilar fails to market)
Pediatric exclusivity	Pediatric exclusivity adds 6 months to all exclusivities	Same
Filing limitation	ANDA cannot be filed until 5 years after Sponsor's FDA approval of new active moiety, but can be filed after 4 years if accompanied by a Para. IV certification	Biosimilar application can be filed 4 years after Sponsor's FDA approval

https://www.fr.com/wp-content/uploads/2019/03/Comparison-of-Hatch-Waxman-Act-and-BPCIA-Chart.pdf

LexisNexis IPWatchdog

POLL QUESTION

Biogen Tecfidera

Unlikely Multiple Sclerosis Pill On Track To Become Blockbuster

October 28, 2013 · 3:21 PM ET

Only a few drugs could really be bought in bulk.
iStockphoto.com

There aren't very many drugs that are also, essentially, industrial chemicals available in railroad-car volumes, pharmaceutical chemist Derek Lowe noted on his blog, In The Pipeline, this spring.

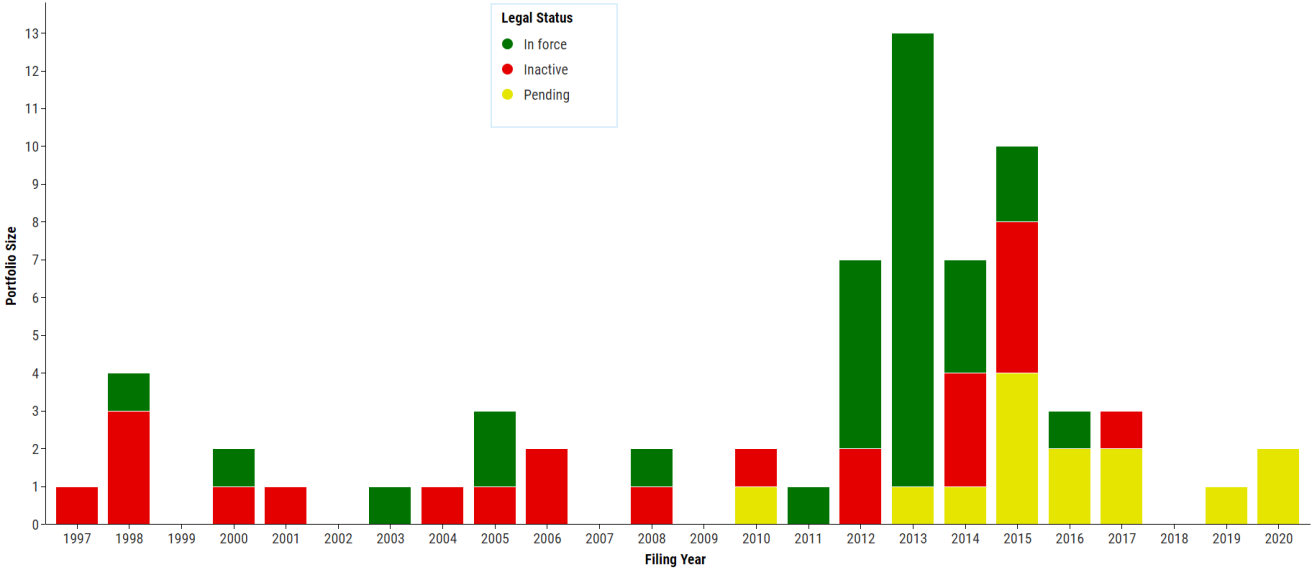
But there are a few. One is lithium carbonate, a staple of glassmaking and ceramic glazes and also the active ingredient in drugs for depression. Another is nitrous oxide, or laughing gas, for anesthesia.

Then there's Tecfidera, or dimethyl fumarate, which was approved by the Food and Drug Administration in March to treat multiple sclerosis. The twice-a-day pill from Biogen Idec was derived from an old, basic chemical: fumaric acid, used industrially to make foods taste sour and to preserve them.

In clinical trials the drug reduced MS relapses by almost half. In a study of more than 800 people, about 27 percent of those taking the drug had MS relapses compared with 46 percent for those who got a placebo.

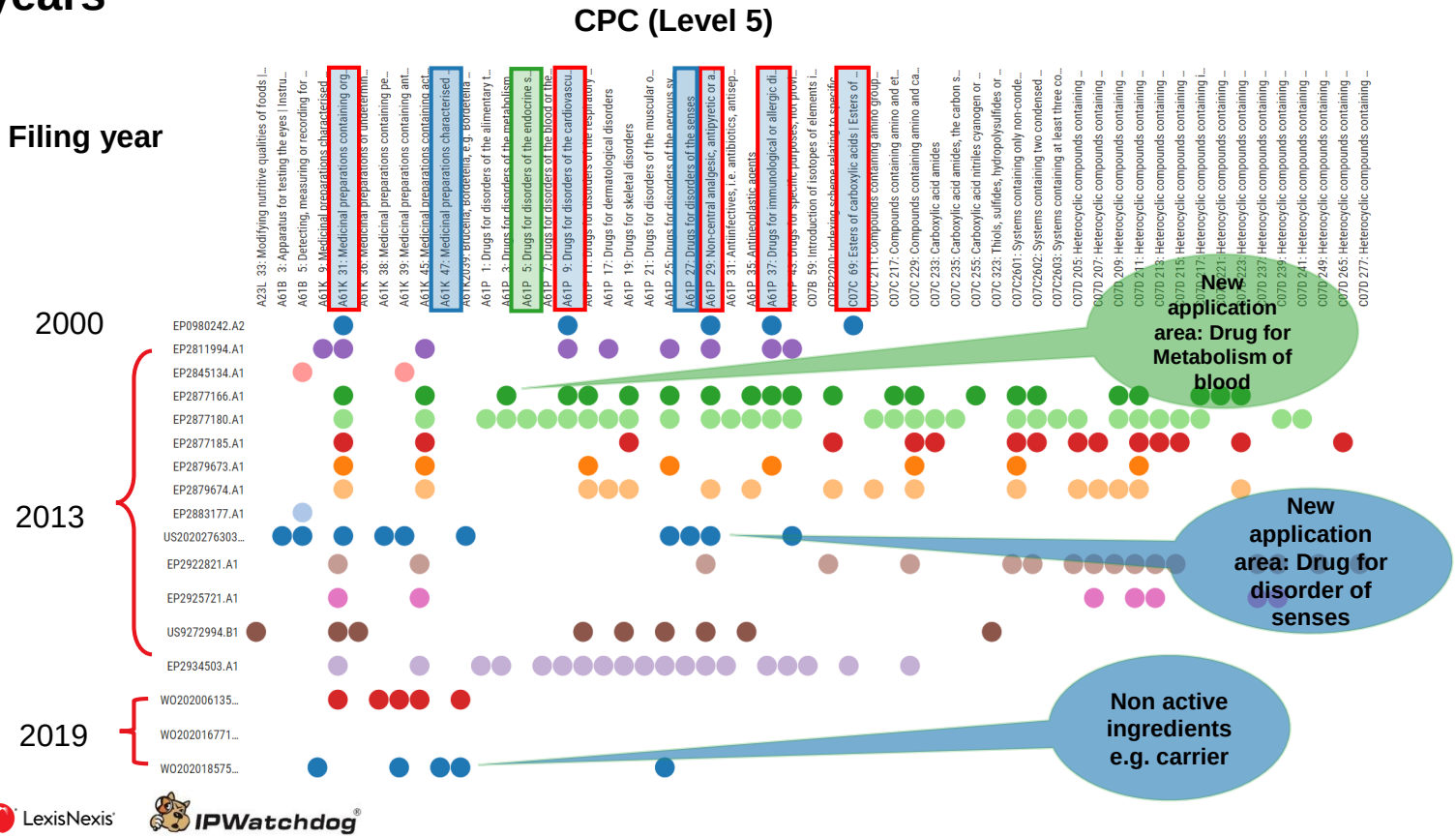
Back in the '50s, a German doctor proposed using fumaric acid derivatives to treat psoriasis. He tried one successfully on himself. By the '90s Fumapharm AG, a Swiss company, was selling a psoriasis drug along those lines in Germany, and it started working on one for multiple sclerosis that became Tecfidera. Biogen Idec bought the company in 2006.

Filing statistics of Biogen patents related to Tecfidera



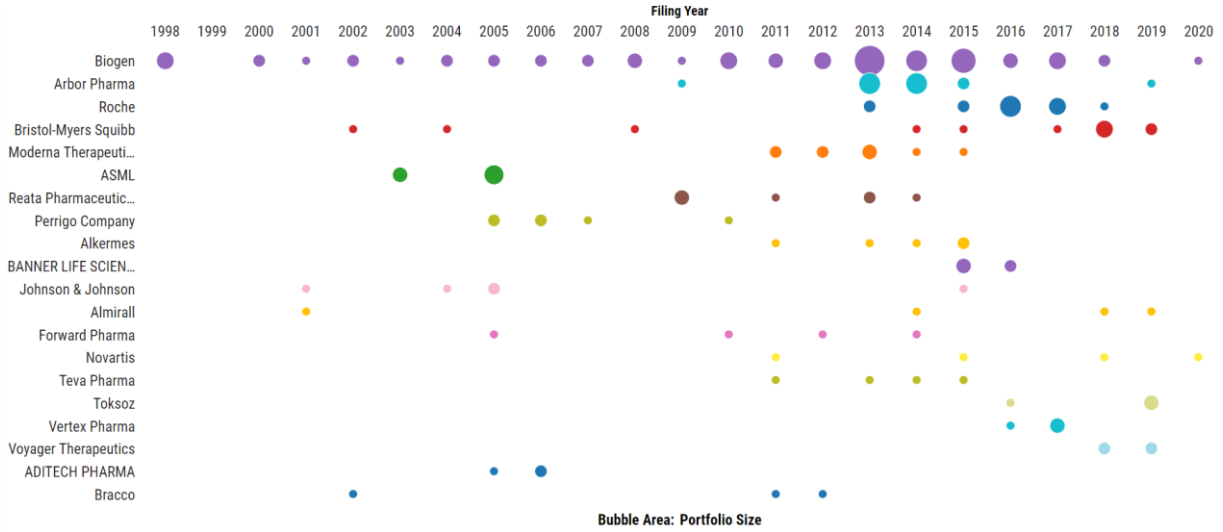
- The first Tecfidera drug patent was filed by Biogen in 1997.
- Biogen has filed patent related to Tecfidera in 2019-2020 thus attempting to protect some aspects of the drug for another 20 years.

Technology Focus of Selected Biogen Tecfidera patents filed along the years



LexisNexis IPWatchdog

Filling statistics of companies citing Biogen Tecfidera patents

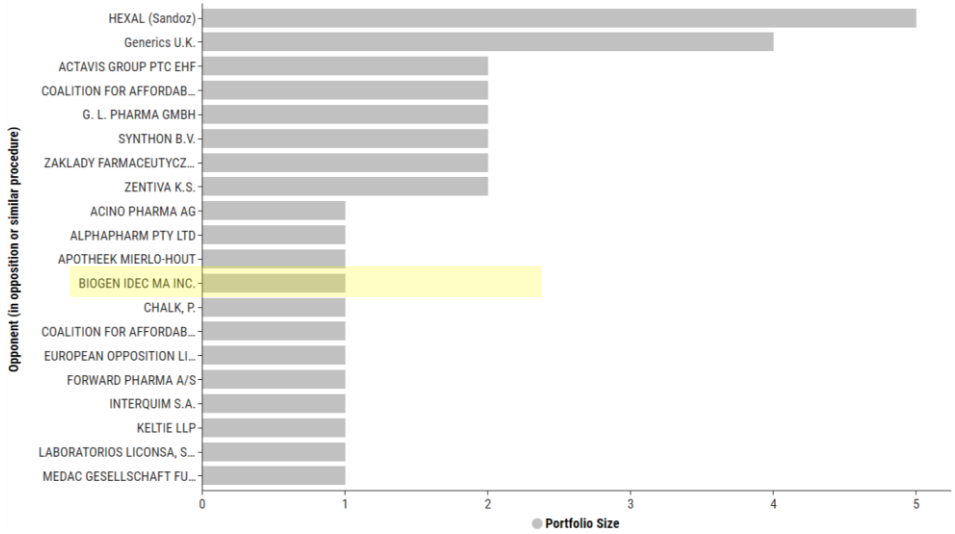


- The earliest filed Biogen patent related to Tecfidera patent filed in 1997 was expected to expire in 2017. Increased filing activity in the recent years is seen for citing companies: Abor Pharma, Roche,Bristol-Myers-Squibb.

- Biogen itself filed patents citing earlier Tecfidera patents, recently i.e., it is actually building on its already existing Humira patents.

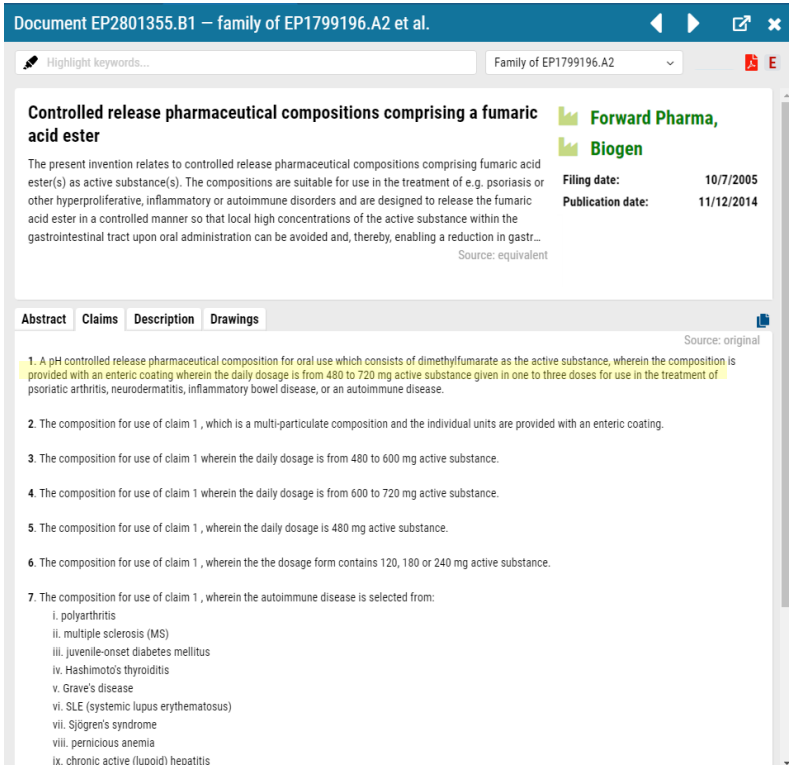
LexisNexis IPWatchdog

Companies involved in Opposition against Biogen Tecfidera patents

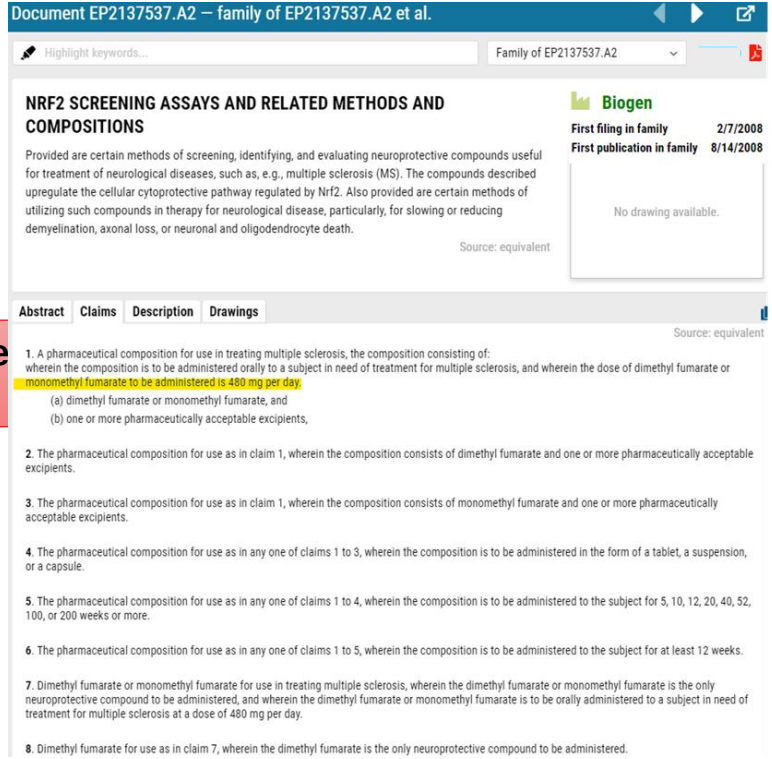


- Generic companies like Generics U.K., Organisations like Coalition for Affordable drugs had opposed the Biogen Tecfidera patents.
- Interstingly Biogen Idec is shown as Opponent here.

Biogen vs Forward Pharma regarding Tecfidera patents



LexisNe



LexisNexis® IPWatchdog®

Biogen vs Forward Pharma regarding Tecfidera patents

MarketWatch · Latest Coronavirus Watchlist Markets Investing Barron's Personal Finance Economy Retir

Biogen's $1.25 billion agreement with Forward Pharma is a very expensive insurance policy on its most valuable drug

Published: Jan. 17, 2017 at 10:46 a.m. ET

By Emma Court

The agreement does not resolve a patent dispute between the two companies

Biogen can now use Forward Pharma's patents to extend the drug's legal protections,

Losing a patent dispute could require a company to take its product off the market and pay hefty sums. Decisions for the U.S. and European patent cases are expected this quarter, with a U.S. decision in late March.

Biogen vs Forward Pharma regarding Tecfidera patents

Biogen

OVERVIEW NEWS

BIOGEN AND FORWARD PHARMA AGREE TO ENTER INTO SETTLEMENT AND LICENSE AGREEMENT

January 17, 2017 at 7:30 AM EST

Biogen to Pay $1.25B in Exchange for License Agreement to Forward Pharma Intellectual Property

Future Payment of Royalties Subject to Resolution of Ongoing Patent Procedures in US and EU

CAMBRIDGE, Mass.--(BUSINESS WIRE)--Biogen Inc. (NASDAQ: BIIB) today announced that it has agreed to enter into a settlement and license agreement with Forward Pharma, subject to the approval of Forward Pharma's shareholders and other customary conditions. The license agreement will provide Biogen an irrevocable license to all intellectual property owned by Forward Pharma.

Upon the effectiveness of the settlement and license agreement, Biogen will provide Forward Pharma a cash payment of $1.25 billion. Under certain circumstances outlined in the agreement, Biogen will pay Forward Pharma royalties on net sales of Biogen products for the treatment of multiple sclerosis that are covered by a Forward Pharma patent and have dimethyl fumarate ("DMF") as an active pharmaceutical ingredient.

FORWARD PHARMA

Home About us Contact Investors Search

Investors

Forward Pharma/ Investors/ News/ Forward Pharma Agrees to Enter Into Settlement and License Agreement with Biogen

Forward Pharma Agrees to Enter Into Settlement and License Agreement with Biogen

- Biogen will pay Forward a non-refundable cash fee of $1.25 billion
- Forward may be eligible to receive royalties of 10% of net sales of Tecfidera beginning in 2021, and of 20% of net sales beginning in 2029, depending on the outcome of certain existing litigation and the receipt of regulatory approvals

COPENHAGEN, Denmark, Jan. 17, 2017 (GLOBE NEWSWIRE) -- Forward Pharma A/S (NASDAQ:FWP) ("we" or "Forward") today announced that it has entered into a binding agreement with two wholly owned subsidiaries of Biogen, Inc. and certain other parties to enter into a Settlement and License Agreement (the "License Agreement") subject to the approval of Forward's shareholders and certain other limited customary conditions. Biogen will pay Forward a non-refundable cash fee of $1.25 billion in connection with the execution and delivery of the License Agreement. Under certain circumstances, Biogen will also be obligated to pay Forward royalties of up to 10-20% of net sales of Biogen products, including Tecfidera, approved for the treatment of multiple sclerosis that are covered by a Forward patent and have dimethyl fumarate ("DMF") as an active pharmaceutical ingredient.

The License Agreement does not resolve the issues pending in the interference proceeding between Forward and Biogen that is currently pending at the Patent Trial and Appeal Board ("PTAB") of the United States Patent and Trademark Office (the "Interference Proceeding") or the opposition proceeding against Forward's European patent EP 2801355 (Application No. 14172398.1) (the "Opposition Proceeding"). Biogen and Forward intend to permit the PTAB and the U.S. Court of Appeals for the Federal Circuit, as applicable, and the European Patent Office and the Technical Board of Appeal and the Enlarged Board of Appeal, as applicable, to make final determinations in the proceedings before them. The non-refundable fee of $1.25 billion to be paid by Biogen is not conditional on the outcome of either proceeding.

LexisNexis IPWatchdog

Biogen vs Forward Pharma regarding Tecfidera patents

Forward Pharma loses European patent case

The European Patent Office has revoked a patent that could have ensured Danish Forward Pharma royalties of US Biogen's multi-blockbuster Tecfidera. Forward Pharma's share price declines by almost 30 percent.

Forward v. Biogen: Biogen Prevails in MS Drug Patent Appeal in Federal Circuit

The European Patent Office (EPO) chose to revoke the company's patent EP2801355 after the oral hearing in the Opposition

Oct 24 (Reuters) - A U.S. appeals court on Wednesday upheld a ruling that patents owned by Biogen Inc covering its blockbuster multiple sclerosis drug Tecfidera are valid, rejecting a challenge by Danish drugmaker Forward Pharma A/S.

The U.S. Court of Appeals for the Federal Circuit said it agreed with a March 2017 ruling by the Patent Trial and Appeal Board that freed Bigoen Inc from future royalty payments to Forward.

LexisNexis IPWatchdog

Thank you.

Dr Sarbani Chattopadhyay
Consultant LexisNexis PatentSight
SChattopadhyay@patentsight.com

Kae Gruner
Associate General Counsel at Acella Pharmaceuticals, LLC

Gene Quinn
CEO IPWatchdog
Gquinn@IPWatchdog.com