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A year in biopharma dealmaking

Over the past year, the biopharma industry has witnessed some landmark approvals, high-value merger and acquisition deals and phenomenal venture funding in the US. In this feature, we chart the key trends in biopharma dealmaking since June 2018.

DealForma and BioPharma Dealmakers

Major mergers and acquisitions (M&As) in the biopharma industry continue to generate headlines, but last year, funding—particularly in the US—was also highly prominent, with more than \$12 billion raised in venture funding during 2018. In this feature, with the help of DealForma, we explore key biopharma deal trends, including M&As, partnerships and venture funding since June 2018.

2019 kicks off with high-value M&As

Since June 2018, over 225 biopharma mergers, acquisitions, and reverse mergers have been announced, with an aggregate value greater than \$145 billion. Several deals had particularly high values, and more than 70% of the total transaction value came from just the top ten deals (Table 1).

Four of the top ten deals have been signed since the start of 2019 and were all in the top five for deal value. Bristol-Myers Squibb's \$74 billion acquisition of Celgene, announced in January 2019, tops the chart, and is the industry's fourth-largest pharma M&A ever

(*Nat. Rev. Drug Discov.* **18**, 93–94; 2019). The deal could establish the merged company as one of the largest in the oncology field, by combining Bristol-Myers Squibb's extensive immuno-oncology (IO) pipeline—including one of the leading marketed checkpoint inhibitors, Opdivo (nivolumab)—with Celgene's blood cancer portfolio. This includes the mega-blockbuster Revlimid (lenalidomide), which had sales of \$9.7 billion in 2018 (*Nat. Rev. Drug Discov.* **18**, 245; 2019). Several other M&As in the top ten were also in the oncology area, including Lilly's \$8 billion acquisition of Loxo Oncology and its pipeline of genomically targeted kinase inhibitors, and GlaxoSmithKline's \$5.1 billion acquisition of Tesaro and its leading product Zejula (niraparib), a poly-ADP ribose polymerase inhibitor that is approved for ovarian cancer.

Finally, two major M&As indicate emerging hot areas for dealmaking beyond oncology: Roche's \$4.3 billion acquisition of gene therapy pioneer Spark Therapeutics, which has recently received landmark regulatory approvals for the ophthalmic gene therapy Luxturna

Table 1 | Top ten biopharma, medical device and diagnostics M&As by total deal value

Target	Buyer	Date announced	Therapeutic areas	Company stage	Total deal value (\$ billions)	Total upfront cash and equity (\$ billions)	Total contingent (\$ billions)	One-day share price premium (%)
Celgene	BMS	03/01/2019	Cancer	Approved	74.0	74.0	6.5	54
Loxo Oncology	Lilly	07/01/2019	Cancer	Approved	8.0	8.0	–	68
Auris Health	J&J (Ethicon)	13/02/2019	Surgical robotics for cancer	Approved	5.8	3.4	2	Private
Tesaro	GSK	03/12/2018	Cancer	Approved	5.1	5.1	–	62
Spark Therapeutics	Roche	23/02/2019	Ophthalmic gene therapy	Approved	4.3	4.3	–	122
BTG	Boston Scientific	20/11/2018	Cancer and vascular devices	Approved	4.2	4.2	–	37
AI Medical Systems	Merrick	06/10/2018	AI and machine learning	–	2.3	2.3	–	Private
Endocyte	Novartis	18/10/2018	Cancer	Phase 3	2.1	2.1	–	54
Ciz Holdings	J&J	23/10/2018	Dermatologic (consumer)	–	2.0	2.0	–	55
Sirtex Medical	CDH Investments and China Grand Pharma	27/06/2018	Cancer	Premarket approval	1.9	1.9	–	78

Data from 4 June 2018–15 April 2019; financials based on disclosed figures. AI, artificial intelligence; BMS, Bristol-Myers Squibb; GSK, GlaxoSmithKline; J&J, Johnson & Johnson. Source: DealForma.

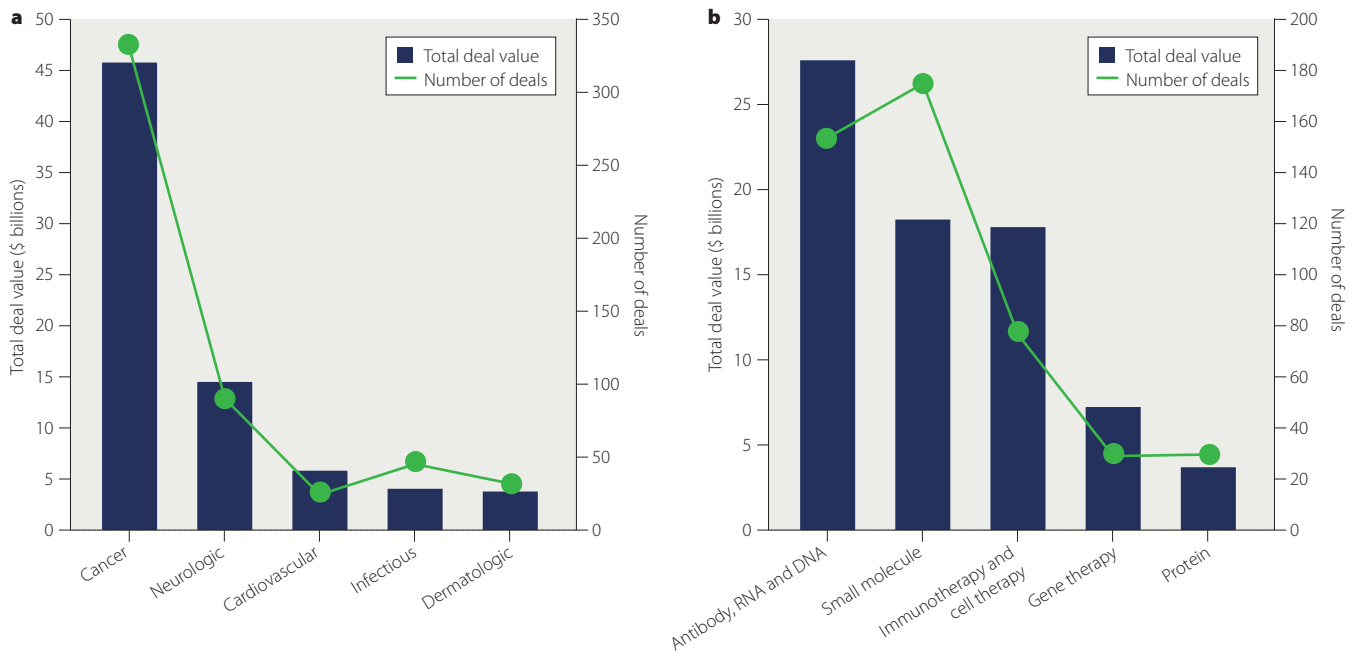


Fig. 1 | Biopharma partnership trends. a | Top five therapeutic areas by total deal value. **b** | Top five technologies by total deal value. See Box 1 for therapeutic and technology category definitions. Data from 4 June 2018–15 April 2019; financials based on disclosed figures.

(voretigene neparvovec); and Merrick’s \$2.3 billion acquisition of AI Medical Systems in the field of artificial intelligence and machine learning.

Oncology partnerships dominate

Since June last year, ~1,000 biopharma research and development and commercial partnerships have been signed, with a total potential value of ~\$100 billion, including \$11 billion upfront in cash.

It is no surprise that oncology is the leading therapeutic area for partnerships, with the total potential value of the oncology deals in the period analyzed being three times as much as the total deal value of the second-place therapeutic area, neurology (Fig. 1a). Of the top ten deals (Table 2), seven are in the oncology area, including the top deal signed in March this year between AstraZeneca and Daiichi Sankyo. AstraZeneca agreed to pay ~\$1.3 billion upfront and \$5.5 billion in potential sales and regulatory milestone payments to partner on Daiichi’s antibody–drug conjugate [Fam-] trastuzumab deruxtecan (DS-8201) as a monotherapy and combination therapy in human epidermal growth factor receptor 2-expressing cancers. Advances

and biopharma interest in IO have contributed to the large increase in oncology dealmaking and deal values, as reviewed in our March edition (*BioPharma Dealmakers* B3–B6; March 2019). For example, in August 2018, Roche’s Genentech subsidiary partnered with Affimed in a deal worth \$5 billion to harness Affimed’s Redirected Optimized Cell Killing (ROCK) platform to develop natural killer cell engager-based immunotherapeutics. Platform deals were also popular, in total making up five of the top ten deals, including four in the oncology area.

Emerging therapeutic modalities

The emergence of recently validated therapeutic modalities beyond small molecules and antibodies (Fig. 1b) is also reflected in recent deals. Last year saw the FDA approval of the first RNA interference (RNAi)-based therapy—Alnylam’s Onpatro (patisiran)—and one of the few top ten deals outside oncology relates to RNAi. In October 2018, Lilly signed a potential \$3.7 billion deal with Dicerna Pharmaceuticals through which the companies will use Dicerna’s GalXC RNAi technology platform to develop therapies for cardiometabolic disease, neurodegeneration and pain.

Table 2 | Top ten biopharma partnerships by total deal value

Licensor	Licensee	Date announced	Therapeutic area	Stage at signing	Total deal value (\$ millions)	Total upfront cash and equity (\$ millions)	Total milestones (\$ millions)
Daiichi Sankyo	AstraZeneca	28/03/2019	Cancer	Phase 3	6,900	1,350	5,550
Affimed	Genentech (Roche)	27/08/2018	Cancer	Platform	5,096	96	5,000
Merck KGaA	GSK	05/02/2019	Cancer	Phase 2	4,210	341	3,869
Dicerna Pharmaceuticals	Lilly	29/10/2018	Multiple diseases	Platform	3,700	200	3,500
Adaptive Biotechnologies	Genentech (Roche)	04/01/2019	Cancer	Platform	2,300	300	2,000
AC Immune	Lilly	12/12/2018	Neurologic	Phase 1	1,890	130	1,760
Voyager Therapeutics	Neurocrine Biosciences	29/01/2019	Neurologic	Phase 2	1,865	165	1,700
Agenus	Gilead	20/12/2018	Cancer	Preclinical	1,850	150	1,700
Tango Therapeutics	Gilead	31/10/2018	Cancer	Platform	1,750	50	1,700
Sutro Biopharma	Merck & Co.	24/07/2018	Cancer	Platform	1,660	60	1,600

Data from 4 June 2018–15 April 2019; financials based on disclosed figures. GSK, GlaxoSmithKline. Source: DealForma.

Box 1 | DealForma data and methodologies

The DealForma database was used to analyze all deals and funding rounds announced between 4 June 2018 and 15 April 2019 (i.e. since BIO 2018). Development and commercialization licenses, option deals, R&D partnerships, joint ventures, along with acquisitions, mergers, reverse mergers and partnerships with an option to acquire were selected for the deals segment. Funding in seed, series and pre-IPO rounds were selected for the venture segment.

The lists of top partnerships, M&A and venture rounds were generated by filtering for biopharma therapeutics, platform/discovery technologies, medical devices and diagnostic technologies among the core assets then sorted by the announced total deal value or funding amount raised, as applicable. Deals for contract services, settlements, royalty stream purchases and certain business unit and asset purchases were excluded.

Data for the top five technologies and top five therapeutic areas were generated by filtering for therapeutic asset deals signed in platform/discovery through phase 3 stages and for relevant technology categories.

Therapeutic areas and specific sub-indications for Figure 1 were assigned by determining each deal's primary development intent based on the most advanced compound or therapy stage at signing. For this analysis, cancer includes all deals for solid tumors and hematologic oncology, and neurologic includes all CNS, pain, psychiatric, and neuromuscular disorders. Technologies were assigned by determining the therapeutic modality of each deal's primary asset among over 40 specific categories. Secondary therapeutic areas and technologies were also tracked in the database.

All financials are based on publicly disclosed figures. The resulting deal and funding counts for the 4 June 2018 to 15 April 2019 period are as follows:

- 972 Biopharma R&D and commercial partnerships; \$95 billion in total deal value
- 227 Biopharma mergers, acquisitions, and reverse mergers; \$147 billion in total deal value
- 318 Venture rounds to biopharma companies; \$15 billion in total funding raised

Feel free to contact analysts@dealforma.com for any questions. DealForma provides expertly curated profiles of deals, M&A, private and public financing, pipelines, and product sales all with biopharma specific categories. More information at dealforma.com.

Gene-therapy-related deals were also prominent, including Voyager Therapeutics' potential \$1.8 billion deal with Neurocrine Biosciences signed in January 2019. Neurocrine has gained rights to four neurology-focused gene therapy programs, including VY-AADC, which is in phase 2 trials for Parkinson's disease.

Surge in venture funding

2018 was a record-breaking year for venture funding, particularly in the US, in which over \$12 billion was raised. Since June 2018, more than 300 venture rounds have been completed, raising a total of ~\$15 billion worldwide (Box 1).

The top ten raises (Table 3) include companies with products at various development stages. Leading the list is regenerative medicine specialist Samumed, which raised \$438 million in an A-6 equity round with investors including Vickers Venture Partners and Family Investors. The company has very recently moved its lead candidate lorecivivint, a small-molecule WNT pathway inhibitor, into a phase 3 trial in knee osteoarthritis.

Among the platform companies in the top ten, Relay Therapeutics raised the highest amount—\$400 million—for its protein motion-based drug discovery platform through a series C round contributed to by Softbank, Foresite Capital and others.

Table 3 | Top ten biopharma, medical device and diagnostics venture rounds by total amount raised

Company	Amount raised (\$ millions)	Date	Therapeutic areas	Company stage at funding	Investors
Samumed	438	06/08/2018	Multiple diseases	Phase 2	Vickers Venture Partners and Family Investors
Relay Therapeutics	400	20/12/2018	Cancer	Platform	Softbank, Foresite Capital, Perceptive Advisors, Tavistock Life Sciences, GV, Casdin Capital, Biotechnology Value Fund, EcoR1 Capital, Alexandria Venture Investments and D.E. Shaw Research
Cerevel Therapeutics	350	23/10/2018	Neurologic	Phase 2	Bain Capital and Pfizer
BridgeBio	299	23/01/2019	Cancer	Phase 2	Kohlberg Kravis Roberts, Viking Global Investors, Perceptive Advisors, Aisling Capital, Hercules Capital and Sequoia Capital
Asklepios BioPharmaceutical	235	11/04/2019	Gene therapy and rare diseases	Phase 1	Vida Ventures, TPG and company founders
Gossamer Bio	230	23/07/2018	Autoimmune	Platform	Hillhouse, Invus, Baupost Group, Polaris Partners, ARCH Ventures, Omega Funds and ADIA
Auris Health	220	28/11/2018	AI and machine learning	–	Partner Fund Management, Wellington Management, Senator Investment Group, Mithril Capital Management, Lux Capital and Viking Global Investors
I-Mab Biopharma	220	29/06/2018	Cancer	Phase 2	Hillhouse, Hopu Investment Management, Ally Bridge, EDBI and C-Bridge Capital
Roivant Sciences	200	13/11/2018	Neurologic	Phase 2	NovaQuest and RTW Investments
Maze Therapeutics	191	28/02/2019	Hematologic	Platform	Third Rock Ventures, ARCH Ventures, GV, Foresite Capital, Casdin Capital and Alexandria Venture Investments
Arvelle Therapeutics	180	18/02/2019	Neurologic	Phase 3	LSP, NovaQuest, Andera Partners and H.I.G. BioHealth

Data from 4 June 2018–15 April 2019; financials based on disclosed figures. AI, artificial intelligence. Source: DealForma.