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## Boom: 2018's biotech IPOs

A historic amount of capital flowed to newly public biotech companies in 2018.

*Chris Morrison*

Biggest, richest, strongest, frothiest, riskiest; no matter what superlatives you want to apply, the biotech initial public offering (IPO) boom of 2018 was record breaking. In early December, Moderna Therapeutics' US\$604 million IPO — the largest ever for a venture-backed US biotech company — propelled the total capital raised in biotech IPOs during the year past the \$8 billion threshold for the first time in the history of the sector.

The extraordinary year for biotech IPOs adds an exclamation point to what Leerink analyst Geoffrey Porges calls “the longest and most active financing window in biopharma history.” As of 8 December, 71 biotech companies had gone public on global exchanges during the year, raising a cumulative \$8.3 billion, excluding IPOs from service companies and medical device companies. In 2014, the previous peak, 88 biotech companies raised \$6.3 billion in IPO capital, according to data from Ernst & Young.

Supporting this watershed fundraising, investors made big bets on intriguing new

technology platforms and compelling science. Highlights included mRNA-based approaches from Moderna and Translate Bio, cell therapies from Rubius Therapeutics, Allogene Therapeutics, Autolus and Unum Therapeutics, gene therapies from Orchard Therapeutics, Homology Medicines, LogicBio Therapeutics, Solid Biosciences and MeiraGTx Holdings, and neoantigen cancer vaccines from Neon Therapeutics and Gritstone Oncology. These and other new therapeutic modalities are attracting substantial capital, rivalling the IPO achievements of more traditional therapeutic approaches.

“ [We are currently in] the longest and most-active financing window in biopharma history ”

On average, 2018's biotech IPOs each raised more than \$116 million, with a median raise of \$98 million. (In 2014, the previous peak year, those figures were \$73 million and \$58 million, respectively.) What's more, those impressive tallies omit IPOs from several already-public companies such as Beigene, the Chinese immuno-oncology specialist that raised more than \$900 million in its August 2018 Hong Kong Stock Exchange IPO (the company was already traded on the Nasdaq) and the German biologics bellwether Morphosys, which raised \$239 million in an April IPO on the Nasdaq (it was already traded in Europe).

According to data compiled by analysts at R. W. Baird, biotech investors also poured nearly \$23 billion into 210 follow-on offerings from a slew of other biotech firms during the first 11 months of 2018.

### Top of the pop

From every angle, 2018 is a banner year for biotech financing (TABLE 1). The stampede towards the public markets follows several

Table 1 | Top ten 2018 IPOs by gross proceeds

Company (location)	IPO proceeds (US\$ millions)	Development stage at IPO	Therapeutic or technology focus
Moderna Therapeutics (USA)	604	Phase I	mRNA vaccines and therapeutics
Innovent Biologics (China)	421	Registration	Innovative and biosimilar therapeutic antibodies
Ascleris Pharma (China)	399	Market	Hepatitis C, other antivirals and oncology
Allogene Therapeutics (USA)	373	Phase II	CAR-T cells
Rubius Therapeutics (USA)	277	Preclinical	Red-cell-based therapeutics
Tricida (USA)	256	Phase III	Chronic kidney disease
Guardant Health (USA)	234	Market	Liquid biopsy technologies
Orchard Therapeutics (UK)	200	Phase III	Ex vivo gene therapy for rare paediatric diseases
Kiniksa Pharmaceuticals (USA)	171	Phase II	Autoimmune and inflammatory diseases
Homology Medicines (USA)	166	Preclinical	In-vivo gene therapy for rare diseases

CAR, chimeric antigen receptor; IPO, initial public offering. Source: Informa's *Strategic Transactions*; SEC filings.

years of free-flowing venture capital into early-stage biotech companies. Biotechs that went public in 2018 had raised at least \$11.3 billion in private financing prior to their IPOs. Moderna alone has raised at least \$1.8 billion since 2010. That venture capital largesse has sparked an ongoing biotech company-building boom, and public market investors have been increasingly willing to make bets while the cranes and scaffolding are still in place.

Even biotechs that have yet to generate any clinical data for their drug candidates made for attractive IPO candidates in 2018. In fact on average, biotechs lacking clinical-stage assets outraised competitors with drug candidates in clinical trials (FIG. 1a).

In 2018, ten companies whose lead compounds had not yet reached the clinic together raised nearly \$1.3 billion in IPO

financing. By comparison, only five such companies went public the previous year, raising only \$121 million. That 2017 total was even eclipsed by three individual IPOs in 2018: the gene therapy start-up Homology Medicine raised \$166 million in March 2018; Solid Biosciences raised \$144 million in January 2018; and the cell therapy platform company Rubius Therapeutics raised \$277 million in July.

Rubius, which is attempting to engineer red blood cells to express therapeutic biologics, achieved the fifth largest haul of 2018. Rubius expects to file its first investigational new drug (IND) application, for a treatment for the inherited rare disease phenylketonuria, in early 2019.

More established players with clinical-stage pipelines also raised big stakes. Moderna, one of the rare 'unicorn' private

companies (valued at more than \$1 billion) in the biotech industry, sold more than 26.2 million shares in its 7 December IPO, representing ~\$600 million in new funding, although its share price dropped around 18% in the week following the IPO.

Moderna's ambition is nothing less than to create a new category of medicines — providing patients' cells with the instructions to express their own therapeutic proteins through an mRNA platform. Companies including Vertex Pharmaceuticals, AstraZeneca and Merck & Co. had already invested in and partnered with the company to access the potentially transformative mRNA modality, fuelling a pipeline of therapeutics and vaccines that boasts more than 20 early-stage programmes across several therapeutic categories.

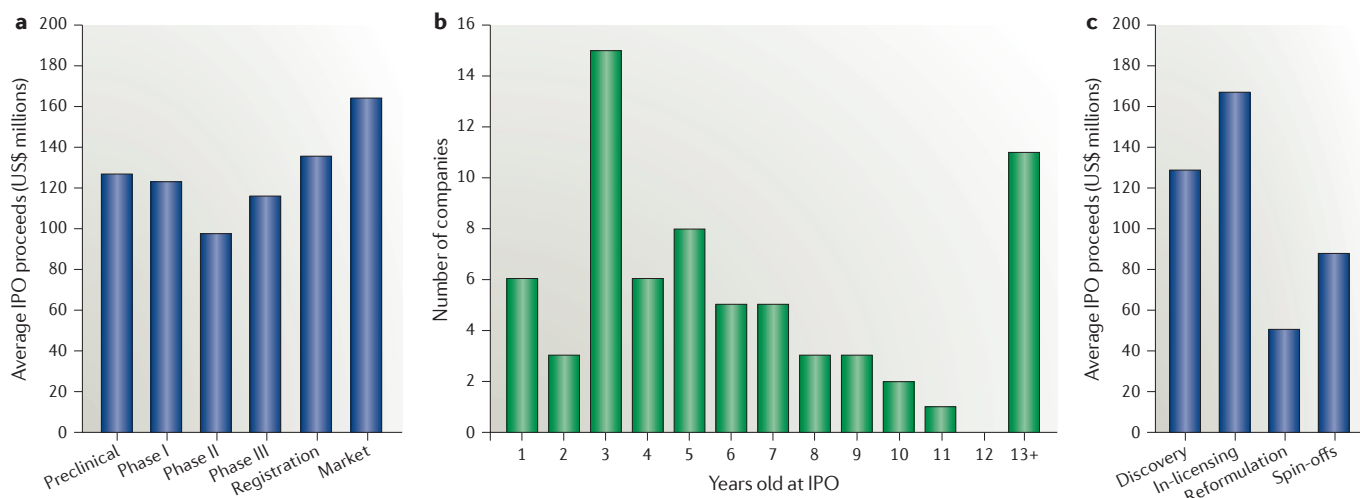


Figure 1 | Characteristics of biotech IPOs in 2018. **a** | Average proceeds by development stage of lead asset. **b** | Age of companies. **c** | Average proceeds by corporate strategy. IPO, initial public offering. Sources: Informa's *Strategic Transactions*; SEC filings; company reports.

Moderna was founded in 2010, which makes it older than most of its IPO classmates. Remarkably, at least two dozen of the biotechs that went public in 2018 hadn't even been founded at the time of the last IPO peak in 2014 (FIG. 1b). The rapidity with which some companies are founded, funded and exit onto the public market suggests both that the biotech sector is maturing and that public investors are becoming increasingly familiar with fledgling drug companies. Venture capitalists may also be taking advantage of the cyclical nature of the availability of public market capital: the window is open now, and it's not always obvious when it will close.

Not all of these biotech toddlers are starting from scratch, however. Several of these young firms boast clinical assets in late-stage development, and were either spun out fully formed from larger biopharmaceutical companies or were started up with in-licensed assets or portfolios.

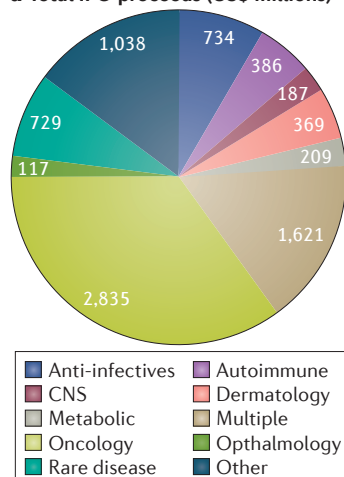
Allogene Therapeutics, for example, raised \$373 million in its October 2018 IPO to support development of a cadre of 17 CAR-T cell programmes in-licensed from Pfizer. Allogene was launched just 6 months earlier, via a \$300 million series A venture round, by former Kite Pharma executives still celebrating the acquisition of that company for \$12 billion by Gilead Sciences. Pre-IPO, Pfizer owned a quarter of Allogene.

The biotech Kiniksa Pharmaceuticals is another young upstart. The company was founded in 2015, has raised more than \$320 million in venture capital, and has licensed in autoimmune and inflammatory disease assets from AstraZeneca, Biogen and Regeneron. It raised \$171 million in its May 2018 IPO.

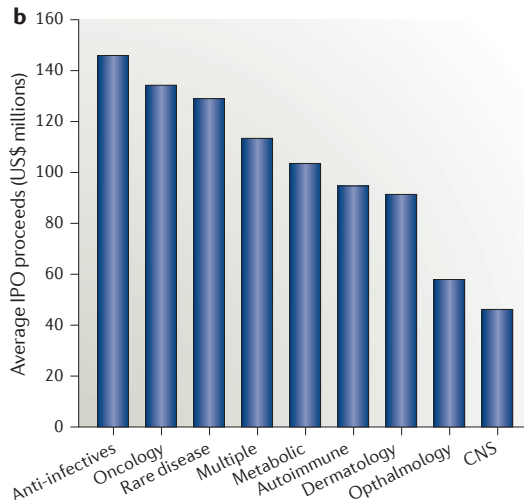
Companies pursuing in-licensing as their core strategy actually outperformed the rest of 2018's IPO field, on average (FIG. 1c). By avoiding de novo drug discovery and instead in-licensing clinical-stage assets, these companies raised \$167 million on average. By comparison, discovery-driven start-ups raised \$128 million (regardless of what stage of development they had reached at the time of their IPOs). In-licensing-based start-ups were also more highly valued by investors than companies that spun-off from existing biopharma companies, which raised \$88 million on average. Companies using drug delivery technologies to reformulate existing therapies raised only \$50 million on average.

The therapeutic area preferences of public market investors are fairly clear: there are oncology companies, and then there is everything else (FIG. 2a). In all, 22

**a Total IPO proceeds (US\$ millions)**



**b Average IPO proceeds (US\$ millions)**



**Figure 2 | Therapeutic area trends for IPOs in 2018.** Total proceeds (panel a) and average proceeds (panel b) by therapeutic area. CNS, central nervous system. Sources: Informa's *Strategic Transactions*; SEC filings; company reports; NRDD analysis.

oncology-focused biotechs raised a total of \$2.8 billion during 2018 IPOs. Leading the pack, China's Innovent Biologics raised \$421 million in its October 2018 IPO on the Hong Kong Stock Exchange. The company has seven assets under development in various cancer indications, alongside a smattering of drug candidates in other areas such as autoimmune disease and ophthalmology.

Although oncology companies attracted the most IPO money in total, other therapeutic areas boasted better average returns per company in 2018 (FIG. 2b). Six infectious disease-focused companies went public during 2018, raising on average \$147 million. This group was led by hepatitis C drug developer Ascleptis Pharma, the first biotech to list in Hong Kong under new rules designed to attract pre-revenue technology companies to that exchange. It raised \$399 million when it went public in July. Those funds will help Ascleptis launch the recently approved hepatitis C virus (HCV) protease inhibitor danoprevir in China. Ascleptis

acquired China rights to that asset from Roche in 2014. Swiss macrocycle peptide platform company Polyphor meanwhile raised \$155 million to develop and commercialize its lead compound, the phase III antibiotic murepavadin for *Pseudomonas* infections.

Rare disease-focused biotechs also fared well in 2018, nearly keeping pace with oncology-focused competitors with an average \$129 million haul. Standing out among rare disease companies, Orchard Therapeutics' \$200 million October IPO will help advance its portfolio of ex vivo gene therapies for rare paediatric diseases.

#### Investor returns

Biotech's bankers largely succeeded in gauging the demand for new issues in 2018, with the vast majority of biotechs pricing their IPOs within expected ranges. Only six companies exceeded their predicted IPO price, with eight biotechs pricing offerings below their anticipated ranges, suggesting that there was steady demand for newly public companies in 2018. Several companies, including Moderna and another late-2018 debut Synthorx, sold more shares in their offerings than they had originally anticipated. Synthorx, which went public on the same day as Moderna, raised \$131 million by selling 11.9 million shares, up from an expected 9.1 million shares. The company's cancer drug candidates, proteins that incorporate novel amino acids created with synthetic DNA base pairs, have not yet entered the clinic.

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Table 2 | Top multiples for the 2018 IPO class

Company	Step-up multiple	Development stage at IPO	Therapeutic or technology focus
BioXcel Therapeutics	28x	Phase I	Artificial intelligence
Equillum	17x	Phase I	Autoimmune disease
Verrica Pharmaceuticals	8.1x	Phase III	Dermatology
Rubius Therapeutics	6.4x	Preclinical	Red-cell-based therapeutics
Surface Oncology	6.3x	Phase I	Oncology
Synthorx	5.9x	Preclinical	Oncology
Eidos Therapeutics	5.3x	Phase I	Rare disease
resTORbio	5x	Phase II	Oncology
LogicBio Therapeutics	4.4x	Preclinical	Gene therapy
Replimune	4.3x	Phase II	Oncology

IPO, initial public offering. Source: Informa's *Strategic Transactions*; SEC filings.

This demand translated into impressive returns for the investors who backed fledgling biotechs at even earlier stages. IPO prices are multiplied by the number of outstanding shares to determine a company's initial market capitalization. A 'pre-money' valuation can then be determined by subtracting a company's IPO proceeds from their market cap. Dividing this pre-money valuation by the total amount a company raised prior to an IPO then generates a rough proxy for pre-IPO shareholder return.

For example, Rubius priced its IPO at \$23 per share, and sold around 10.5 million of 77 million outstanding shares. That equates to an initial market cap of \$1.8 billion and a pre-money valuation of around \$1.5 billion — a high valuation for a preclinical biotech company. The company had previously raised about \$240 million from venture investors, resulting in a 6.4x step-up multiple. Actual returns will vary based on the different prices paid for Rubius shares in its various earlier venture rounds, as well as when venture capitalists are able to sell their shares on the open market.

Other early-stage investors fared as well, or better (TABLE 2). BioXcel Therapeutics, an artificial intelligence (AI) platform spin-off from the drug developer BioXcel Corporation, went public in March 2018 with a pre-money valuation of only \$112 million. But because pre-IPO shareholders had invested only \$4 million, they would have made a theoretical 28x return. In reality, shares held by investors and insiders are typically subject to a standard 180-day 'lock-up' agreement, such that they can't be sold to immediately realize IPO returns.

As for post-IPO success, fewer than half of the biotechs that went public during 2018

were trading above their offering prices as of 30 November. The median return for the cohort was -8%, and the average return was 9%. This was due to high-performing outliers pulling up the average (TABLE 3). The immunomodulatory antibody company Allakos was up 227% since its July IPO, for example, and ARMO Biosciences was up 194% since its January IPO.

Allakos's lead drug candidate is in several mid-stage clinical trials that have yet to read out, but the company's valuation has increased steadily since its July debut. Investor demand for Allakos shares has been there from the start: its IPO was one of the handful in 2018 that priced above its anticipated range, and Allakos sold 8.2 million shares in the deal, more than the 6 million shares expected.

ARMO is one of biotech's biggest financial success stories in 2018. Its investors locked in their gains when Eli Lilly acquired the immuno-oncology company in May for \$1.6 billion, only a few months after it raised \$147 million at a \$370 million valuation.

Other investors may not fare as well. Biotech bull markets don't last forever; a downturn in the broader market or a change in sentiment around biotech is possible, or even probable. Poor clinical trial results, safety concerns around promising technologies, and shifts in political winds tend to force freewheeling biotech investors to apply the brakes. Even so, the cash raised across the biotech ecosystem in 2018 should prove sufficient to advance scores of drug discovery and development programmes for years to come.

Table 3 | Top-performing IPOs of 2018<sup>a</sup>

Company	IPO date	Return since IPO (%)	Development stage at IPO	Therapeutic or technology focus
Allakos	19 July	227	Phase II	Immunomodulation
ARMO Biosciences <sup>b</sup>	26 January	194	Phase III	Oncology
Autolus	22 June	130	Phase I	T-cell therapies
Crinetics Pharmaceuticals	18 July	106	Phase I	Endocrine disorders
Liquidia Technologies	26 July	103	Phase III	Nanoparticle delivery
Kezar Life Sciences	21 June	98	Phase I	Protein homeostasis
Solid Biosciences	26 January	95	Preclinical	Gene therapy
Gamida Cell	26 October	93	Phase III	Cell therapy
Twist Bioscience	31 October	89	Market	Synthetic DNA
Guardant Health	4 October	88	Market	Liquid biopsy

IPO, initial public offering. Source: Google Finance. <sup>a</sup>Calculated on 30 November 2018. <sup>b</sup>Acquired by Eli Lilly in May 2018.