



Building a better
working world

With disruptors at the gates, how will you secure your company's future?

2018 M&A Firepower Report:
Life Sciences Deals and Data

ey.com/firepowerindex



The better the question.
The better the answer.
The better the world works.

2018 M&A Firepower Report: Life Sciences Deals and Data



With disruptors at the gates, how will you secure your company's future?

What lessons does 2017 provide for setting your company's transaction strategy in 2018?

In the wake of year-end US tax legislation, conditions are ripe for a surge in life sciences M&A as business leaders weigh strategic priorities for capital allocation decisions to generate inorganic growth. Despite relatively high target valuations, M&A remains essential for growth, especially as technology's health care convergence threatens traditional business models.

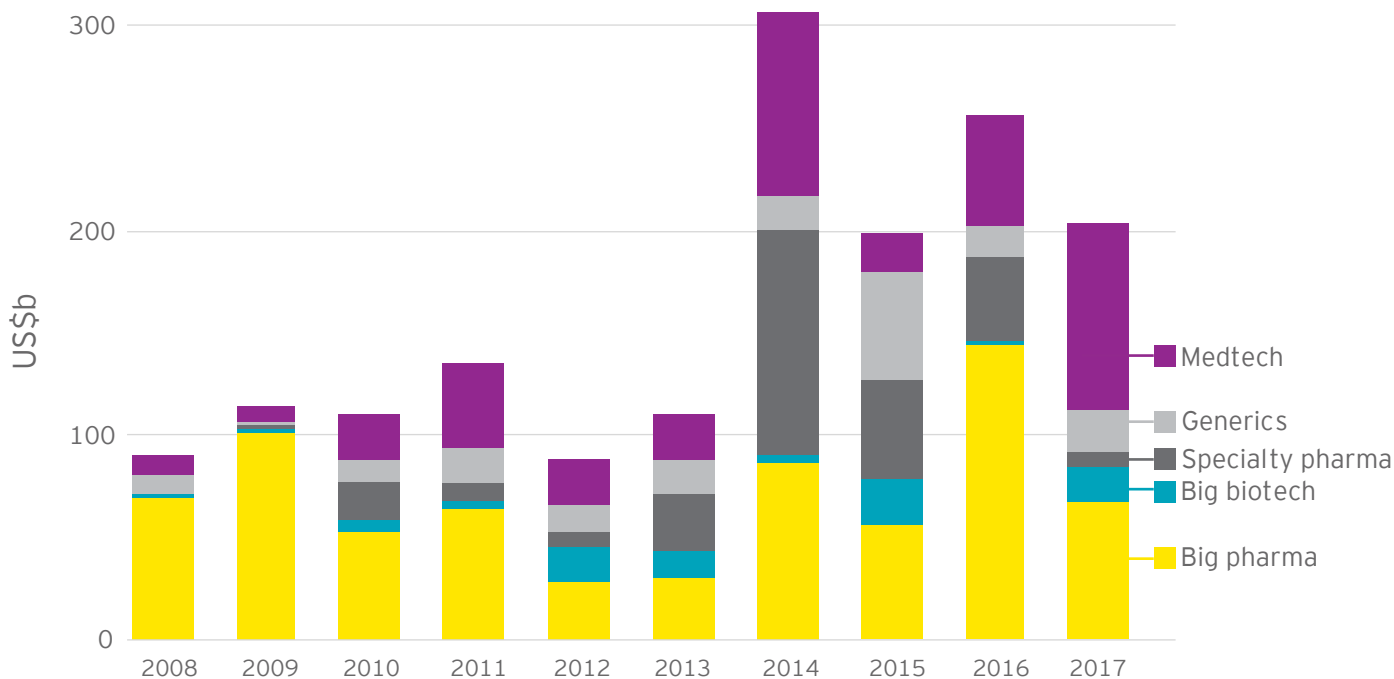
Here are six essential questions to consider in formulating your 2018 M&A strategy:

- ▶ **Do we build scale, diversify or expand our geographic reach?**
The core strategic alternatives for today's biopharma and medtech companies haven't changed, and companies will continue to rationalize portfolios to focus on their innovative cores – or diversify.
- ▶ **Are we ready to buy?**
Waiting for attractive targets to become less expensive or for geopolitical uncertainties to resolve shifted dealmaking from M&A toward risk-sharing alliances and joint ventures in 2017, particularly in biopharma. As the implementation of US tax reform becomes a question of "when," not "if," can we afford to wait any longer to pursue transformative M&A?
- ▶ **Does our business model deliver value, not just a drug or device?**
Successful companies will use M&A and partnerships to establish platforms of care to drive value for multiple stakeholders. And in the process, adapting their strategies to the increasing sway of payers, with a focus on diversifying away from commercial and policy risk, reacting to new competition in core markets or moving beyond the pill/device into services that help to differentiate their products.
- ▶ **Will there be a return of mega-mergers?**
As incursions from technology behemoths threaten the health care status quo, traditional biopharma and medtech leaders may find mega-mergers more tempting as a means to protect profitability, maintain competitiveness in key therapeutic areas and build scale to confront new challenges in the supply chain. The transformative CVS/Aetna merger may exacerbate these challenges, as payers move to drive value through lower costs.
- ▶ **Are we vulnerable?**
Yesterday's acquirers may be tomorrow's targets. Several large and acquisitive companies have seen their abilities to continue to consolidate threatened by slowing growth forecasts, weakened valuations and excessive debt. Companies more accustomed to hunting for acquisition targets may find themselves on the other side of the deal table.
- ▶ **Will buoyant capital markets empower targets to remain independent?**
Small and mid-sized biopharma and medtechs have their own trade-offs to navigate: raising capital to advance promising and cutting-edge science is a realistic alternative to acquisition – for now.

In 2018, facing continued pricing and market access challenges and increased competition in key markets, life sciences companies must confront important decisions on how to generate needed growth. Given the pace of technological change and altered customer expectations, M&A must remain on the C-suite agenda. Well-capitalized non-traditional buyers, whether they are technology giants or new health care or financial entrants from Asia-Pacific, are also interested in the same M&A opportunities, threatening to upend current market dynamics.

While the competitive threats have been increasing and most likely will continue to increase, the urgency to do deals didn't manifest in 2017. Indeed, the total volume and value of life sciences industry M&A fell nearly 20% in 2017, as positive policy developments around areas like corporate tax reform in the US and a favorable tax rate for repatriation of cash held overseas by US companies failed to materialize until year-end. Bucking these trends, medtech M&A value rose 50% in 2017, driven by therapeutic device companies seeking economies of scale in the face of increasing leverage from payers, helping to lift the value of aggregate M&A to more than US\$200 billion (see Exhibit 1).

Exhibit 1. Will M&A rebound in 2018?



Source: Thomson Reuters and EY analysis

Life sciences M&A and divestitures during 2017 also featured a pronounced shift away from the typical epicenters of the biopharma sector and the United States. Biopharmaceutical acquisitions accounted for roughly only a quarter of all M&A value, as compared with almost 80% in 2016.

Strong emerging markets growth cited by several pharma companies during third quarter 2017 investor calls suggest an expectation for improved global growth. A more cautious view on the US pricing and market access outlook as well as policy uncertainty may have contributed to more cross-border M&A.

US deals¹ represented only

30%

of 2017 M&A value,

trending down further from

39%

in 2016

and

52%

in 2015.

But overall, deal drivers remained fairly consistent with prior years, as companies sought scale to help in their defense against rivals and payers and (particularly in biopharma) new assets to drive growth.

¹ US deals are defined as acquisitions where both buyer and seller are US-based.

Betting on focused strategies



Divestitures accounted for roughly 20% of deal value in 2017, in line with the past several years, as companies in biopharma and medtech sectors continued to jettison underperforming, overlapping or non-core divisions or businesses to amass “firepower” (EY’s metric that reflects a company’s ability to pursue M&A - see box).

Firepower defined

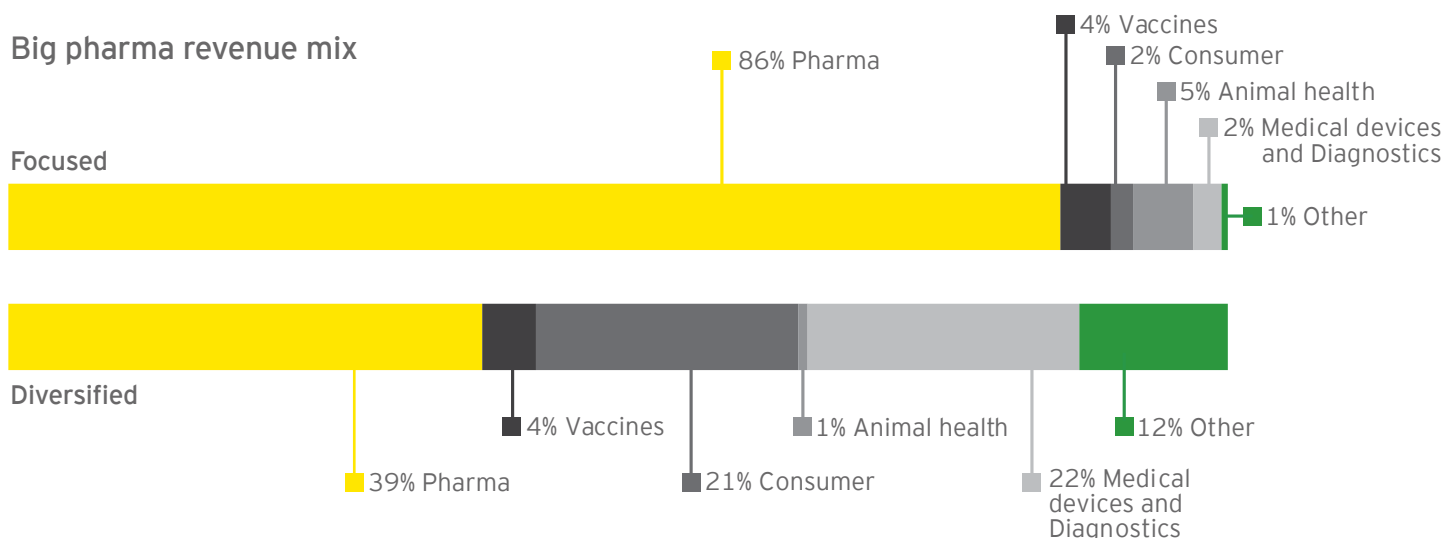
The **EY F repower Index** tracks a group of life sciences companies and their “firepower,” which EY defines as a company’s ability to do M&A based on the strength of its balance sheet. Together, a company’s market capitalization, cash equivalents and debt capacity provide the “firepower” needed for deals. Thus, a company’s firepower increases when either its market capitalization or its cash and equivalents rise – or its debt falls. For more details about the methodology and the assumptions underpinning the **EY F repower Index**, please see the Appendix on page 26.

A slate of significant divestitures could drive substantial deal value in 2018. Eli Lilly’s Elanco animal health unit, Novartis’ Alcon eye care division and Merck KgaA’s and Pfizer’s consumer health care businesses are among several units up for sale or spin-off in 2018. Meanwhile, financially stressed specialty pharma players like Valeant Pharmaceuticals and Teva Pharmaceutical Industries, with drastically reduced firepower, may need to consider further divestitures to reduce leverage and better support their core businesses.

Few in the group of big pharma companies that we have been tracking in our index since the inaugural **2013 EY F repower Index and Growth Gap Report** have opted to further diversify. Although some companies have adopted drug-device strategies in select areas (for example, Eli Lilly’s recent entry with alliance partner Dexcom into diabetes management devices) only a few have meaningfully taken this less traveled road (see Exhibit 2).

While diversified pharmas can deliver smoother earnings and cash flow, they face the challenge of managing multiple businesses that each require different capabilities. In addition, investors continue to be skeptical of conglomerates’ value, advocating for higher margin (and higher risk) biopharma focus. Concentrating on innovative biopharmaceuticals may allow these companies to more quickly engage in large-scale M&A with similarly focused players, as there would be fewer non-core assets to dispose of post-closing. With its intrinsically higher risk profile, the focus model may increase the need for those deals as well.

Exhibit 2. Strategic divergence: focused pharmas versus the road less traveled



Pharma focus: AbbVie, AstraZeneca, BMS, Eli Lilly, Merck, Novartis, Pfizer, Roche, Sanofi; Diversified: Abbott, Bayer, GSK, J&J

Source: EY analysis and financial statements pro forma sales



Seeking scale to combat payer pressure and customer consolidation

Much of 2017's M&A was spurred by three strategic drivers: the need for inorganic growth to fill revenue shortfalls, the pursuit of economies of scale in the face of increasingly consolidated customers (particularly in medtech) and strategies to access complementary product lines or new geographic territories in core markets.

The proposed combination that brings together Luxottica and Essilor integrates two complementary global players in the eyewear industry – the largest ophthalmology device maker with the largest retailer in the space – helping the combined group to fend off competition from less expensive, online rivals. Becton Dickinson also achieves helpful scale in the hospital supply market with its US\$24 billion acquisition of C. R. Bard, where the companies' customers are increasingly focused on reducing costs and gaining clout of their own through mergers.

In 2018, more dealmaking is likely as the collective firepower in biopharma and medtech sectors surges and larger companies see an increasingly crowded field of smaller, high-growth competitors. Competition and payer pressure continue to stunt biopharma growth – both in terms of slower launches and quicker erosion of mature asset revenue. These growth gaps have been core to our *M&A Firepower Report* thesis for several years. In 2017 the growth gaps continued to drive M&A as companies sought to broaden portfolios and move into areas with less pricing pressure or less competition.

Still, biopharma M&A was unusually quiet, with Johnson & Johnson's (J&J) US\$30 billion acquisition of Swiss pulmonary arterial hypertension specialist Actelion leading the way (see Exhibit 3). J&J adds Actelion's on-market and late-stage pulmonary arterial hypertension (PAH) portfolio of specialty medicines, extending J&J's reach into a complementary therapeutic area, while creatively spinning off Actelion's R&D engine into a new biotech, Idorsia. Likewise, Gilead Sciences' US\$11.9 billion acquisition of chimerical antigen receptor T-cell therapy specialist Kite Pharma accelerates Gilead's oncology therapeutics ambitions.

These and a handful of smaller biopharma acquisitions, such as Takeda's US\$5 billion acquisition of cancer specialist ARIAD Pharmaceuticals, illustrate the demand for products and pipeline in growth areas like specialty therapies and oncology that continued to drive biopharma dealmaking in 2017.

Exhibit 3. 2017's top M&A deals see biopharma and medtech bracing for continued payer and competitor pressures

■ Medtech
 ■ Specialty pharma/generics
 ■ Biotech
 ■ Big pharma

Announced	Target name	Target country	Acquirer name	Acquirer country	Value (US\$m)	Strategic drivers (buyer)
23 April	C. R. Bard Inc.	United States	Becton Dickinson	United States	24,078	Scale
16 January	Luxottica and Essilor	Italy and France	Merger of equals	n/a	24,000	Vertical integration
15 May	Patheon NV	Netherlands	Thermo Fisher	United States	7,286	Diversification
18 April	Medtronic-Patient Care	United States	Cardinal Health	United States	6,100	Products & pipeline
20 June	PAREXEL	United States	Pamplona	United States	5,000	Private equity
07 April	Akorn Inc	United States	Fresenius Kabi AG	Germany	4,870	Products & pipeline
13 February	ZELTIQ Aesthetics	United States	Allergan	United States	2,321	Products & pipeline
07 August	NxStage Medical Inc	United States	Fresenius	Germany	2,001	Products & pipeline
31 July	Chiltern	United States	LabCorp Covance	United States	1,200	Scale
15 February	Depuy Synthes (J&J)	United States	Integra	United States	1,045	Products & pipeline
07 April	Merck KGaA's biosimilars	Germany	Fresenius Kabi AG	Germany	729	Products & pipeline
17 October	Impax Labs	United States	Amneal	United States	6,000	Scale
12 February	STADA	Germany	Bain Capital	United States	5,448	Private equity
26 December	Sucampo	US	Mallinckrodt	UK	1,200	Diversification
28 August	Kite Pharma	United States	Gilead Sciences	United States	11,889	Products & pipeline
26 January	Actelion Pharma	Switzerland	J&J	United States	29,258	Products & pipeline
13 October	Bayer Crop Science	Germany	BASF	Germany	7,000	Products & pipeline
09 January	ARIAD Pharma	United States	Takeda	Japan	5,049	Products & pipeline
30 October	Advanced Accelerator	France	Novartis	Switzerland	3,900	Products & pipeline
22 December	Ignitya	US	Roche	Switzerland	1,700	Products & pipeline

Source: Thomson Reuters and EY analysis

High-priced targets require rigorous strategic and financial rationale



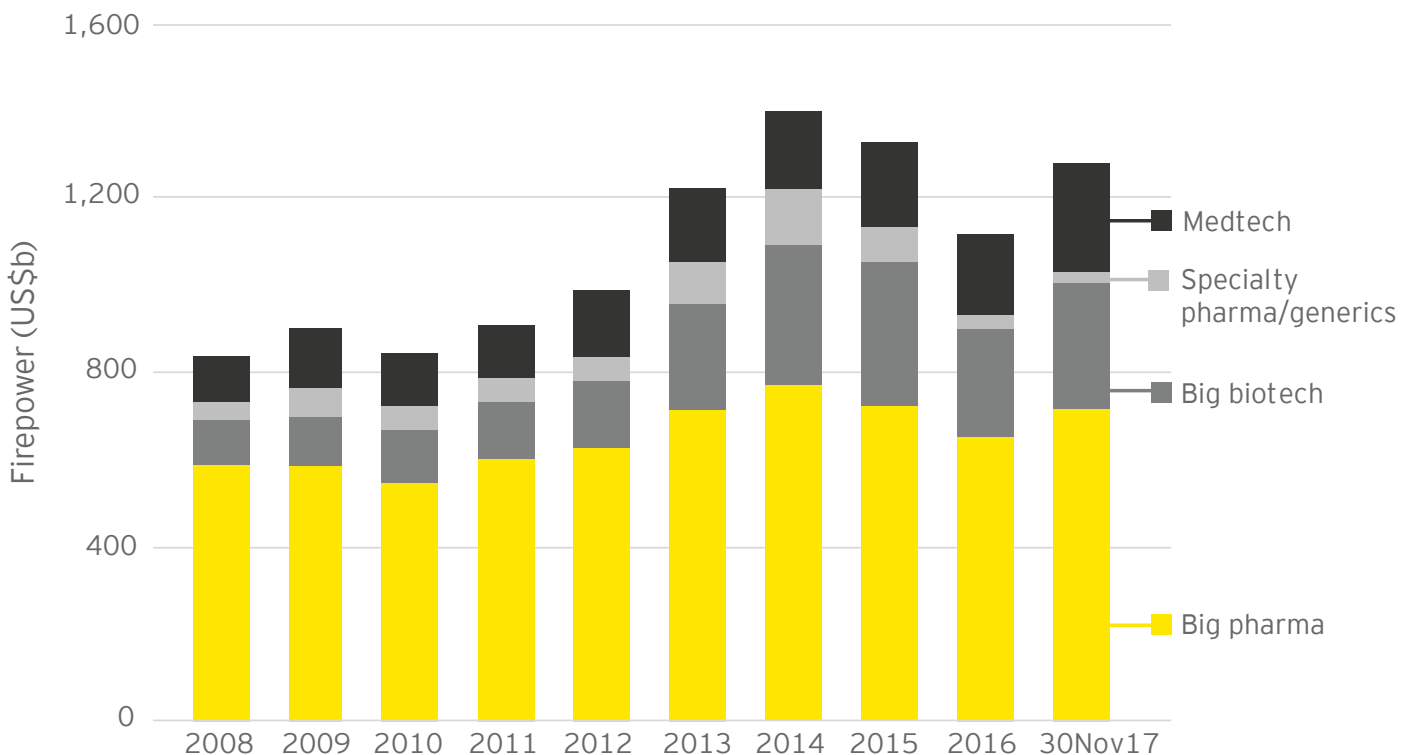
As key therapeutic markets like immuno-oncology continue to consolidate, even positive trends in these core pharma areas can prove to be double-edged swords for companies seeking products and pipeline assets. Acquisition target valuations have been boosted by the availability of private and public market capital, giving target biotechs with mid- and late-stage clinical assets more opportunities to take products deeper into development (see *Life Sciences 2017 Data Book*, Exhibits 15A and 15B). And an industry-friendly regulatory environment is resulting in greater on-market competition and allowing payers to pit competitors against one another (see *Life Sciences 2017 Data Book*, Exhibits 11A and 11B).

With target valuations rising, biopharma M&A dropped in 2017 despite an aggregate increase in the sector's firepower, as many big pharma and big biotechs added to their coffers (see Exhibit 4). Increased small- and mid-sized biotech and device valuations were abetted by increasing access to capital markets, and a continued willingness among large biopharmaceutical companies to hedge risk and share future revenue through creative alliance structures.

Despite high target valuations, determined acquirers may have been more likely to act if macro policy trends had played out differently. Boards waiting for clarity on tax reform as well as the fate of the Affordable Care Act in the US may have shifted potential M&A into a holding pattern, or toward pursuing alternative strategic paths including alliances. Now that (as of this writing) tax reform including favorable tax rates for repatriated foreign earnings appears certain, M&A may accelerate in anticipation of the legislation's enactment.

Indeed, the latest results from EY's *Global Capital Confidence Barometer* suggest pent-up M&A demand from life sciences acquirers. In October 2017, 60% of respondents to that semi-annual survey expected their companies to actively pursue M&A in the next year, up from only 46% when asked that question in April.

Exhibit 4. Life sciences buyers have the firepower and strategic imperatives to boost M&A



Source: S&P Capital IQ and EY analysis

Embracing new business models for a value-driven future

The competitive forces and increasing payer clout affecting the biopharma and medtech markets has driven change in the health care services space as well. M&A can fortify a company against those forces in the near term and enable longer-term strategic repositioning. Fresenius Medical Care has been a leader in dialysis products and services but strategic acquisitions by both Fresenius Medical Care and its sister division, Fresenius Kabi, will align the company with the central forces shaping health care spending in the US while also responding to increasing pricing pressures in the dialysis services market. Fresenius Kabi's acquisition of Akorn establishes US manufacturing for sterile injectables while its acquisition of Merck KGaA's biosimilars business provides a source of erythropoietin (EPO) which is used in dialysis patients. Fresenius Medical's acquisition of the portable dialysis company NxStage for US\$2 billion accelerates its transformation to a full-service dialysis company.

The at-home dialysis market is expected to grow significantly (at the expense of Fresenius' existing business). The three deals in 2017 collectively position Fresenius Medical to remain successful in a dialysis market, a market that is expected to grow more slowly and face significant margin pressure. The company can offer dialysis at lower cost - a better value proposition for payers and patients. Just as Fresenius Medical has envisioned a future dialysis market where it would no longer have been well positioned to serve the needs of patients and payers alike, life sciences leaders need to adopt similarly farsighted views as they formulate their M&A strategies. But there was little evidence of this in 2017 beyond Fresenius.

CEOs and boards should ask how they can position today's drug and device makers to compete in value-driven ecosystems, and to whom they're delivering that value: patients/consumers, health care providers or payers, or some combination of all three. Identifying that customer will enable life sciences companies to design strategies - which may rely on M&A or partnerships - tailored to their needs. Value creation in this environment will be powered by patient-focused, collaborative, data-enabled business models that increasingly expand beyond the product to platforms of care. Creating more effective personalized therapies and better customer outcomes will rely on capturing, combining and sharing sources of behavioral, psychological, social and economic data that are generated by a range of stakeholders.

Value creation in this environment will be powered by patient-focused, collaborative, data-enabled business models that increasingly expand beyond the product to platforms of care.

Traditional M&A isn't the only route to platform building. Joint ventures and other kinds of strategic alliances are flourishing, including Onduo, the Sanofi/Verily diabetes management company, and Medtronic's suite of partnerships in diabetes with tech giant Qualcomm, diabetes data company Glooko, and the insurer UnitedHealthcare, among others.

Through M&A or alliances, life sciences companies must build – or participate in – interoperable information systems that collect, combine and share streams of data. These new health care platforms are emerging to capture value across life sciences: beyond physicians' offices, beyond traditional hospital or laboratory settings, beyond the pill. As new health care platforms enable a frictionless transfer of data and information among stakeholders, challenges to traditional biopharma and medtech strategies will also come from companies that shift from product-centric to customer-centric business models (see EY's paper [Life Sciences 4.0: platform models to capture value](#)).



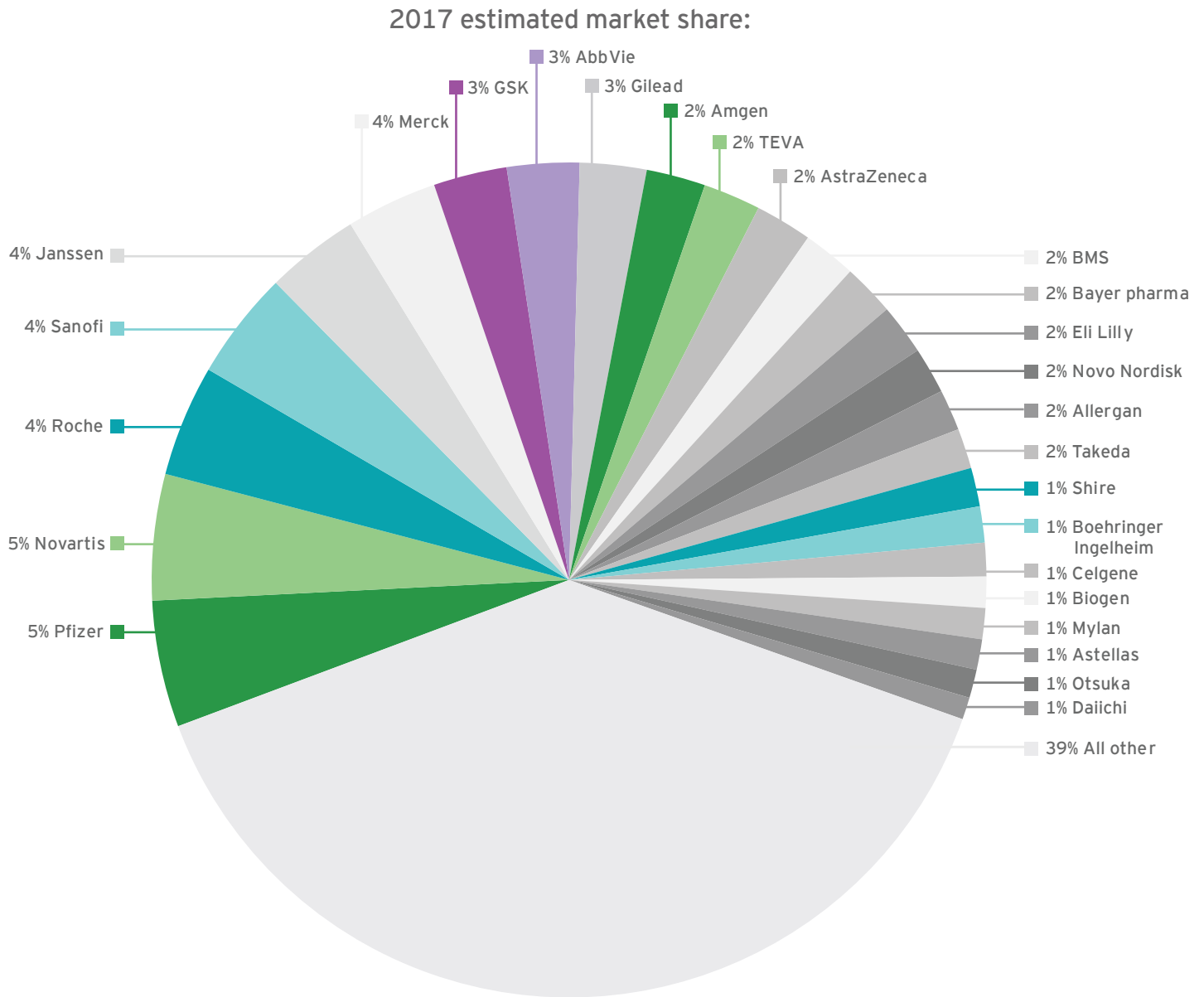
Breaking into the supply chain: what are the ramifications?

The emergence of customer-centric care platforms, a key strategic driver of the CVS/Aetna merger, may spark a new and vigorous round of consolidation among manufacturers, payers and intermediaries, such as UnitedHealthcare's US\$4.9 billion acquisition in December of DaVita Medical Group, DaVita Inc.'s chain of medical groups and physician networks. The underlying dynamics already support larger-scale consolidation within life sciences, and in biopharma in particular, where the market remains highly fragmented. Indeed, the top five companies in the trillion-dollar global pharmaceutical market – Pfizer, Novartis, Roche, Sanofi and Johnson & Johnson's Janssen – each have no greater than 5% market share (see Exhibit 5).

As we've written in prior *M&A Firepower Reports*, biopharma leaders are facing payer pushback on new product launches enabled in part by increasingly competitive therapeutic marketplaces and faster erosion of revenue from older products. Incursions in traditional biopharma and medtech supply chain markets by technology companies intent on transforming health care may exacerbate these conditions.



Exhibit 5. Global pharmaceutical industry remains highly fragmented: no leaders have greater than 5% share of US\$1 trillion global market



Source: IMS, S&P Capital IQ and EY analysis.

Indeed, recent disclosures reflecting Amazon’s expected entry into pharmacy services cast new light on supply chain and insurer dealmaking activity.² Other technology giants could similarly shake-up health care markets in ways that aren’t necessarily to the benefit of pharmaceutical and device manufacturers.

Big biopharmas have generally avoided large-scale M&A since 2009, but mega-mergers have become a compelling strategic alternative for some as consolidation in the supply chain puts additional pressure on manufacturers. The wave of medtech mega-mergers over the past few years (such as Medtronic/Covidien, Zimmer/Biomet, Becton Dickinson/C. R. Bard, to name a few) is in large part a response to the impact of rising customer purchasing power. Medtech has put its firepower to work; biopharma’s considerable firepower mostly remains idle. Large-scale consolidation offers big pharma a means to simultaneously gain the muscle necessary for the fights ahead and remain focused on core innovation.

² Amazon’s wholesale distributor licenses the company obtained in several states are needed for the sale of medical equipment to licensed professionals - and don’t necessarily signal entry into the drug supply chain.



Yesterday's acquirers may be tomorrow's targets

Not all large biopharmas are dealing from positions of strength as pipeline projects fail, firepower is spent or erodes, or competition and payer pressure cuts into revenue projections. Some are being forced to divest assets and use the resulting capital to pay down debt.

The largest specialty pharma players, Allergan and Shire, continue to exhibit above-market growth but now may lack sufficient firepower to pursue significant deals (and possibly, to fend off a determined acquirer). Companies that are expected to outgrow the market but whose ability to make further acquisitions has been hobbled by reduced firepower might be considered vulnerable.

In late October, Celgene disappointed the market by missing consensus top-line estimates in the third quarter, significantly lowering its market capitalization. Celgene, like Allergan and Shire, remains a growth story. Unlike those companies, the big biotech still has significant firepower – approximately US\$30 billion (see *Life Sciences 2017 Data Book*, Exhibit 8).

The availability of public and private capital to fund biotech pipelines has reduced biotech's need to pursue M&A exits. The appetite among venture capitalists (VCs) – traditional players, crossovers and strategic investors alike – remains strong. In several cases VCs have been willing to finance private biotech with enough capital for them to have reached so-called “unicorn” status: billion-dollar-plus valuations more common in the technology world than in biotech.

Companies that are expected to outgrow the market but whose ability to make further acquisitions has been hobbled by reduced firepower might be considered vulnerable.

With so much capital available from investors and through partnerships – the liquid biopsy company Grail, the mRNA therapeutics company Moderna and the diabetes drug/device combination play Intarcia come to mind – these unicorns have no need to launch into the relatively choppy waters of the public capital markets.

For those companies that do need to provide liquidity to their investor syndicates, the biotech IPO market has rebounded nicely off 2016's lows, driving public market competition and reducing sellers' need for deals, increasing valuations and at the very least delaying M&A exits.

M&A alternatives and capital markets enable risk-and reward-sharing, even between large pharmas

There's more than one way to fill a pipeline. Amid increasingly rapid competitive cycles and uncertainty around pricing power, biopharma strategic alliance spending has increased while M&A has fallen. In 2017, upfront alliance payments represented nearly 10% of all firepower spending by biopharma companies, a figure that has risen steadily over the past five years. This might be more correlation than causation, but the relative firepower of buyers compared with the relative valuations of target biotech companies suggests that many targets are currently out of reach. What's more, large pharma companies appear increasingly willing to partner with each other – hedging risk and sharing reward on some of industry's most intriguing clinical-stage assets.

2017 year-to-date alliance volume and value suggest the industry is on pace to match 2016's record totals (see *Life Sciences Data Book*, Exhibit 12). Since 2013, total alliance value, upfront alliance value and deal volume have all increased significantly. Partnerships such as Bayer's November 2017 US\$400 million global development and commercialization partnership with Loxo Oncology might have been acquisitions in less buoyant markets.

The strategic alliance established in July 2017 between Merck and AstraZeneca (AZ) illustrates how large companies are willing to partner with one another in what are becoming extremely valuable deals. Merck paid US\$1.6 billion up front to co-develop and co-commercialize AZ's first-in-class Lynparza PARP inhibitor, with each company free to combine Lynparza with its own marketed and experimental oncology therapeutics (the deal could be worth up to US\$8.5 billion).

Moreover, to the extent that aggregate alliance and milestone payments are rising, this may contribute to the deployment of firepower that at one time would have been allocated for M&A. The Merck/AZ deal also reflects the massive opportunity in combination oncology therapeutics, companies' willingness to partner even their best assets in order to be able to afford to develop them to the fullest extent possible, and an alternative use of considerable firepower. Several other large company alliances have emerged over the past few years – in neurology/CNS, Amgen and Novartis swapped co-development and co-commercialization rights to key migraine and Alzheimer's disease candidates, for example.

Not every deal is so highly valued, but each strategic alliance sets up future possible acquisitions and can allow large players to begin steering development relatively early and less expensively. In therapeutic areas driven by combination therapy, such as oncology, these alliances can even enable large players to test combinations without committing significant firepower, or any firepower at all.

Unlike in the biopharma sector, medtech strategic alliances aren't typically an integral way for entrenched players to access new assets and technologies in their chosen areas of focus. Although medtechs have enjoyed an atypically buoyant financing environment – particularly in terms of venture capital – IPOs have not competed with M&A exits to the same degree as in the biopharma sector (see *Life Sciences Data Book*, Exhibit 15B).

2018 outlook: firepower finally unleashed?

A year ago we contemplated how pent-up acquisition demand coupled with potential new policy initiatives, principally US tax reform and repatriation, could unleash firepower for M&A in 2017. Based on EY analysis, the top 10 US life sciences companies have roughly US\$160 billion in cash overseas and we expected some of that cash to be deployed for M&A in the US. We also argued that heightened pricing pressure for newly launched products and mature assets alike would create momentum to consolidate.

Tax reform and the anticipated deal spree that might have followed was only delayed; payer strength and competition (abetted by an unusual accomplice: the increasingly industry-friendly regulatory environment) are indeed sapping biopharma and medtech companies' pricing power. As we move into 2018, M&A becomes even more important for life sciences companies to meet their growth goals. Yet leaders in the biopharma and medtech industries face new and well-capitalized challengers as well as the possible disruption of the supply chain, which may have unanticipated consequences.

Regulatory green lights spark increased competition

Fighting for market share in key therapeutic areas has already begun to affect individual players' growth and pricing power as US generic drug approvals surge and new products join first-in-class pioneers in areas where pricing power has been relatively strong.

Take for instance oncology. There are now five PD-1/PD-L1 inhibitor therapeutics on the US market. These so-called "immuno-oncology backbone therapies" could soon be joined by new entrants. Competitors are emerging in other key targets as well (see *Life Sciences 2017 Data Book*, Exhibit 11B). AstraZeneca's first-in-class Lynparza PARP inhibitor, so valuable to Merck in the companies' blockbuster 2017 deal, already faces two on-market competitors. AstraZeneca itself received approval for Calquence in late October, a BTK inhibitor that represents the first competition to the blockbuster Imbruvica sold by AbbVie and J&J. Pfizer's Ibrance enjoyed time as the sole CDK4/6 inhibitor on the market but by the end of 2017 faced new competition from similar drugs from Novartis and Eli Lilly.

This competition will eventually affect the oncology marketplace - and similar scenarios could play out even more quickly in other core biopharma markets that haven't shown the price resiliency of oncology therapeutics (see *Life Sciences 2017 Data Book*, Exhibit 10). As such, we continue to expect consolidation in highly fragmented therapeutic areas such as oncology, as well as some flight to therapeutic white spaces such as Alzheimer's disease, where few treatments are available and the unmet medical need is high, but the scientific risk is undeniable.

Emerging sources of firepower complicate incumbents' strategies

Meanwhile, there are emerging sources of firepower that may play an increasingly visible and complex role in biopharma and medtech M&A. CEOs and boards should examine the implications of increased dealmaking by these non-traditional players.

First, consider the vast and largely untapped firepower from corporations and investors in Asia that are interested in accessing global innovation and gaining more exposure to Western markets. China in particular is increasingly pouring investment into the life sciences sector – and much of that investment is moving outside of its own borders. Large specialty pharma companies were once key buyers of biopharmaceutical assets. But some of those same companies are now forced to divest assets that are finding homes among Asia-Pacific strategic investors, including generics companies, or private equity firms. The Chinese retail, health care and financial services group Sanpower Group acquired Valeant's Dendreon cancer vaccine business for US\$820 million, for example.

Secondly, firepower is amassing from outside the life sciences sector altogether. In the October 2017 edition of EY's *Global Capital Confidence Barometer* survey, life sciences executives pegged increased competition from companies outside the industry as the top disruptive force.

This effect on the life sciences industry is too big to ignore, especially as several well-capitalized players such as Amazon, Apple, Alphabet and Tencent openly muse about the future impact they may have on health care. Several of these companies are already placing bets alongside traditional life sciences plays, either as strategic investors or joint venture partners. Their investments follow major commitments to health care from the likes of IBM (Watson), Intel and Samsung, among others.

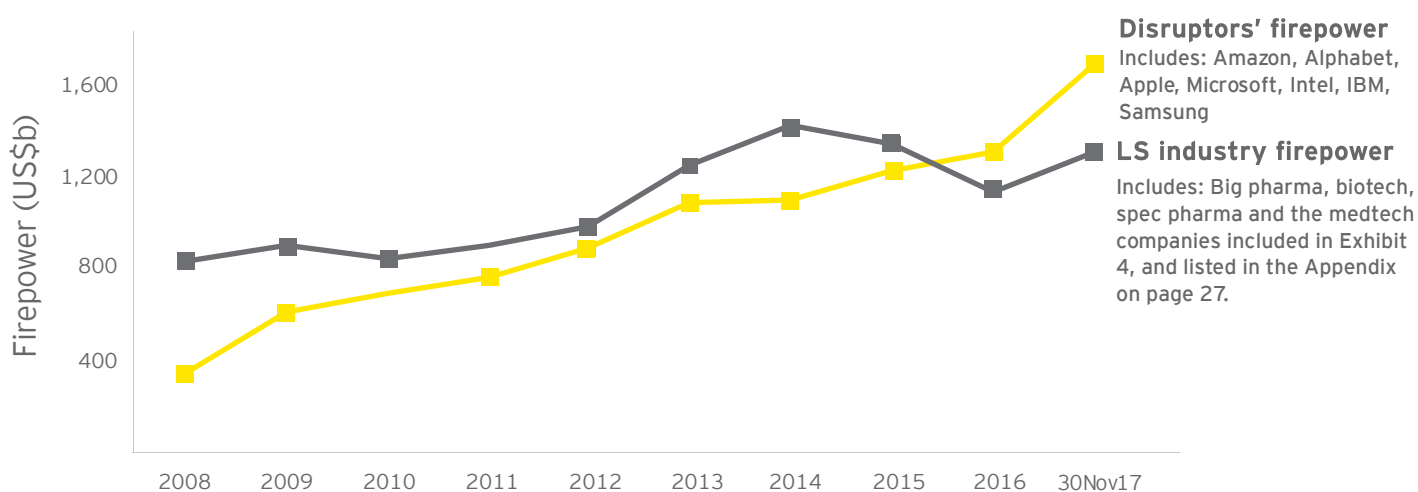
There are already many examples of cross-sector partnerships that may form the basis for future disruptive moves. Alphabet's Verily Life Sciences has partnered with Johnson & Johnson's Ethicon to create Verb Surgical, with GlaxoSmithKline to create the bioelectric medicine company Galvani Bioelectronics, and with Alcon to develop new intra-ocular lenses. Amazon has backed Grail's liquid biopsy endeavors and partnered with Merck in diabetes management, while Apple's ResearchKit is already changing how clinical trials are structured and the kinds of data that can be captured.



The effects of disruptive firepower on the life sciences industry

As 2018 dawns it's increasingly necessary for CEOs and boards to imagine the effect that the tech giants' firepower might have on the life sciences industry should any of them decide to deploy it. A group of just seven technology sector disruptors boasts more firepower than 65 life sciences leaders (see Exhibit 6). Over the past decade, this set of disruptors' firepower has soared five-fold to nearly US\$1.7 trillion.

Exhibit 6. Tech firepower outpacing life sciences firepower

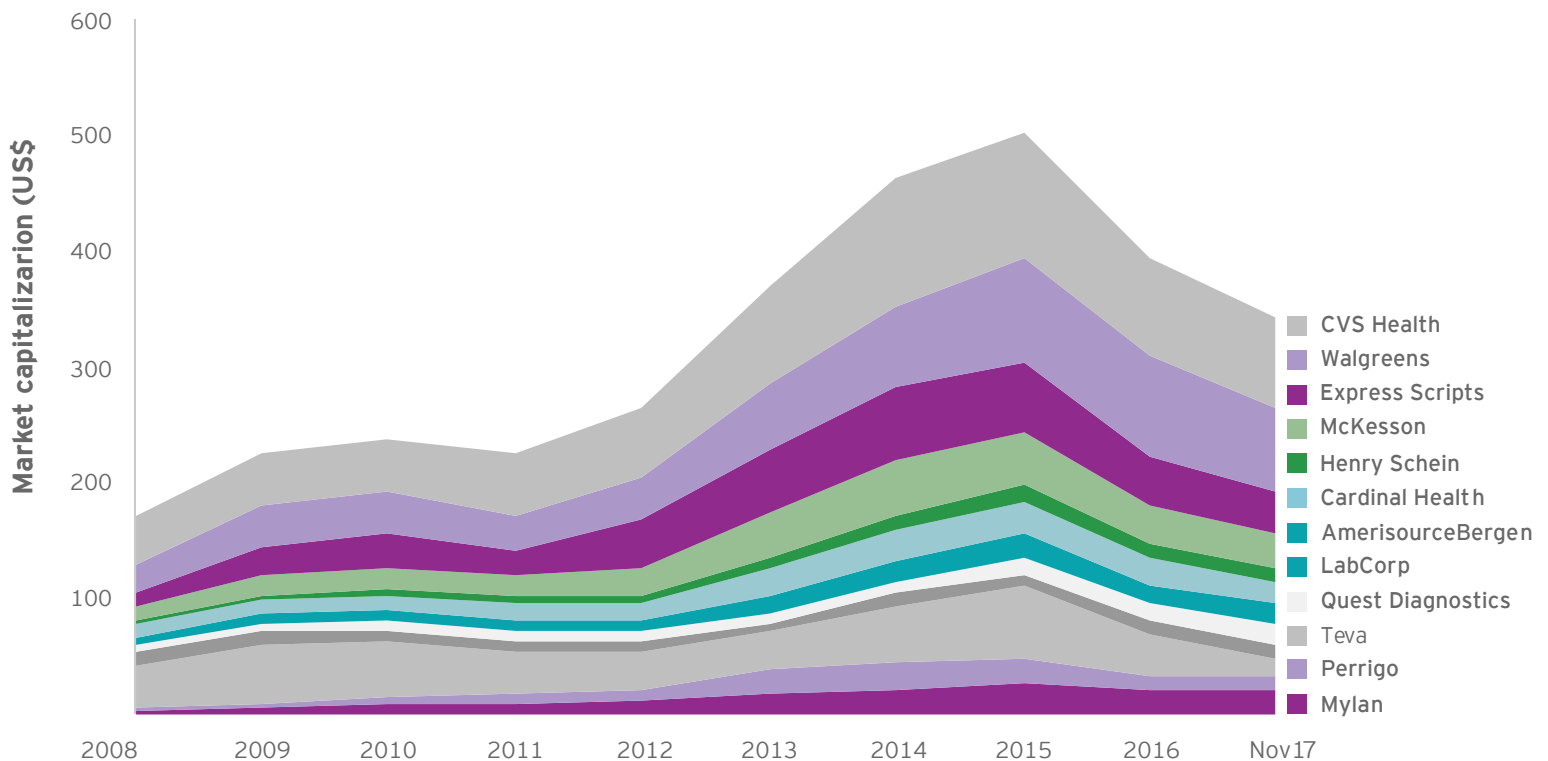


Source: S&P Capital IQ

And this firepower could soon be focused on the life sciences supply chain, with its high-volume generic drug manufacturers, diagnostic laboratories, distributors/wholesalers, pharmacy benefit managers and retail pharmacies each ripe for potential disruption. (Owning a leading company in the generics space – which accounts for about 85% of all US drug volume according to the QuintilesIMS May 2017 report – could put 10% or more prescriptions filled in the US in the hands of a distribution-savvy technology player.)

The aggregate market capitalization of the companies responsible for the largest volume share of drug and diagnostics distribution peaked in 2015 at about US\$500 billion, but has since fallen at least 30% (see Exhibit 7). Also, according to S&P Capital IQ data and EY analysis, the collective revenue of this group is projected to exceed US\$1 trillion in 2017, with an average 6% EBITDA margin (roughly US\$55 billion in 2017 profit).

Exhibit 7. Supply chain's falling market capitalization



Source: S&P Capital IQ and EY analysis

Potential disruption could take several forms. But any entry into the life sciences supply chain could result in a reduction in profitability for incumbents as margins get squeezed along any link in the chain. Might this be welcome news for biopharma or medtech companies?

“Just like science is disrupted with gene therapy or novel treatments, I think the drug distribution channel also should be disrupted with improvements based on technology or efficiency,” Allergan CEO Brent Saunders noted during the company’s November call with analysts to discuss the company’s third quarter results. Pfizer CEO Ian Read was equally sanguine: “Any system of distribution that can cut costs and get a wide availability of products to patients is something that the whole industry would be interested in,” he noted in response to a question about Amazon’s intentions during Pfizer’s own third quarter call.

“Any system of distribution that can cut costs and get a wide availability of products to patients is something that the whole industry would be interested in,”

Pfizer CEO Ian Read noted in response to a question about Amazon’s intentions during Pfizer’s own third quarter call.

Vertical integration? Disruption's shadow looms larger

Biopharma CEOs' calm notwithstanding, such moves could ultimately drive margins down for major biopharmas and medtechs even as they usher in a streamlined or more rational supply chain. Biopharmaceutical companies in particular have enjoyed significant EBITDA margin expansion over the past several years, from 32% in 2013 to a projected 37% in 2017, according to S&P Capital IQ.

This expansion is unsustainable in a disruption-influenced supply chain scenario, as Amazon and its ilk shift the balance of negotiating power (just ask book publishers). Drug and device executives and boards would be wise to consider pre-emptive measures beyond ongoing portfolio rationalization and growth-driven alliances and M&A. Recent transactions creating various combinations of insurers, pharmacy benefit managers, physician practices, and pharmacies provide compelling evidence that such thinking is already being implemented within the supply chain.

Maneuvering by drug and device companies could include select attempts at vertical integration through acquisitions or partnerships across the supply chain, or the exploration of new business models that move biopharma and medical device companies beyond their core drug/device markets. Such deals would mitigate the impact of supply chain shakeups by capturing greater control and limiting the breadth of new entrants' market opportunities – or at least raising barriers to market entry.

Streamlining the drug supply chain or otherwise implementing technological advances enable the combination of payer-level and pharmacy-level data would ideally help to better track patient outcomes. Better data on patient outcomes would accelerate the ongoing shift to outcomes-based payment contracts, and could also hasten the decline in overall prescription volume (off 3% year-on-year, according to drug data firm IMS, including an 8% decrease in branded drug prescriptions), which would exacerbate biopharma's revenue growth gaps and increase the need for consolidation.

Stage set for M&A surge

We expect that in 2018 the total value of life sciences M&A should once again surpass US\$200 billion, as the fundamental drivers of competition and pricing pressure in core therapeutic battlefields intensify, as the downstream effects of US tax reform materialize and as new sources of capital from outside the traditional centers of life sciences M&A increasingly join the fray.

In 2017 we reached this “new normal” threshold with an unusual mix of medtech and ex-US M&A. It’s not hard to see those expectations being eclipsed as underlying biopharma growth challenges persist.

Multiple large divestitures remain in the industry pipeline, and could be announced in 2018. Big biotechs, threatened by biosimilar penetration and pipeline setbacks, may finally deploy significant firepower. Overleveraged specialty pharmaceutical companies may return to the deal table in 2018 as determined sellers. Firepower trapped overseas has finally been unleashed by new tax legislation in the US, and may be put to work. Any of these possibilities could boost M&A value in 2018 beyond the US\$200 billion threshold of the past few years. Most notably, the specter of disruption in the pharmaceutical supply chain is likely to accelerate defensive consolidation among entrenched players. If so, it could even spark a return to megadeals in the biopharma sector as drug companies spy margin pressure on the horizon.



M&A Outlook

The life sciences industry's firepower was not unleashed in 2017, as we had expected. While executives waited for tax reform or better deal terms, the need for inorganic growth became even more acute:

1 Core innovation

Leaders in biopharma and medtech sectors will ramp up efforts to focus on core innovation in 2018, while continuing to broaden geographic reach to hedge against increasing pricing pressure in the US.

2 M&A surge

Following 2017's lull in biopharma dealmaking and the passage of US tax reform, in 2018 the need to access inorganic growth via M&A will outweigh concerns about target valuations. Total life sciences M&A value is likely to exceed US\$200 billion once again.

3 Delivering value

The life sciences industry has been slow to act on the imperative to deliver value, not just products, to the marketplace. M&A and partnerships, along with the creation of data-centric platforms, will be key to this transformation in 2018.

Where are your opportunities to expand and enhance key therapeutic or device franchises?

Is your capital allocation strategy aligned with your growth needs?

Does your business model generate value across patients, providers and payers?

4 Creative structures
Buyers' agendas will be complicated by smaller targets' access to private venture and public market capital. Creative deal structures will be key to accessing small- and mid-sized biotech and medtech innovation in 2018.

5 Disruptive firepower
Biopharma and medtech leaders are facing new pressures from unfamiliar competitors outside traditional life sciences sector strongholds, as technology companies evaluate taking a bite out of supply chain margins.

6 Megamergers return
The erosion of industry pricing power by competition and payer pressure as well as the effect of disruptive firepower in 2018 could well result in the kind of large-scale dealmaking not seen in biopharma in nearly a decade. Several large targets, hobbled by weakened growth outlooks and lacking firepower, find merging a more compelling strategic alternative.

Is your business development approach flexible enough to deliver the best pipeline opportunities?

Are you positioned to withstand the ramifications of supply chain incursions?

Do you have the dealmaking firepower to play offense - and defense?

New in this report is the *Life Sciences 2017 Data Book* which can be found on the following pages. This section consolidates EY's extensive research and analysis on the biotech and medtech sectors – including new product approvals, deal activity, financial performance and financing – into a single compendium of 2017 data. We supplement key charts with brief insights on significant trends and takeaways.

Appendix: methodology and definitions

The EY Firepower Index follows a group of life sciences companies (see next page) to measure “firepower” trends. EY defines firepower as a company’s capacity to fund transactions based on the strength of its balance sheet. It has four key inputs:

1. Cash and equivalents
2. Existing debt
3. Debt capacity, including credit lines
4. Market capitalization

The following assumptions are the underlying factors for the EY Firepower Index:

- ▶ A company will not acquire targets that exceed 50% of its existing market capitalization.
- ▶ The debt/equity ratio of the combined entity created by a transaction cannot exceed 30%. (Equity is measured on a market value basis.)

While some pharma companies have made acquisitions that go beyond these upper limits, our intent is to apply a uniform methodology to measure relative changes in firepower. The EY Firepower Index measures the capacity to conduct M&A transactions financed with cash or debt. It does not measure the ability to conduct stock-for-stock transactions. However, increases in a company’s stock price do boost its firepower under the EY Firepower Index’s formula because increased equity enables companies to borrow more to finance transactions.

While the EY Firepower Index and this report focus on M&A, we acknowledge that licensing will remain an important business development strategy. However, in assessing the growth gaps of big pharmas, M&A is more relevant than in-licensing since acquiring companies with commercialized products have a more immediate effect on a pharma company’s revenue gap than does in-licensing pipeline assets.

In this report, we include the following companies in the big pharma category:

- ▶ AbbVie Inc.
- ▶ Astellas Pharma Inc.
- ▶ AstraZeneca plc
- ▶ Bayer AG
- ▶ Bristol-Myers Squibb Company
- ▶ Daiichi Sankyo Company Ltd.
- ▶ Eisai Co. Ltd.
- ▶ Eli Lilly and Company
- ▶ GlaxoSmithKline plc
- ▶ Johnson & Johnson
- ▶ Merck & Company Inc.
- ▶ Novartis AG
- ▶ Pfizer Inc.
- ▶ Roche Holding AG
- ▶ Sanofi
- ▶ Takeda Pharmaceutical Co. Ltd.

We include the following companies in the big biotech category:

- ▶ Alexion Pharmaceuticals Inc.
- ▶ Amgen Inc.
- ▶ Baxalta plc
- ▶ Biogen Idec
- ▶ BioMarin Pharmaceutical Inc.
- ▶ Celgene Corporation
- ▶ Gilead Sciences Inc.
- ▶ Incyte Corporation
- ▶ Novo Nordisk A/S
- ▶ Regeneron Pharmaceuticals Inc.
- ▶ Seattle Genetics Inc.
- ▶ Vertex Pharmaceuticals Inc.

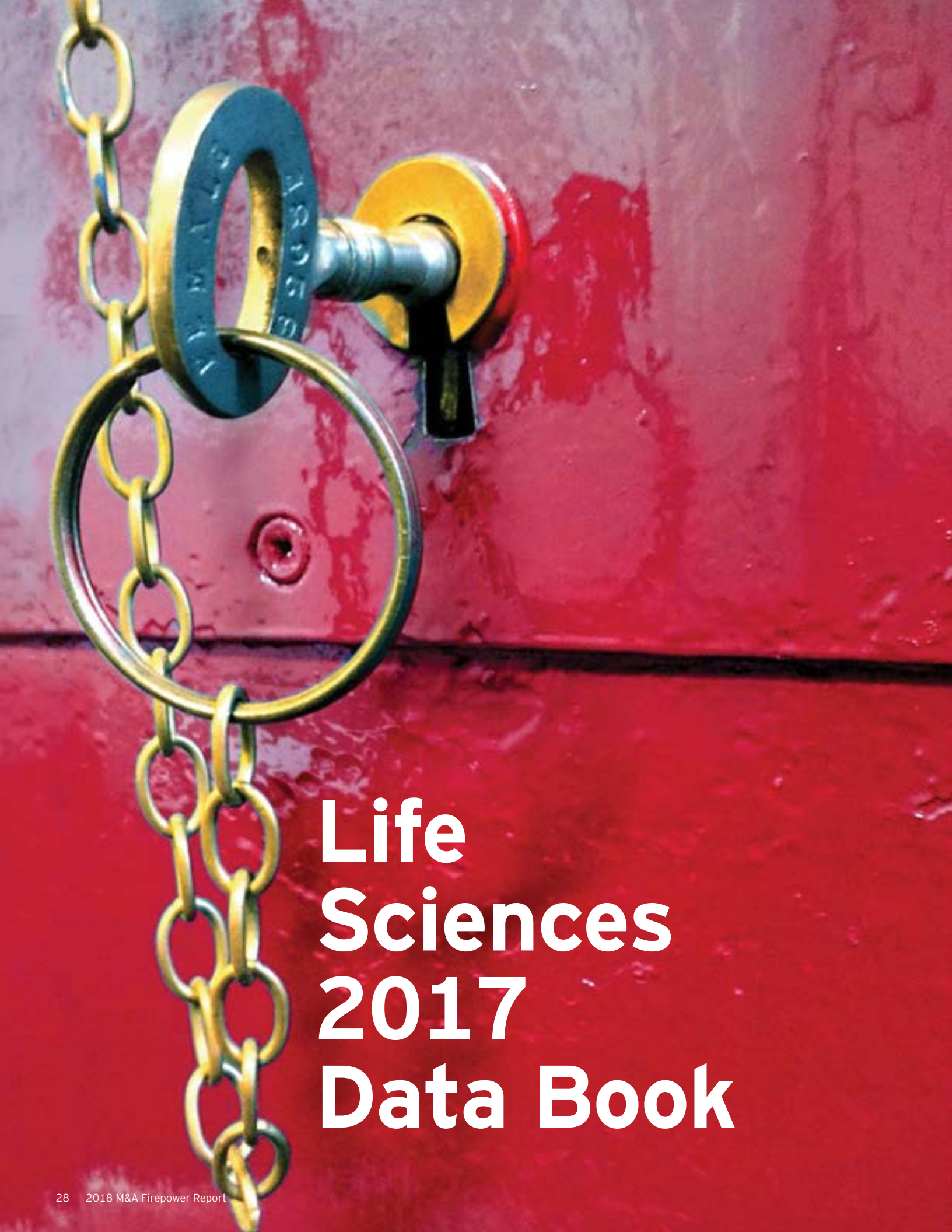
We include the following companies in the specialty pharma/generics category:

- ▶ Alkermes
- ▶ Allergan plc
- ▶ Endo International plc
- ▶ Jazz Pharmaceuticals plc
- ▶ Mylan Inc.
- ▶ Perrigo Company plc
- ▶ Shire plc
- ▶ Teva Pharmaceutical Industries Ltd.
- ▶ UCB
- ▶ Valeant Pharmaceuticals International Inc.

Four companies in the specialty pharma/generics list have generics businesses (Allergan, Endo, Mylan and Teva).

We include the following companies in the medtech category:

- ▶ Abbott Laboratories
- ▶ Baxter International Inc.
- ▶ Becton Dickinson
- ▶ bioMérieux S.A.
- ▶ Bio-Rad Laboratories, Inc.
- ▶ Boston Scientific Corporation
- ▶ Bruker Corporation
- ▶ C. R. Bard, Inc.
- ▶ DexCom, Inc.
- ▶ DiaSorin S.p.A.
- ▶ Edwards Lifesciences Corporation
- ▶ Foundation Medicine, Inc.
- ▶ Genomic Health, Inc.
- ▶ Haemonetics Corporation
- ▶ Hill-Rom Holdings, Inc.
- ▶ Hologic, Inc.
- ▶ Illumina, Inc.
- ▶ Integra LifeSciences Holdings Corporation
- ▶ Intuitive Surgical, Inc.
- ▶ Medtronic plc
- ▶ Myriad Genetics, Inc.
- ▶ Opko Health, Inc.
- ▶ OraSure Technologies, Inc.
- ▶ PerkinElmer, Inc.
- ▶ QIAGEN N.V.
- ▶ Quidel Corporation
- ▶ Smith & Nephew plc
- ▶ Sonic Healthcare Limited
- ▶ Stryker Corporation
- ▶ Sysmex Corporation
- ▶ Teleflex Incorporated
- ▶ Thermo Fisher Scientific Inc.
- ▶ Varian Medical Systems, Inc.
- ▶ Veracyte, Inc.
- ▶ Waters Corporation
- ▶ Zimmer Biomet Holdings, Inc.

A close-up photograph of a brass padlock and chain on a red metal surface. The padlock is yellow with a blue ring. The chain is made of brass links. The background is a textured red metal surface with a small hole visible below the padlock.

Life Sciences 2017 Data Book

Index

Additional analyses

- Exhibit 8. Recent biopharma firepower dynamics make mega-mergers more likely
- Exhibit 9. Healthy medtech growth and rising firepower support ongoing consolidation
- Exhibit 10. Intensifying oncology therapeutic battlefield should accelerate M&A and alliances

Supplemental biotech and medtech research

► New product approvals

- Exhibit 11A. FDA approvals rebound strongly in 2017; PMA approvals uptick slightly from 2016
- Exhibit 11B. Accelerating generic drug approvals are pressuring US pharma sales growth

► Deal activity and trends

- Exhibit 12. Increased strategic alliances provide lower risk alternatives to M&A
- Exhibit 13. Therapeutics companies valued primarily on their pipelines could be attractive acquisition targets

► Financial performance

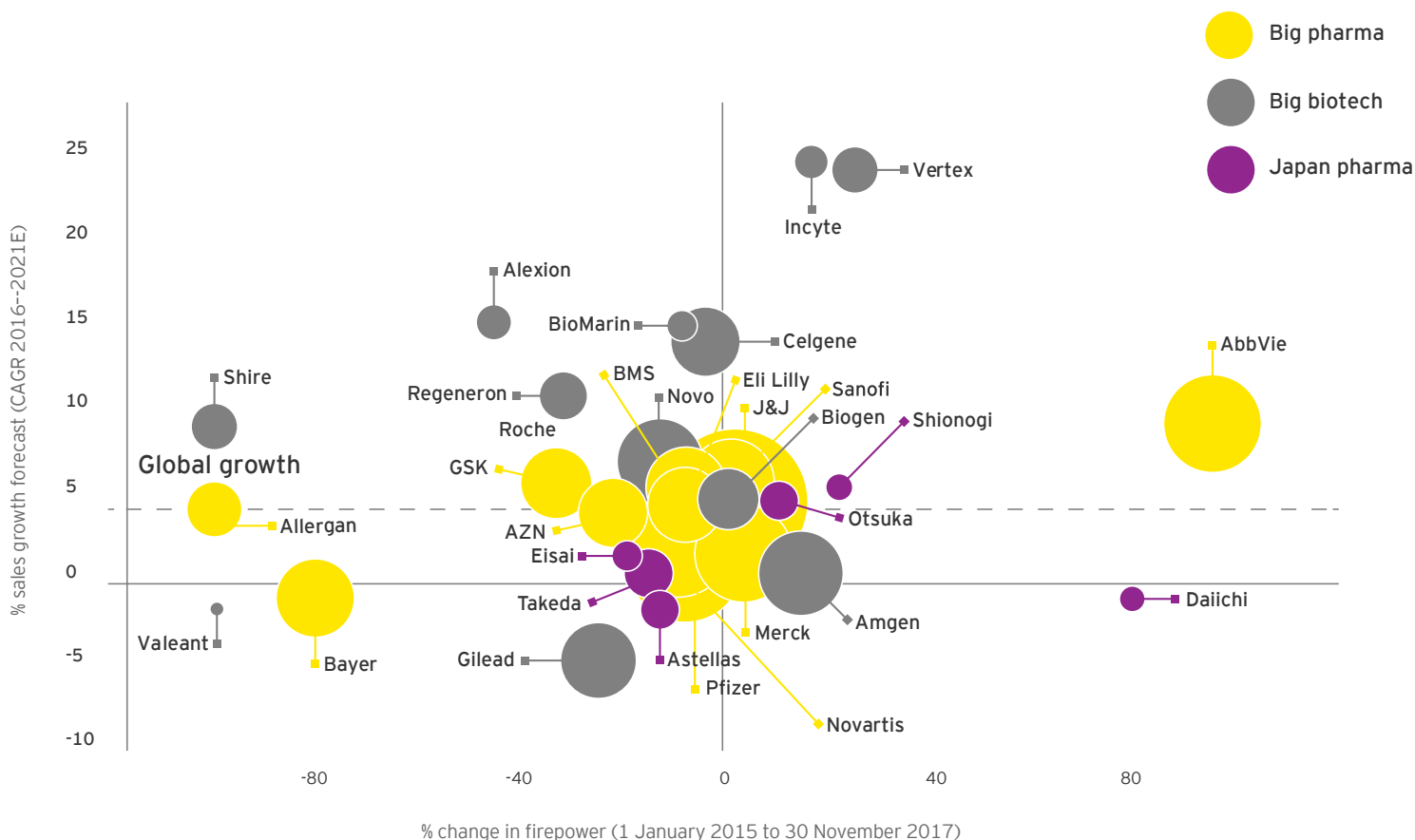
- Exhibit 14. US biotech's stock prices underperformed indices, while earnings growth and shareholder-friendly capital allocation strategies helped medtech outperform

► Financing

- Exhibit 15A. Biotech raised nearly US\$100b over past three years to advance pipelines and delay M&A exits
- Exhibit 15B. Medtech financing levels reflect investor expectations for strong growth
- Exhibit 16. Biotech IPOs rebounded while medtech IPOs slowed
- Exhibit 17A. IPO investors focused on oncology in search of future blockbusters
- Exhibit 17B. US and Sweden dominate the medtech IPO market with 18 out of 20 IPOs
- Exhibit 18A. Lucrative oncology market attracts most US venture financing
- Exhibit 18B. 60% of European venture financing went to oncology in pursuit of the next breakthrough
- Exhibit 18C. Most of the top US medtech venture financings in 2017 were in late-stage rounds
- Exhibit 18D. In contrast to the US, most of the top European medtech venture financings in 2017 were in early-stage rounds
- Exhibit 19A. Medtech innovation capital in the US and Europe regained ground as investor confidence rose
- Exhibit 19B. Biotech innovation capital recovered as drug price regulation fears receded
- Exhibit 20A. Hunting for pipeline assets and commercial growth, US and European biotechnology early-stage venture capital remained high
- Exhibit 20B. Early-stage VC funding in medtech reached record levels as investors pursued promising innovation
- Exhibit 21. Corporate VC investment soared as companies invested directly to create growth options
- Exhibit 22. New England and San Francisco biotech hubs continue to lead in raising biotech capital
- Exhibit 23. VCs found most of their key medtech opportunities in California

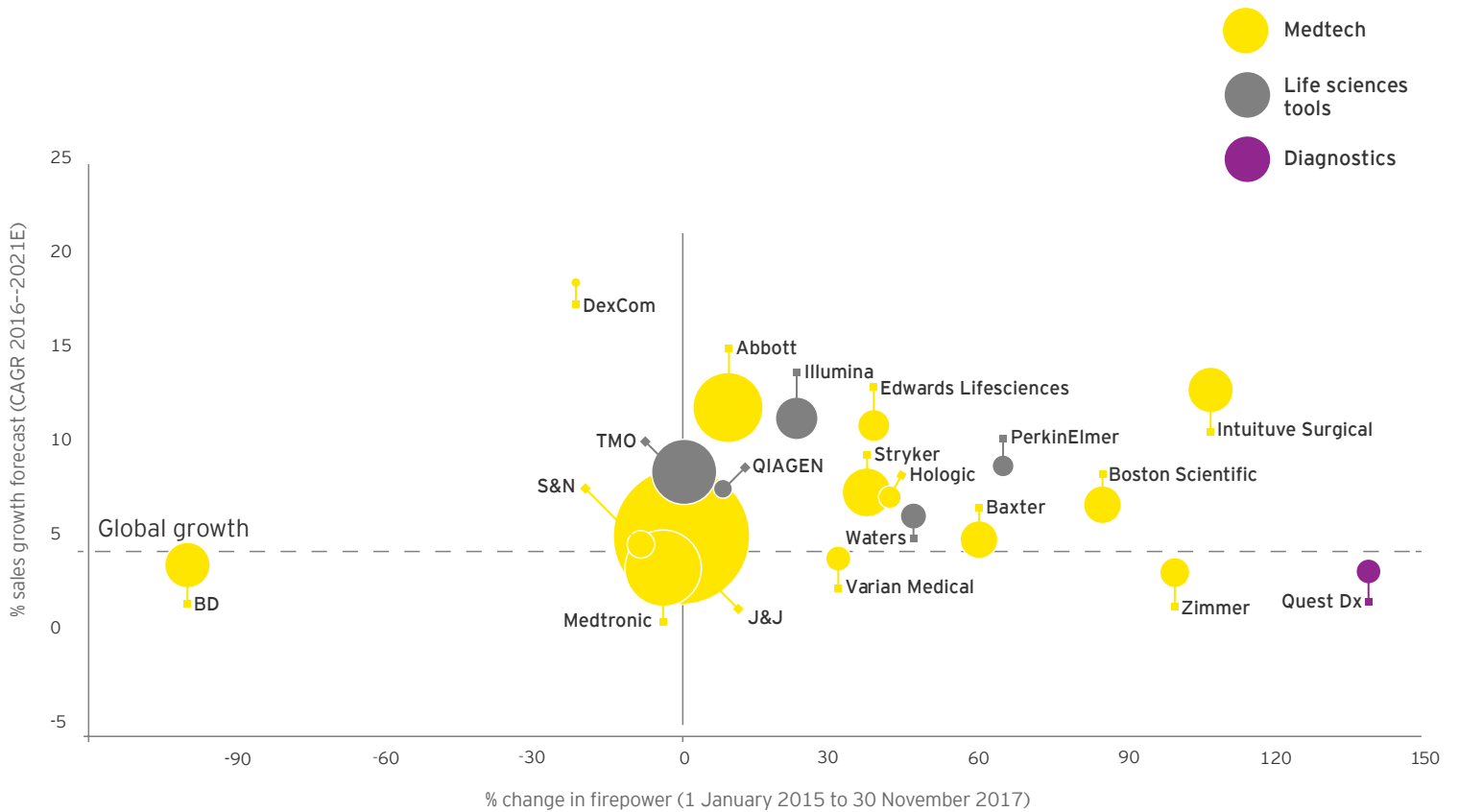
Additional analyses

Exhibit 8. Recent biopharma firepower dynamics make mega-mergers more likely



- ▶ Growth challenges persist, with most majors' growth outlook trailing the industry
- ▶ Majors with lower growth and declining firepower are more likely to consider mega-mergers
- ▶ Biopharmas with higher growth, smaller valuations and declining firepower are more vulnerable targets

Exhibit 9. Healthy medtech growth and rising firepower support ongoing consolidation



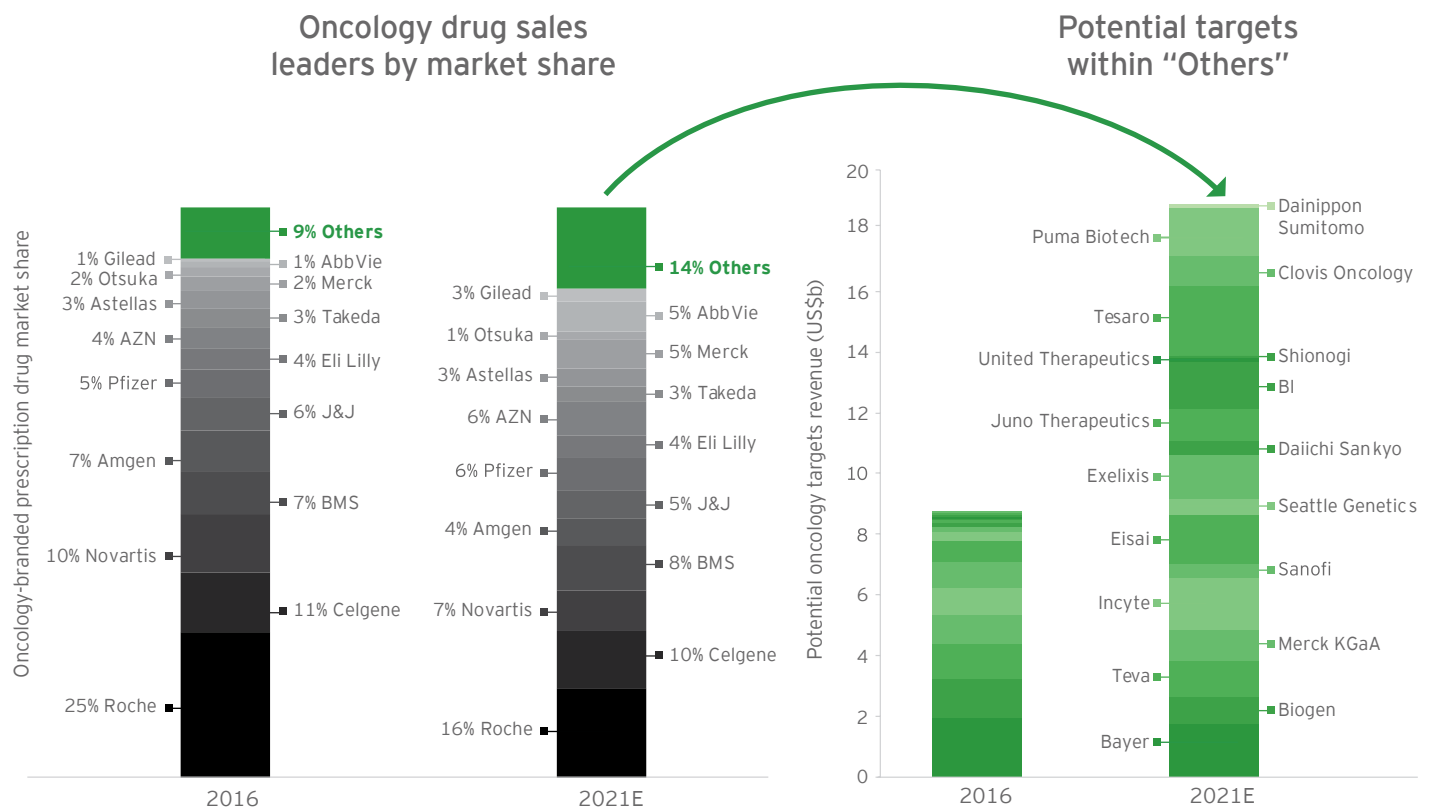
Size of bubble is based on relative market capitalization

Source: IMS, S&P Capital IQ, EY analysis

- ▶ The wave of consolidation over the past several years has revitalized this sector's growth
- ▶ Rising firepower propelled by strong growth bodes well for M&A
- ▶ Several medtech majors with lower growth are more likely to pursue acquisitions
- ▶ Recent divestitures affect growth outlook, but net proceeds boost firepower for acquisitions

Additional analyses

Exhibit 10. Intensifying oncology therapeutic battlefields should accelerate M&A and alliances



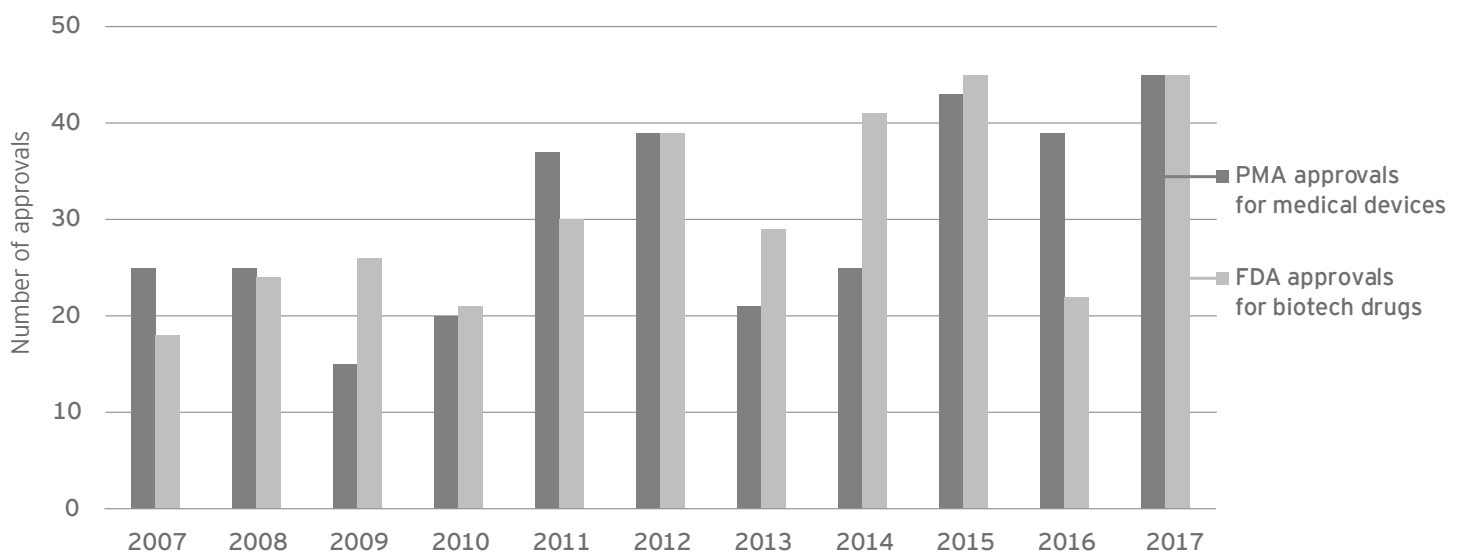
Source: Datamonitor and EY analysis.

- ▶ Many incumbent leaders are projected to lose share due to generics and biosimilars entrants
- ▶ Only Takeda and Gilead improved their projected 2021 share thanks to 2017 acquisitions
- ▶ Shares for "Others" – representing sales of 15 lower-tier players who have an aggregate of US\$10bn in estimated sales for 2017– are increasing, which makes them more likely to be targets for acquisitions or divestitures
- ▶ Post-tax reform, oncology M&A could rise significantly in 2018

Supplemental biopharma and medtech research

New product approvals

Exhibit 11A. FDA approvals rebound strongly in 2017; PMA approvals set new record



US FDA product approvals are based only on approvals by FDA's Center for Drug Evaluation and Research (CDER).
PMA and FDA (NME and BLA) approvals as of 31 December 2017
Source: FDA

- ▶ New US FDA commissioner accelerated approval process
- ▶ FDA approvals reach near-record high at 46 approvals in 2017
- ▶ PMA approvals, also reached 46, setting 10-year record number of approvals

Supplemental biopharma and medtech research

New product approvals

Exhibit 11B. Accelerating generic drug approvals are pressuring US pharma sales growth



Source: FDA Office of Generic Drugs

- ▶ Generic drug approvals reached new monthly high of 92 in October 2017
- ▶ There has been a more than 50% increase in monthly approvals over past few years
- ▶ New FDA commissioner has accelerated approvals, supported more completions and increased pricing pressure

Deal activity and trends

Exhibit 12. Increased strategic alliances provide lower risk alternatives to M&A

US and European strategic alliances based on potential value (2007-2017)

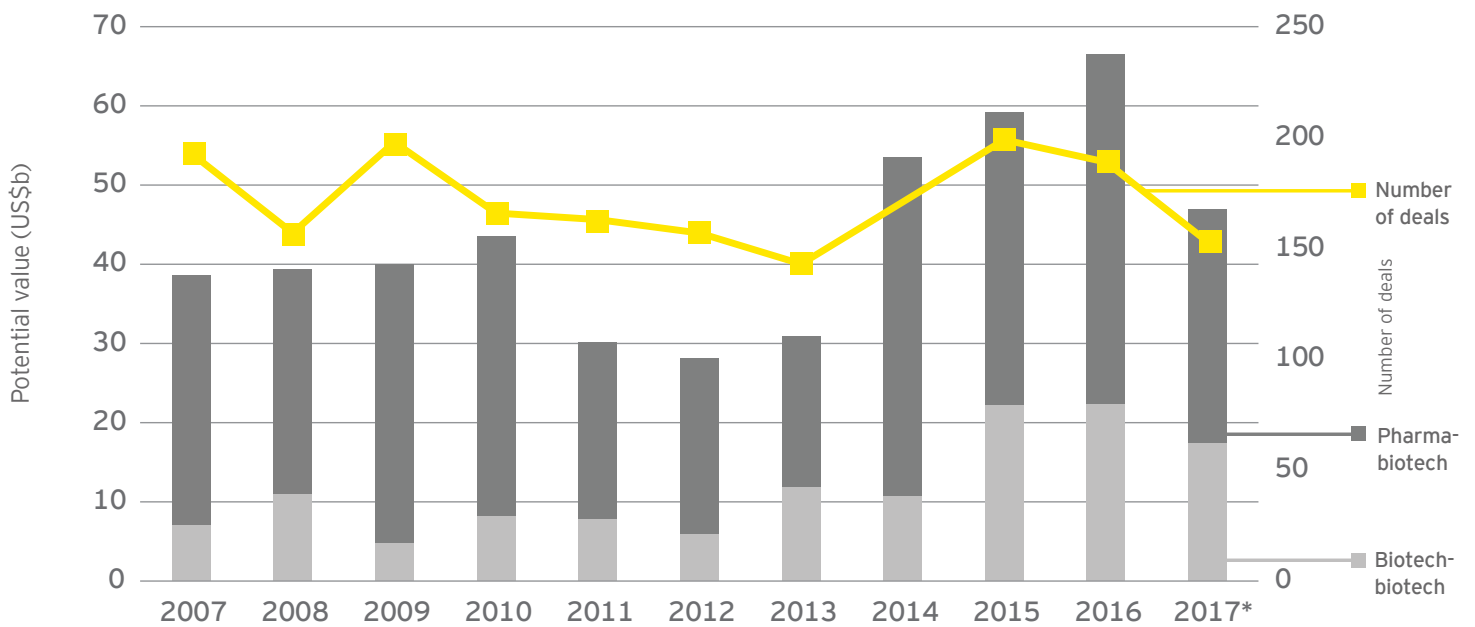


Chart shows potential value, including up-front and milestone payments, for alliances where deal terms are publicly disclosed.
 *Data through 31 October 2017

Source: Medtrack, company news and EY analysis.

- ▶ Increase in alliances reflects science, strategic and capital markets trends
- ▶ M&A optionality from alliances increases as R&D milestones are achieved

Supplemental biopharma and medtech research

Deal activity and trends

Exhibit 13. Therapeutic companies that have achieved substantial value primarily on their pipelines

Company	Market cap (as of 31 October 2017, US\$m)	Most advanced status	Main disease area
Alnylam Pharmaceuticals	11,177	Phase III	Genetic
Bluebird bio	6,341	Phase III	Hematology
Neurocrine Biosciences	5,479	Approved	Neurology
Juno Therapeutics	5,014	Phase II	Oncology
Puma Biotechnology	4,736	Approved	Oncology
FibroGen	4,423	Phase III	Renal
Nektar Therapeutics	3,766	Registration	Multiple
AveXis	3,337	Phase I	Neurology
Portola Pharmaceuticals	3,171	Approved	Hematology
Spark Therapeutics	2,957	Registration	Ophthalmology
Blueprint Medicines	2,604	Phase I	Oncology
Loxo Oncology	2,572	Phase II	Oncology
Sage Therapeutics	2,369	Phase III	Neurology
Aerie Pharmaceuticals	2,244	Registration	Ophthalmology
Insmed	2,066	Phase III	Respiratory
Array Biopharma	2,059	Phase III	Multiple
Intrexon	1,970	Registration	Cardiovascular
Ultragenyx Pharmaceutical	1,957	Phase III	Multiple
Accelaron Pharma	1,762	Phase III	Hematology
Global Blood Therapeutics	1,742	Phase III	Hematology
Immunomedics	1,622	Phase III	Oncology
AnaptysBio	1,538	Phase I	Inflammation
Aimmune Therapeutics	1,469	Phase III	Autoimmune
MyoKardia	1,364	Phase II	Cardiovascular
Dynavax Technologies	1,331	Approved	Autoimmune
Five Prime Therapeutics	1,297	Phase II	Inflammation
Akcea Therapeutics	1,219	Registration	Metabolic
Esperion Therapeutics	1,175	Phase III	Metabolic
Epizyme	1,132	Phase II	Oncology
Arena Pharmaceuticals	1,099	Phase II	Multiple
Biohaven Pharmaceutical Holding Company	1,080	Phase III	Neurology
Sangamo BioSciences	1,037	Phase I/II	Genetic
Editas Medicine	1,034	Discovery	Genetic
Ignyta	1,020	Phase II	Oncology

Source: S&P Capital IQ, published financial statements, EY analysis.

Financial performance

Exhibit 14. US biotechs' stock prices underperformed indices, while earnings growth and shareholder-friendly capital allocation strategies helped medtech outperform

Stock price performance since January 2013



Market closing prices as on 13 November 2017 have been captured

Source: S&P Capital IQ, EY analysis

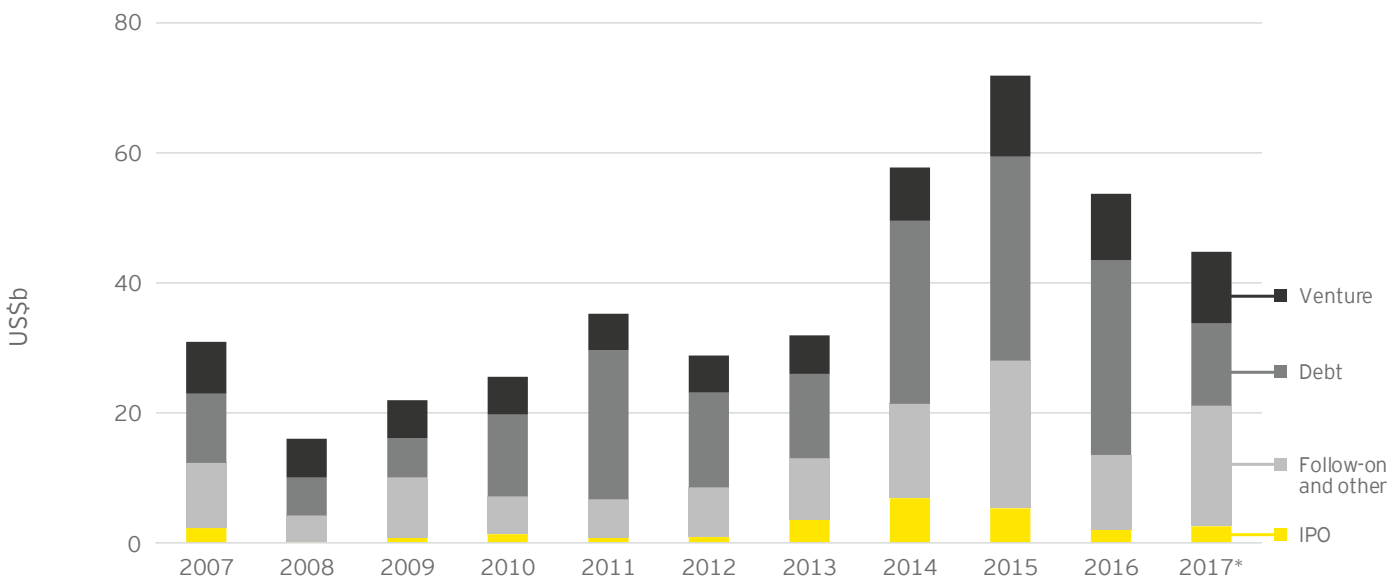
- ▶ For medtech, strong M&A activity has also helped contribute to strong performance versus market indices
- ▶ While European biotechs surpassed the leading indices, US biotechs have trailed since 2016 but have begun to rebound on the strength of mid-cap performance, the possibility of corporate tax reform, and an M&A surge enabled by potential cash repatriation

Supplemental biopharma and medtech research

Financing

Exhibit 15A. Biotech raised nearly US\$100b capital over past three years to advance pipelines and delay M&A exits

Capital raised in the US and Europe biotech sector



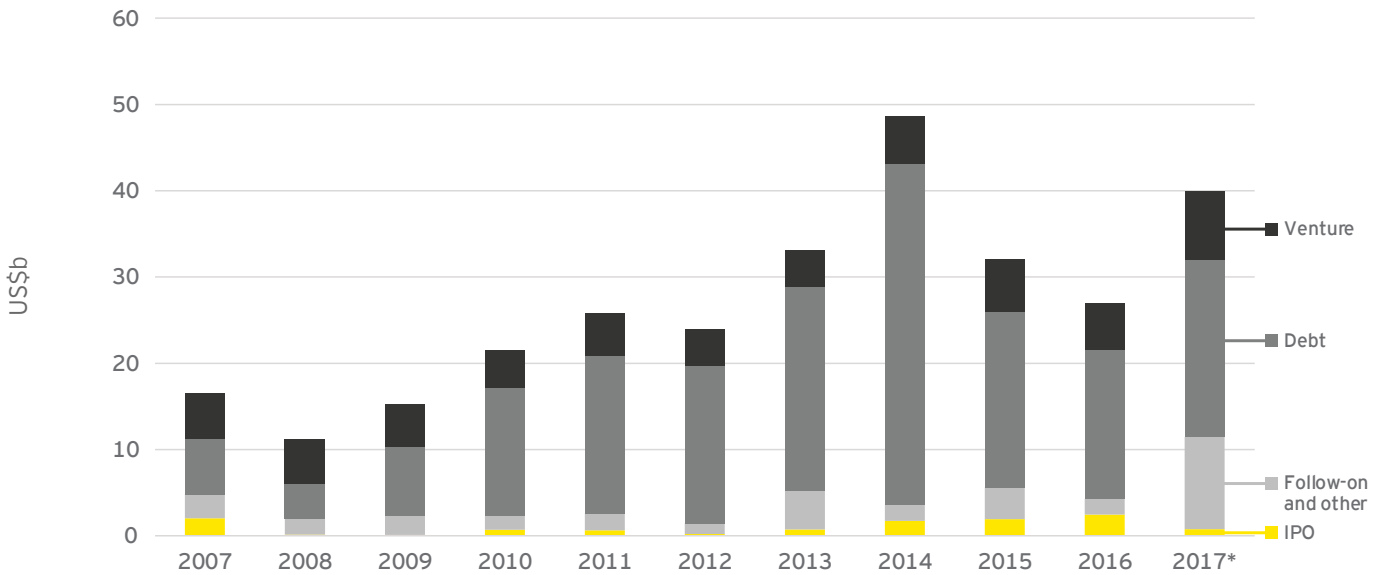
*Capital raised as of 31 October 2017.

Source: S&P Capital IQ, Dow Jones VentureSource, EY analysis.

- ▶ Robust capital markets continued encouraged by equity follow-ons
- ▶ Debt financing wave slowing as interest rates started to climb

Exhibit 15B. Medtech financing levels reflect investor expectations for strong growth

Capital raised in the US and Europe medical technology sector



*Capital raised as of 31 October 2017.

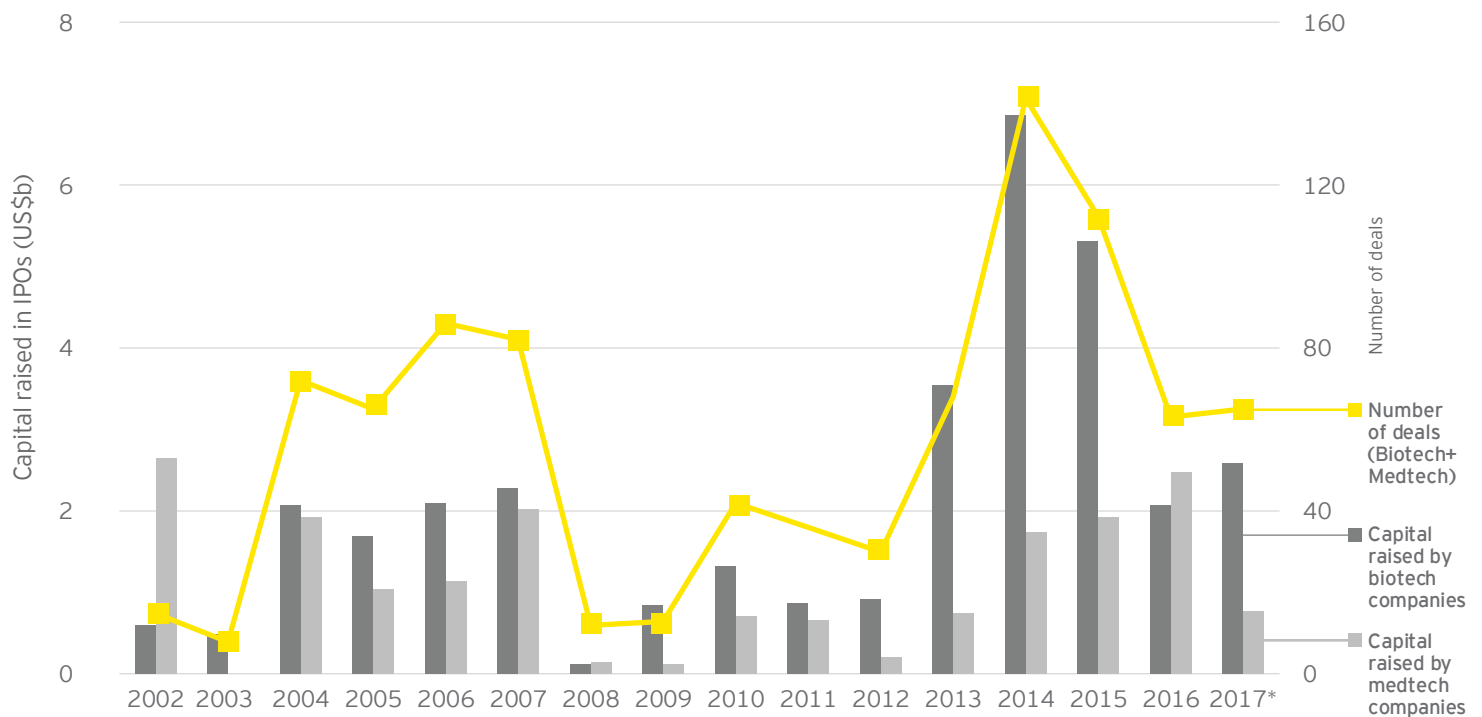
Source: BMO Capital Markets, S&P Capital IQ, Dow Jones VentureSource, EY analysis.

Supplemental biopharma and medtech research

Financing

Exhibit 16. Biotech IPOs rebounded in 2017 while medtech IPOs slowed

US and European medtech and biotech IPOs by year



*IPOs as of 31 October 2017.

Source: S&P Capital IQ, Dow Jones VentureSource, EY analysis.

► Medtech IPOs decline as investors focus on financing existing medtechs

Exhibit 17A. IPO investors focused on oncology in search of future blockbusters

US and Europe biotech IPOs January – October 2017

Company	Ticker	Amount (US\$m)	Country	Status	Main disease area	Date
Biohaven Pharmaceutical Holding Company	BHVN	193.5	US	CBC – Phase III	Central nervous system/Neurology	May
Akcea Therapeutics	AKCA	143.8	US	CBC – Registration	Cardiovascular	July
Deciphera Pharmaceuticals	DCPH	138.8	US	CBC – Phase I	Oncology	September
Rhythm Pharmaceuticals	RYTM	137.8	US	CBC – Phase III	Metabolic/Endocrinology	October
Jounce Therapeutics	JNCE	117.1	US	CBC – Phase II	Oncology	January
G1 Therapeutics	GTHX	116.7	US	CBC – Phase II	Oncology	May
NuCana	NCNA	114.0	UK	SPC – Phase III	Oncology	September
Kala Pharmaceuticals	KALA	103.5	US	CBC – Phase III	Ophthalmic	July
Tocagen	TOCA	97.8	US	CBC – Phase II/III	Oncology	April
ObsEva	OBSV	96.8	Switzerland	CBC – Phase III	Women's health	January
Dova Pharmaceuticals	DOVA	86.3	US	CBC – Phase III	Hematology/Blood and Lymphatic System	June
AnaptysBio	ANAB	86.3	US	CBC – Phase I	Inflammation	January
Nightstar Therapeutics	NITE	86.3	UK	CBC – Phase I/II	Ophthalmic	September
BioArctic Neuroscience	BIOA B	81.6	Sweden	CBC – Phase II	Central nervous system/Neurology	October
Oncopeptides	ONCO	81.0	Sweden	CBC – Phase III	Oncology	February
Athenex	ATNX	75.9	US	CBC – Phase III	Oncology	June
Mersana Therapeutics	MRSN	75.0	US	CBC – Phase I	Oncology	June
Ovid Therapeutics	OVID	75.0	US	CBC – Phase II	Central nervous system/Neurology	May
Sienna Biopharmaceuticals	SNNA	74.8	US	CBC – Phase II	Dermatology	July
Urogen Pharma	URGN	66.9	Israel	CBC – Phase II	Urology/Pelvic	May
Calyxt	CLXT	64.4	France	CBC – AgBio & Industrial	Agriculture	19 Jul 2017

Source: BMO Capital Markets, S&P Capital IQ, EY analysis.

- ▶ New class of 2017 IPOs fuel pipeline advancement, enhancing future M&A prospects
- ▶ Oncology IPOs spark alliances and M&A with commercial players

Financing

Exhibit 17B. US and Sweden dominate the medtech IPO market

US and Europe medtech IPOs January – October 2017

Company	Ticker	Amount (US\$m)	Country	Status	Main disease area	Date
Aileron Therapeutics	ALRN	56.3	US	CBC – Phase II	Oncology	June
Inventiva	IVA	54.2	France	CBC - Services, technologies and tools	Multiple	February
BerGenBio	BGBIO	51.3	Norway	CBC – Phase II	Oncology	April
Isofol Medical	ISOFOL	50.1	Sweden	CBC – Phase II	Oncology	April
Krystal Biotech	KRYS	45.5	US	CBC – Preclinical	Dermatology	September
Avenue Therapeutics	ATXI	38.0	US	SPC – Phase II	Non-disease-specific	June
Celcuity	CELC	26.2	US	CBC – Molecular diagnostics	Oncology	September
Lysogene	LYS	25.3	France	CBC – Phase I/II	Central nervous system/Neurology	February
Theranexus société anonyme	ALTHX	23.4	France	CBC – Phase II	Central nervous system/Neurology	October
Destiny Pharma	DEST	19.5	UK	SPC – Phase II	Infection	September
Xspray Pharma AB	XSPRAY	15.4	Sweden	CBC – Preclinical	Oncology	September
Valbiotis	ALVAL	14.0	France	CBC – Phase II	Metabolic/Endocrinology	June
IRLAB Therapeutics	IRLAB A	13.5	Sweden	CBC – Phase I	Central nervous system/Neurology	February
SenzaGen AB	SENZA	10.5	Sweden	CBC – Molecular diagnostics	Non-disease-specific	September
Promore Pharma	PROMO	8.9	Sweden	CBC – Phase II	Dermatology	June
Co-Diagnostics	CODX	7.1	US	CBC – Molecular diagnostics	Infection	July
Biovica International	BIOVIC B	7.0	Sweden	CBC – Molecular diagnostics	Oncology	March
Annexin Pharmaceuticals	ANNX	5.8	Sweden	CBC – Preclinical	Cardiovascular	March
BeyondSpring	BYSI	3.5	US	CBC – Phase III	Oncology	08 Mar 2017

Source: BMO Capital Markets, S&P Capital IQ, EY analysis.

Exhibit 18A. Lucrative oncology market attracts most US venture financing

Top US biotech venture financings

Company	Round	Amount (US\$m)	City	Status	Main disease area	Date
Vir Biotechnology	1	500.0	San Francisco	CBC - Services, technologies and tools	Infection	January
Harmony Biosciences	1	270.0	Plymouth Meeting	CBC – Development	Central nervous system/Neurology	September
SomaLogic	Later stage	163.0	Boulder	CBC – Molecular Diagnostics	Multiple	July
Indigo	4	156.0	Boston	CBC - Services, technologies and tools	Non-disease-specific	September
Cullinan Oncology	1	150.0	Cambridge	CBC – Development	Oncology	October
Vir Biotechnology	1	150.0	San Francisco	CBC - Services, technologies and tools	Infection	January
Rubius Therapeutics	2	120.0	Cambridge	CBC – Development	Multiple	June
SpringWorks Therapeutics	1	103.0	New York	CBC – Phase II	Oncology	September
Mustang Bio	1	94.5	New York	CBC – Phase I	Oncology	February
Gritstone Oncology	2	92.7	Emeryville	CBC – Phase I/II	Oncology	September
Melinta Therapeutics	Later stage	90.0	New Haven	CBC – Approved	Infection	June
Homology Medicines	2	83.5	Bedford	CBC - Services, technologies and tools	Genetic	August

Source: BMO Capital Markets, S&P Capital IQ, EY analysis.

- ▶ Oncology products comprised a third of the financings in 2017, however, infectious disease comprised 38% of the financing dollars, thanks to strong interest in Vir Biotechnology.
- ▶ 50% of the financings were Round 1

Financing

Exhibit 18B. 60% of European venture financing went to oncology in pursuit of next breakthrough

Top Europe biotech venture financings

Company	Round	Amount (US\$m)	Country	Status	Main disease area	Date
ADC Therapeutics	Later stage	200.0	Switzerland	CBC – Phase I	Oncology	October
Neurimmune Therapeutics	1	150.0	Switzerland	CBC – Phase III	Central nervous system/Neurology	October
Autolus	3	80.0	UK	CBC - Services, technologies and tools	Oncology	September
Cell Medica	3	76.7	UK	CBC – Phase II	Oncology	March
Iterum Therapeutics	2	65.0	Ireland	CBC – Phase II	Infection	May
Immatics Biotechnologies	5	58.0	Germany	CBC – Phase I/II	Oncology	October
InflaRx	4	55.0	Germany	CBC – Phase II	Inflammation	October
Bicycle Therapeutics	2	52.0	UK	CBC – Preclinical	Oncology	June
Breath Therapeutics	1	48.6	Germany	CBC – Phase II	Respiratory system	March
Nouscom	2	47.0	Switzerland	CBC – Preclinical	Oncology	October
Nightstar Therapeutics	3	45.0	UK	CBC – Phase I/II	Ophthalmic	June
MiNA Therapeutics	1	44.8	UK	CBC – Phase I	Oncology	May
Vivet Therapeutics	1	41.9	France	CBC – Development	Hepatic	May
Gamida-Cell	Later stage	40.0	Israel	CBC – Phase III	Oncology	June
Immunocore	2	40.0	UK	CBC – Phase III	Oncology	September

Source: BMO Capital Markets, S&P Capital IQ, EY analysis.

- ▶ As of October, the UK continued its lead in venture financings with 40% of the top 15 deals, and a focus mainly on oncology; Switzerland, however, took the lead in total venture financing with 38% of the total vs. 32% for the UK

Exhibit 18C. Most of the top US medtech venture financings in 2017 were in late-stage rounds

Top US medtech venture financings

Company	Region	Product type (disease)	Gross raised (US\$m)	Quarter	Round type
Grail Bio	Northern California	Non-imaging diagnostics	973.0	Q1	Early stage
Verily Life Sciences	Northern California	Non-imaging diagnostics	800.0	Q1	Early stage
Guardant Health	Northern California	Non-imaging diagnostics	360.0	Q2	Late stage
Auris Surgical Robotics	Northern California	Therapeutic devices (oncology)	280.2	Q3	Late stage
23andMe	Northern California	Non-imaging diagnostics	250.0	Q3	Late stage
Biocare Medical	North Carolina	Non-imaging diagnostics	85.0	Q3	Early stage
Color Genomics	Northern California	Non-imaging diagnostics	80.0	Q3	Late stage
Outset Medical	Northern California	Therapeutic devices (hematology/renal)	76.5	Q2	Late stage
NeuroPace	Northern California	Therapeutic devices (neurology)	74.0	Q4	Late stage
EarLens	Northern California	Therapeutic devices (ear, nose and throat)	73.0	Q2	Late stage
Freenome	Northern California	Non-imaging diagnostics	72.0	Q1	Early stage
Livongo Health	Northern California	Non-imaging diagnostics	52.5	Q1	Late stage
Sonendo	Southern California	Therapeutic devices (dental)	50.0	Q3	Late stage
Ivenix	Massachusetts	Therapeutic devices (non-disease-specific)	50.0	Q1	Late stage
Moximed	Northern California	Therapeutic devices (orthopedic)	50.0	Q1	Late stage

Source: BMO Capital Markets, S&P Capital IQ, Dow Jones VentureSource, EY analysis.

Financing

Exhibit 18D. In contrast to the US, most of the top Europe medtech venture financings in 2017 were in early-stage rounds

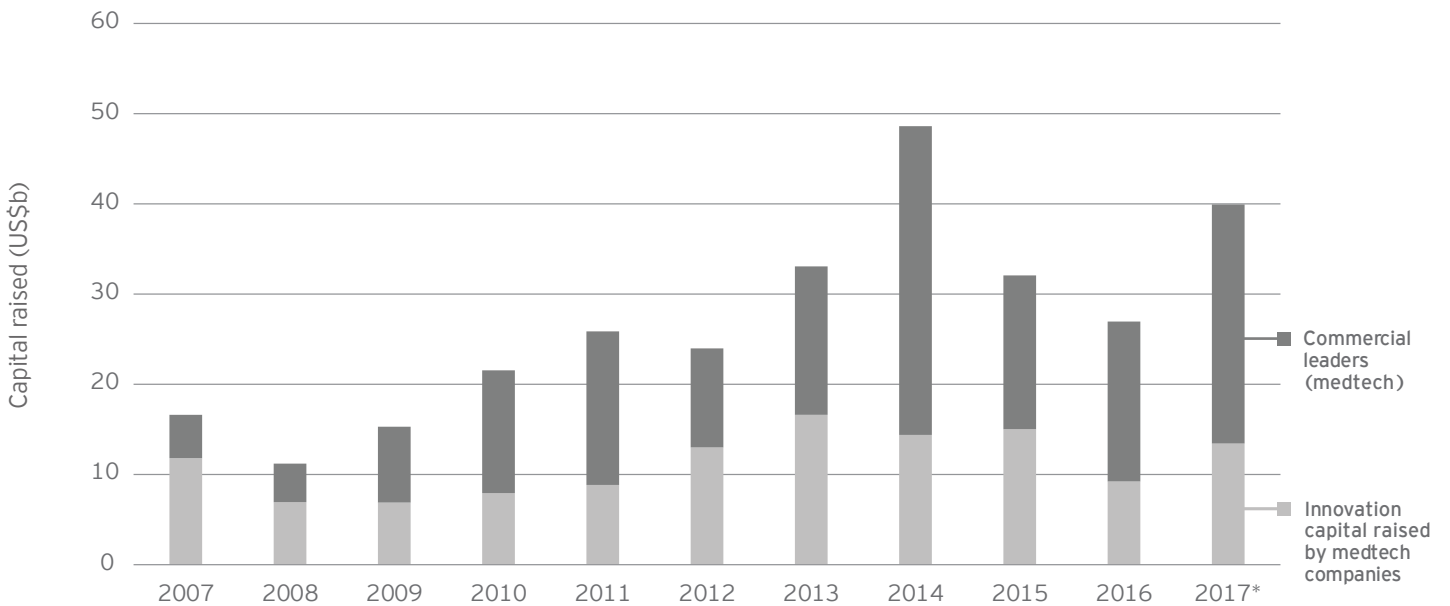
Top Europe medtech venture financings

Company	Location	Product type (disease)	Gross raised (US\$m)	Quarter	Round type
Cnoga Medical	Israel	Non-imaging diagnostics	50.0	Q1	Late stage
Breath Therapeutics	Germany	Therapeutic devices (respiratory)	48.6	Q1	Early stage
Impulse Dynamics	Germany	Therapeutic devices (cardiovascular/vascular)	45.0	Q2	Late stage
OrCam Technologies	Israel	Therapeutic devices (ophthalmic)	41.0	Q1	Late stage
Medlumics	Spain	Imaging	38.5	Q1	Early stage
Atlas Genetics	UK	Non-imaging diagnostics	35.0	Q1	Late stage
Laser Quantum	UK	Therapeutic devices (non-disease-specific)	32.6	Q1	Early stage
Aspect Imaging	Israel	Imaging	30.0	Q2	Early stage
MeMed Diagnostics	Israel	Non-imaging diagnostics	30.0	Q3	Early stage
MOTUS GI	Israel	Imaging	30.0	Q1	Early stage
Cambridge Medical Robotics	UK	Therapeutic devices (non-disease-specific)	26.0	Q3	Early stage
ART Medical	Israel	Non-imaging diagnostics	20.0	Q2	Early stage
CartiHeal	Israel	Therapeutic devices (orthopedic)	18.3	Q2	Late stage
Dermtreat	Denmark	Therapeutic devices (dermatology)	18.1	Q2	Early stage
Wandercraft	France	Therapeutic devices (orthopedic)	18.0	Q3	Early stage

Source: BMO Capital Markets, S&P Capital IQ, Dow Jones VentureSource, EY analysis.

Exhibit 19A. Medtech innovation capital in the US and Europe regained ground as investor confidence rose

Innovation capital raised by US and Europe medtechs



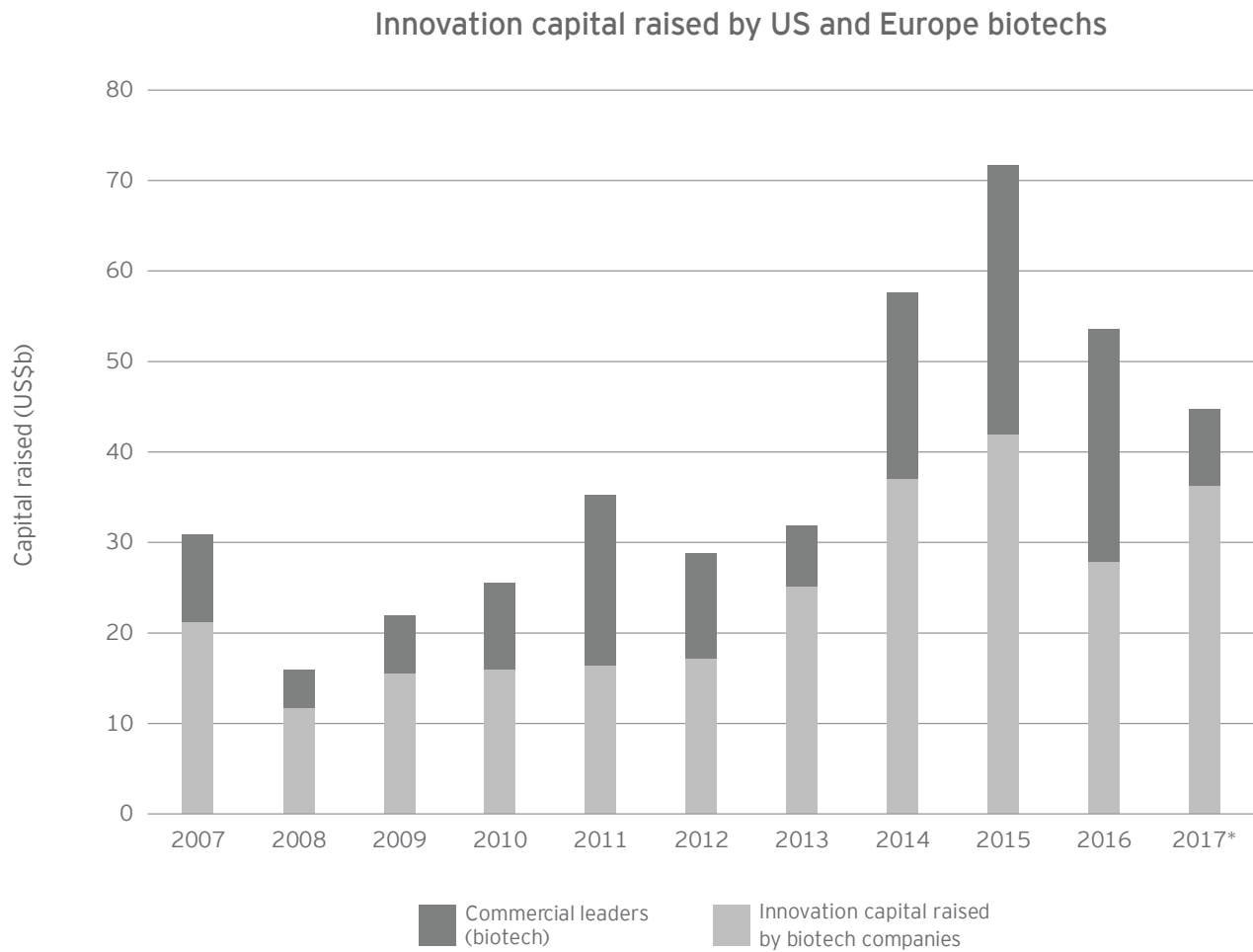
Innovation capital is the amount of capital raised by companies with revenues of less than US\$500 million.
 *Capital raised as of 31 October 2017.

Source: BMO Capital Markets, S&P Capital IQ, Dow Jones VentureSource, EY analysis.

- ▶ Rising biotech valuations facilitated financings, including follow-ons and IPOs
- ▶ Big biotech tapped capital markets mainly for M&A

Financing

Exhibit 19B. Biotech innovation capital recovered as drug price regulation fears receded

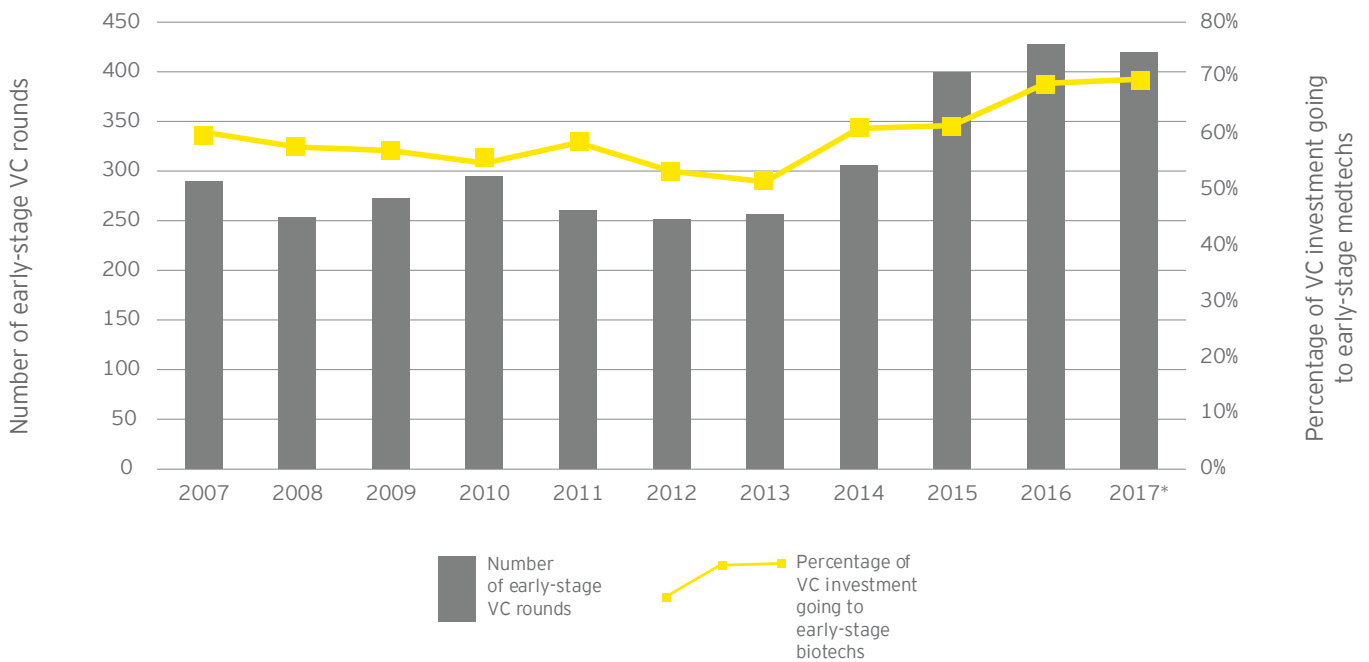


Innovation capital is the amount of capital raised by companies with revenues of less than US\$500 million.
 *Capital raised as of 31 October 2017.

Source: S&P Capital IQ, Dow Jones VentureSource, EY analysis.

Exhibit 20A. Hunting for pipeline assets and commercial growth, US and European biotechnology early-stage VC funding remained high

US and European biotechnology early-stage VC rounds



Early-stage rounds are seed-, first- and second-round VC investments.
 *Venture capital raised as of 31 October 2017

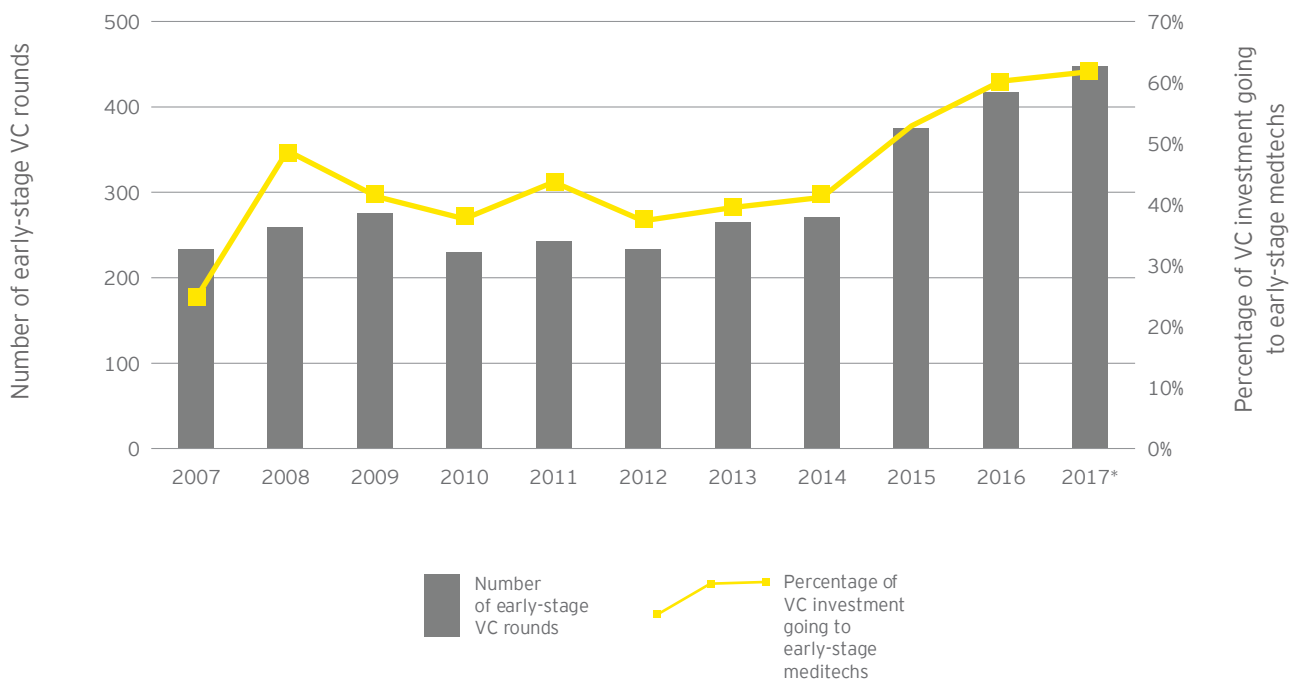
Source: S&P Capital IQ, Dow Jones VentureSource, EY analysis.

▶ VC funding remained consistently robust as IPO exit proceeds were reinvested

Financing

Exhibit 20B. Early-stage VC funding in medtech reached record levels as investors pursued promising innovations

US and European medical technology early-stage VC rounds



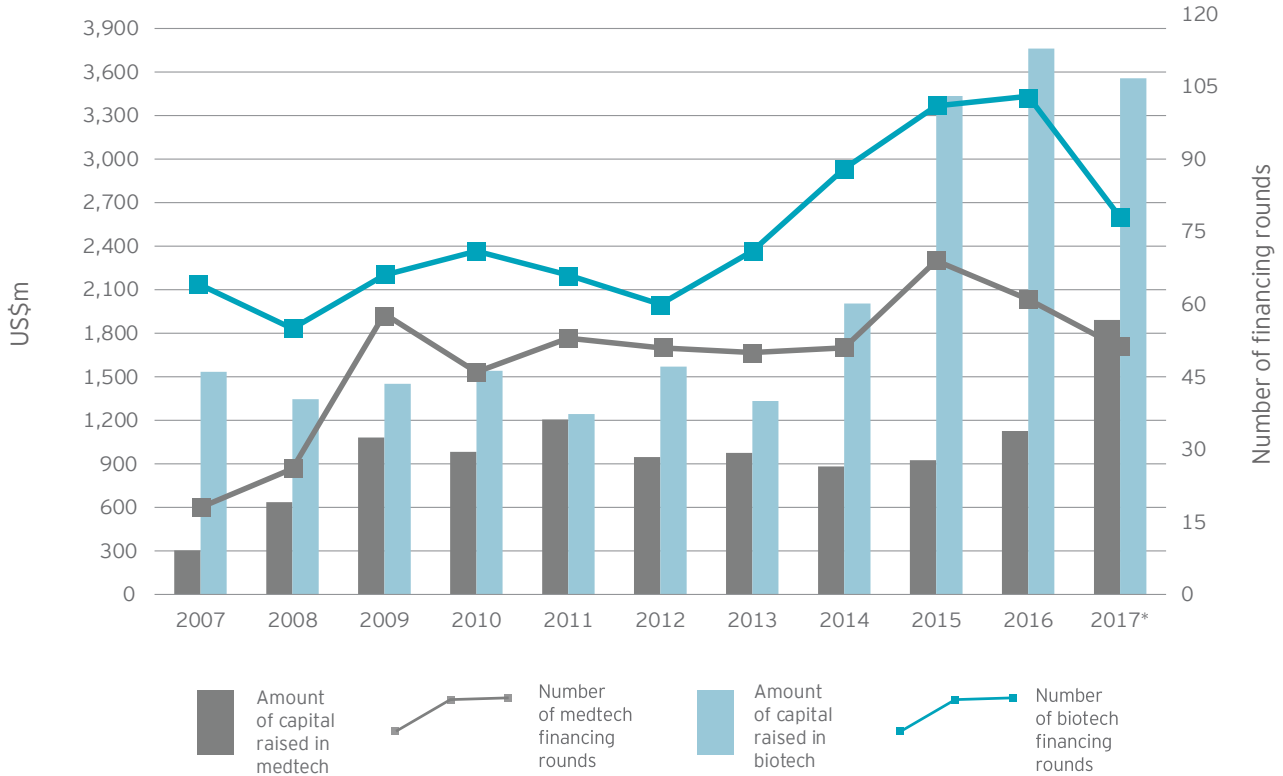
Early-stage rounds are seed-, first- and second-round VC investments.
 *Venture capital raised as of 31 October 2017

Source: S&P Capital IQ, Dow Jones VentureSource, EY analysis.

▶ The wave of IPOs in 2013-2017 helped maintain investments in early-stage deals

Exhibit 21. Corporate VC investment soared as companies invested directly to create growth options

Corporate VC investment in biotech and medtech companies



* Data as of 31 October 2017.

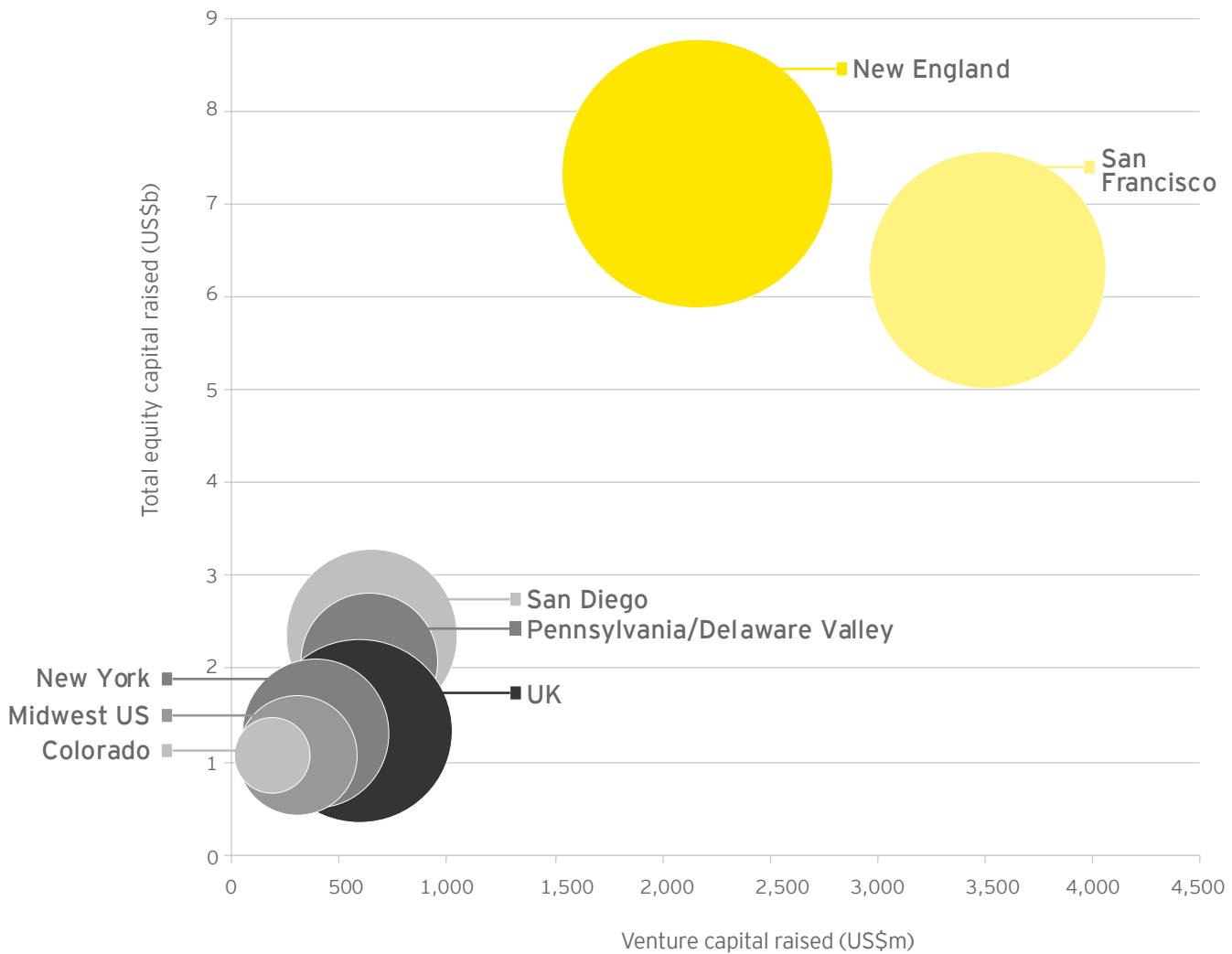
Source: BMO Capital Markets, S&P Capital IQ, Dow Jones VentureSource, EY analysis.

► Strategic investors from medtech, high tech and pharma bolstered the early-stage medtech ecosystem

Financing

Exhibit 22. New England and San Francisco biotech hubs continue to lead in raising biotech capital

Biotech capital raised by leading US and Europe regions, (January-October 2017)



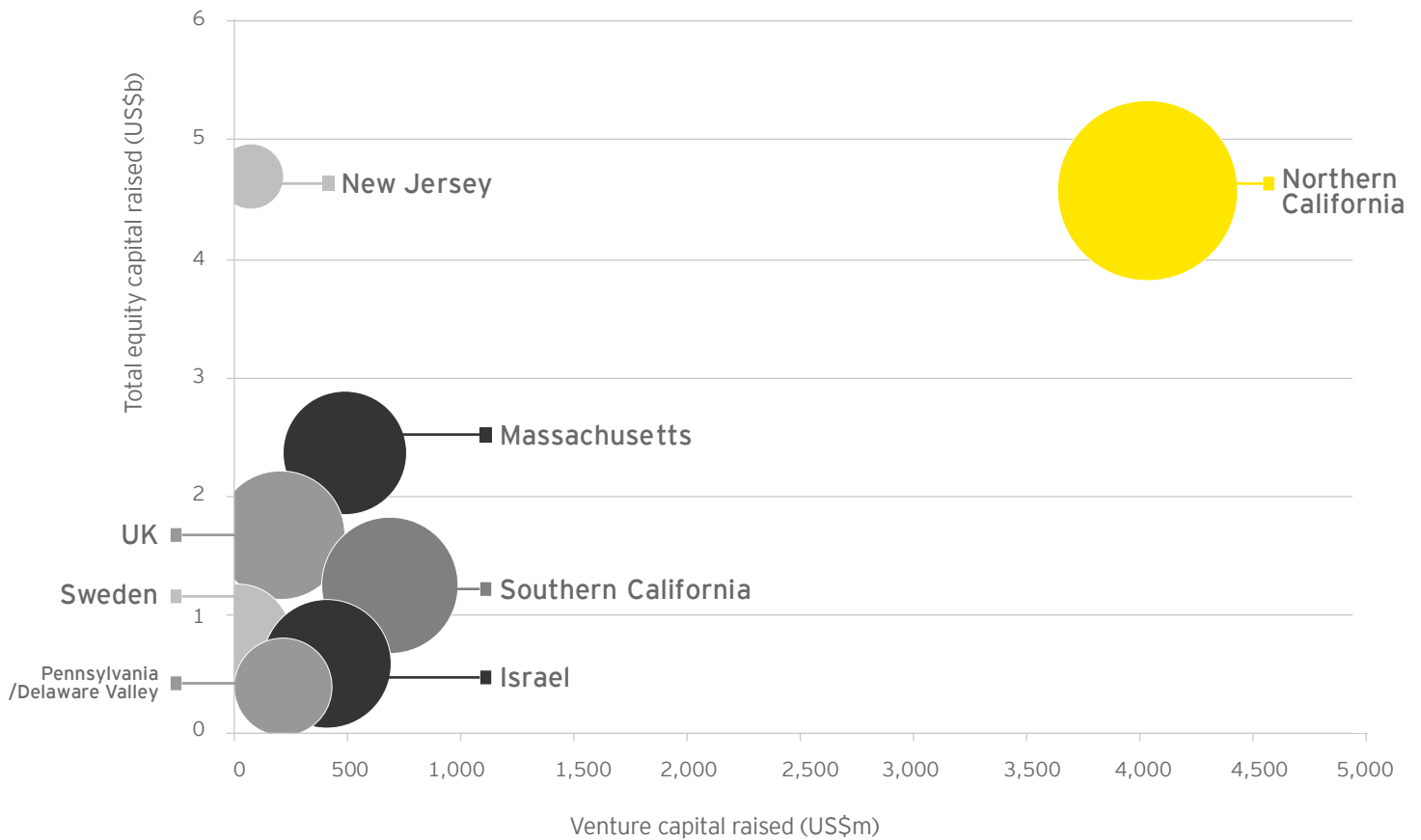
Size of bubbles shows relative number of financings per region.
Total capital excludes debt.

Source: BMO Capital Markets, S&P Capital IQ, Dow Jones VentureSource, EY analysis.

- ▶ New England moves to the top in raising capital for biotech
- ▶ Though oncology was well-represented among the year's largest rounds, all top-dollar financings were committed to broader platform or tools companies

Exhibit 23. VCs found most of their key medtech opportunities in California

Medtech capital raised by leading US and Europe regions
(January – October 2017)



Size of bubbles shows relative number of financings per region.
Total capital excludes debt.

Source: BMO Capital Markets, S&P Capital IQ, Dow Jones VentureSource, EY analysis.



Contacts

Pamela Spence
EY Global Life Sciences Industry Leader
pspence2@uk.ey.com
+44 207 951 3523
Twitter: @pamelaspence_EY

Glen Giovannetti
EY Global Biotechnology Leader
glen.giovannetti@ey.com
+1 617 374 6218
Twitter: @GlenGiovannetti

Andrew Forman
EY Knowledge, Transaction Advisory
Services - Life Sciences
andrew.forman@ey.com
+1 732 516 4698
Twitter: @FormanAndrew

Jeffrey Greene
EY Global Transaction Advisory Services
Leader, Life Sciences
jeffrey.greene@ey.com
+1 212 773 6500
Twitter: @JeffreyRGreene

Ed Phippen
EY Global Transaction Advisory Services
Sector Resident, Life Sciences
ephippen@uk.ey.com
+44 2079 514 119

Acknowledgments

Our sincere thanks to EY Global Life Sciences Industry Leader Pamela Spence and EY Global Life Sciences Transaction Advisory Services Leader Jeff Greene for guiding the report's strategic direction and providing industry insights based on their years of experience, and to EY Knowledge, Transaction Advisory Services Senior Manager Andrew Forman for providing in-depth analysis of the industry trends and helping develop the report's key themes. Thank you also to Harish Kumar, Stavita Bali, Shivam Jaitly, Jasraj Sokhi, Tanya Mehra and Arushi Agrawal from EY Global Delivery Services Group for their important contributions to the industry research and analysis, Ellen Licking, EY Knowledge Senior Analyst, Life Sciences, for her editorial direction and Ed Phippen, Global Transactions Advisory Services Sector Resident, Life Sciences, for his industry insights and analysis. And special thanks to Chris Morrison, contributing writer and report editor, for his invaluable role in creating this year's report and in shaping the narrative.

EY | Assurance | Tax | Transactions | Advisory

About EY

EY is a global leader in assurance, tax, transaction and advisory services. The insights and quality services we deliver help build trust and confidence in the capital markets and in economies the world over. We develop outstanding leaders who team to deliver on our promises to all of our stakeholders. In so doing, we play a critical role in building a better working world for our people, for our clients and for our communities.

EY refers to the global organization, and may refer to one or more, of the member firms of Ernst & Young Global Limited, each of which is a separate legal entity. Ernst & Young Global Limited, a UK company limited by guarantee, does not provide services to clients. For more information about our organization, please visit ey.com.

How EY's Global Life Sciences Sector can help your business

As populations age and chronic diseases become commonplace, health care will take an ever larger share of GDP. Scientific progress, augmented intelligence and a more empowered patient are driving changes in the delivery of health care to a personalized experience that demands health outcomes as the core metric. This is causing a power shift among traditional stakeholder groups, with new entrants (often not driven by profit) disrupting incumbents. Innovation, productivity and access to patients remain the industry's biggest challenges. These trends challenge the capital strategy of every link in the life sciences value chain, from R&D and product supply to product launch and patient-centric operating models.

Our Global Life Sciences Sector brings together a worldwide network of 15,000 sector-focused professionals to anticipate trends, identify their implications and help our clients create competitive advantage. We can help you navigate your way forward and achieve sustainable success in the new health-outcomes-driven ecosystem.

© 2018 EYGM Limited.
All Rights Reserved.
EYG no. 00018-184GbI
1612-2128885
ED None

This material has been prepared for general informational purposes only and is not intended to be relied upon as accounting, tax or other professional advice. Please refer to your advisors for specific advice.

The views of third parties set out in this publication are not necessarily the views of the global EY organization or its member firms. Moreover, they should be seen in the context of the time they were made.

ey.com/VitalSigns