



# Emerging Therapeutic Company Investment and Deal Trends

US Venture Capital and Public Offerings, 2007-2016  
Global Licensing and Acquisitions, 2007-2016  
Current Pipeline for Emerging Companies

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by David Thomas, CFA and Chad Wessel  
**BIO INDUSTRY ANALYSIS**



Biotechnology  
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## About BIO

BIO is the world's largest trade association representing biotechnology companies, academic institutions, state biotechnology centers and related organizations across the United States and in more than 30 other nations. BIO members are involved in the research and development of innovative healthcare, agricultural, industrial, and environmental biotechnology products. BIO also produces the BIO International Convention, the world's largest gathering of the biotechnology industry, along with industry-leading investor and partnering meetings held around the world.



# Letter from the Honorable Jim Greenwood & Dr. Cartier Esham

June 1, 2017

With more than 90% of the biopharmaceutical industry made up of small, emerging companies, it is important for BIO to better understand early-stage investor and deal-making trends in order to determine where scientific or policy issues may be impacting the industry's ability to maintain a robust pipeline of innovative medicines. The ability to access capital and form strategic alliances is vital for small therapeutic-focused companies to succeed in translating novel drug candidates into approved medical products for patients.

In this report, we set out to highlight five investment and deal-making activities involving emerging therapeutic companies: venture capital, IPOs, follow-on public offerings (FOPOs), licensing, and acquisitions. These categories are broken down by phase of development and by disease area, allowing us to gauge interest levels across a wide range of company types and financing methods. In addition, we examined the current clinical pipeline, including an analysis of partnered vs. unpartnered small company clinical programs for each major disease area.

Some of the key findings from this report are:

- **Pipeline:** Emerging companies are responsible for 70% of the global clinical pipeline and 84% of all Orphan-designated programs.
- **Venture Capital:** 2016 was a decent year for US venture capital with \$5.5 billion raised, an amount below 2015's record level (\$6.9 billion) but above 2014 total (\$4.7 billion). Funding of immuno-oncology and neurodegenerative disease companies remain key drivers. The number of companies receiving venture financing dropped to a decade low of 258. Series A financing increased to a record \$1.9 billion in 2016.
- **IPOs:** The IPO market continued to show strength in 2016 with 23 IPOs, albeit at lower levels than 2014 and 2015. Since the signing of the JOBS Act five years ago, more than 200 emerging biotech companies have gone public.
- **Follow-On Public Offerings:** US emerging companies raised 56% less in 2016 vs. 2015 through FOPOs. This was reflective of the tough public market performance for biotechs in 2016.
- **Licensing:** The number of R&D-stage licensing deals valued at \$10 million or more declined 19% in 2016, ending a three-year uptrend. Upfront payments in 2016 totaled only half the level seen in 2015.
- **Acquisitions:** The number of acquisitions of R&D-stage companies reached the highest level in eight years, but the total amount paid was only half the level seen in 2015.

This report will help inform our future policy work and provide industry, policymakers, and other stakeholders with a comprehensive view of the investment and partnering environment for novel therapeutics.

Sincerely,



**Jim Greenwood**

*President & CEO, BIO*



**E. Cartier Esham, Ph.D.**

*EVP, Emerging Companies Section, BIO*



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# Introduction

In this report, we set out to identify trends affecting emerging therapeutic companies across five core areas of investment and deal-making: venture capital, initial public offerings (IPOs), follow-on public offerings (FOPOs), licensing, and acquisitions. We analyzed the most recent 10 years of data in these core areas using six databases to create the broadest, most comprehensive study possible. The Cortellis Competitive Intelligence from Clarivate Analytics & Thomson Reuters, Cortellis Deals Intelligence from Clarivate Analytics (formerly ReCap), Informa's Strategic Transactions and BioMedtracker Databases, BioCentury's BCIQ, and EvaluatePharma were indispensable resources for this endeavor.

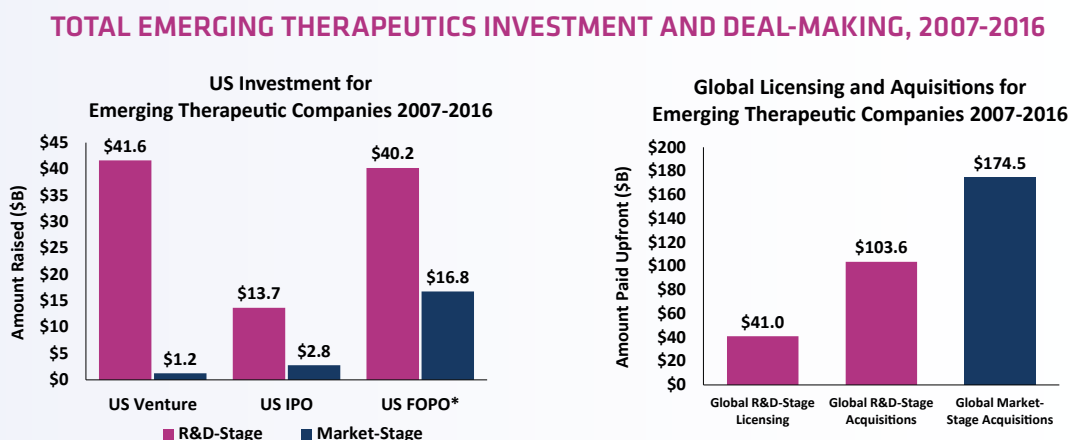
Transactions in this report are detailed by clinical development stage and disease area of the lead product under development by the emerging company. In addition, clinical pipeline data for each disease area are provided to give context on the degree of industry partnering. This broad-based analysis will help identify where scientific or policy issues may be impacting the ability to maintain a robust pipeline of innovative medicines – a goal that is shared by patients, healthcare providers, policymakers, investors, and the biopharmaceutical industry alike.

Private emerging companies working on innovative therapeutics are highly dependent on access to capital. For early-stage private companies, the majority of this investment funding comes in the form of venture capital until the eventual listing on a public exchange. This initial public offering is the first of what can be many rounds of financing from public investors through follow-on offerings, financings that can provide timely access to capital after key clinical or regulatory milestones. All three events – venture financing, IPOs, and FOPOs – are impactful for emerging companies, and are captured in this report by both stage of development and lead therapeutic category for US companies.

Licensing is also a significant source of funding for emerging companies, and often entails sharing of development expertise and technical resources with a larger company. The inclusion of company acquisitions in this study aims to shed light on where global drug developers are willing to go “all in” on innovation to complement their own pipelines. For both licensing and acquisitions, US and ex-US transactions are presented.

## 2007-2016 Emerging Company Investment and Deal Making

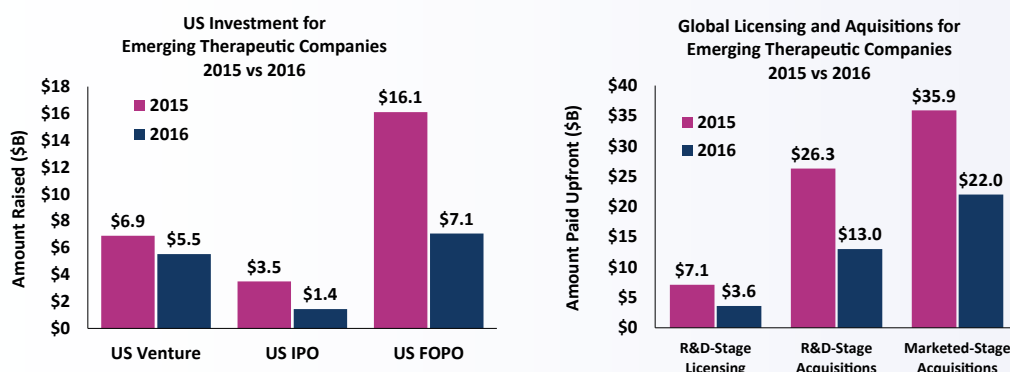
Over the last decade, a total of \$116 billion in investment dollars went into US emerging therapeutic companies through venture capital (\$43 billion), initial public offerings (\$16 billion), and follow-on public offerings (\$57 billion). More than \$144 billion went into upfront payments for either in-licensing assets or acquiring global R&D-stage emerging companies. Although there were far fewer market-stage acquisitions (123), larger biopharma companies spent more on market-stage acquisitions (\$175 billion) than on licensing transactions (\$41 billion up front across 1,203 deals) or R&D-stage acquisitions (\$103 billion paid up front for 308 companies) in the last decade.



**Chart 1. Left: Breakdown of emerging company investment in the US from 2007-2016. Right: Breakdown of large company spending (as upfront payments) to access innovation through licensing deals and acquisitions with global emerging biotech companies.**

Comparing the total investment and deal-making amounts in 2016 with 2015 shows a broad divergence in dollar terms. Every financing category dropped in dollar terms, including a 19% drop in private venture funding (\$1.4 billion in 2016 vs. \$3.5 billion in 2015), a 57% drop in public market funding (\$8.5 billion in 2016 vs. \$19.6 billion in 2015), and a 58% drop in licensing upfront payments and acquisitions (\$28.6 billion in 2016 vs. \$69.3 billion in 2015). In terms of number of transactions the drop was not as severe. For example, the number of venture companies funded declined 14%, IPOs declined 41%, and FOPOs declined 34% in number.

## TOTAL EMERGING THERAPEUTICS INVESTMENT AND DEAL-MAKING, 2015 VS. 2016



**Chart 2. Left: Breakdown of emerging company investment in the US, 2015 vs 2016. Right: Breakdown of large company spending (as upfront payments) to access innovation through licensing deals and acquisitions with emerging biotech companies, 2015 vs 2016.**

It should be noted that publically traded biotechs had their second worst performance in history in 2016, with the Nasdaq Biotech Index down 24%. Some of the industry specific sentiment may have contributed to a more tepid financing and deal environment. During last year's US presidential campaign, the political rhetoric surrounding drug pricing created a cloud of uncertainty over the industry. Although much of the attention derived from the pricing practices of a few biopharma companies, including generics companies, the companies hurt the most were innovators without a product on the market. For example, comparing two equal weight indices managed by LifeSci Index Partners underscores the outsized effect on emerging biotechs: the LifeSci R&D-stage company index lost 36% while the LifeSci index for companies with FDA-approved products gained 6% in 2016.

## US Investment by Disease, 2007-2016

US Investment (\$M) 2007-2016	US Venture		US IPO		US FOPO		Total
Oncology	\$11,382	27%	\$3,665	22%	\$16,168	28%	\$31,215 27%
Infectious Disease	\$4,597	11%	\$1,558	9%	\$8,406	15%	\$14,561 13%
Neurology	\$4,724	11%	\$1,988	12%	\$7,810	14%	\$14,522 12%
Metabolic	\$2,291	5%	\$1,043	6%	\$6,163	11%	\$9,497 8%
Endocrine	\$3,143	7%	\$919	6%	\$3,892	7%	\$7,955 7%
Other	\$3,067	7%	\$1,992	12%	\$2,828	5%	\$7,888 7%
Immunology	\$1,923	4%	\$667	4%	\$2,812	5%	\$5,402 5%
Hematology	\$1,074	3%	\$1,671	10%	\$2,067	4%	\$4,812 4%
Cardiovascular	\$1,971	5%	\$734	4%	\$2,004	4%	\$4,709 4%
Platform	\$4,030	9%	\$475	3%	\$0	0%	\$4,505 4%
Ophthalmology	\$1,930	5%	\$824	5%	\$1,445	3%	\$4,200 4%
Gastrointestinal	\$758	2%	\$509	3%	\$1,916	3%	\$3,183 3%
Respiratory	\$1,303	3%	\$268	2%	\$1,232	2%	\$2,803 2%
Psychiatry	\$640	1%	\$131	1%	\$218	0%	\$989 1%
Total	\$42,834	100%	\$16,443	100%	\$56,962	100%	\$116,239 100%

**Table 1. Ten year totals, by disease, for US venture funding, initial public offerings (IPOs), and follow-on public offerings (FOPOs). The percentage indicates the proportion of total dollars raised. For FOPOs, the total dollars includes only transactions raising over \$10 million. Private Investments in Public Equity (PIPEs), such as Registered Direct Offerings to a single investor, are not included in this post-IPO offering analysis. However, the analysis of FOPOs here is intended to capture the broad, public investment sentiment in the sector.**

## Global Deals by Disease, 2007-2016

Global Deals (\$M) 2007-2016	Licensing R&D-Stage		Acquisitions R&D-Stage		Acquisitions Market-Stage		Total
Oncology	\$12,935	32%	\$28,733	28%	\$69,472	40%	\$111,140 35%
Other	\$2,468	6%	\$3,698	4%	\$35,991	21%	\$42,157 13%
Immunology	\$2,815	7%	\$23,360	23%	\$4,685	3%	\$30,860 10%
Infectious Disease	\$2,789	7%	\$4,591	4%	\$18,944	11%	\$26,324 8%
Gastrointestinal	\$1,682	4%	\$8,769	8%	\$12,267	7%	\$22,718 7%
Endocrine	\$2,771	7%	\$5,632	5%	\$8,768	5%	\$17,170 5%
Neurology	\$4,692	11%	\$8,017	8%	\$2,784	2%	\$15,493 5%
Respiratory	\$986	2%	\$2,070	2%	\$10,675	6%	\$13,731 4%
Metabolic	\$2,005	5%	\$9,834	9%	\$1,760	1%	\$13,599 4%
Cardiovascular	\$1,903	5%	\$2,196	2%	\$3,468	2%	\$7,567 2%
Platform	\$3,142	8%	\$2,938	3%	\$0	0%	\$6,081 2%
Psychiatry	\$737	2%	\$717	0.7%	\$3,814	2.2%	\$5,267 2%
Hematology	\$970	2%	\$1,654	2%	\$1,282	1%	\$3,906 1%
Ophthalmology	\$1,063	3%	\$1,374	1%	\$561	0%	\$2,998 1%
Total	\$40,957	100%	\$103,582	100%	\$174,472	100%	\$319,011 100%

**Table 2. Ten year totals, by disease, for R&D-stage licensing, R&D-stage acquisitions, and marketed product-stage acquisitions. The percentage indicates the proportion of total dollars raised. Total dollars include totals of upfront payments for transactions with potential disclosed values over \$10 million. For acquisitions, R&D-stage acquisitions tend to have Contingent Value Rights (CVRs) built in but are not guaranteed funds and have thus been excluded from this analysis.**



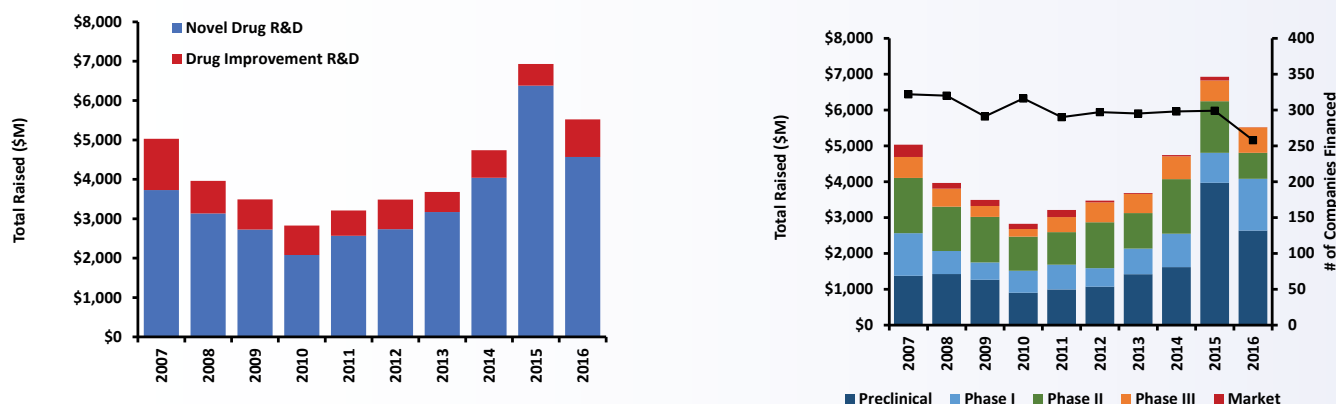
# Venture Capital Funding of US Therapeutic Companies

As shown in **Chart 3**, venture equity funding of private drug development companies declined from the record amount raised in 2015 (\$6.9 billion) to \$5.5 billion in total venture capital raised in 2016. Although this represents a \$1.4 billion decrease, it should be noted that 2016 was the second strongest year over the 10 year period from 2007-2016.

Over the past decade, roughly 300 companies per year have received venture financing. In 2016, there was a 14% reduction in the number of companies funded, with only 258 receiving funding. Most of this decline can be attributed to late-stage rounds of finance. Furthermore, most of the capital went to a small group of companies. The top quartile of companies received 70% (\$3.9 billion) of all venture funding in 2016. Five companies raised more than \$100 million each, with two of the five bringing in over \$400 million each.

We also categorized venture capital investments according to level of novelty and by phase of development, as can be seen in **Chart 3**. Investments were differentiated as either “novel” drug R&D or drug “improvement” R&D. Novel drug R&D examines innovative, unique, and potentially disease-modifying agents for diseases with current unmet medical need. Improvements include new delivery methods, new formulations, or using approved drugs for new indications. The majority of the venture funding continues to flow into novel drug R&D, reaching a peak of 92% in 2015 and down slightly to 83% in 2016. With respect to phase of development, the early stages (Preclinical and Phase I) continue to receive more funding vs. late stage from venture capital investment. Early-stage financing has increased from just above 50% of total funding in the 2007-2014 period to 69% in 2015 and 74% in 2016.

## VENTURE FUNDING OF US THERAPEUTIC COMPANIES, 2007-2016



**Chart 3. Total venture funding from 2007-2016. Left: Funding is represented as investment toward R&D of novel molecular entities vs. R&D for improvements of approved drugs (including delivery and reformulation). Right: Total venture funding by Phase of Development with the number of companies financed by year.**

**Novel Drug R&D** = R&D pursuing new chemical entities to treat disease, with no prior regulatory approval.

**Drug Improvement R&D** = R&D that improves upon existing therapeutics, such as new delivery methods, new formulations, or using approved drugs for new indications. Examples: Drug delivery patch, topical cream, implanted delivery device, needle-less injection, extended release, prolonged half-life chemical modifications (conjugations, including pegylated variants), and reformulations of approved drugs.

# Venture Funding of US Therapeutic Companies by Disease in 2016

Oncology is the only disease area with an increase in the number of venture financing transactions in 2016, with 90 transactions in 2016 vs. 83 in 2015. This increase took place while total dollars decreased from \$1.98 billion to \$1.46 billion. As a percentage of total venture capital tracked, 26% went into oncology in 2016, on par with the allocation seen annually since 2007 and the highest by far of all 12 disease areas tracked.

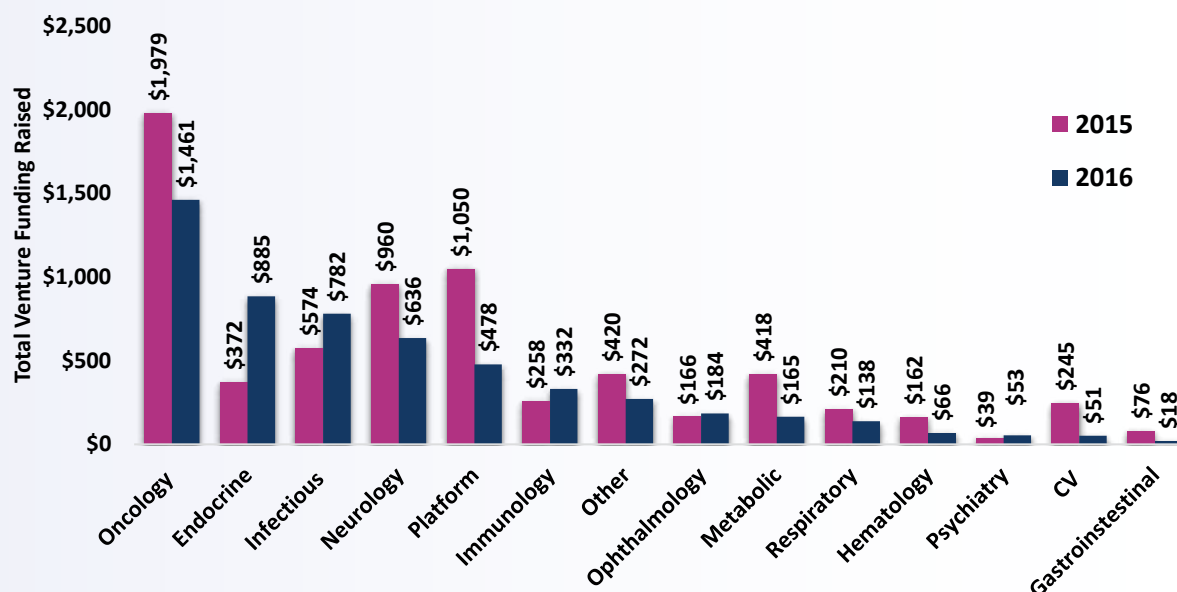
Both endocrine and infectious disease experienced a large increase in funding in 2016 due to three well-above-average transactions that brought in more than \$200 million each. One company in Phase III testing in Type 2 Diabetes received \$421 million. Another endocrine-focused company in Phase I for sarcopenia received a \$220 million Series B round. A company previously classified as platform that has moved into the clinic with an infectious disease vaccine received a record-setting \$474 million in a single round.

As can be seen in **Chart 4**, neurology companies experienced a decrease in venture funding in 2016 for the first time in six years, receiving \$636 million compared to \$960 million in 2015. The number of companies funded declined only slightly. Nearly 40% of the neurology companies funded in 2016 had lead products in Alzheimer's or Parkinson's disease at the time of the investment.

The metabolic disease category saw a major drop in both dollars and number of transactions in 2016. Funding dropped from \$435 million to \$165 million and the number of companies receiving funds dropped from 16 in 2015 to eight in 2016, the lowest number in 10 years. Seven of the eight metabolic companies had lead products for rare genetic diseases.

Companies with lead programs in psychiatry, hematology, cardiovascular, and gastrointestinal diseases received the least amount of funding in 2016, with each category receiving well under \$100 million.

## VENTURE FUNDING OF US THERAPEUTIC COMPANIES BY DISEASE, 2015 VS. 2016



**Chart 4. Total venture funding in 2015 and 2016 by disease, sorted highest to lowest funding in 2016.**

## US Venture Funding of Novel Drug R&D by Disease, 2007-2011 vs. 2012-2016

A look at novel R&D funding over the two five-year periods 2007-2011 vs. 2012-2016 (in **Chart 5**) reveals platform technology investment outpacing all other categories on a percentage change basis. In dollar terms, platform investment increased \$2 billion between the two five-year periods, larger than oncology's \$1.9 billion increase.

Neurology, immunology, endocrine, infectious, psychiatric, and other diseases all show gains due to the larger amounts invested in 2015 and 2016 compared to previous years.

Investment in companies focused on gastrointestinal, respiratory, cardiovascular, and ophthalmology all show a decrease in novel R&D funding over the two-five year periods. However, as seen in **Chart 5**, the decline in dollar terms for cardiovascular and ophthalmology is less than \$100 million per disease when comparing the two five-year periods, making the variability potentially more dependent on single transactions.

### PERCENT CHANGE IN NOVEL DRUG R&D VENTURE FUNDING 2007-2011 VS. 2012-2016

Disease Area	5 yr period 2007-2011	5 yr period 2012-2016	Change in terms of dollars	Percentage change
Platform	\$882	\$2,942	\$2,061	234%
Psychiatry	\$122	\$334	\$212	175%
Neurology	\$1,020	\$2,097	\$1,078	106%
Immunology	\$603	\$1,064	\$462	77%
Other	\$842	\$1,352	\$510	61%
Metabolic	\$881	\$1,364	\$483	55%
Oncology	\$4,189	\$6,098	\$1,908	46%
Endocrine	\$623	\$863	\$240	38%
Infectious Disease	\$1,963	\$2,164	\$201	10%
Hematology	\$508	\$506	-\$2	0%
Ophthalmology	\$739	\$717	-\$23	-3%
Cardiovascular	\$751	\$687	-\$64	-9%
Respiratory	\$649	\$475	-\$174	-27%
Gastrointestinal	\$420	\$235	-\$185	-44%

**Chart 5. The percent change in novel venture capital investment by disease between the past two-five year periods (2007-2011 vs. 2012-2016)**

# Total US Venture Funding by Disease, 2007-2016

**Table 3** shows the number of deals and the total dollar amount invested in each disease area each year, as well as a comparison of the two five-year periods. The totals include both novel drug and drug improvement funding.

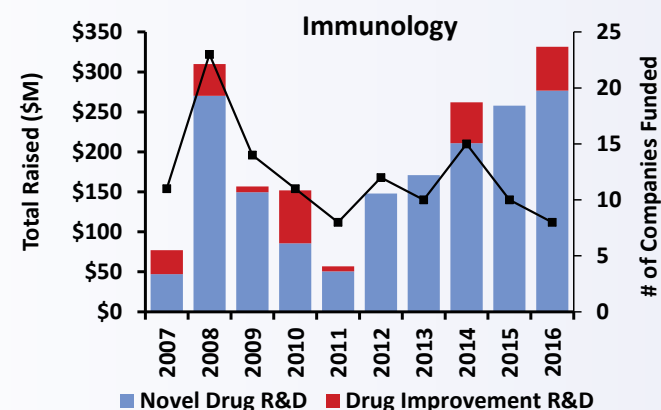
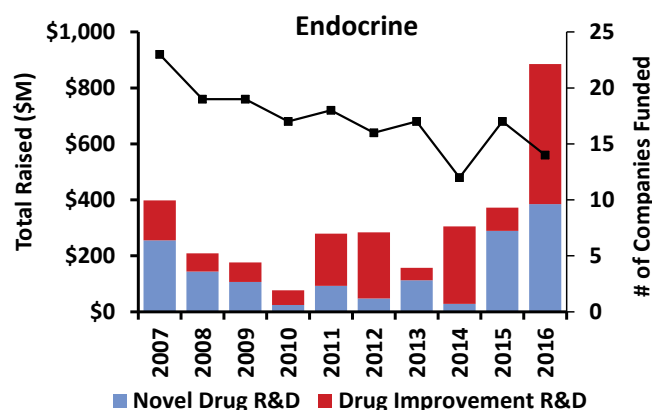
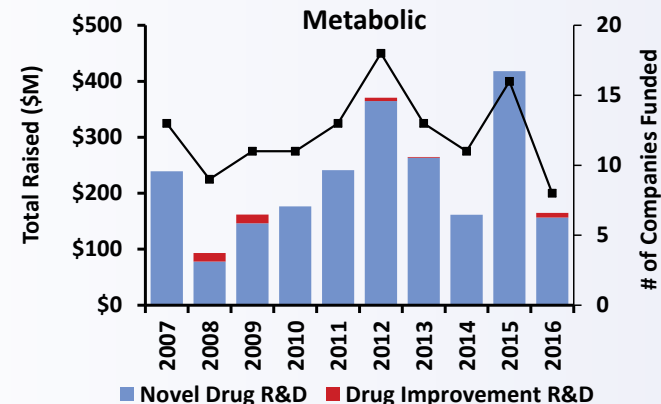
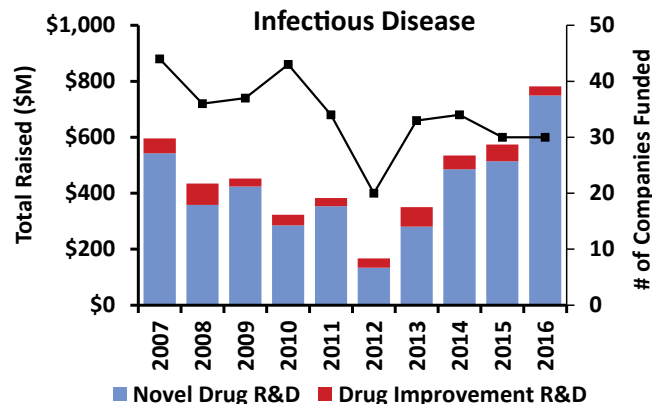
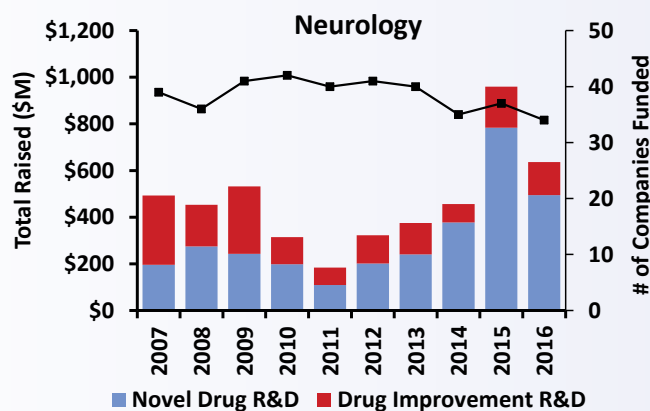
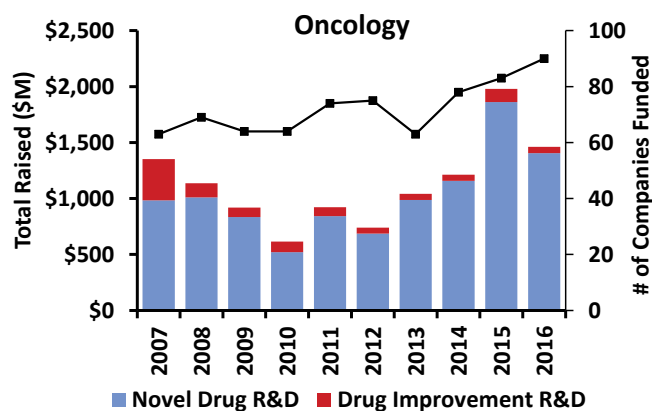
In **Chart 6**, on the following two pages, venture investment into each disease area is displayed by novel drug R&D and drug improvement R&D investment. Over the last decade, endocrine and neurology have experienced a much higher percentage in drug improvement R&D investment than most other disease areas. In contrast, oncology and metabolic continue to have mostly novel R&D investment.

Disease Area	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	5 yr period 2007-2011	5 yr period 2012-2016	5 yr period change
Oncology	63	69	64	64	74	75	63	78	83	90	334	389	16%
	\$1,353	\$1,136	\$919	\$616	\$923	\$740	\$1,042	\$1,213	\$1,979	\$1,461	\$4,946	\$6,435	30%
Neurology	39	36	41	42	40	41	40	35	37	34	198	187	-6%
	\$493	\$453	\$532	\$314	\$184	\$322	\$375	\$456	\$960	\$636	\$1,975	\$2,749	39%
Infectious Disease	44	36	37	43	34	20	33	34	30	30	194	147	-24%
	\$596	\$435	\$452	\$323	\$383	\$167	\$350	\$535	\$574	\$782	\$2,189	\$2,407	10%
Platform	25	35	24	32	23	27	29	36	24	23	139	139	0%
	\$208	\$180	\$221	\$250	\$141	\$286	\$341	\$874	\$1,050	\$478	\$1,000	\$3,030	203%
Other	26	29	25	34	19	24	26	27	29	19	133	125	-6%
	\$370	\$271	\$225	\$320	\$206	\$367	\$283	\$333	\$420	\$272	\$1,393	\$1,675	20%
Endocrine	23	19	19	17	18	16	17	12	17	14	96	76	-21%
	\$398	\$209	\$176	\$77	\$279	\$284	\$157	\$305	\$372	\$885	\$1,139	\$2,004	76%
Ophthalmology	16	11	18	15	15	13	21	15	12	11	75	72	-4%
	\$285	\$138	\$196	\$92	\$216	\$107	\$275	\$272	\$166	\$184	\$927	\$1,004	8%
Metabolic	13	9	11	11	13	18	13	11	16	8	57	66	16%
	\$239	\$93	\$162	\$176	\$241	\$371	\$265	\$161	\$418	\$165	\$912	\$1,380	51%
Immunology	11	23	14	11	8	12	10	15	10	8	67	55	-18%
	\$77	\$310	\$157	\$152	\$57	\$148	\$171	\$262	\$258	\$332	\$753	\$1,170	55%
Respiratory	15	14	9	11	10	7	8	8	13	8	59	44	-25%
	\$237	\$169	\$106	\$154	\$106	\$65	\$60	\$59	\$210	\$138	\$771	\$532	-31%
Hematology	9	8	6	10	7	11	7	5	7	4	40	34	-15%
	\$170	\$109	\$90	\$104	\$91	\$150	\$90	\$42	\$162	\$66	\$563	\$511	-9%
Psychiatry	4	2	5	4	6	10	7	6	4	3	21	30	43%
	\$56	\$36	\$50	\$39	\$58	\$111	\$44	\$154	\$39	\$53	\$238	\$402	68%
Cardiovascular	24	19	15	18	18	16	16	12	12	3	94	59	-37%
	\$374	\$221	\$167	\$141	\$256	\$283	\$177	\$56	\$245	\$51	\$1,158	\$812	-30%
Gastrointestinal	7	10	3	4	4	8	5	4	5	3	28	25	-11%
	\$128	\$207	\$39	\$67	\$66	\$87	\$52	\$18	\$76	\$18	\$508	\$251	-51%
Total	319	320	291	316	289	298	295	298	299	258	1535	1448	-6%
	\$4,984	\$3,964	\$3,491	\$2,826	\$3,207	\$3,488	\$3,682	\$4,741	\$6,928	\$5,522	\$18,473	\$24,361	32%

**Table 3. Total number of venture capital deals for each disease group as well as the amount invested by disease from 2007-2016.**

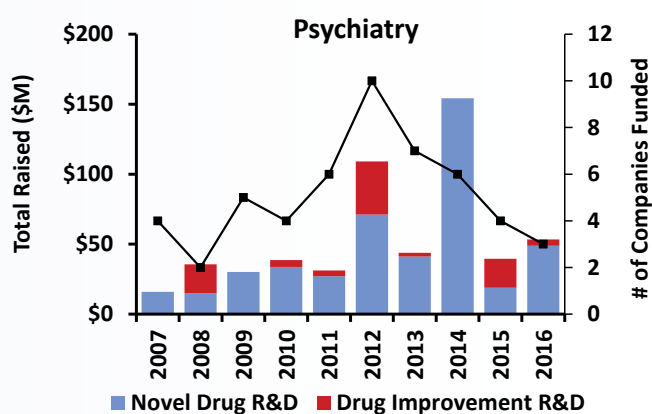
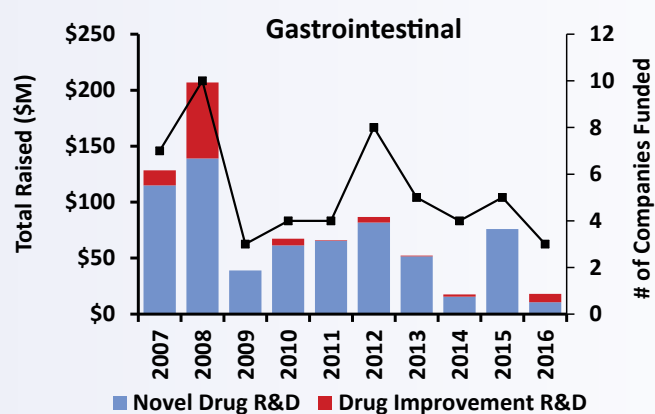
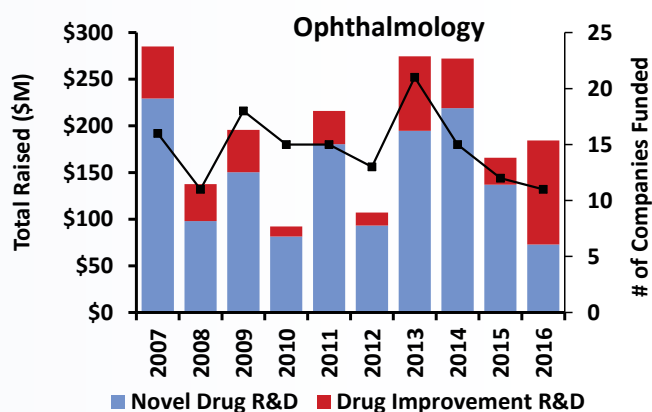
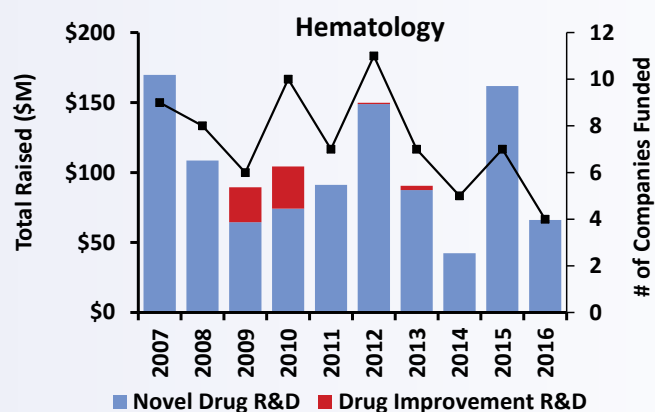
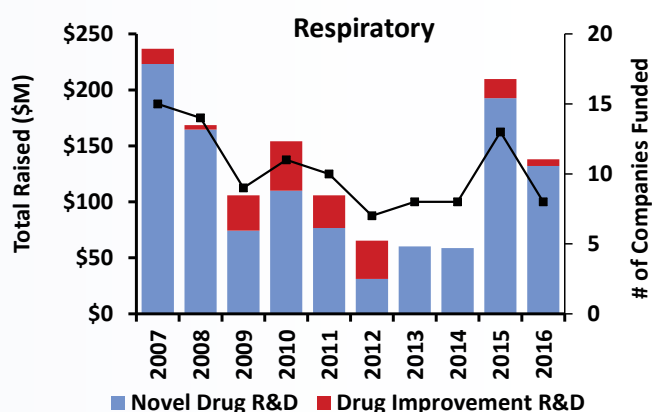
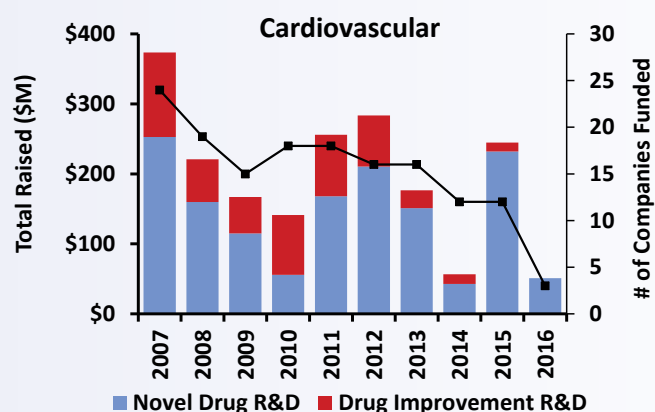


## US Venture Capital by Disease Area, 2007-2016



**Chart 6. Total venture funding for each major disease area from 2007-2016. Funding is represented as investment toward R&D of novel molecular entities (blue) vs. improvements of approved drugs (red).**

## US Venture Capital by Disease Area, 2007-2016



**Chart 6. Total venture funding for each major disease area from 2007-2016. Funding is represented as investment toward R&D of novel molecular entities (blue) vs. improvements of approved drugs (red).**

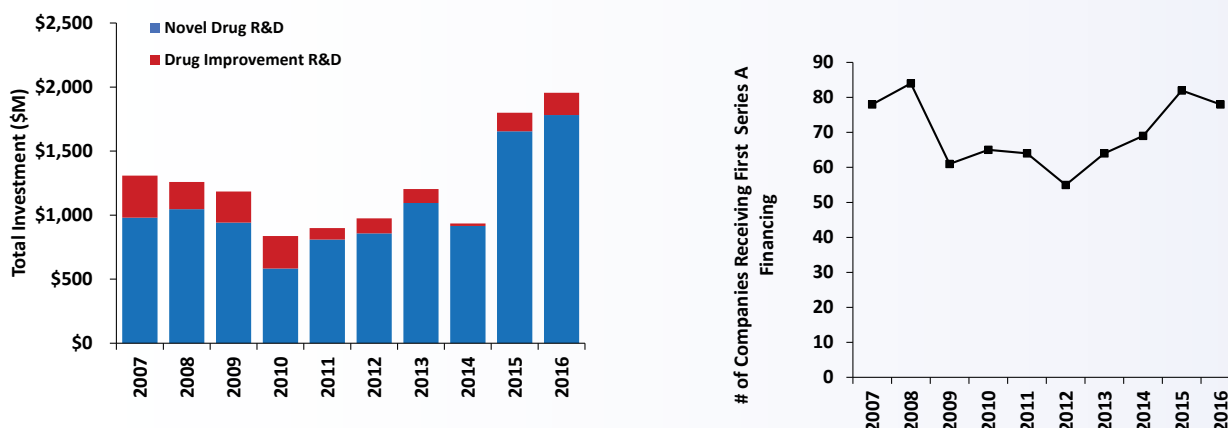
## Series A Venture Funding of US Therapeutic Companies

Series A funding is the first significant financing round after the smaller “Seed” round, and often involves a syndicate of venture firms that back a new approach to drug development. Tracking these rounds allows us to gauge investor appetite for, and commitment to, new early-stage companies.

In 2016, a record amount was raised in Series A rounds, with nearly \$2 billion going to early-stage companies. Over the last 10 years, Series A has accounted for 29% of all venture investment, but in 2016 this increased to 36%, indicating a shift toward earlier stage investment. Preclinical companies took in 77% of all Series A venture dollars in 2016, above the decade average of 63%. Almost all Series A funding went into novel drug R&D, with only 10% heading into drug improvement R&D.

Series A rounds have increasingly been tranchied, meaning the total sum for an A round may come across long periods of time in separate payments dependent on company progress. Although the total number of companies receiving Series A across all tranches increased in 2016, the number of “first-time” Series A financings (A-1 rounds) decreased slightly to 78 in 2016, from 82 in 2015. The combination of fewer companies and an increase in funding boosted the average amount per Series A-1 round to \$18.9 million vs. \$17.5 million in 2015. These averages have increased in recent years from the lows seen in 2008-2011 when averages were below \$10 million.

**SERIES A VENTURE FUNDING OF US THERAPEUTIC COMPANIES, 2007-2016**



**Chart 7. Left: Series A venture funding (\$M) from 2007-2016. Funding is represented as investment toward R&D of novel molecular entities (blue) vs. improvements of approved drugs (red). Right: Number of companies receiving their First Series A Round (A-1 rounds), 2007-2016.**

## Series A Venture Funding by Disease

Oncology Series A financing reached record levels in 2016, with \$765 million funding 53 companies. This represents 40% of all Series A transactions for emerging therapeutic companies.

As seen in **Table 4** below, in 2016 more neurology companies were funded (18) but with less money (\$269 million) vs. 2015. Eleven of these companies received series A financings for the first-time in 2016. Platform companies represented the third highest category in terms of number of companies (15) receiving Series A funding in 2016. As with neurology, eleven of the platform companies received first-time Series A financings.

At the opposite end of Series A activity, cardiovascular and respiratory diseases saw only one company each receive financing. The drop in cardiovascular stands out as in prior years there have been 5-8 companies per year receiving Series A financing.

Gastrointestinal, respiratory, ophthalmology, and psychiatry were the bottom four disease areas in terms of Series A financing in 2016, with each receiving under \$50 million. For gastrointestinal, respiratory, and psychiatry, this is consistent with past years.

## Series A Venture Funding by Disease

Disease Area	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	5 yr period 2007-2011	5 yr period 2012-2016	5 yr period change
Oncology	19	29	21	21	30	23	25	27	46	53	120	174	45%
	\$238	\$290	\$324	\$135	\$250	\$99	\$372	\$240	\$663	\$765	\$1,236	\$2,139	73%
Neurology	9	13	21	17	20	20	16	13	14	18	80	81	1%
	\$128	\$107	\$226	\$119	\$84	\$123	\$162	\$163	\$352	\$269	\$663	\$1,070	61%
Platform	9	16	11	13	7	10	17	18	13	15	56	73	30%
	\$47	\$98	\$113	\$98	\$47	\$152	\$215	\$228	\$205	\$266	\$403	\$1,066	165%
Infectious Disease	23	18	12	17	9	9	10	10	14	11	79	54	-32%
	\$271	\$173	\$86	\$37	\$118	\$56	\$88	\$87	\$169	\$57	\$686	\$457	-33%
Other	11	13	12	15	9	10	11	10	9	8	60	48	-20%
	\$91	\$121	\$98	\$126	\$67	\$82	\$95	\$39	\$51	\$142	\$503	\$409	-19%
Endocrine	8	8	5	6	8	7	4	4	7	5	35	27	-23%
	\$53	\$48	\$47	\$12	\$12	\$29	\$5	\$19	\$65	\$68	\$173	\$187	8%
Hematology	4	6	4	5	1	4	3	3	3	4	20	17	-15%
	\$36	\$40	\$26	\$45	\$2	\$54	\$35	\$37	\$21	\$66	\$148	\$213	43%
Ophthalmology	9	7	6	8	6	7	7	3	2	4	36	23	-36%
	\$156	\$71	\$49	\$45	\$92	\$59	\$113	\$26	\$8	\$32	\$413	\$238	-43%
Metabolic	4	4	4	4	5	6	2	2	6	3	21	19	-10%
	\$47	\$23	\$28	\$13	\$79	\$80	\$28	\$18	\$131	\$79	\$190	\$335	77%
Immunology	7	11	7	3	6	4	2	3	0	3	34	12	-65%
	\$37	\$150	\$115	\$16	\$50	\$51	\$10	\$44	\$0	\$63	\$368	\$167	-55%
Gastrointestinal	2	5	2	3	0	2	1	0	2	2	12	7	-42%
	\$9	\$48	\$9	\$64	\$0	\$16	\$15	\$0	\$27	\$11	\$130	\$69	-47%
Psychiatry	2	0	1	2	3	4	4	1	3	2	8	14	75%
	\$8	\$0	\$2	\$25	\$24	\$39	\$20	\$7	\$19	\$45	\$59	\$129	118%
Cardiovascular	9	7	6	8	8	7	6	5	5	1	38	24	-37%
	\$98	\$39	\$41	\$38	\$22	\$133	\$44	\$18	\$54	\$50	\$238	\$299	25%
Respiratory	8	7	3	6	4	1	2	3	2	1	28	9	-68%
	\$90	\$52	\$22	\$62	\$50	\$3	\$0	\$8	\$34	\$45	\$275	\$90	-67%
TOTAL	124	144	115	128	116	114	110	102	126	130	627	582	-7%
	\$1,308	\$1,259	\$1,184	\$836	\$898	\$975	\$1,202	\$934	\$1,800	\$1,957	\$5,486	\$6,868	25%

**Table 4. Series A venture funding (\$M) and number of venture transactions by disease area, 2007-2016**

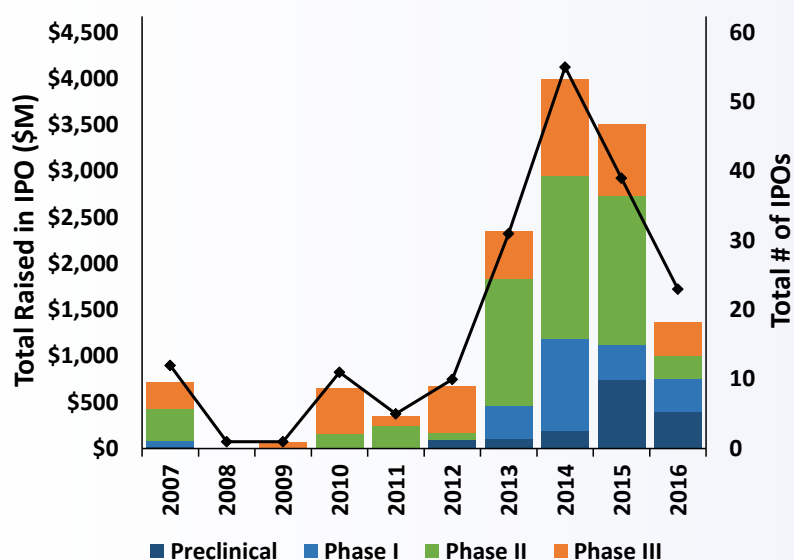


# Initial Public Offerings from US Therapeutic Companies

Public financing of emerging therapeutic companies dropped to pre-2013 levels in 2016, with 23 initial public offerings (IPOs) raising \$1.4 billion. Although this represents the second consecutive annual drop in dollars and number of IPOs, it should be noted that since the JOBS Act became law in 2012, more than 170 emerging therapeutic biotechs have gone public (and more than 200 if we include diagnostics and industrial biotechs). In total, \$11.8 billion was raised by R&D-stage emerging therapeutics companies in the five years after the signing of the JOBS Act, as compared to just \$1.7 billion in the five years prior to the JOBS Act (2007 to 2011). The JOBS Act allows for enhanced communication between company management and investors prior to filing for a listing on a US exchange and reduces the regulatory cost burden of being a public company.

The average amount raised per IPO for R&D-stage companies was \$62 million in 2016, down from \$90 million in 2015. The number of Preclinical and Phase I companies remained the same in 2016 and 2015 at 13, although total dollars were raised was down slightly. The fact that the same number of early-stage companies went public suggests investor interest has not waned from new innovative platforms and novel compounds that have yet to prove themselves in the clinic.

IPOS FOR US R&D-STAGE THERAPEUTIC COMPANIES, 2007-2016



Stage at time of IPO	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Preclinical - Phase III (#)	12	1	1	11	5	10	31	55	39	22
Marketed (#)	3	0	2	1	3	1	1	5	0	1
Total (#)	15	1	3	12	8	11	32	60	39	23
Preclinical - Phase III (\$M)	\$711	\$5	\$68	\$650	\$343	\$672	\$2,350	\$3,993	\$3,508	\$1,366
Marketed (\$M)	\$159	\$0	\$1,035	\$56	\$197	\$55	\$37	\$1,161	\$0	\$75
Total (\$M)	\$870	\$5	\$1,103	\$706	\$541	\$727	\$2,387	\$5,154	\$3,508	\$1,441

**Chart 8. Top: IPOs for US R&D-stage emerging therapeutic companies, by phase, 2007-2016. Bottom: The number of IPOs and total dollars raised via IPOs per year for R&D-stage and market-stage companies.**

## IPOs for US Therapeutic Companies, by Disease

Between 2011 and 2015, oncology and neurology companies raised more money through IPOs each year than any other disease groups. This changed in 2016. Metabolic, infectious disease, and platform companies each raised more than oncology and neurology combined. The number of oncology IPOs was only half of that seen in 2015 (4 in 2016 vs. 9 in 2015) and companies with lead neurology programs were notably absent from the 2016 list after seeing 11 IPOs in 2015.

Another change for 2016 was the lack of IPOs from companies with lead products in endocrine, hematology, and psychiatric diseases. On the other end of the spectrum, gastrointestinal (2), immunology (2), and platform (3) companies reversed course from having no IPOs in 2015.

Disease Area	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	5 yr period 2007-2011	5 yr period 2012-2016
Oncology	1 \$50	0 \$0	0 \$0	1 \$81	3 \$248	3 \$236	14 \$958	10 \$1,033	9 \$897	4 \$162	5 \$379	40 \$3,286
Platform	0 \$0	0 \$0	0 \$0	0 \$0	0 \$0	1 \$45	1 \$70	2 \$102	0 \$0	3 \$258	0 \$0	7 \$475
Metabolic	2 \$172	0 \$0	0 \$0	0 \$0	0 \$0	1 \$50	3 \$301	2 \$176	3 \$155	3 \$189	2 \$172	12 \$871
Infectious Disease	4 \$172	0 \$0	0 \$0	3 \$123	0 \$0	2 \$140	4 \$315	8 \$420	2 \$211	3 \$178	7 \$294	19 \$1,264
Other	0 \$0	0 \$0	1 \$85	1 \$30	1 \$106	1 \$81	0 \$0	6 \$1,212	2 \$215	2 \$263	3 \$221	11 \$1,771
Immunology	0 \$0	0 \$0	0 \$0	1 \$17	1 \$50	2 \$120	1 \$73	4 \$302	0 \$0	2 \$105	2 \$67	9 \$600
Gastrointestinal	2 \$86	0 \$0	0 \$0	1 \$188	1 \$55	0 \$0	1 \$25	1 \$60	0 \$0	2 \$95	4 \$329	4 \$180
Cardiovascular	0 \$0	1 \$5	0 \$0	2 \$90	0 \$0	0 \$0	2 \$134	3 \$161	3 \$253	2 \$91	3 \$95	10 \$639
Ophthalmology	0 \$0	0 \$0	0 \$0	1 \$72	0 \$0	0 \$0	2 \$234	4 \$267	2 \$201	1 \$50	1 \$72	9 \$752
Respiratory	1 \$69	0 \$0	0 \$0	0 \$0	0 \$0	0 \$0	1 \$72	0 \$0	1 \$77	1 \$50	1 \$69	3 \$199
Endocrine	2 \$155	0 \$0	0 \$0	0 \$0	0 \$0	0 \$0	0 \$0	8 \$612	2 \$152	0 \$0	2 \$155	10 \$764
Psychiatry	0 \$0	0 \$0	0 \$0	0 \$0	0 \$0	0 \$0	0 \$0	1 \$33	2 \$98	0 \$0	0 \$0	3 \$131
Hematology	1 \$15	0 \$0	1 \$950	0 \$0	0 \$0	0 \$0	3 \$205	3 \$309	2 \$192	0 \$0	2 \$965	8 \$706
Neurology	2 \$152	0 \$0	1 \$68	2 \$106	2 \$82	1 \$55	0 \$0	8 \$467	11 \$1,058	0 \$0	7 \$408	20 \$1,580
Total	15 \$870	1 \$5	3 \$1,103	12 \$706	8 \$541	11 \$727	32 \$2,387	60 \$5,154	39 \$3,508	23 \$1,441	39 \$3,225	165 \$13,218

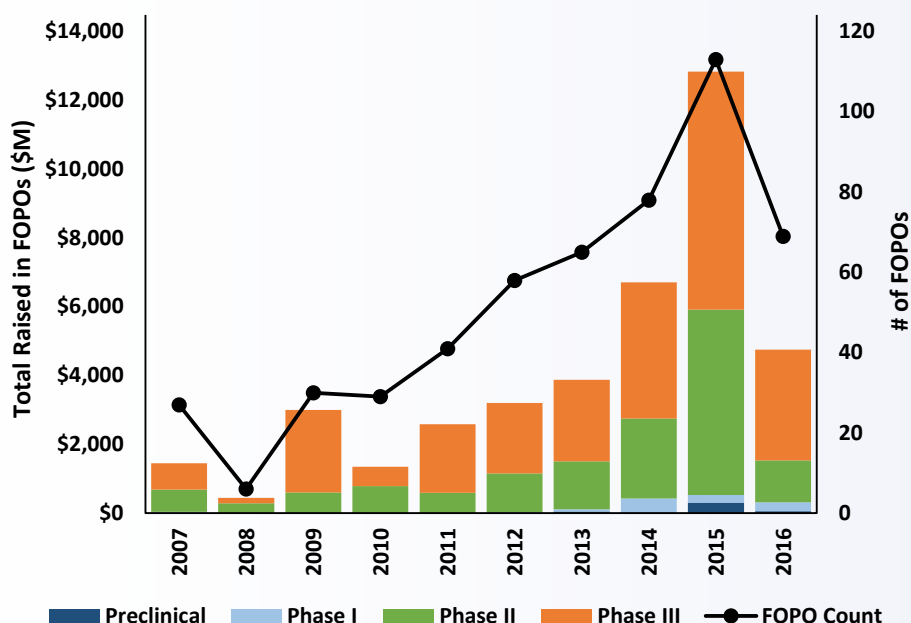
**Table 5. IPOs by US R&D-stage companies, 2007-2016. Amount raised (\$M) and number of deals by disease. Listed by total number of deals in 2016, top to bottom.**

# Follow-On Public Offerings from US Therapeutic Companies

Capital raised via follow-on public offerings (FOPOs) dropped substantially in 2016 for US emerging companies, from a record high of \$16.1 billion across 132 financings in 2015 to \$7 billion across 87 financings in 2016. The drop was more pronounced for R&D-stage companies than for Market-stage companies (a 63% drop vs. 29%).

In 2015, 49 R&D-stage companies raised over \$100 million; in 2016, only 18 R&D-stage companies raised more than \$100 million. R&D-stage companies in Phase II and III were responsible for much of the capital flow prior to 2016, as can be seen in Chart 9. This remained the case in 2016, with the majority of capital raised going to Phase II and Phase III companies, though Phase II funding was still its lowest in five years.

FOPOS FOR US THERAPEUTIC COMPANIES, 2007-2016



Stage at time of FOPO	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Preclinical - Ph III #, (>\$10M)	27	6	30	29	41	58	65	78	113	69
Marketed #, (>\$10M)	7	5	12	16	10	18	24	21	19	18
Total # (>\$10M)	34	11	42	45	51	76	89	99	132	87
Preclinical - Ph III (\$M)	\$1,453	\$443	\$2,996	\$1,352	\$2,583	\$3,202	\$3,876	\$6,710	\$12,831	\$4,748
Marketed (\$M)	\$608	\$580	\$1,692	\$1,281	\$812	\$1,647	\$2,403	\$2,147	\$3,282	\$2,314
Total (\$M)	\$2,060	\$1,023	\$4,688	\$2,633	\$3,395	\$4,850	\$6,279	\$8,857	\$16,113	\$7,062

**Chart 9. Top: FOPOs for US R&D-stage emerging therapeutic companies, 2007-2016. Bottom: The number of FOPOs (with values above \$10M) and total FOPO dollars raised per year for R&D-stage and market-stage companies, 2007-2016.**

## US Follow-On Public Offerings by Disease

Emerging oncology companies raised the most capital through FOPOs (\$2.1 billion) and had the most transactions (23) compared to all other disease areas in 2016. This is in contrast to 2015, when metabolic diseases companies focused on rare disorders raised the largest share of funding (\$3.2 billion across 10 offerings). Oncology remained on top despite a 39% drop in the number of financings.

Major declines of more than two thirds in dollar terms were seen in four disease areas: endocrine (\$1.5 billion in 2015 down to \$239 million in 2016), immunology (\$1.2 billion to \$286 million), cardiovascular (\$988 million to \$86 million), and metabolic (\$3.3 billion to \$436 million).

Disease Area	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	5 yr period 2007-2011	5 yr period 2012-2016
Oncology	11 \$791	2 \$174	15 \$1,570	11 \$644	19 \$1,518	28 \$1,782	25 \$2,260	30 \$2,090	38 \$3,246	23 \$2,093	58 \$4,697	144 \$11,471
Neurology	9 \$625	3 \$242	3 \$115	9 \$463	4 \$238	11 \$531	12 \$423	13 \$1,712	17 \$1,792	16 \$1,669	28 \$1,683	69 \$6,127
Infectious Disease	0 \$0	2 \$338	7 \$1,765	11 \$512	9 \$572	9 \$613	16 \$1,049	10 \$1,054	17 \$1,863	9 \$641	29 \$3,187	61 \$5,219
Other	2 \$68	0 \$0	1 \$109	0 \$0	2 \$46	2 \$70	7 \$418	8 \$646	10 \$1,071	9 \$401	5 \$222	36 \$2,606
Ophthalmology	0 \$0	0 \$0	2 \$155	1 \$62	0 \$0	4 \$146	1 \$11	4 \$284	7 \$442	7 \$345	3 \$217	23 \$1,228
Metabolic	1 \$109	1 \$81	3 \$173	0 \$0	3 \$170	6 \$662	2 \$254	8 \$949	10 \$3,329	4 \$436	8 \$533	30 \$5,630
Hematology	1 \$16	0 \$0	1 \$86	2 \$270	2 \$63	1 \$18	4 \$203	5 \$403	4 \$547	4 \$460	6 \$436	18 \$1,631
Endocrine	3 \$92	1 \$51	2 \$181	4 \$140	5 \$249	6 \$657	8 \$538	5 \$255	13 \$1,491	4 \$239	15 \$713	36 \$3,179
Immunology	2 \$84	2 \$139	4 \$244	2 \$241	1 \$58	1 \$38	3 \$175	3 \$334	10 \$1,215	3 \$286	11 \$765	20 \$2,047
Psychiatry	1 \$12	0 \$0	0 \$0	0 \$0	0 \$0	1 \$22	0 \$0	1 \$11	1 \$130	3 \$44	1 \$12	6 \$206
Gastrointestinal	2 \$149	0 \$0	2 \$190	1 \$111	3 \$294	4 \$197	4 \$342	3 \$345	0 \$0	2 \$288	8 \$744	13 \$1,172
Cardiovascular	1 \$35	0 \$0	0 \$0	3 \$76	2 \$91	3 \$114	3 \$270	6 \$345	5 \$988	2 \$86	6 \$202	19 \$1,803
Respiratory	1 \$78	0 \$0	2 \$100	1 \$114	1 \$96	0 \$0	4 \$337	3 \$432	0 \$0	1 \$75	5 \$388	8 \$844
Total	34 \$2,060	11 \$1,023	42 \$4,688	45 \$2,633	51 \$3,395	76 \$4,850	89 \$6,279	99 \$8,857	132 \$16,113	87 \$7,062	183 \$13,800	483 \$43,161

**Table 6. FOPOs, 2007-2016. Amount raised (\$M) and number of deals by disease. Listed by total number of deals in 2016, top to bottom. Due to the definition used, Platform companies did not raise money through FOPOs during the timeframe. To meet our definition of Platform, companies cannot have advanced into a specific indication. For further details, see the Methodology section at the end of this report.**



# Global Licensing

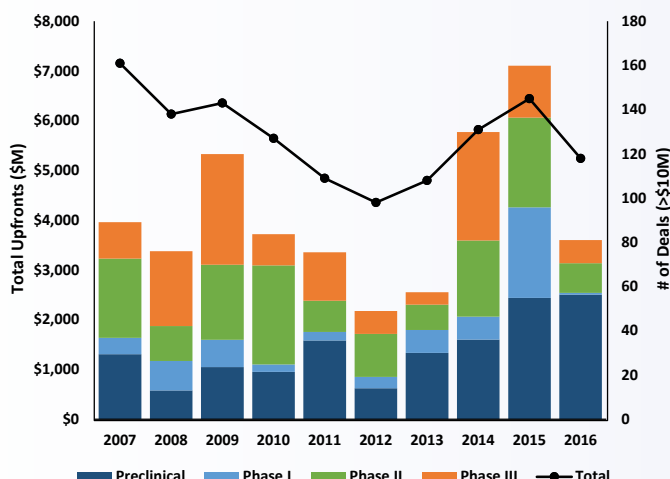
For licensing, we analyzed R&D-stage asset out-licensing activity by emerging companies (both US and ex-US) to best represent deal flow and interest from large biopharmaceutical players. For 2016, there was a 17% drop in the number of deals with a disclosed potential value over \$10M, from 145 in 2015 to 118 in 2016. The total dollar amount paid upfront to small companies for these out-licensed programs dropped precipitously in 2016, by 52%, from a record \$7.1 billion to \$3.6 billion in 2016. As seen in Chart 10, both the number of deals and the total upfront dollar amounts place 2016 above the low periods witnessed in 2011-2013, but below the strong licensing period of 2007-2009.

Looking at deal activity by geographic location of target companies, the US was the main contributor to the overall drop in 2016. European asset out-licensing declined only 2%, compared to a drop of 23% in the US, and Japanese deal volume doubled from 2 deals in 2015 to 4 deals in 2016.

Looking specifically at Preclinical-stage deals, the story is quite different. 2016 was a record year in terms of total upfront dollars paid to Preclinical-stage companies in out-licensing deals (\$2.5 billion). Although the number Preclinical-stage deals dipped slightly, it came in at the second highest level in a decade (73 deals in 2016 vs. 79 in 2015). Another record was set for the number of Preclinical-stage deals with a total potential value over \$1 billion – there were 15 such deals in 2016, whereas the previous high year was 4 in 2014.

Clinical-stage deals fell in number and total dollars in 2016, with Phase I having the biggest drop. Year over year, the number of Phase I deals declined from 16 to 9, Phase II dropped from 31 to 21, and Phase III fell from 19 to 15. Furthermore, average upfront payments and total potential deal values were higher for Preclinical-stage deals (\$47 million upfront, \$647 million including milestones) vs. Clinical-stage deals (\$31 million upfront, \$250 million including milestones).

GLOBAL LICENSING OF R&D-STAGE THERAPEUTICS, 2007-2016



Stage at Licensing Date	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Preclinical # of deals >\$10M	71	62	60	61	65	50	63	69	79	73
Clinical # of deals >\$10M	90	76	83	66	44	48	45	62	66	45
Total	161	138	143	127	109	98	108	131	145	118
Preclinical Upfront \$M	\$1,308	\$582	\$1,052	\$955	\$1,584	\$626	\$1,334	\$1,601	\$2,442	\$2,505
Clinical Upfront \$M	\$2,653	\$2,798	\$4,278	\$2,764	\$1,771	\$1,551	\$1,219	\$4,171	\$4,663	\$1,099
Total	\$3,961	\$3,381	\$5,330	\$3,719	\$3,355	\$2,177	\$2,553	\$5,772	\$7,105	\$3,604

**Chart 10. Global licensing for R&D-stage emerging therapeutics, 2007-2016. The number of licensing deals (with values above \$10M) and total upfront dollars per year for R&D-stage assets. To more accurately reflect actual money flow into small company R&D, potential payments for regulatory and sales milestones are not included in the numbers, as many of these payments are not realized due to the challenges faced in drug development. For example, only 16% of drug programs in Phase II will make it to FDA approval (Thomas, D., et al. Clinical development success rates for investigational drugs, 2016, <https://www.bio.org/iareports.com>).**

## Global Licensing by Disease

Oncology R&D-stage deals once again led the therapeutic areas in both volume of deals and total upfront payments in 2016. However, 2015 remains a record year for this disease area with \$3.4 billion in upfront payments spread across 58 transactions vs. \$2.0 billion and 53 deals in 2016. These last two years have been the highest on record for oncology deal-making activity and exemplify the interest surrounding immuno-oncology today, with a significant number of deals signed for combination testing with existing PD-1/PD-L1 inhibitors or for new targets.

Neurology was the second most active disease area in terms of deal volume with 11 R&D-stage deals. This is a drop from the 18 seen in 2015, and the total dollars from upfront payments slipped to \$229 million in 2016 from \$327 million in 2015. The majority of this came from Preclinical-stage deals in Alzheimer's and Parkinson's, or for new biologics with the potential to penetrate the blood brain barrier.

In **Chart 11** below, the platform and "other" categories rank third and fourth for 2016. Platform deals comprised a mix of seven biologics platforms, three delivery and a single small molecule diversity platform. The deals in the "other" category were largely comprised of dermatology deals. Psychiatry, metabolic, and gastrointestinal disease areas saw gains in 2016 over the volume seen in 2015. Immunology and platform programs continue to attract large companies at a steady rate of six to nine significant deals per year.

Endocrine and infectious disease deals dropped precipitously in 2016. Endocrine deals dropped from 12 to 3 deals in 2016, and Infectious disease dropped from 8 to 3 deals. The upfront dollar amounts dropped by more than 75% for both categories.

GLOBAL LICENSING OF R&D-STAGE THERAPEUTICS BY DISEASE, 2015 VS. 2016

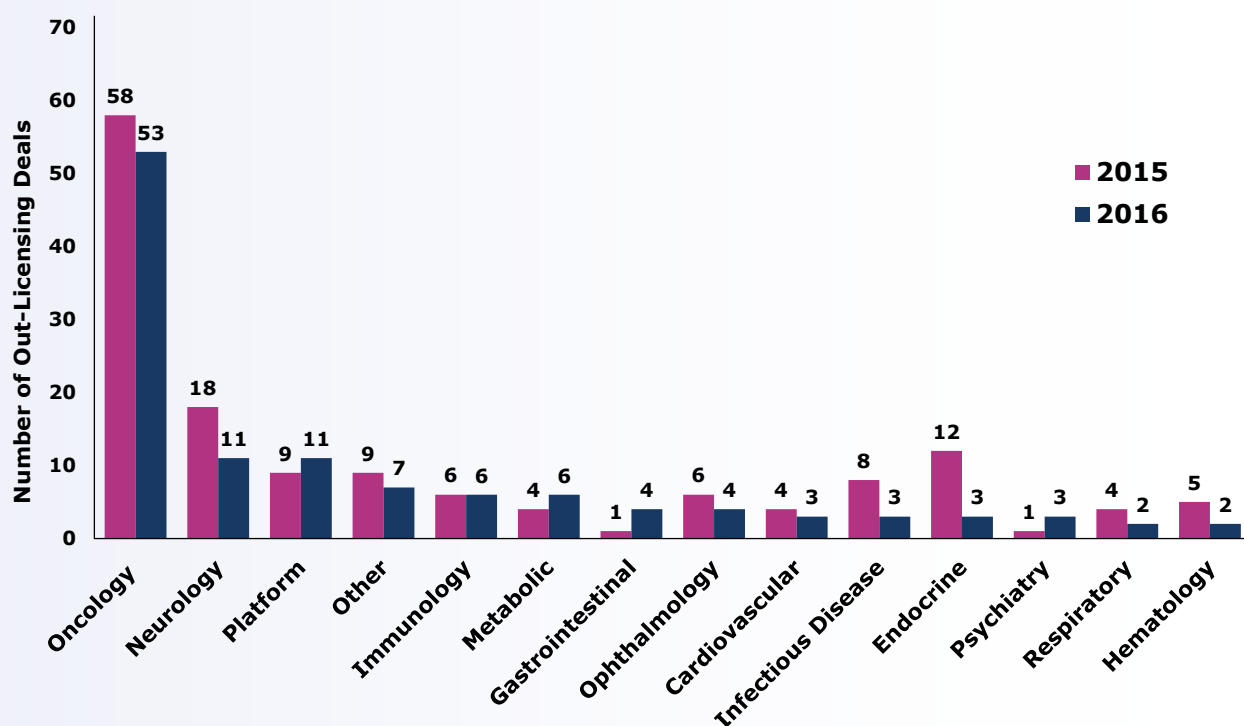
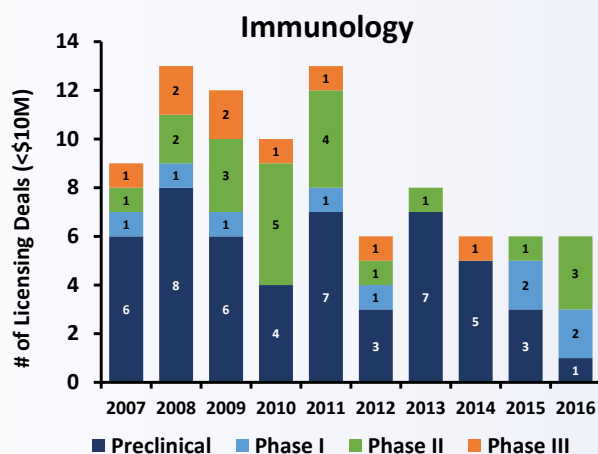
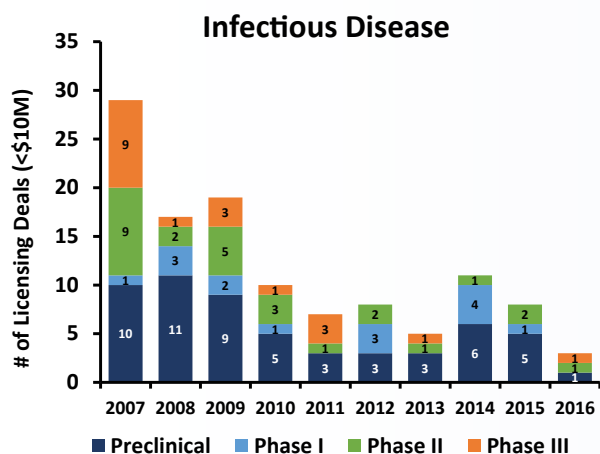
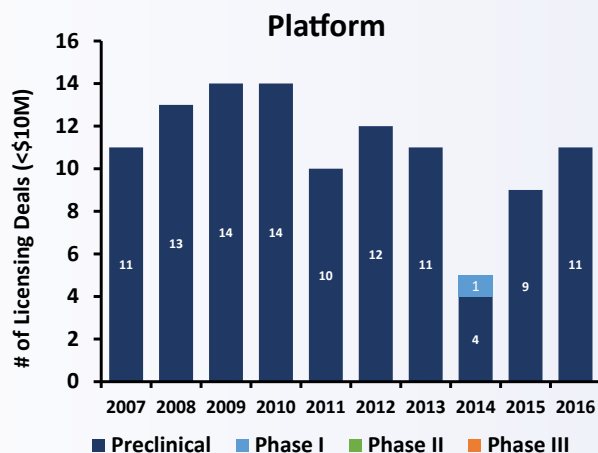
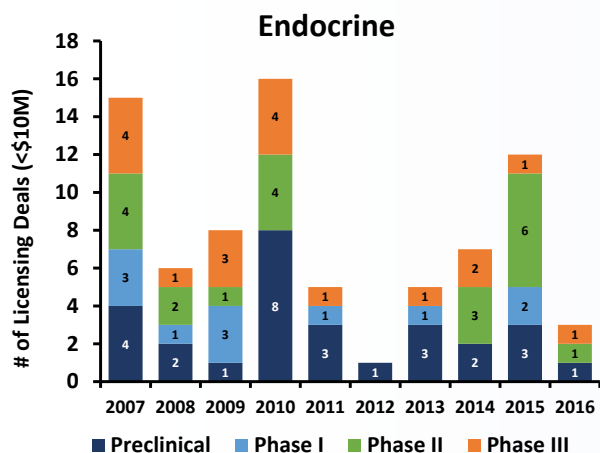
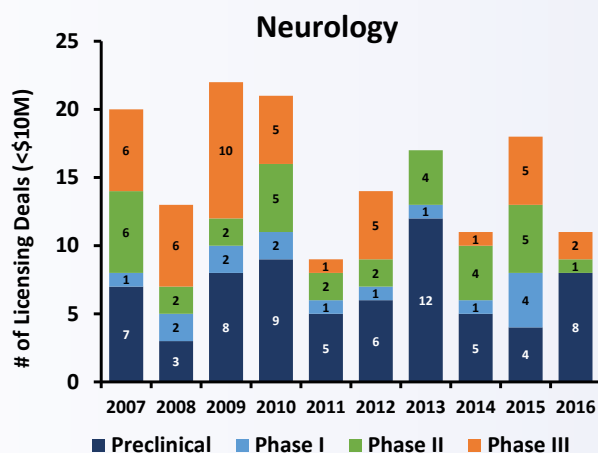
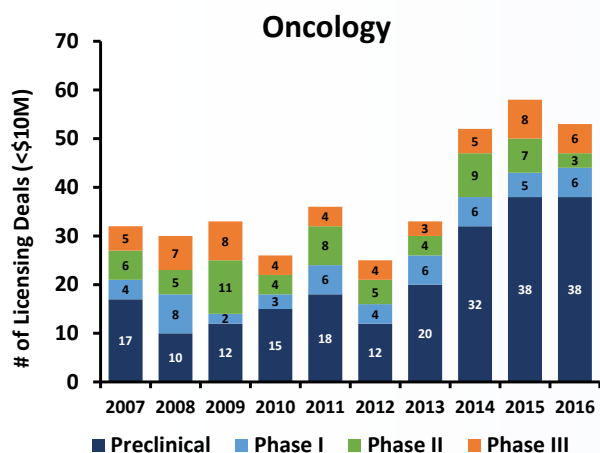


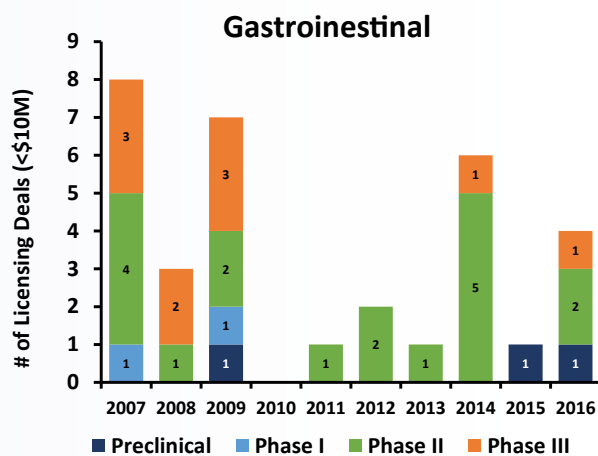
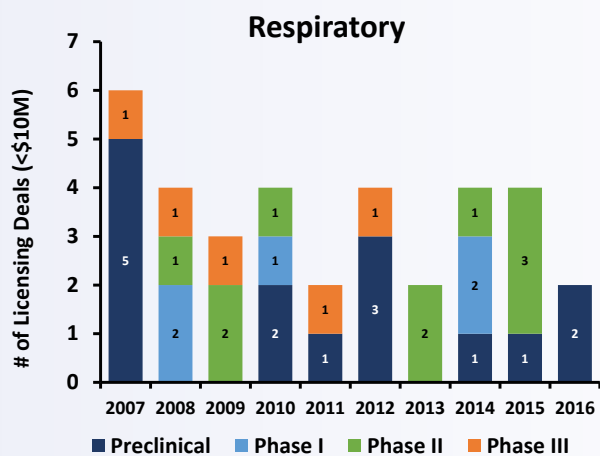
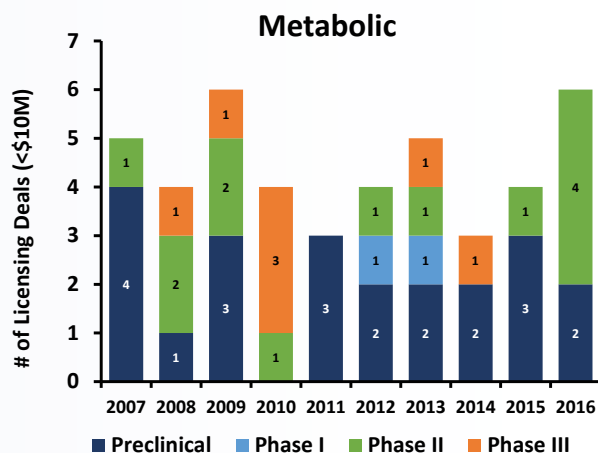
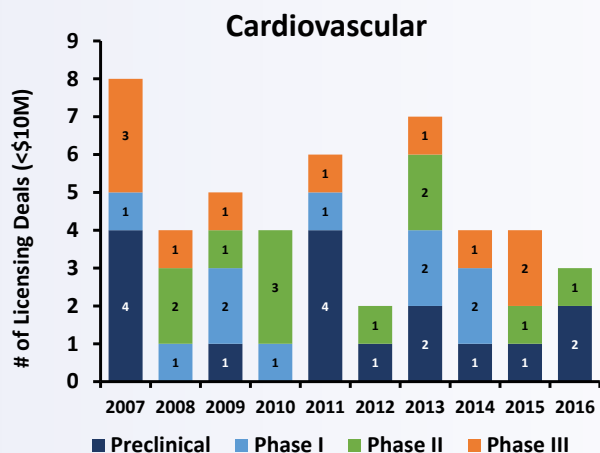
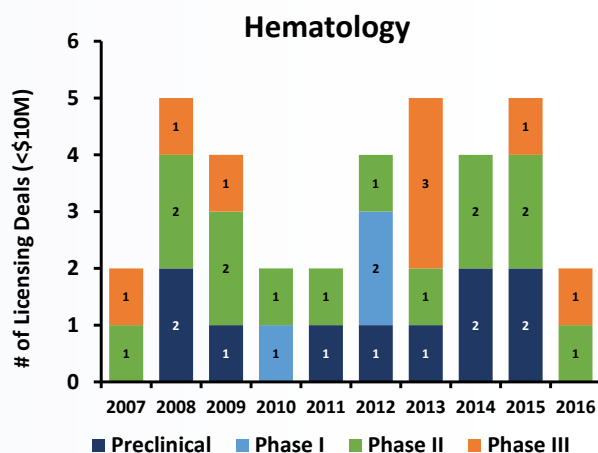
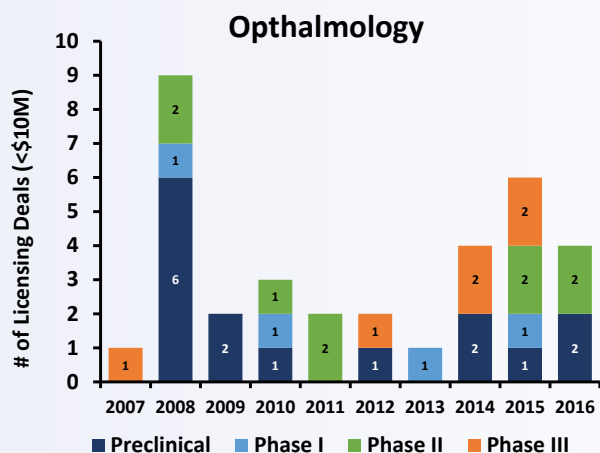
Chart 11. R&D-Stage Licensing in 2015 vs. 2016, by Disease Area, for deals with disclosed value above \$10M. Deals are sorted highest to lowest by number of deals in 2016.

# Global Emerging Company Out-Licensing by Disease, by Phase



**Chart 12. Number of licensing deals with disclosed potential value above \$10M for global emerging therapeutic companies and number of deals by disease, 2007-2016.**

# Global Emerging Company Out-Licensing by Disease, by Phase



**Chart 12. Number of licensing deals with disclosed potential value above \$10M for global emerging therapeutic companies and number of deals by disease, 2007-2016.**



## Global Emerging Company Out-Licensing by Disease

Disease Area	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	5 yr period 2007-2011	5 yr period 2012-2016
Oncology	32 \$726	30 \$841	33 \$919	26 \$533	36 \$1,139	25 \$804	33 \$874	52 \$1,697	58 \$3,421	53 \$1,981	157 \$4,158	221 \$8,777
Neurology	20 \$417	13 \$624	22 \$1,589	21 \$264	9 \$128	14 \$231	17 \$296	11 \$586	18 \$327	11 \$229	85 \$3,022	71 \$1,670
Platform	11 \$797	13 \$270	14 \$139	14 \$230	10 \$487	12 \$71	11 \$396	5 \$142	9 \$377	11 \$234	62 \$1,923	48 \$1,219
Other	11 \$222	14 \$138	5 \$107	10 \$681	10 \$106	12 \$310	7 \$95	13 \$152	9 \$462	7 \$195	50 \$1,254	48 \$1,214
Immunology	9 \$50	13 \$233	12 \$396	10 \$189	13 \$259	6 \$163	8 \$261	6 \$82	6 \$898	6 \$259	57 \$1,126	32 \$1,663
Metabolic	5 \$105	4 \$272	6 \$185	4 \$166	3 \$33	4 \$95	5 \$62	3 \$738	4 \$230	6 \$120	22 \$761	22 \$1,244
Gastrointes- tinal	8 \$145	3 \$148	7 \$266	0 \$0	1 \$50	2 \$20	1 \$70	6 \$798	1 \$0	4 \$185	19 \$609	14 \$1,073
Ophthalmol- ogy	1 \$0	9 \$53	2 \$36	3 \$25	2 \$60	2 \$163	1 \$10	4 \$418	6 \$248	4 \$51	17 \$174	17 \$889
Endocrine	15 \$354	6 \$138	8 \$113	16 \$476	5 \$588	1 \$8	5 \$96	7 \$530	12 \$377	3 \$92	50 \$1,668	28 \$1,103
Cardiovas- cular	8 \$180	4 \$365	5 \$175	4 \$737	6 \$72	2 \$6	7 \$120	4 \$91	4 \$82	3 \$75	27 \$1,529	20 \$374
Psychiatry	4 \$93	3 \$22	3 \$231	3 \$32	3 \$202	2 \$11	1 \$98	1 \$25	1 \$10	3 \$13	16 \$580	8 \$157
Infectious Disease	29 \$717	17 \$218	19 \$797	10 \$304	7 \$197	8 \$257	5 \$58	11 \$196	8 \$65	3 \$6	82 \$2,233	35 \$582
Hematology	2 \$75	5 \$19	4 \$102	2 \$30	2 \$25	4 \$38	5 \$66	4 \$260	5 \$230	2 \$125	15 \$251	20 \$719
Respiratory	6 \$81	4 \$41	3 \$275	4 \$52	2 \$9	4 \$1	2 \$50	4 \$57	4 \$380	2 \$40	19 \$458	16 \$528
Total	161 \$3,961	138 \$3,381	143 \$5,330	127 \$3,719	109 \$3,355	98 \$2,177	108 \$2,553	131 \$5,772	145 \$7,105	118 \$3,604	678 \$19,745	600 \$21,212

**Table 7. Licensing, amount paid upfront (\$M) for deals with disclosed potential value above \$10M and number of deals by disease, 2007-2016.**

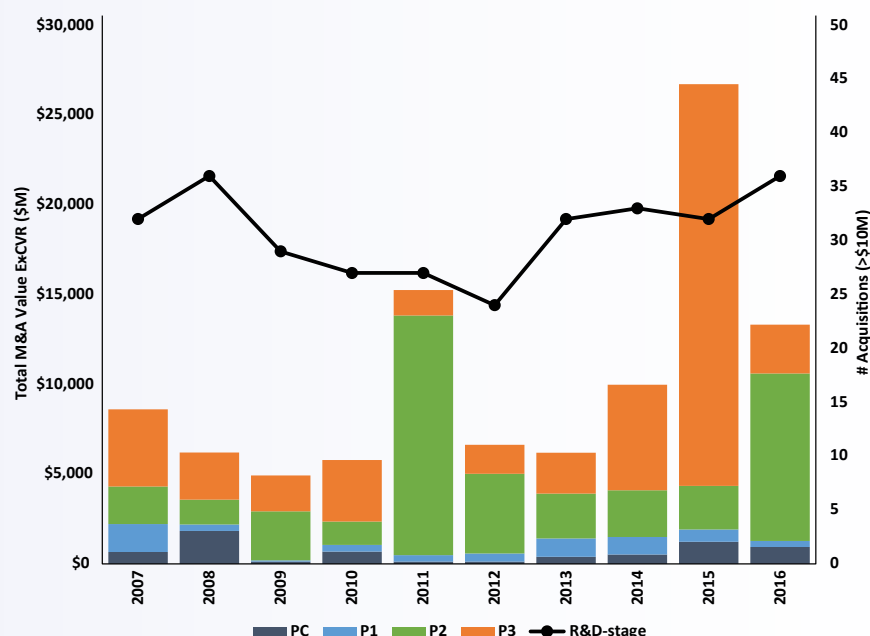
# Global Acquisitions

The total number of emerging therapeutic company acquisitions has remained nearly the same for three straight years, with 43 acquisitions in 2016 and 44 in 2014 and in 2015. However, the total amount paid has been far more varied. As can be seen in Chart 13, the dollars spent on these small companies was 44% less in 2016 vs. 2015 (\$35.5 billion vs. \$62.6 billion ). Although the \$14 billion acquisition of Medivation by Pfizer in 2016 was the second highest amount paid for an emerging company in the last decade, the 2015 total is likely to remain a high water mark for some time due to the \$21 billion Pharmacyclics acquisition by AbbVie.

The median price paid for an emerging therapeutic company in 2016 was \$200 million upfront and \$520 million when all contingent payments are included. This was an increase from 2015 (\$195 million upfront and \$467 million with contingent payments), but the average deal value fell 40%. This is primarily a result of a few outliers in 2015, like the Pharmacyclics deal mentioned above and two Phase III acquisitions for more than \$5 billion upfront each.

For R&D-stage buyouts, there was an increase in the number of acquisitions, from 32 in 2015 to 37 in 2016. This represents the highest number of acquisitions of R&D-stage therapeutic companies in a decade. Contrary to the increase in the number of acquisitions, however, is the sizable drop in the total amount paid. The total amount in upfront dollars dropped 51%, from \$26.7 billion in 2015 to \$12.6 billion in 2016. 2016 saw fewer Phase III acquisitions but more Phase II acquisitions than in 2015. The increase from 9 Phase II acquisitions in 2015 to 15 in 2016 accounts for much of the increase in R&D-stage acquisition activity.

## GLOBAL ACQUISITIONS OF R&D-STAGE THERAPEUTIC COMPANIES, 2007-2016



Stage at Acquisition	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
R&D-stage	32	36	29	27	27	24	32	33	32	36
Market-stage	7	15	10	13	15	16	17	11	12	7
Total	39	51	39	40	42	40	49	44	44	43
R&D-stage Upfront (\$M)	\$8,603	\$6,203	\$4,923	\$5,777	\$15,250	\$6,627	\$6,182	\$9,979	\$26,716	\$13,321
Market-stage Upfront (\$M)	\$11,346	\$19,680	\$9,630	\$11,598	\$3,396	\$16,390	\$25,096	\$19,285	\$35,887	\$22,165
Total	\$19,948	\$25,883	\$14,553	\$17,375	\$18,646	\$23,017	\$31,278	\$29,265	\$62,603	\$35,486

**Chart 13. Top: Acquisitions of global emerging therapeutic companies, by phase, 2007-2016. Bottom: The number of acquisitions (with values above \$10M) and total dollars raised per year for R&D-stage and market-stage companies.**

## Global Acquisitions by Disease

In 2016, the number of oncology acquisitions more than doubled the amount seen in 2015, from only 6 acquisitions in 2015 to 14 in 2016. Medivation was the only Market-stage acquisition in 2016, with the remaining 13 acquisitions spread out across the four R&D phases (Preclinical through Phase III). This is in contrast to 2015, which saw a noticeable absence of Phase II or III emerging oncology company acquisitions. An example of this shift was the acquisition of Stemcentryx for \$5.8 billion, the highest amount ever paid upfront for an oncology company in Phase II.

Outside of oncology, the disease areas neurology, ophthalmology, and dermatology had strong appeal in 2016, outpacing 2015 numbers. Cardiovascular and gastrointestinal companies were absent from the acquisition list in 2016.

Excluding the Market-stage company acquisitions, a similar trend can be seen in 2016 among the 36 R&D-stage company acquisitions shown in **Chart 14**. Oncology, neurology, and the “other” category dominated the list. One area with far fewer acquisition transactions in 2016 was the platform category, where both acquisitions were delivery technology companies rather than the novel drug design companies that were acquired in prior years.

GLOBAL ACQUISITIONS OF R&D-STAGE THERAPEUTICS BY DISEASE, 2015 VS. 2016

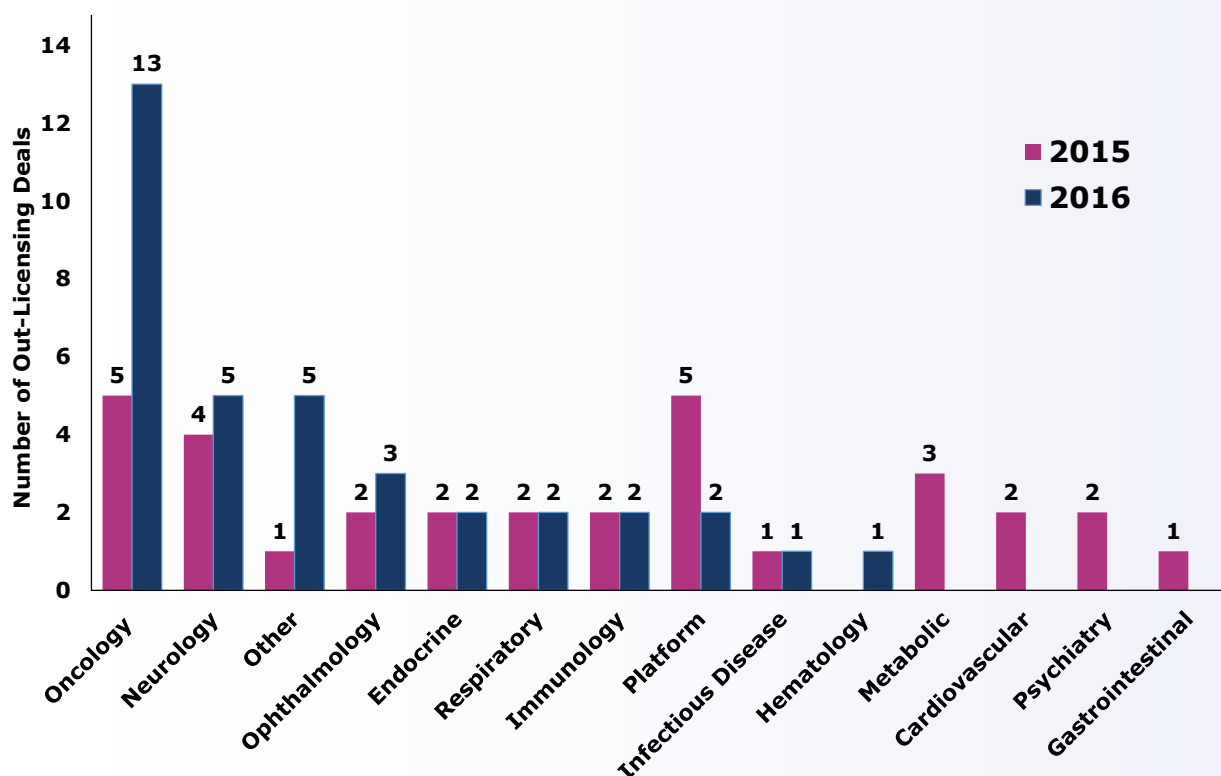


Chart 14. R&D-Stage Acquisitions in 2015 vs. 2016, by Disease Area, for deals with disclosed value above \$10M. Acquisitions are sorted highest to lowest by number of deals in 2016.

## Global Acquisitions by Disease, 2007-2016

Disease Area	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	5 yr period 2007-2011	5 yr period 2012-2016
Oncology	11 \$5,014	9 \$726	8 \$1,773	4 \$2,833	11 \$2,218	7 \$2,175	10 \$2,616	12 \$1,435	5 \$1,011	13 \$8,931	43 \$12,565	47 \$16,168
Neurology	2 \$327	3 \$81	4 \$703	2 \$695	3 \$210	3 \$46	1 \$37	5 \$952	4 \$3,644	5 \$1,322	14 \$2,017	18 \$6,000
Other	2 \$545	5 \$1,553	2 \$302	1 \$70	3 \$175	1 \$9	0 \$0	0 \$0	1 \$229	5 \$815	13 \$2,646	7 \$1,052
Ophthalmology	0 \$0	0 \$0	3 \$298	0 \$0	0 \$0	0 \$0	1 \$160	2 \$67	2 \$679	3 \$170	3 \$298	8 \$1,075
Endocrine	3 \$620	0 \$0	0 \$0	3 \$472	1 \$71	1 \$315	3 \$730	3 \$107	2 \$2,722	2 \$594	7 \$1,163	11 \$4,469
Respiratory	0 \$0	0 \$0	0 \$0	3 \$204	1 \$328	2 \$178	2 \$600	0 \$0	2 \$260	2 \$500	4 \$532	8 \$1,538
Immunology	3 \$933	3 \$1,012	2 \$221	1 \$102	2 \$186	1 \$1,272	0 \$0	1 \$260	2 \$330	2 \$275	11 \$2,454	6 \$2,137
Platform	5 \$427	7 \$946	1 \$29	8 \$598	1 \$10	3 \$111	2 \$51	3 \$175	5 \$541	2 \$50	22 \$2,010	15 \$928
Infectious Disease	4 \$358	5 \$916	6 \$1,187	0 \$0	2 \$11,412	3 \$2,131	7 \$1,339	4 \$5,827	1 \$190	1 \$0	17 \$13,873	16 \$9,487
Hematology	0 \$0	1 \$400	1 \$255	0 \$0	0 \$0	1 \$94	1 \$240	0 \$0	0 \$0	1 \$665	2 \$655	3 \$999
Metabolic	0 \$0	1 \$30	0 \$0	1 \$22	1 \$610	1 \$293	3 \$74	1 \$89	3 \$8,716	0 \$0	3 \$662	8 \$9,172
Cardiovascular	1 \$350	2 \$538	2 \$153	1 \$165	1 \$10	1 \$3	2 \$336	1 \$42	2 \$600	0 \$0	7 \$1,215	6 \$981
Psychiatry	1 \$29	0 \$0	0 \$0	1 \$226	0 \$0	0 \$0	0 \$0	0 \$0	2 \$462	0 \$0	2 \$255	2 \$462
Gastrointestinal	0 \$0	0 \$0	0 \$0	2 \$390	1 \$21	0 \$0	0 \$0	1 \$1,027	1 \$7,332	0 \$0	3 \$411	2 \$8,359
Total	32 \$8,603	36 \$6,203	29 \$4,923	27 \$5,777	27 \$15,250	24 \$6,627	32 \$6,182	33 \$9,979	32 \$26,716	36 \$13,321	151 \$40,756	157 \$62,826

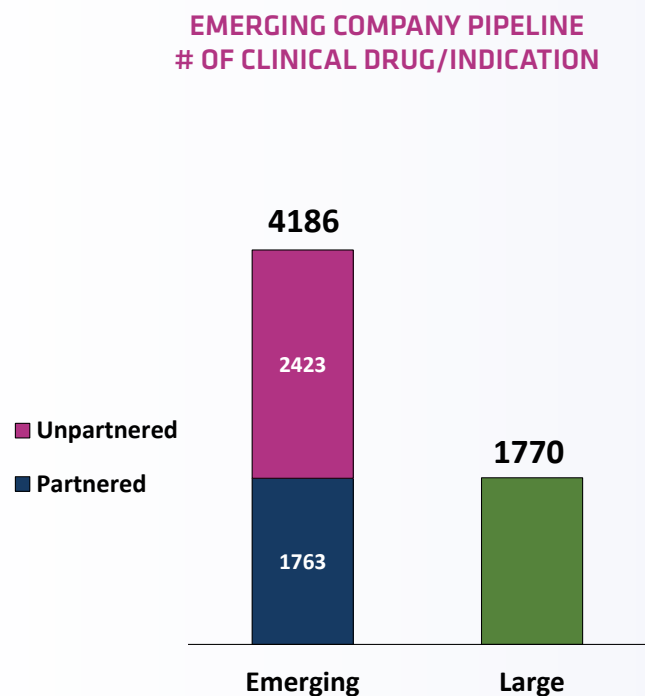
**Table 8. R&D-stage acquisitions, 2007-2016. Both the number of full company acquisitions and the total value of non-conditional acquisition cost is shown in the table, by year, for deals with disclosed potential value above \$10M.**

# Clinical Pipeline

Emerging companies have a robust pipeline, with 4,186 drug indication programs under development. This accounts for a full 70% of the entire global industry pipeline, which stands at 5,956 programs. Roughly 42% of emerging company programs are partnered with other companies, demonstrating the importance of licensing and collaborations in the biopharmaceutical industry.

More than half of the emerging therapeutic company pipeline is in Phase II (2,180 programs, or 52% of the ETC pipeline). As might be expected, a much smaller portion is found in Phase III (651 programs, or 16% of the ETC pipeline). These late-stage assets are more likely to be partnered than early-stage assets, as evidence by 51% of Phase III programs being partnered vs. only 36% for Phase I programs.

Oncology makes up the largest percentage of the emerging company clinical pipeline (39%), with 1,640 drug programs. As shown in **Table 9**, neurology and infectious disease follow, with 531 and 345 programs respectively. Two of the main disease areas (psychiatry and hematology) have less than 100 clinical programs run by emerging companies, with only a handful in late-stage clinical testing.



**Chart 15. Number of clinical (Phase I, II, III) Drug/Indication programs in the pipeline at emerging therapeutic companies (blue partnered/ orange unpartnered) and large drug developers (green). Based on analysis of the BioMedTracker database accessed March 2017.**

## Emerging Company Pipeline by Disease

Disease Area	Partnering Status	Phase I	Phase II	Phase III	Total
Oncology	Partnered	275	414	89	778
	Unpartnered	363	427	72	862
Neurology	Partnered	50	94	54	198
	Unpartnered	127	152	54	333
ID	Partnered	29	62	33	124
	Unpartnered	99	94	28	221
Other	Partnered	20	68	33	121
	Unpartnered	43	106	37	186
Endocrine	Partnered	12	53	19	84
	Unpartnered	53	88	22	163
Immunology	Partnered	29	58	19	106
	Unpartnered	39	88	16	143
CV	Partnered	10	30	18	58
	Unpartnered	35	65	14	114
Ophthalmology	Partnered	12	39	13	64
	Unpartnered	13	51	20	84
Metabolic	Partnered	8	27	13	48
	Unpartnered	17	40	17	74
GI	Partnered	10	27	13	50
	Unpartnered	22	40	10	72
Respiratory	Partnered	17	38	12	67
	Unpartnered	24	33	5	62
Psychiatry	Partnered	10	15	4	29
	Unpartnered	14	32	13	59
Hematology	Partnered	7	18	11	36
	Unpartnered	17	21	12	50

Total ETC Partnered	489	943	331	1763
Total ETC Unpartnered	866	1237	320	2423
Total ETC	1355	2180	651	4186
% of ETC partnered	36%	43%	51%	42%
Large Company	644	778	348	1770
Total Pipeline	1999	2958	999	5956
% ETC vs. total pipeline	68%	74%	65%	70%

**Table 9. Number of emerging therapeutic company clinical (Phase I, II, III) programs, partnered vs. unpartnered. Bottom: Percentage of the entire clinical pipeline from small vs. large companies. ETC means Emerging Therapeutic Company.**

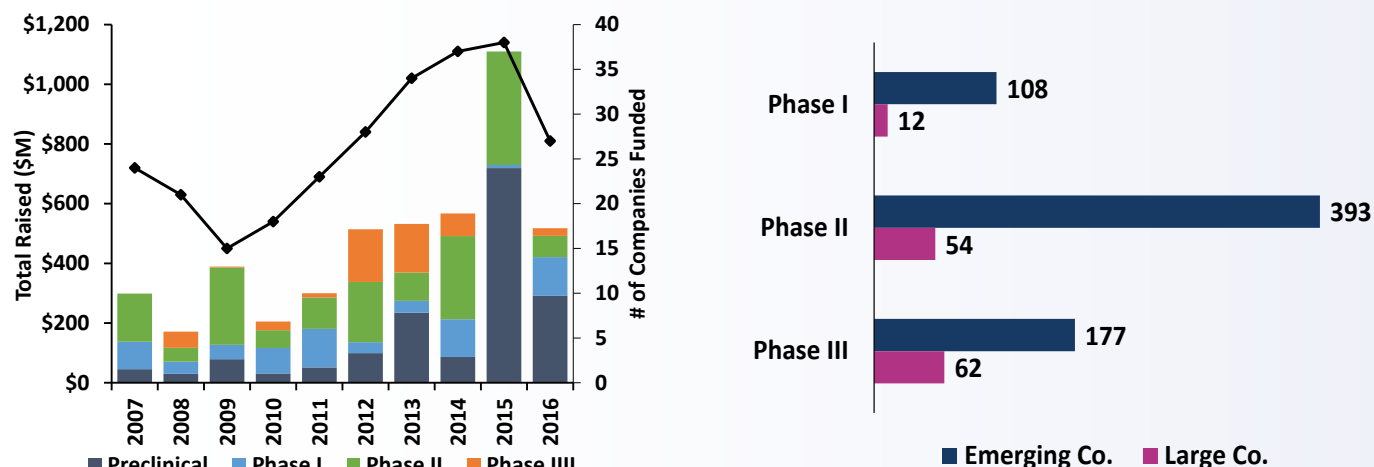


# Rare Disease

According to a recent report from Global Genes<sup>1</sup>, there are 7,000 rare diseases that cumulatively affect 30 million Americans. Approximately 350 therapeutics are approved for these diseases, indicating that thousands of rare diseases are without a treatment or cure.

**Venture Capital:** Over the last ten years, there has been an increase in investment into rare diseases, with the highest amount seen in 2015 (over \$1.1 billion). In 2016, there was a 28% drop in the number of rare disease companies funded vs 2015, and a 53% drop in total dollars invested (from over \$1.1 billion to \$518 million). The \$518 million investment is similar to levels seen in 2012-2014. However, that period saw more companies funded per year than we saw in 2016.

**US VENTURE FUNDING OF RARE DISEASES, 2007-2016  
AND ORPHAN DRUG PIPELINE FOR EMERGING THERAPEUTIC COMPANIES**



**Chart 16. Left: Total venture funding (\$M) into companies with a lead drug in a rare disease, 2007-2016. Total Investment by Phase of R&D and Number of companies receiving financing per year for a specific venture round. Right: Clinical pipeline for Orphan Designated products developed by emerging companies and large companies as of March 2017. Partnered programs are categorized by lead sponsor.**

**IPOs:** Only three of the 23 companies that completed an IPO in 2016 had a lead product for a rare disease. Two of these were companies that employ CRISPR-based therapies to address rare genetic diseases. The number of rare disease IPOs was down from the nine rare disease company IPOs that took place in 2015.

**Licensing and Acquisitions:** The number of licensing transactions (>\$10M potential value) for rare diseases each year has decreased slightly to below 10 per year. Whereas 2008-2014 had greater than 10 rare disease deals each year, 2015 and 2016 had just 8 and 9 deals, respectively. There were fewer rare disease company acquisitions in 2016 (5) than in any year of the last five years. Most of these tend to be R&D-stage companies developing products for inherited disorders.

**Pipeline:** Small emerging companies account for 84% of all Orphan-designated products in development<sup>2</sup>, as shown in **Chart 16**, of the 806 total Orphan programs in development in 2017, emerging companies are designated as lead sponsor for 678. The majority of these 678 programs are in Phase II (58%), and 26% are in late-stage clinical testing. More than 44% of emerging company Orphan designated programs are partnered.

<sup>1</sup> <http://globalgenes.org/rare-diseases-facts-statistics>

<sup>2</sup> Orphan-designation as described under the Orphan Drug Act of 1983 (Public Law 97-414)

# Discussion

The aim of this study was to accurately define the levels of funding and deal interest in small drug development companies by disease area and stage of development. Tracking this activity over a ten year time period allows for the identification of strengths and weaknesses across this often fragile ecosystem of drug innovation.

Overall, across both investments and deal-making, there continues to be an emphasis on oncology and rare diseases over high prevalence disease areas such as cardiovascular and psychiatry. More broadly, investors and companies have shifted their attention to the Preclinical stage where they can play a larger role in shaping the drug candidates and their pathway into the clinic.

Venture investment has been strong in some areas, but weak in others. Series A funding reached a record in 2016, but later rounds declined to a decade low. Oncology continues to grab the largest percentage of total US venture funding, but there is continued weakness for companies pursuing high-prevalence, chronic indications. Companies focused on respiratory, gastrointestinal, and cardiovascular diseases raised less money in the most recent five year period (2012-2016) than the prior five year period (2007-2011). In addition to declines, total dollars and number of companies receiving funding for high prevalence, chronic disease R&D is small compared to an area such as oncology, perhaps suggestive of a more difficult environment for fundraising in these areas. Neurology is a notable exception to this list due to the last few years of increased investment into companies focused on neuro-degenerative diseases.

R&D-stage licensing deal volume dropped in 2016, from 145 deals to 118, but total deal volume remains well above the lows seen in the last decade (during 2011-2013 there fewer than 110 deals, with disclosed values above \$10 million, per year). As emerging companies lead 70% of all clinical programs (4,486 of 5,956 global programs), and with 40% still unpartnered as of March 2017, there is still a substantial number of opportunities waiting to attract larger companies to in-license or collaborate on. However, in recent years some disease areas have seen a drop in activity. Infectious disease out-licensing has declined from 82 deals during the years 2006-2011 to only 35 deals in the period 2012-2016. Others, such as oncology and ophthalmology, have seen increases in the number of deals over the same periods.

The number of acquisitions of R&D-stage companies (36 in 2016) also indicates a steady buy-side interest in emerging company innovation. There continues to be more emphasis on clinical-stage drug candidates in oncology and neurology for full company acquisitions. With respect to acquisitions of market-stage emerging companies, 2016 reached a decade low of 7 companies acquired. However, as the total paid for these market-stage companies was \$22 billion, strength can be seen in the average valuations increasing to a record high average of \$3.2 billion upfront. Successful companies, either in the clinic or post-approval, remain strategically attractive as bolt-on additions to large company franchises.

At a higher level, we see recent acquisition activity targeted at market-stage and Phase III companies, and licensing more focused upstream at the Preclinical stage. Within venture capital, the strength is seen in Preclinical-stage companies as well, while IPOs were typically at Phase II and FOPOs strongest with Phase III companies. This is indicative of the roles various capital inputs have along the drug development path, but the variance seen within certain disease areas demands close monitoring in the coming years.

Maintaining balance through funding cycles can be challenging but manageable with a sound policy environment. It is imperative that the right policy environment is maintained to ensure that biopharmaceutical companies are able to develop new medicines and solutions that address our most pressing and emerging public health needs. Over the period of this study, a number of policies have buttressed the industry through difficult and uncertain times. Notable examples such as the JOBS Act, FDASIA (including PDUFA V), 12 years of data exclusivity for biologics, the R&D Tax Credit, and the Orphan Drug Tax Credit have helped strengthen a diverse innovation ecosystem. Continued investment requires strong intellectual property protections, a regulatory system that is reflective of current and emerging medical science, incentives for private and public sector investment in this innovative industry, and a biopharmaceutical marketplace that appropriately values and rewards such high-risk investment.

# Methodology

## Definitions:

**Emerging Therapeutic Company Definition:** All companies analyzed for this report are “Emerging Therapeutic” companies that are a) developing therapeutics with a lead drug in R&D, or b) have a drug on the market, but have less than \$1 billion in sales at the time of the transaction.

**Novel vs. Improvement R&D:** We grouped companies into two categories for level of innovation: novel R&D pursuing a new chemical entity, and R&D that expands the properties, availability, patient experience, etc. of an already-approved chemical entity. In the first category, novel R&D, we included in-licensed assets with prior data, such as spin-outs from big pharmaceutical companies. The lead drug for the novel category cannot have had a prior approval for any indication. The second category, drug improvement, included delivery technologies such as nanotechnology, lipids (micelles), new adjuvants for approved vaccines, extended release and prolonged half-life chemical modifications (conjugates and linkers, including pegylated variants), patches, topical creams, implanted delivery devices, needle-less injections, as well as reformulation of an approved drug, repurposing of an approved drug, and nutraceuticals.

**Company Category:** Each event (Venture, IPO, FOPO, Licensing, or Acquisitions) was tagged by the company’s lead program disease area and phase of development as of the date of payment for Venture, traction for IPO/FOPO, or announcement of deal for Licensing and Acquisitions.

## Disease Categorizing:

Vaccines include both bacterial and viral vaccines. Thus, all other infectious disease categories are for small molecule or large molecule approaches ex-vaccine. Oncology vaccines are tagged as vaccines if a true antigen (often peptides) is being utilized and will have the modality tagged with vaccine instead of large molecule. Thus, oncology vaccines do not show up under vaccines within infectious disease. This allows us to sort vaccines across all disease areas. “Other” in Infectious Disease refers mainly to anti-parasitic medicines and head lice treatments.

Wound healing was placed under dermatology if directly related to skin injury, but if directly affecting the immune system it is labeled under immunology. Immunology is ex-GI diseases. This is significant as some databases will place IBD under inflammation, but we chose to place it under gastrointestinal.

Platform refers to molecular platforms only, not target- or hypothesis-driven platforms. For example, a company focused on the mTOR pathway would not be a platform company, but a company designing bispecific Fab fragments would count as platform.

Strokes involving the brain are classified under neurology, but if designed for heart stroke in patients they are labeled as cardiovascular.

Osteoporosis falls under endocrine, and Osteoarthritis was placed under “Other.” Also under “Other” are dermatology, allergy, musculoskeletal diseases, otology (ear diseases), periodontitis, urology/genitourinary, non-viral liver diseases, fertility drugs, and treatments for side effects of chemotherapy or radiation.

## Data Sources

**Venture Capital:** Four databases were combined to create the broadest VC study possible: BioCentury’s BCIQ, Informa’s Strategic Transactions Database, EvaluatePharma, and Cortellis Competitive Intelligence from Clarivate Analytics and Thomson Reuters. Further, investigation of company R&D and financings was complemented with Factset and SEC filings as well as Fierce Biotech, Xconomy, BiotechGate, and company press releases. Equity investments from 2006 to 2015 were aggregated, and duplicates and non-drug company financing events were removed. Generics, distribution, and pharmacy companies were also excluded. Cases where private money was raised for the sole purpose of acquiring an existing company were also excluded. Equity investments in this study are predominantly venture in nature, with some differences at the Seed stage where angel investors, family offices, and other non-venture capital investors have an impact. Additionally, debt financing, bridge loans, government grants, and disease/patient foundation grants were also excluded.

As mentioned above, the tagging is based on the date of actual funding, not commitment to future tranches. For example, large Series A rounds can be spread out into payments stretching beyond a single year when press releases and major media outlets report a financing event. Each year of funding, for each round, investment was labeled by one of 14 major diseases and by sub-indication – these indications are listed in the Appendix.

Series financings often occur over multiple years as tranche payments. For example, a Series A round can have the sequence of A1, A2, A3 rounds within the same year or in different years. These were accounted for by year such that the accounting is for companies financed per year, not payments/tranches per year. For example, a company with A1, A2, and A3 payments in 2012 would be treated as a single company financing in 2012, not three separate Series A round financings. If the A1, A2, and A3 rounds occurred in 2011, 2012, and 2013, then these would be counted as one Series A round investment per year. This enables an accurate accounting of breadth of funding on a yearly basis.

IPOs: BIO Industry Analysis tracks IPOs from a variety of news feeds, which includes Biocentury Extra, FierceBiotech, and Renaissance Capital. Disease areas and phase were tagged according to lead product in R&D at the time of investment.

FOPOs: Biocentury was the primary data source for FOPOs. Only new shares issued in a follow-on offering valued at more than \$10 million were included. Values exclude sales of shares by inside investors. Disease areas and phase were tagged according to lead product in R&D at the time of investment.

Licensing: Informa's Strategio Transactions database and Cortellis Deals Intelligence from Clarivate Analytics (formerly Recap) were the primary data sources for licensing. Disease areas and phase were tagged according to lead product in R&D at the time of the deal.

Pipeline: BioMedTracker was the primary source for pipeline data. We analyzed each company and partner for inclusion as an emerging company or large biopharmaceutical company, defined by below or above \$1 billion in sales, respectively.

Acquisitions: Primary data sources on acquisitions were Informa Strategic Transactions, Cortellis Deals Intelligence from Clarivate Analytics (formerly Recap), and EvaluatePharma. Disease areas and phase were tagged according to lead product in R&D at the time of the deal. For global acquisition data, we only reported upfront payments to more accurately reflect the actual money flow into small company investors. Although Contingent Value Rights (CVRs) structures are now being used extensively in emerging company acquisitions (66% of acquisitions in our dataset), the upfront dollars are an immediate, guaranteed commitment from the partner or acquirer. The data presented for acquisitions includes both R&D-stage emerging companies (with a lead product in Preclinical, Phase I, Phase II, or Phase III testing), and market-stage emerging companies (with an approved product but with under \$1 billion in product sales). By focusing only on emerging companies, this data may differ from other currently available reports that often include large company acquisitions.

Rare Disease: Although many oncology companies do seek Orphan Drug status for rare cancer indications, we only found a few unique cases where a company's lead program was for a specific rare cancer. Most oncology companies analyzed had multiple lead cancer areas and indications often switched from lead to non-lead status from year to year.



# Appendix

Disease-Subindication	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	5 yr period 2007-2011	5 yr period 2012-2016
Oncology - Oncology	\$1,353	\$1,136	\$919	\$616	\$923	\$740	\$1,042	\$1,213	\$1,979	\$1,461	\$4,946	\$6,435
CV - Hypercholesterolemia	\$29	\$12	\$2	\$13	\$51	\$16	\$54	\$0	\$118	\$0	\$106	\$188
CV - Hypertension	\$3	\$10	\$11	\$25	\$3	\$10	\$13	\$1	\$1	\$0	\$52	\$25
CV - Other Indication	\$332	\$191	\$115	\$93	\$202	\$257	\$109	\$55	\$126	\$51	\$933	\$599
CV - Multiple Indications	\$10	\$8	\$39	\$10	\$0	\$0	\$0	\$0	\$0	\$0	\$67	\$0
ID - Antimicrobial g+	\$169	\$31	\$134	\$50	\$74	\$70	\$65	\$101	\$19	\$60	\$458	\$315
ID - Antimicrobial g-	\$21	\$46	\$2	\$5	\$44	\$9	\$70	\$10	\$41	\$76	\$118	\$205
ID - Antimicrobial broad	\$87	\$73	\$19	\$114	\$65	\$0	\$28	\$147	\$117	\$112	\$357	\$404
ID - Anti-fungal	\$6	\$39	\$75	\$6	\$22	\$3	\$41	\$102	\$135	\$9	\$149	\$289
ID - Antiviral - other	\$97	\$25	\$95	\$20	\$71	\$14	\$55	\$99	\$84	\$38	\$308	\$291
ID - HCV	\$85	\$89	\$43	\$25	\$12	\$0	\$21	\$13	\$0	\$0	\$254	\$34
ID - HIV	\$84	\$50	\$16	\$18	\$42	\$15	\$11	\$0	\$15	\$0	\$210	\$41
ID - Vaccine	\$19	\$82	\$63	\$84	\$53	\$56	\$59	\$36	\$163	\$486	\$301	\$801
ID - Other Indication	\$29	\$0	\$6	\$1	\$0	\$0	\$0	\$27	\$0	\$0	\$35	\$27
ID - Multiple Indications	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Immunology - Arthritis	\$56	\$86	\$5	\$29	\$8	\$56	\$0	\$109	\$5	\$116	\$184	\$285
Immunology - Psoriasis	\$0	\$6	\$2	\$2	\$0	\$11	\$10	\$74	\$18	\$0	\$10	\$113
Immunology - Other Indication	\$7	\$122	\$106	\$83	\$49	\$70	\$116	\$79	\$187	\$171	\$366	\$623
Immunology - Multiple Indications	\$15	\$97	\$44	\$38	\$0	\$11	\$45	\$0	\$48	\$45	\$193	\$149
Endocrine - T2D	\$165	\$138	\$23	\$37	\$180	\$219	\$29	\$229	\$207	\$517	\$543	\$1,200
Endocrine - T1D	\$34	\$5	\$16	\$8	\$3	\$0	\$14	\$3	\$33	\$11	\$65	\$61
Endocrine - Other Indication	\$200	\$66	\$138	\$32	\$96	\$65	\$114	\$74	\$132	\$358	\$531	\$743
Endocrine - Multiple Indications	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Metabolic - Obesity	\$7	\$37	\$11	\$32	\$73	\$21	\$35	\$12	\$43	\$0	\$159	\$111
Metabolic - Genetic Disorder	\$92	\$29	\$100	\$31	\$133	\$235	\$97	\$135	\$339	\$154	\$385	\$960
Metabolic - Other Indication	\$96	\$19	\$51	\$113	\$35	\$115	\$133	\$14	\$12	\$8	\$315	\$283
Metabolic - Multiple Indications	\$44	\$8	\$0	\$0	\$0	\$0	\$0	\$0	\$24	\$2	\$52	\$26
Psychiatry - Schizophrenia	\$14	\$0	\$2	\$0	\$0	\$19	\$18	\$17	\$0	\$0	\$16	\$54
Psychiatry - Depression	\$2	\$36	\$4	\$38	\$27	\$75	\$7	\$121	\$4	\$0	\$107	\$207
Psychiatry - Other Indication	\$40	\$0	\$44	\$0	\$31	\$17	\$19	\$16	\$36	\$13	\$115	\$101
Psychiatry - Multiple Indications	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$40	\$0	\$40

## A1. Venture capital, by sub-indication (\$M invested per year), 2007-2016.

# Appendix

Disease-Subindication	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	5 yr period 2007-2011	5 yr period 2012-2016
Neurology - Pain	\$266	\$158	\$245	\$124	\$106	\$161	\$97	\$137	\$159	\$38	\$899	\$591
Neurology - Parkinson's	\$28	\$0	\$0	\$26	\$10	\$15	\$39	\$117	\$196	\$10	\$63	\$377
Neurology - Alzheimer's	\$15	\$44	\$47	\$48	\$31	\$34	\$54	\$28	\$105	\$289	\$184	\$511
Neurology - MS	\$48	\$129	\$40	\$2	\$9	\$17	\$21	\$5	\$0	\$0	\$228	\$43
Neurology - Other Indication	\$134	\$31	\$181	\$66	\$21	\$78	\$134	\$169	\$282	\$278	\$432	\$941
Neurology - Multiple Indications	\$2	\$91	\$19	\$50	\$8	\$18	\$30	\$0	\$217	\$22	\$170	\$286
Respiratory - Asthma	\$137	\$39	\$52	\$31	\$9	\$3	\$6	\$38	\$4	\$0	\$267	\$50
Respiratory - COPD	\$37	\$20	\$0	\$59	\$49	\$53	\$42	\$0	\$0	\$8	\$164	\$103
Respiratory - Other Indication	\$56	\$106	\$22	\$65	\$34	\$6	\$13	\$21	\$206	\$130	\$282	\$375
Respiratory - Multiple Indications	\$8	\$4	\$32	\$0	\$14	\$3	\$0	\$0	\$0	\$0	\$58	\$3
Hematology - Blood Stimulator	\$129	\$3	\$3	\$22	\$52	\$63	\$3	\$0	\$0	\$26	\$209	\$92
Hematology - Coagulation	\$0	\$40	\$25	\$22	\$0	\$7	\$11	\$32	\$93	\$4	\$88	\$147
Hematology - Other Indication	\$34	\$65	\$56	\$60	\$39	\$80	\$77	\$10	\$69	\$36	\$254	\$272
Hematology - Multiple Indications	\$6	\$0	\$6	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$12	\$0
GI - IBS	\$97	\$85	\$39	\$18	\$30	\$30	\$26	\$11	\$18	\$8	\$269	\$91
GI - GERD	\$0	\$5	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$5	\$0
GI - Crohn's	\$3	\$105	\$0	\$0	\$0	\$16	\$0	\$0	\$38	\$0	\$108	\$54
GI - Ulcerative Colitis	\$2	\$6	\$0	\$0	\$0	\$19	\$1	\$2	\$0	\$0	\$8	\$22
GI - Other Indication	\$26	\$6	\$0	\$49	\$35	\$22	\$26	\$5	\$0	\$8	\$117	\$60
GI - Multiple Indications	\$0	\$0	\$0	\$0	\$1	\$0	\$0	\$0	\$20	\$3	\$1	\$23
Ophthalmology	\$285	\$138	\$196	\$92	\$216	\$107	\$275	\$272	\$166	\$184	\$927	\$1,004
PLATFORM	\$208	\$180	\$221	\$250	\$141	\$286	\$341	\$874	\$1,050	\$478	\$1,000	\$3,030
Other - Allergy	\$0	\$0	\$0	\$0	\$0	\$0	\$29	\$41	\$93	\$10	\$0	\$173
Other - Dermatology	\$60	\$49	\$62	\$81	\$80	\$72	\$110	\$120	\$146	\$66	\$332	\$514
Other - Renal	\$68	\$67	\$53	\$71	\$27	\$103	\$45	\$70	\$81	\$82	\$286	\$383
Other - Chemo/Rad side effects	\$33	\$0	\$10	\$20	\$44	\$58	\$0	\$0	\$0	\$0	\$109	\$58
Other - Other Indication	\$109	\$57	\$47	\$84	\$35	\$134	\$53	\$101	\$84	\$74	\$333	\$445
Other - Multiple Indications	\$100	\$97	\$53	\$64	\$19	\$0	\$46	\$0	\$16	\$40	\$333	\$102

## A1. Venture capital, by sub-indication (\$M invested per year), 2007-2016.





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