

William Blair

January 2024

The Quarterly Rx: 2023 U.S. Biopharma Recap



2023 U.S. Biopharma Market Summary – Shake It Off, Shake It Off

Nearly three years after the XBI hit its peak in February 2021, the U.S. biopharma market closes out a challenging 2023 reinvigorated following an improving economic outlook and a flurry of M&A activity, although high profile clinical setbacks to close out the year rekindled investor jitters



I Don't Know About You, But I'm Feeling 2024

- Major U.S. biopharma indices ended the year slightly up as participants navigated between sector specific news flow and macroeconomic noise
- Tax-loss selling drove the XBI to recent lows in October, but the market rallied into year-end thanks to encouraging Fed commentary in December; the market is currently pricing in at least five rate cuts by the end of 2024, prompting renewed optimism for high-growth sectors
- \$155 billion in total biopharma M&A deal volume in 2023, the highest since 2019; conditions are ripe for another busy year in 2024 with robust big pharma balance sheets, upcoming patent expirations for major blockbuster drugs, and lowering interest rates



FTC & IRA...You Need To Calm Down

- Both Amgen/Horizon and Pfizer/Seagen successfully navigated FTC review and closed in Q4 2023, recycling \$70.8 billion of investor capital back into the ecosystem
- However, heightened FTC concerns remain following Sanofi's decision to terminate its early-stage licensing agreement with Maze Therapeutics after an unprecedented challenge, a first for an industry where big pharma and biotech have a symbiotic relationship
- Sector is in a "wait and see" mode to monitor outcomes of pending lawsuits and negotiations related to the IRA



It's Been a Long Time Coming (for the Private Markets)

- After remaining relatively insulated in 2022, the private financing market faced greater challenges in 2023, with only 244 deals involving at least one U.S./EU healthcare investor, for \$17.2 billion in total proceeds raised, down 16% and 29%, respectively, compared to 2022
- Unsurprisingly, this was a year of extension rounds, comprising 21% of all private financings (compared to only 5-11% in 2021 and 2022) and there was a continued focus on clinical-stage companies, representing ~50% of private financings
- Large mega-rounds remain in vogue as investors pile into quality assets, with 11 deals for over \$200 million in proceeds raised in 2023
- Significant private financing overhang remains, with 245 companies that raised a Series A or B from 2020-2022 that likely need to finance



It's Me, IPOs, I'm the Problem It's Me

- While the U.S. IPO window cracked open in 2023 with 9 offerings priced in H2 2023, the asset class continues to underperform with a median offer-to-1-day of (2%); 50% of IPOs priced this year are currently trading below issue price
- IPO phenotype remains late-stage clinical assets in areas with high investor interest, in particular I&I and cardiometabolic
- Reverse mergers continue to be a viable alternative path to the public markets, outpacing overall IPO activity this year, with 14 total reverse mergers announced; however, aftermarket trading has been mixed with a median announced to 1-day performance of (6%)



Good Karma in the Follow-On Market

- Total U.S. secondary activity (FOs, PIPEs, RD) in 2023 surpassed 2022, with continued bias from investors to "overfund" companies (median proceeds increased to a recent high of \$97.8 million while also encouraging management teams to operate with greater discipline)
- Catalyst-driven offerings dominated activity as investors were eager to reward companies with positive clinical data
- Heightened volatility and investor scrutiny has resulted in more atypical financing structures, especially in the PIPE market
- Public overhang remains with 113 U.S.-listed small-cap biopharma companies with <1 year of cash runway and 111 trading below cash



You Belong With Me – M&A Returns!

- M&A rebounded in Q4 2023, with 10 transactions >\$1 billion in deal value announced and contributing to a lift in investor sentiment
- High-profile public company M&A becoming more competitive in 2023 with ~57% of processes having multiple bidders (compared to vast majority with just one bidder in 2020-2022); 100% catalyzed by an unsolicited bid and 33% included CVR structures
- While partnering activity slowed in 2023, it remained a key source of capital, with 144 deals in 2023 for \$9.9 billion in total upfront payments
- Notable increase in partnering with Asian licensors and collaborators, representing 30% of partnerships in Q4 2023, underscoring the growing importance of the region as a source of innovation

Looking Ahead: Our 2024 Predictions

The stage is set for a long-awaited rebound in biopharma, but updates from Washington DC may create headwinds



Ingredients are in Place for a Biopharma Recovery

- Biopharma stocks have typically performed well in easing interest rate environments as investors shift focus to riskier assets
- Ongoing wave of scientific innovation, highlighted by the recent groundbreaking approval of the first medicine that uses gene-editing tool CRISPR, will continue to drive institutional LPs into blue-chip healthcare dedicated funds

Robust M&A Activity Should Continue, In Line With 2023

- Key considerations that made 2023 a highly active M&A year will continue to drive activity in 2024, as IRA and patent cliffs become a more near-term reality
- High profile public M&A processes were more competitive in 2023, underscoring the unsatiated appetite amongst big pharma heading into 2024
- Big pharma sitting on \$230 billion of cash reserves, with nearly \$200 billion of LOEs expected between 2024-2028⁽¹⁾
- Notably, BI, Bayer and J&J amongst big pharma with substantial upcoming patent cliffs and/or IRA exposure that have not done high profile M&A in the last 2 years
- Expect big pharma to continue to favor tuck-in acquisitions for late-stage and marketed assets focused on novel targets in cardiometabolic, I&I, and neurology as well as ADC and radiopharma modalities in oncology

FTC Will Litigate More M&A Deals in 2024

- On the heels of the surprising FTC lawsuit of the proposed Maze / Sanofi licensing deal and subsequent termination, we expect heightened regulatory scrutiny across both small and large transactions in biopharma
- With FTC Chair, Lina Khan's term expiring in September 2024, we predict that the FTC will be more aggressive in pushing forth its antitrust agenda, but ultimately think the current zero-win track record will continue
- Nonetheless, more second reviews and increased scrutiny by the FTC will increase time to close and potential need for earlier-stage divestitures where there may be overlap with existing pipeline

IPO Activity will Increase and Reverse Mergers will Push Additional Debutants into the Public Markets

- Recent conversations with market participants suggests a modest, but healthy increase in IPO activity compared with 2022-2023
- IPO activity will likely be heavier-weighted to the first half of the year as issuers look to avoid U.S. presidential election volatility in Q4 2024
- Market will continue to favor clinical-stage stories in I&I and cardio-metabolic, but expect more activity in radiopharma and genetic medicines
- Reverse merger activity will continue, especially for situations with significant investor overlap, but will fall below 2023 levels given increased cadence of investors submitting take-private proposals for distressed companies with high cash balances, including Tang Capital, Foresite, Orbimed and The Column Group

Financing Overhang Will Result in Increased Company Liquidations / Down Rounds

- Many public biopharma companies have announced strategic alternative (SA) processes, but a significant portion with lower cash balances will likely liquidate (in 2023, nearly 50% of disclosed SA outcomes were closures)
- Significant overhang in the private biopharma market will result in an increased number of down rounds as companies try to attract new investor dollars

Public Capital Raising Will Require a Swiss Army Knife of Solutions

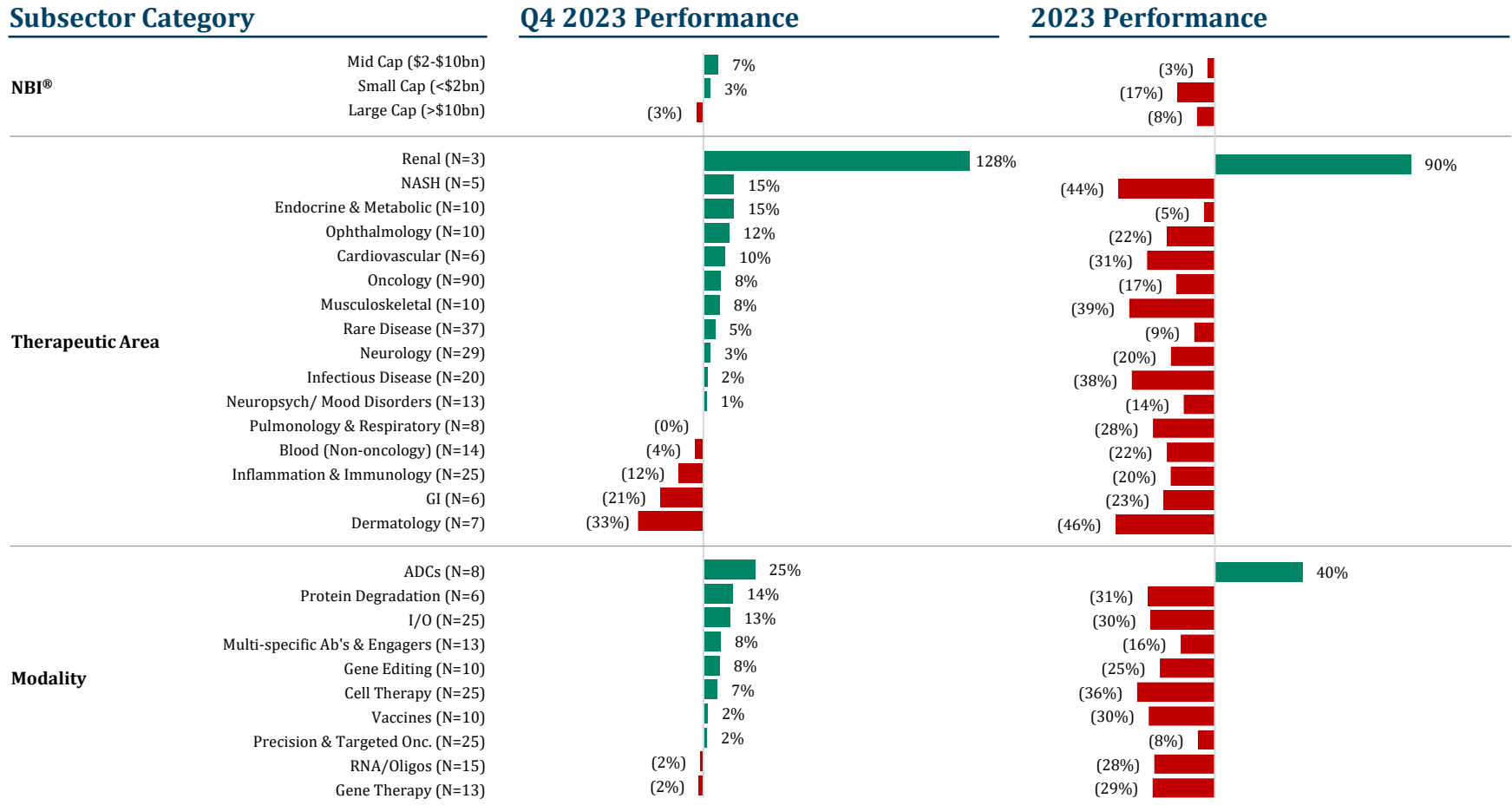
- Clinical catalyst driven follow-on offerings will continue to leverage traditional follow-on process
- Increase in novel financing structures, especially in situations where capital requirement represents a significant percentage of issuer's market capitalization
- Issuers will increasingly leverage At-the-Market (ATM) facilities to catalyze reverse inquiry demand
- Lower interest rates will result in increased debt solutions for issuers, especially those with late-stage trials or on the cusp of regulatory approval

Note: Reflects views of William Blair Investment Banking and Equity Capital Markets teams.

(1) Source: Company Filings as of December 31, 2023.

NBI® Subsector Market Performance

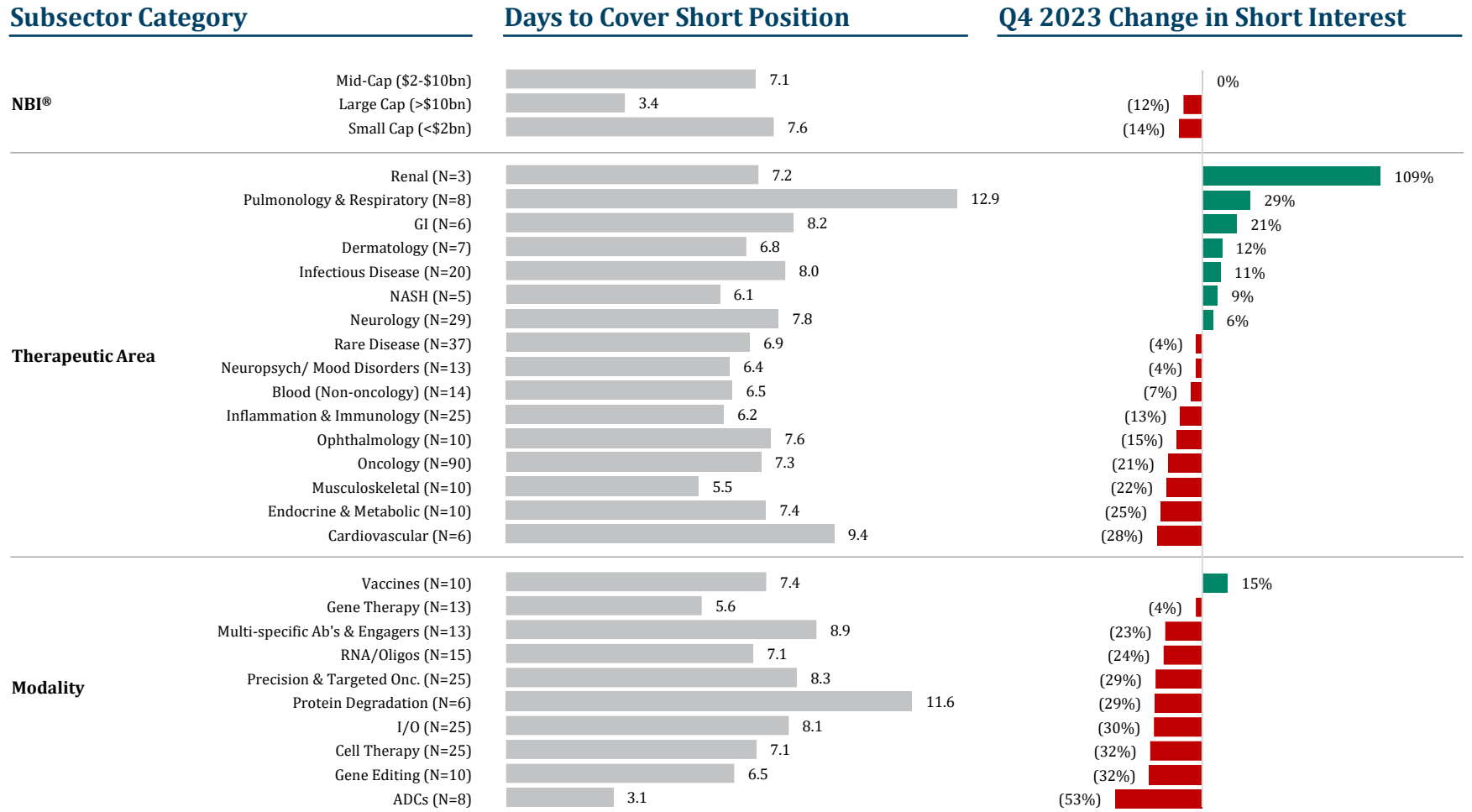
- SMID-cap names outperformed large cap in Q4 2023 as investors returned to riskier assets
- Renal and ADCs were the biggest gainers by therapeutic area and modality, respectively, in 2023
- Evident tax-loss selling occurred in early Q4 2023 with top 2023 performers through September 2023 falling only 8.5% in October 2023 while bottom 2023 performers fell 17.6%



Note: Subsector indices are equally weighted and averaged. Includes NBI® constituents' as of December 17, 2023 prior to annual reconstitution and excludes non-therapeutic focused companies in the NBI®. Source: FactSet, CapIQ and William Blair internal reporting. Q4 2023 and 2023 performance as of December 31, 2023. Therapeutic area and modality based on William Blair analysis.

NBI® Subsector Q4 2023 Short Interest Trends

Short interest changes were mixed across market cap ranges and therapeutic areas, while breakdown by modalities saw mostly decreases

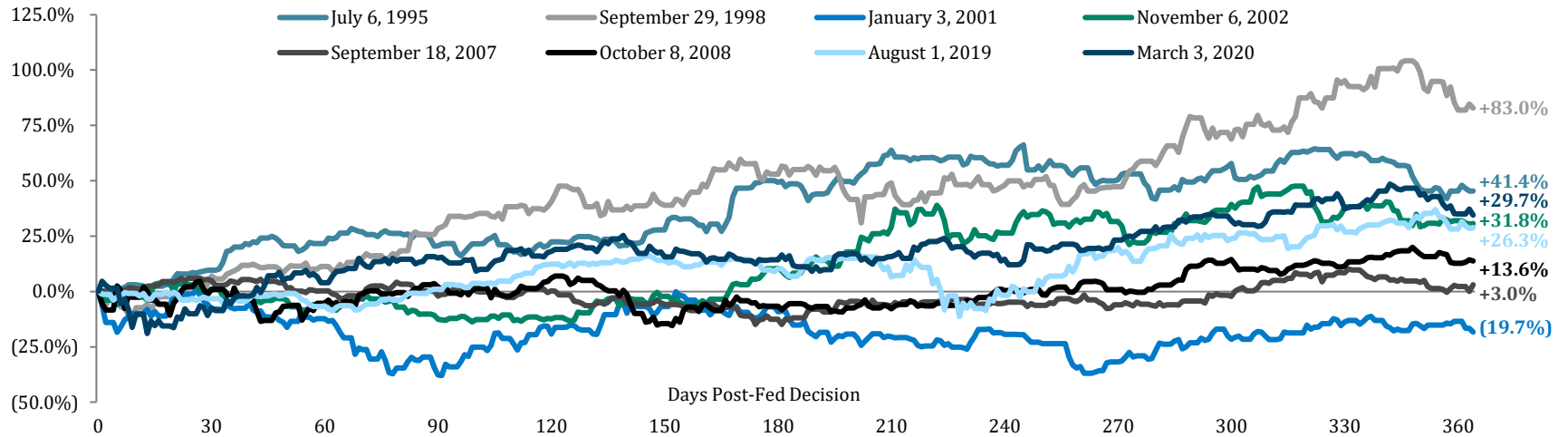


Note: NBI® constituents are equally weighted and averaged. Includes NBI® constituents' as of December 17, 2023 prior to annual reconstitution and excludes non-therapeutic focused companies in the NBI®. Days to cover short position calculated as total number of shares shorted / 30-day ADTV.
 Source: FactSet, CapIQ, and William Blair internal reporting. Days to cover short position as of 12/15/23 settlement date. Short Interest change measured from 9/30/23 to 12/15/23 settlement dates.

Biopharma Performance During Falling Interest Rate Environments

With inflation edging closer to the Fed's 2% target, markets are expecting interest rate cuts as early as the first half of 2024. In previous cycles of rate cuts, the NBI® has typically traded up over the following twelve-month period, but lagged behind the broader Nasdaq index

Indexed One-Year Performance of the NBI® After First Fed Interest Rate Cut



Fed Ann. Date	Fed Funds Rate			NBI® Performance			
	Pre-Ann	Post-Ann	1 Yr Post-Ann	1 Year Prior vs Nasdaq	1 Month	1 Year	1 Year vs Nasdaq
Jul 6, 1995	6.00%	5.75%	5.50%	+5.5%	+22.1%	+41.4%	+19.9%
Sep 29, 1998	5.50%	5.25%	5.25%	+80.7%	+11.5%	+83.0%	+25.5%
Jan 3, 2001	6.50%	6.00%	1.75%	+13.2%	(9.2%)	(19.7%)	+2.1%
Nov 6, 2002	1.50%	1.25%	1.00%	+54.5%	(3.9%)	+31.8%	(7.5%)
Sep 18, 2007	5.25%	4.75%	2.00%	(15.6%)	+4.5%	+3.0%	+18.4%
Oct 8, 2008	2.00%	1.50%	0.00%	+51.5%	(8.9%)	+13.6%	(8.5%)
Aug 1, 2019	2.50%	2.25%	0.00%	+21.1%	(2.2%)	+26.3%	(6.2%)
Mar 3, 2020	1.75%	1.25%	0.00%	+15.0%	+1.9%	+29.7%	(20.0%)
2024	5.50%	???	???	(39.7%) ⁽¹⁾	???	???	???

Source: FactSet as of December 31, 2023.

(1) 2023 Performance of NBI® vs. Nasdaq

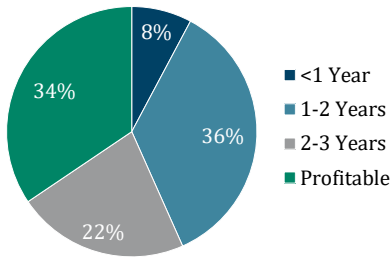
Phenotype of Positive NBI® Performers in 2023

- In 2023, 39% (90/229) of biopharma companies in the NBI® ended the year in positive territory
- Distinct “winning” phenotype were late-stage (pivotal/Phase 3) or commercial-stage companies that had key positive clinical readouts in 2023

Breakdown of Positive Performers

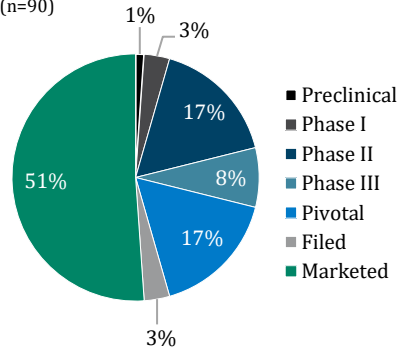
By Cash Runway

(n=90)



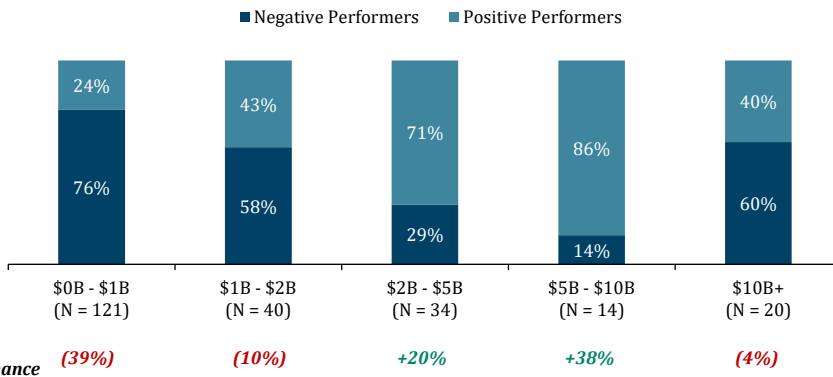
By Lead Stage of Development

(n=90)



NBI® Performance by Market Cap

Percent of NBI® constituents with positive or negative share performance in 2023



Top 15 Performers of the NBI®

(\$ in millions)

Company	Area of Focus	2023 Share Price %Δ	Current Market Cap	2023 Market Cap Δ	Stage of Development	Modality
bridgebio	Metabolic / Rare Disease	+430%	\$7,023	\$5,884	Marketed	Small Molecule
CYMABAY	Hepatology / Rare Disease	+277%	\$2,679	\$2,148	NDA Submitted	Small Molecule
GRACELL ⁽¹⁾	Oncology	+247%	\$594	\$438	Phase Ib/II	Cell Therapy
immunogen ⁽²⁾	Oncology	+224%	\$4,276	\$3,181	Marketed	ADC
MARINUS	Neurology / Rare Disease	+173%	\$593	\$396	Marketed	Small Molecule
INVIVYD	Infectious Disease	+163%	\$434	\$270	Phase III (Pivotal)	Antibody
ALPINE Immune Sciences	I&I	+159%	\$1,106	\$768	Phase II Ready	Small Molecule
CENTESSA	Hematology / Rare Disease	+157%	\$777	\$484	Phase IIb (Pivotal)	Protein
Nuvalent	Oncology	+147%	\$4,609	\$2,928	Phase I/II	Small Molecule
IMMUNOVANT	I&I	+137%	\$6,095	\$3,802	Phase III (Pivotal)	Antibody
ardelyx	GI / Nephrology	+118%	\$1,439	\$905	Marketed	Small Molecule
blueprint	Oncology	+111%	\$5,607	\$2,986	Marketed	Small Molecule
Protagonist Therapeutics	Hematology / Rare Disease	+110%	\$1,323	\$786	Phase III	Peptide
Aurinia	I&I / Rare Disease	+108%	\$1,291	\$677	Marketed	Peptide
Scholar Rock	Neurology / Oncology	+108%	\$1,356	\$889	Phase III	Antibody

Note: NBI® constituents are equally weighted. Includes NBI® constituents' as of December 17, 2023 prior to annual reconstitution and excludes non-therapeutic focused companies in the NBI®.

Source: CapIQ, PitchBook Data, Inc., FactSet, and SEC Filings as of December 31, 2023.

(1) Gracell stock performance measured from December 22, 2023, prior to AstraZeneca's announcement on December 26, 2023 that it would acquire the company

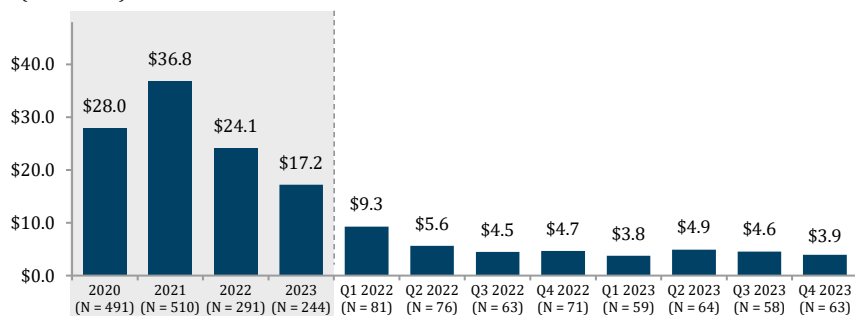
(2) Immunogen stock performance measured from November 29, 2023, prior to AbbVie's announcement on November 30, 2023 that it would acquire the company

Biopharma Private Financings Trends

- The biopharma private financing market continued to tighten in 2023, with total proceeds raised and total volume down 29% and 16%, respectively, compared to 2022
- With the IPO market expected to slowly re-open up in 2024, "crossover" activity should perk up as investors regain confidence around near-term liquidity

Total Proceeds and Deal Volume

(\$ in billions)



Analysis by Series Round

(\$ in millions, deal size represents median, includes extension rounds)

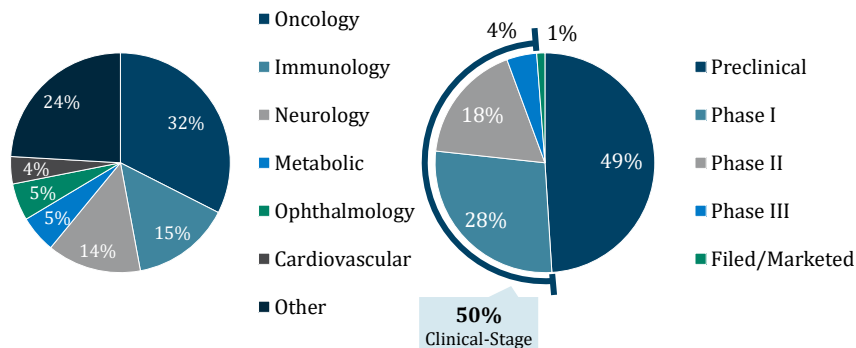
Series Round	2021				2022				2023			
	Deal Size	Series Count	% Ext. Rounds	% Clin. Stage	Deal Size	Series Count	% Ext. Rounds	% Clin. Stage	Deal Size	Series Count	% Ext. Rounds	% Clin. Stage
Series A	\$40	232	6%	25%	\$47	150	11%	21%	\$50	113	23%	31%
Series B	\$76	182	5%	42%	\$74	93	14%	41%	\$76	87	25%	55%
Series C	\$98	63	0%	59%	\$101	34	9%	59%	\$100	30	13%	83%
Series D+	\$80	33	6%	73%	\$122	14	0%	86%	\$90	14	0%	93%
All Rounds	\$51	510	5%	38%	\$55	291	11%	34%	\$50	244	21%	50%

Meaningful increase in percent of companies completing extension rounds and financings for clinical-stage companies in 2023

Analysis by Therapeutic Area and Stage

Therapeutic Area

Stage of Development



Crossover Deals Analysis⁽¹⁾

(\$ in millions)

Quarter	Number of Deals	Median Deal Size	Median Pre-Money	Median Step-Up	Currently Public
Q1 2021	33	\$106	\$226	2.1x	26
Q2 2021	21	\$115	\$250	2.1x	9
Q3 2021	24	\$103	\$250	1.8x	11
Q4 2021	8	\$120	\$150	3.1x	2
Q1 2022	11	\$115	\$350	1.6x	1
Q2 2022	8	\$121	\$145	1.8x	1
Q3 2022	9	\$132	\$440	1.7x	3
Q4 2022	7	\$120	\$159	1.0x	1
Q1 2023	10	\$118	\$150	1.2x	1
Q2 2023	6	\$150	\$480	1.7x	0
Q3 2023	13	\$155	\$242	1.4x	0
Q4 2023	11	\$101	\$195	1.2x	0

Source: CapIQ, PitchBook Data, Inc., FactSet, and SEC Filings as of December 31, 2023.

Note: Includes private financing deals and extension rounds with a minimum disclosed deal size of \$5M, involving at least one U.S./EU healthcare investor. Excludes seed rounds. Ext = Extensions.

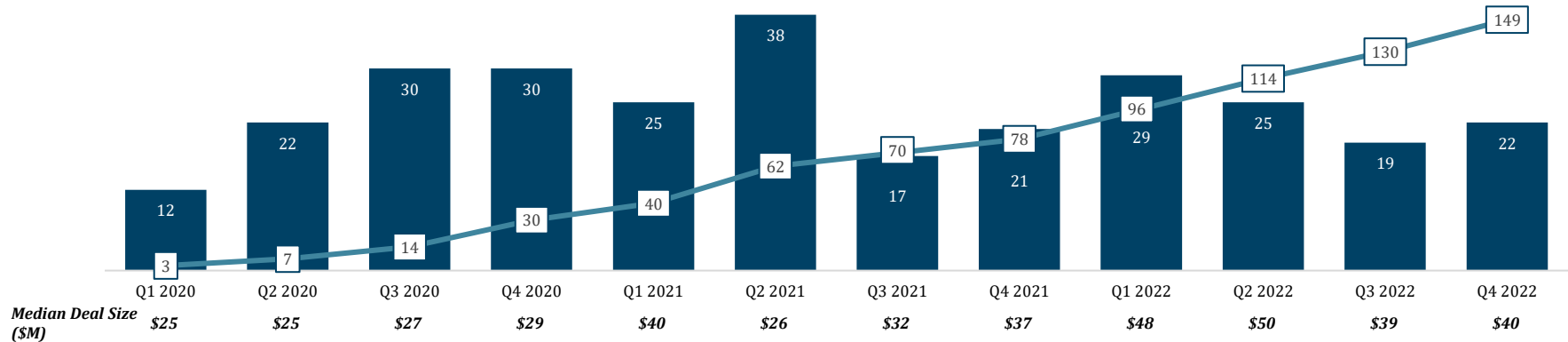
(1) Includes crossover rounds for companies that have completed an IPO as well as crossover rounds where the next round of financing will likely be an IPO: either a \$50M+ raise (Series B onwards) or a \$100M+ raise (Series A) with multiple crossover and/or large mutual funds in the syndicate). Difference between the currently private and public columns are due to companies who were acquired or are no longer operational.

Significant Private Company Financing Overhang

245 companies raised Series As and Bs with blue-chip healthcare investors from 2020 to 2022, but have not raised again since, underscoring a significant financing overhang that persists in the private markets

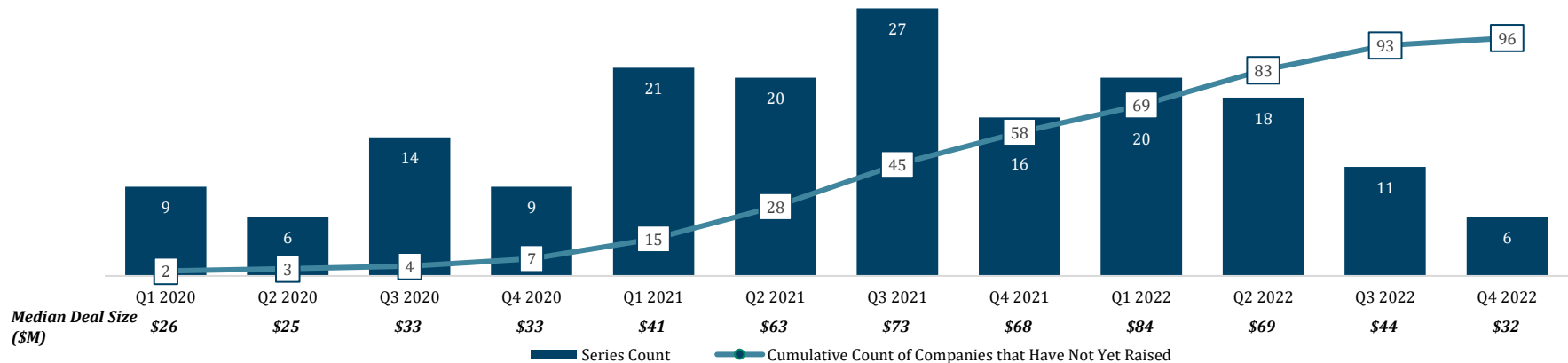
Post-Series A Financing Overhang

51% (149/290) of companies with blue-chip investor backing have not raised their Series B yet



Post-Series B Financing Overhang

54% (96/177) of companies with blue-chip investor backing have not raised their Series C yet

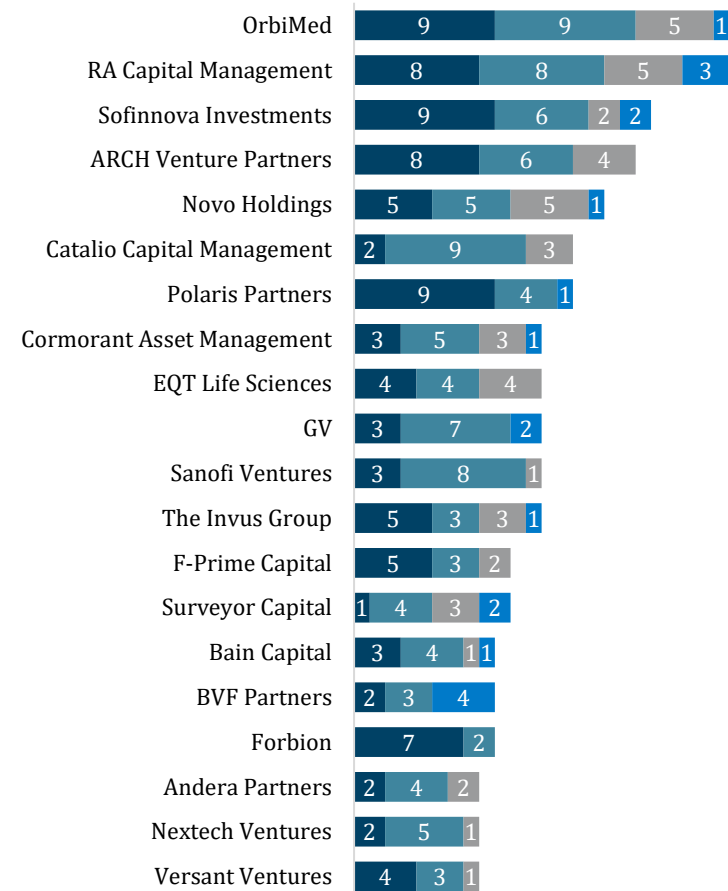


Note: Excludes companies that dissolved, public, were acquired, or completed a post-financing partnership with >\$50 million in upfront proceeds. Includes financings involving select blue-chip healthcare investors.
Source: CapIQ, PitchBook Data, Inc., FactSet, and SEC Filings as of December 31, 2023.

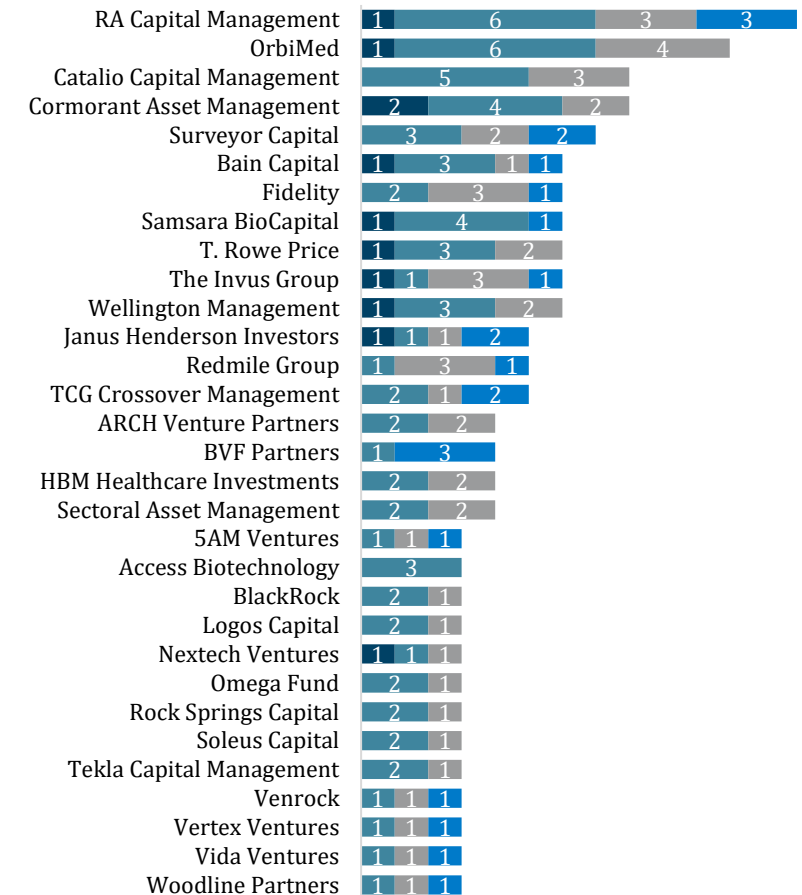
2023 Biopharma Private Financings Most Active Investors

- Life science specialists remain the most active investors across all private rounds and “crossover” rounds
- 68 new company formations in 2023, including those funded by ARCH, Flagship, Forbion, and Versant

Most Active Investors Across All Rounds



Most Active Investors in Crossover Rounds



■ Series A ■ Series B ■ Series C ■ Series D+

Source: CapIQ, PitchBook Data, Inc., FactSet, and SEC Filings as of December 31, 2023.

Note: Includes private financing deals and extension rounds with a minimum disclosed deal size of \$5M, involving at least one U.S./EU healthcare investor. Excludes seed rounds.

2023 Biopharma Largest Private Financings and New Fund Formation Snapshot

Despite market headwinds throughout 2023, there were 14 financings for \$200+ million and \$28 billion in new fund formations announced this year

Largest Private Company Raises

Company	Area of Focus	Round	Date	Deal Size (\$M)
 elevatebio	Cell and Gene Therapy	Series D	5/24/23	\$401
 CARDURIION PHARMA	Cardiovascular	Series A	7/12/23	\$300
 ReNAgade THERAPEUTICS	RNA Targeted Therapeutics	Series A	5/23/23	\$300
 itm	Oncology / Radiopharma	Series B	6/5/23	\$278
 Generate:Biomedicines	Infectious Disease / Immunology	Series C	9/14/23	\$273
 ORBITAL	RNA Targeted Therapeutics	Series A	4/26/23	\$270
 APOLLO THERAPEUTICS	Immunology	Series C	9/6/23	\$260
 AIOLOS BIO	Immunology	Series A	10/24/23	\$245
 MapLight	Neurology	Series C	10/30/23	\$225
 nimbus THERAPEUTICS	Oncology / Immunology	Series G	9/6/23	\$210
 Genesis Therapeutics	Multiple	Series B	8/21/23	\$200
 ADARx PHARMACEUTICALS	RNA / Immunology	Series C	8/9/23	\$200
 UpstreamBIO	Immunology	Series B	6/8/23	\$200
 CARGO THERAPEUTICS	Cell Therapy	Series A	3/1/23	\$200

New Funds Closed

Investor Name	Close Date	Fund Size (\$M)	Investor Name	Close Date	Fund Size (\$M)
 8VC	3/1/23	\$880	 LU+	4/13/23	\$1,150
 ABINGWORTH	10/30/23	\$356	 medicxi	7/27/23	\$400
 ARTIS VENTURES	12/14/23	\$200	 NEA	1/23/23	\$6,200 ⁽¹⁾
 BGV	7/13/23	\$163 (€150)	 OrbiMed	10/24/23	\$4,300
 BIOLUMINESCENCE	11/1/23	\$477	 PATIENT SQUARE	2/1/23	\$3,900
 Canaan	4/6/23	\$850	 PICTET	12/13/23	\$320
 COWEN HEALTHCARE INVESTMENTS	5/3/23	\$556	 P VOTAL	12/18/23	\$389
 CURE VENTURES	4/4/23	\$350	 playground	12/14/23	\$410
 Curie.Bio	ND	\$520	 Revelation Partners	10/25/23	\$608
 IQM	1/25/23	\$350	 sanofi ventures	1/11/23	\$750
 IQV	3/29/23	~\$281	 Sofinnova partners	10/26/23	\$200
 Forbion ⁽²⁾	4/19/23	\$658 (€600)	 SR One	3/27/23	\$600
	4/19/23	\$822 (€750)	 vertex VENTURES	6/26/23	\$200
 Gilead HEALTHCARE	4/19/23	\$658 (€600)	 wellington partners	4/13/23	\$476
 Goldman Sachs Asset Management	ND	\$400	 WESTLAKE VILLAGE BIOPARTNERS	7/17/23	\$450
 LONGWOOD FUND	5/3/23	\$180	 Yosemite	8/1/23	\$200

Source: CapIQ, PitchBook Data, Inc., FactSet, and SEC Filings as of December 31, 2023.

(1) Includes \$6.2B across two funds focused on early-stage and venture growth-stage opportunities.

(2) Includes Forbion Growth Opportunities Fund II and Forbion Ventures Fund VI

2023 Biopharma IPOs

- Slight increase in IPO activity compared with 2022, with 12 IPOs in 2023 compared to 11 in 2022
- Late-stage clinical assets continue to dominate the IPO market, with 67% (8/12) of 2023 IPOs in Phase II or later
- Despite the challenging IPO backdrop, investors favored cardiometabolic and I&I, which together represented 58% (7/12) of the 2023 IPOs

(\$ in millions)

Pricing Date	Issuer	At Pricing										Lead Product at Pricing				
		Deal Value	Market Cap	Pre-Money				Days from Crossover to IPO	Initial File / Offer vs. Range	Insider Shadow Book at Launch	Deal Value as % of Market Value	% Change Offer /		Phase	Therapeutic Area / Modality	Next Major Catalyst (months)
				Equity Value	Net Debt	Enterprise Value	Step-Up ⁽¹⁾					1 Day	Current			
11/9/23	CARGO THERAPEUTICS	\$281.3	\$618.8	\$318.8	(\$174.3)	\$144.5	1.1x	273	In Range	100%	45%	(3%)	54%	Phase II	Oncology / Cell therapy	13 to 25
11/3/23	LEXEO THERAPEUTICS	\$100.0	\$345.4	\$219.4	(\$45.5)	\$173.8	0.6x	785	Below	100%	29%	(9%)	22%	Phase I/II	Cardiovascular / Gene therapy	7 to 13
10/20/23	ABIVAX	\$235.8	\$782.0	\$529.2	(\$58.9)	\$470.3	N/A	NA	Below	ND	30%	(25%)	(8%)	Phase III	Inflammatory / Small molecule	15 to 17
9/29/23	Adlai Nortye 阿黛利诺泰	\$57.5	\$808.7	\$751.2	(\$60.0)	\$691.2	N/A	NA	In Range	100%	7%	(35%)	(61%)	Phase III	Oncology / Small molecule	10 to 15
9/14/23	Neumora	\$250.1	\$2,583.1	\$2,333.1	(\$334.1)	\$1,999.0	1.4x	338	In Range	100%	10%	(4%)	0%	Phase III	Neurology / Small molecule	10 to 15
9/14/23	RayzeBio	\$357.6	\$1,094.2	\$757.5	(\$257.0)	\$500.5	1.4x	366	In Range	100%	33%	33%	247% ⁽²⁾	Phase III	Oncology / Small molecule	4 to 9
7/21/23	TURNSTONE BIOLOGICS	\$80.0	\$266.3	\$186.3	(\$64.0)	\$122.3	0.5x	737	In Range	100%	30%	(8%)	(79%)	Phase I	Oncology / Cell therapy	8 to 13
7/13/23	SAGIMET BIOGENEUTRACEUTICALS	\$85.0	\$354.8	\$269.8	(\$25.3)	\$244.5	1.5x	882	In Range	100%	24%	(0%)	(66%)	Phase IIb	Metabolic / Small molecule	6 to 8
7/13/23	APOGEE THERAPEUTICS	\$345.1	\$853.9	\$508.8	(\$141.3)	\$367.5	1.8x	218	In Range	100%	40%	25%	64%	Preclinical	Inflammatory / Antibody	8 to 13
5/4/23	ACELYRIN	\$621.0	\$1,749.6	\$1,128.0	(\$321.4)	\$806.6	1.5x	237	In Range	100%	35%	31%	(59%)	Phase IIb/ III	Inflammatory / Protein	2 to 8
2/9/23	MINERALYS	\$192.0	\$624.9	\$432.9	(\$121.0)	\$312.0	1.7x	253	In Range	100%	31%	15%	(46%)	Phase II	Cardiovascular / Small molecule	9 to 15
2/2/23	STRUCTURE THERAPEUTICS	\$185.3	\$573.0	\$387.7	(\$102.8)	\$285.0	1.2x	185	In Range	100%	32%	73%	172%	Phase Ib	Metabolic / Small molecule	6 to 12
Mean (n=12)		\$238.3	\$893.6	\$651.9	(\$142.1)	\$509.8	1.3x	427		100%	30%	8%	20%			
Median		\$228.3	\$717.9	\$470.9	(\$111.9)	\$339.7	1.4x	306		100%	31%	(2%)	(4%)			
75th Percentile		\$297.2	\$914.0	\$752.8	(\$59.7)	\$548.2	1.5x	644		100%	34%	26%	57%			
25th Percentile		\$99.4	\$518.4	\$306.5	(\$195.0)	\$226.9	1.1x	241		100%	28%	(8%)	(59%)			

Note: Includes U.S. IPOs only. Excludes best efforts IPOs. Excludes IPOs less than \$25 million in gross proceeds. ND = Not Disclosed. NA = Not Applicable. Source: CapIQ, Dealogic, Factset and SEC Filings as of December 31, 2023. Note: All valuations performed on basic share count basis.

(1) Step-up multiple available for those IPOs in which there was crossover participation in the mezzanine round.

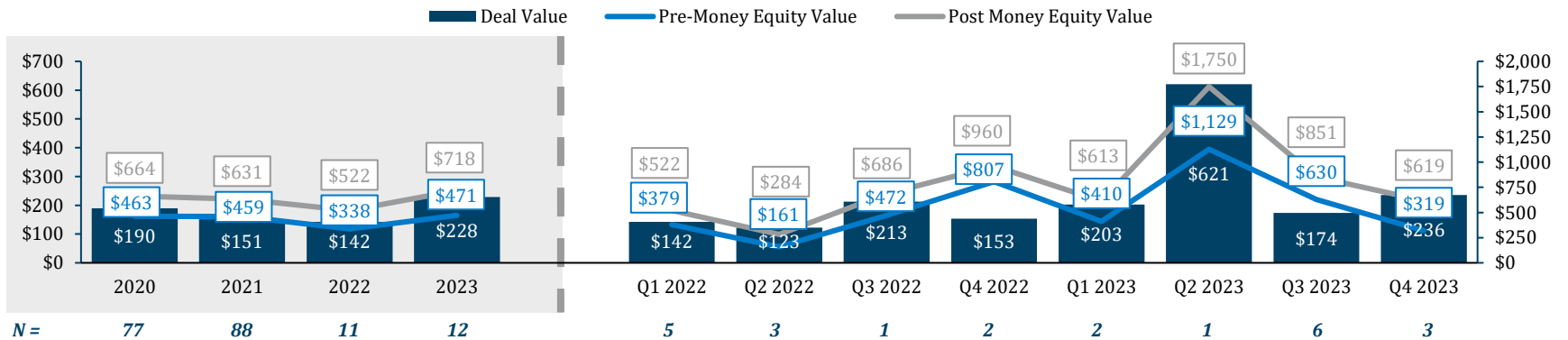
(2) Bristol Myers Squibb merger announcement on December 26, 2023 to acquire all of RayzeBio's outstanding shares for a price of \$62.50 per share.

Biopharma IPO Trends

- Despite median IPO pre-money equity value dipping in Q4 2023, overall, valuations were elevated in 2023 at \$471 million, in line with 2020 and 2021 cohorts
- IPO step-ups in 2023 also returned to 2020 and 2021 levels, while days between crossover to IPO increased and reached a four year high of 306 days

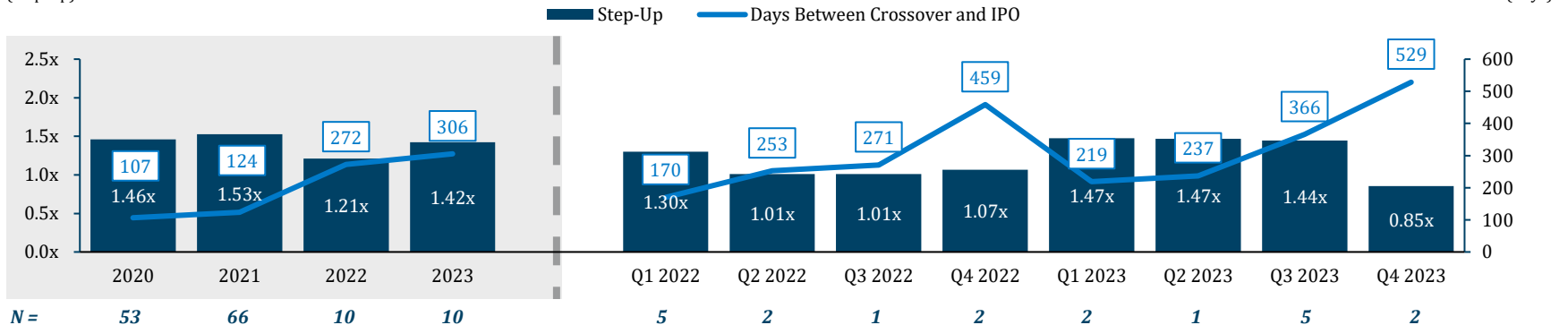
Deal Sizing and Valuation

(\$ in millions)



Crossover-to-IPO Metrics⁽¹⁾

(Step-Up)



Note: Represents median values. Includes U.S. IPOs only. Excludes best efforts IPOs. Excludes IPOs less than \$25 million in gross proceeds.


Source: CapIQ, Dealogic, FactSet, and SEC Filings as December 31, 2023. Note: All valuations performed on basic share count basis.





























































































































(1) Crossover rounds defined as pre-IPO financings completed with multiple crossover and/or large mutual funds in the syndicate.

2020-2023 Biopharma IPOs: Where Are They Now?

Of biopharma companies that completed an IPO since 2020, ~80% remain operational

Current Status of Biopharma Companies By IPO Class Since 2020

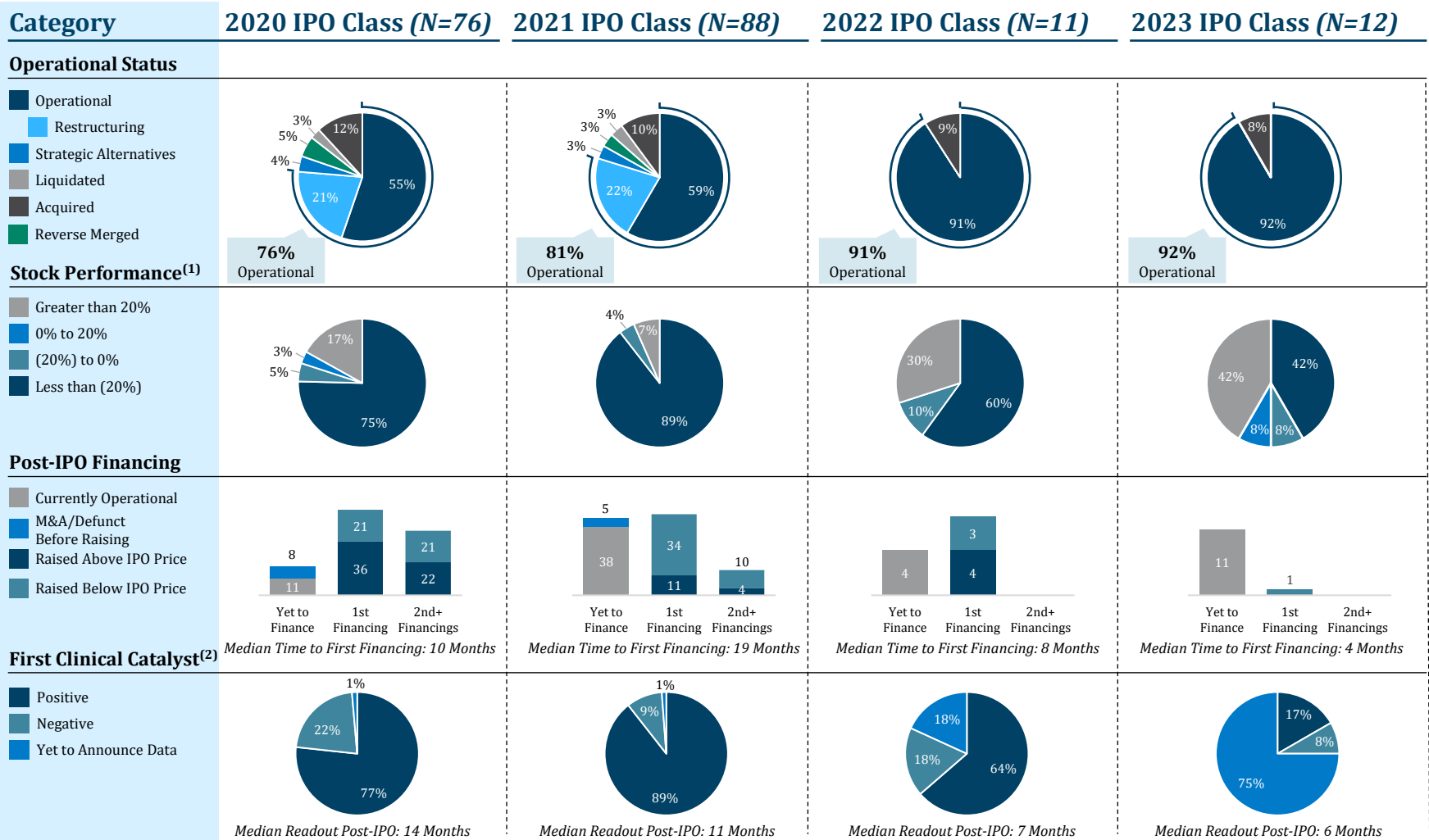
 Indicates first post-IPO financing raised above IPO offer price

	2020	2021	2022	2023	Total
Acquired	    	    			20 11% of total
Operational	    	    	 		150 80% of total
	    	    			
Publicly Announced Restructuring	    	   			31 17% of total
	    	   			
Ongoing Strategic Alternatives	    	   			6 3% of total
	    	   			
Reverse Merged	    	   			6 3% of total
	    	   			
Liquidated	   	    			5 3% of total
	    	    			
Total IPOs	76	88	11	12	187

Note: Includes U.S. IPOs only. Excludes best efforts IPOs. Excludes IPOs less than \$25 million in gross proceeds. Source: CapIQ, Dealogic, Factset and SEC Filings as of December 31, 2023.

2020-2023 Biopharma IPOs: “State of the Union” Analysis

Although 78% of biopharma IPOs since 2020 have announced a “positive” initial clinical catalyst, the challenging market environment has forced many biopharma companies to raise below their IPO offer price



Note: Includes U.S. IPOs only. Excludes best efforts IPOs. Excludes IPOs less than \$25 million in gross proceeds. Source: CapIQ, Dealogic, Factset and SEC Filings as of December 31, 2023.

(1) Stock performance since IPO. Excludes announced/closed acquisitions and liquidations.

(2) First post-IPO clinical catalyst for a company’s designated lead asset at the time of going public.






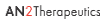









2020-2023 Biopharma IPOs: Phenotype of Positive Performers

Excluding acquisitions/liquidations, only ~15% (25/162) of biopharma companies that IPO'd since 2020 are currently trading above their issue price, all driven by positive clinical catalysts; a large majority also executed follow-on offerings above their IPO price, helping anchor new investors at higher support levels




















2023 (N=5)

2022 (N=3)

2021 (N=5)

													
IPO Date	7/13/2023	11/9/2023	11/2/2023	9/14/23	2/2/2023	3/24/2022	2/3/2022	4/28/2022	6/29/2021	2/4/2021	7/28/2021	2/4/2021	5/13/2021
First Financing	-	-	-	-	\$300M PIPE (09/29/2023) (Above IPO)	\$70M FO (08/15/2023) (Below IPO)	\$112M FO (06/15/2022) (Above IPO)	\$30M FO (05/30/2023) (Above IPO)	-	\$140M PIPE (07/20/2022) (Above IPO)	\$230M FO (10/31/2022) (Above IPO)	\$70M PIPE (06/20/2023) (Below IPO)	\$75M FO (02/10/2022) (Above IPO)
Lead Phase at IPO / Current	Preclinical / Phase I	Phase II	Phase I/II	Phase III	Phase Ib / Phase II	Phase I / Phase II/III	Phase I / Phase II	Phase III	Phase I	Phase III / Commercial	Preclinical / Phase II	Phase I / Phase III	Phase II
First Catalyst	-	-	-	-	Positive (09/29/2023)	-	Positive (11/03/2022)	Positive (05/05/2022)	Positive (05/16/2022)	Positive (08/24/2021)	Positive (09/08/2021)	Positive (12/08/2022)	Positive (05/10/2022)
Key Post-IPO Partners	-	-	-	-	-	-		-	-	-	-	-	
Offer/Current	+64%	+54%	+22%	+0.3%	+172%	+37%	+270%	+663%	+62%	+163%	+333%	+40%	+40%

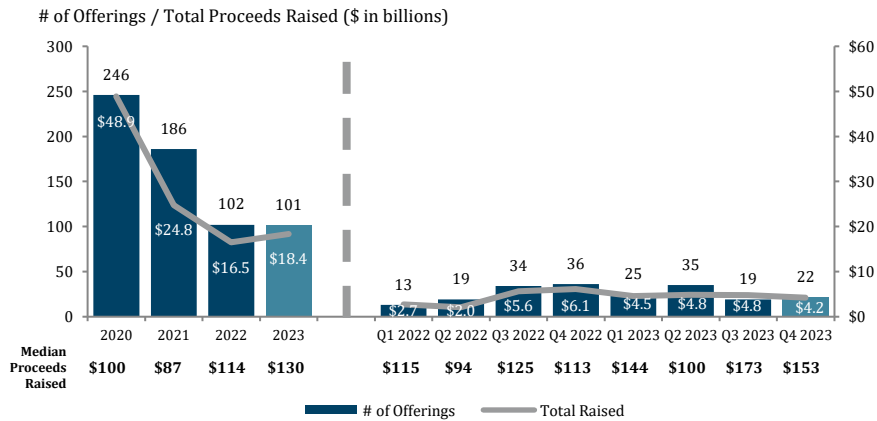
2020 (N=12)

												
IPO Date	2/5/2020	6/5/2020	8/18/2020	8/18/2020	4/7/2020	8/20/2020	6/5/2020	6/2/2020	2/12/2020	2/5/2020	10/15/2020	6/12/2020
First Financing	\$118M FO (09/20/2023) (Above IPO)	\$38M RD (08/12/21) (Below IPO)	-	\$200M PIPE (08/29/2023) (Above IPO)	\$130M FO (11/12/2020) (Above IPO)	\$224M FO (06/30/2021) (Above IPO)	\$300M PIPE (05/13/2021) (Below IPO)	\$200M FO (07/12/2022) (Above IPO)	\$156M FO (07/08/2020) (Above IPO)	\$297M FO (12/08/2020) (Above IPO)	\$76M FO (05/02/2022) (Below IPO)	\$100M FO (01/13/2022) (Above IPO)
Lead Phase at IPO / Current	Preclinical / Phase I/II	Phase III / Commercial	Commercial	Phase I / Phase II	Phase I / Phase II	Preclinical / Phase II	Phase II / Commercial	Phase II	Phase I/II / Phase II	Preclinical / Phase I	Phase II / Commercial	Preclinical / Phase III
First Catalyst	Positive (11/10/2021)	Positive (11/08/2020)	-	Positive (05/16/2022)	Positive (06/22/2021)	Positive (12/14/2022)	Positive (12/05/2020)	Positive (09/07/2021)	Positive (10/12/2020)	Positive (06/28/2022)	Positive (06/21/2021)	Positive (01/06/2022)
Key Post-IPO Partners	 	 	-	-		-		-	-	-		-
Offer/Current	+60%	+32%	+35%	+124%	+149%	+27%	+162%	+13%	+69%	+111%	+27%	+293%

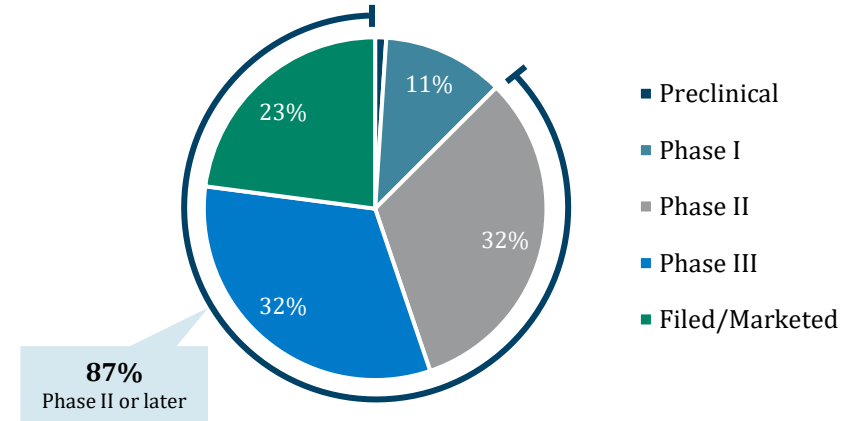
Biopharma Follow-ons Trends

- Follow-on activity in Q4 2023 was slightly elevated compared to Q3 2023 with 22 offerings priced raising \$4.2 billion
- Median proceeds raised remained elevated at \$153 million in Q4 2023, the second-highest quarterly median deal size in over 10 years behind only Q3 2023 as investors look to further de-risk any financing overhang and make fewer, more concentrated bets

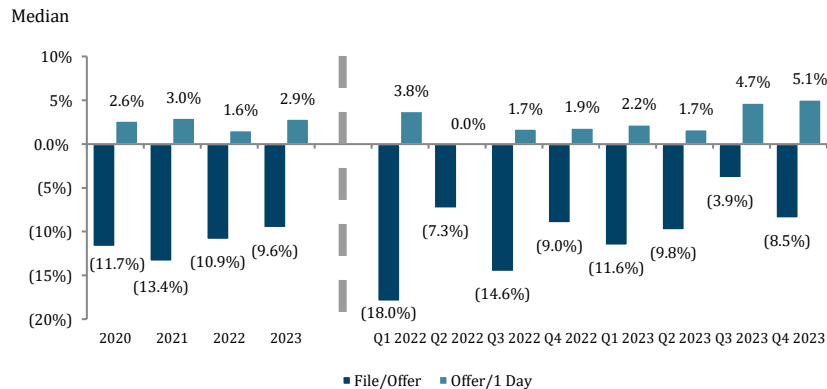
Deal Volume



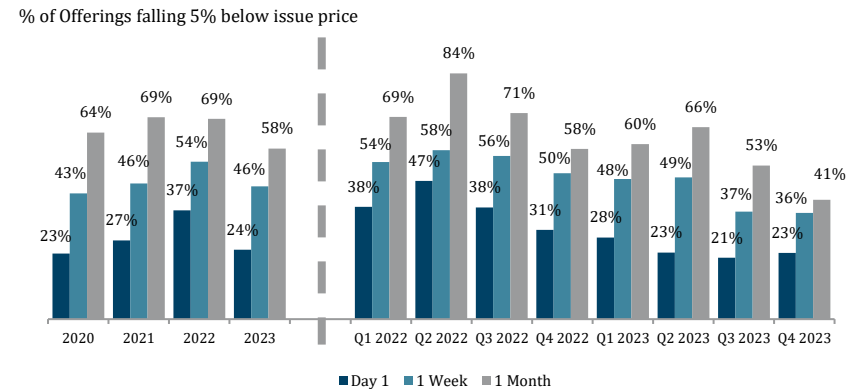
2023 Follow-ons by Stage of Development



Pricing and Performance



Breaking Issue Price



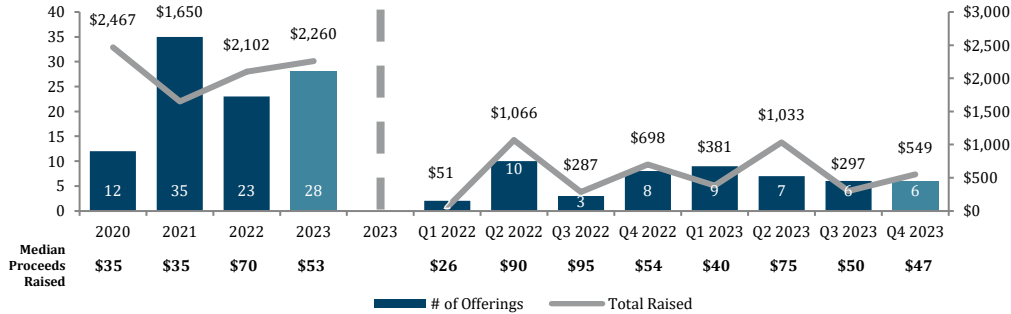
Note: Excludes Registered Directs, PIPEs, and offerings with gross proceeds below \$20 million. Median Pricing and Performance includes offerings with warrants.
Source: Dealogic as of December 31, 2023.

Unregistered PIPEs and Registered Directs Trends

PIPEs and Registered Directs continue to be used by issuers as alternative financing vehicles and are increasingly being utilized by companies raising capital for the first-time post-IPO

Registered Directs

of Offerings / Total Proceeds Raised (\$ in millions)

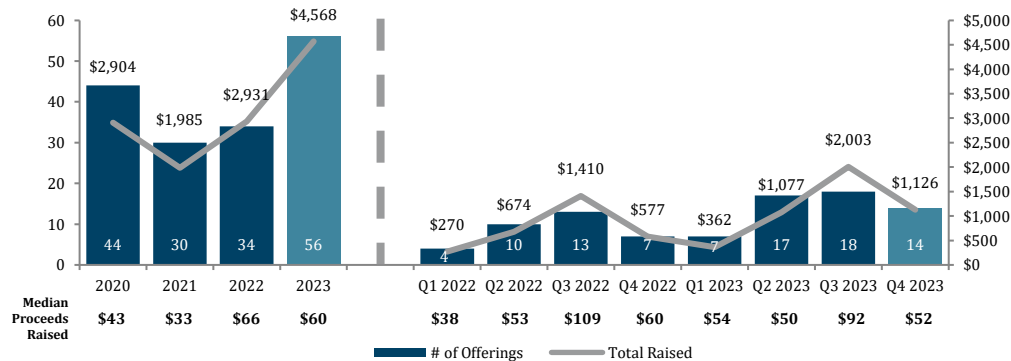


Key Highlights

- 6 offerings priced in Q4 2023 raising \$549 million in gross proceeds
- Activity continues to be largely driven by reverse inquiries and desire to keep allocations highly concentrated amongst smaller investor syndicate
- All 6 of the offerings were catalyst-driven and all were for companies in Phase II or later
- Discounts remained tight with a median pricing at last trade and warrant coverage on four of the six offerings in Q4 2023
- Moderate aftermarket performance, with a median 1-day return of 2.7%

Unregistered PIPEs

of Offerings / Total Proceeds Raised (\$ in millions)



Key Highlights

- PIPE activity decreased in Q4 2023, but remains elevated with 14 offerings raising \$1.1 billion in gross proceeds
- Discounts remained tight with a median discount of 0.0% in Q4 2023 as many offerings remained subject to the 20% Nasdaq threshold
- Only 2 of the 14 offerings (14.3%) in Q4 2023 included warrant coverage; both having 50% coverage
- 11 of the 14 offerings (78.6%) in Q4 2023 were catalyst-driven up from 50% of offerings in Q3 2023
- 11 of 14 PIPEs (78.6%) in Q4 2023 were for companies in Phase II or later

Note: Excludes strategic transactions and transactions with gross proceeds under \$20.0 million.
Source: Dealogic, Company press releases, and Factset as of December 31, 2023.

2023 Strategic Alternatives Outcomes

Steady pace of strategic alternative outcomes being announced, providing a bonafide path for private companies to become public through the reverse merger route

Announced Outcome	Q1 2023	Q2 2023	Q3 2023	Q4 2023	Total in 2023
Reverse Merger Traditional reverse mergers with private companies					14 Deals
Public-Public Merger Public-public mergers following strategic alternatives reviews					4 Deals
Acquisition Full company buyouts following strategic alternatives reviews					11 Deals
Chapter 11/ Closure Companies pursuing dissolution or liquidation					25 Co.'s
# of Outcomes	13	15	12	14	54

Source: SEC Filings, Company Press Releases, and William Blair analysis as of December 31, 2023. Note: outcomes are categorized by quarter of announcement.

(1) Jounce entered into agreement to be acquired by Concentra Biosciences for \$1.85 per share, plus additional CVR consideration, after terminating merger agreement with Redx announced on February 23, 2023.

2023 Biopharma Reverse Mergers Detail

Total of 14 reverse mergers announced with a median premium paid for net cash of ~\$20 million since the start of 2023

(\$ in millions)

Announced Date	Operating Company	Public Shell	Pro Forma Ownership (%) ⁽¹⁾		Implied Valuation			Premium Paid Over Net Cash	Concurrent PIPE?	PIPE Size	NewCo. Cash Runway from Announcement (Months)	Price Performance		
			Operating Company	Public Shell	Operating Company	Public Shell	Net Cash Acquired					Announced to 1-Day	Close to 1-Day	Close to Current
11/16/23	Q32 BIO	HOMOLOGUE Medical, Inc.	71%	29%	\$195.0	\$80.0	\$60.0	\$20.0	✓	\$42.0	31	(35%)	-	-
11/15/23	L E N Z	GRAPHITE BIO	65%	35%	\$231.6	\$126.5	\$115.0	\$11.5	✓	\$53.5	26	(3%)	-	-
08/30/23	serina therapeutics	AGEX therapeutics	75%	25%	ND	ND	ND	ND	✗ ⁽²⁾	-	28	0%	-	-
07/18/23	NEUROGENE	neoleukin	80%	20%	\$295.0	\$76.0	\$66.0	\$10.0	✓	\$95.0	35	(20%)	8%	39%
11/13/23	Cartesian	Selecta Biosciences	73%	27%	\$170.0	\$62.6	ND	ND	✓	\$60.3	ND	(8%)	(8%)	(28%)
07/14/23	KORRO	FREQUENCY THERAPEUTICS	89%	11%	\$325.6	\$38.5	\$23.5	\$15.0	✓	\$117.0	30	77%	3%	220%
06/29/23	morphimmune	immunome	42%	58%	\$72.5	\$100.1	ND	ND	✓	\$125.0	27	30%	(4%)	35%
06/22/23	TOURMALINE	talaris therapeutics	74%	26%	\$230.0	\$82.5	\$67.5 ⁽³⁾	\$15.0	✓	\$75.0	42	23%	(2%)	(10%)
06/22/23	SPYRE THERAPEUTICS	aeglea	76%	24%	\$110.0	\$35.0	ND	ND	✓	\$210.0	32	329%	329%	709%
05/03/23	DIANIHUS THERAPEUTICS	magenta	74%	26%	\$225.0	\$80.0	\$60.0	\$20.0	✓	\$70.0	38	(14%)	(8%)	(14%)
03/30/23	EIP PHARMA	Diffusio2n Pharmaceuticals Inc.	77%	23%	\$127.2	\$37.5	\$14.0	\$23.5	✗	-	21 ⁽⁴⁾	(13%)	12%	29%
02/27/23	DMK	ADAMIS	ND	ND	\$27.0	ND	ND	ND	✗	-	ND	(15%)	(17%)	(72%)
02/23/23	Notable	vbl	76%	24%	\$110.0	\$35.0	\$15.0	\$20.0	✓	\$10.3	24	30%	(18%)	(65%)
01/17/23	elicio	angion	66%	34%	\$95.0	\$50.0	\$29.0	\$21.0	✗	-	11	(31%)	81%	(17%)
Mean (n=14)			72%	28%	\$170.3	\$67.0	\$50.0	\$17.3	Yes: 71%	\$85.8	29	25%	34%	75%
Median			74%	26%	\$170.0	\$69.3	\$60.0	\$20.0	No: 29%	\$72.5	31	(6%)	(2%)	(10%)

Source: SEC Filings, Company Press Releases, and William Blair analysis as of December 31, 2023.

Note: Implied valuation, expected net cash and pro forma cash runway at time of announcement. Shaded rows indicate transactions which have not closed yet.

(1) Pro forma ownership split specified at announcement and prior to giving effect to additional share issuance associated with PIPE financing.

(2) Prior to the merger agreement, AgeX invested \$10M in Serina through a Senior Convertible Loan Note. Upon completion of the merger, AgeX stockholder, Juvenescence, will be issued post-merger warrants totaling up to \$15M.

(3) Target cash balance is net of planned \$64.8M dividend to Talaris shareholders concurrent with closing of the merger.

(4) Cash runway in part extended by a recent \$21M grant which was awarded to EIP Pharma by the NIH in order to fund their ongoing Phase 2b program in Lewy Body Dementia.

Venture Debt in Biopharma

Despite lower valuations, SVB's collapse, and rising interest rates in 2023, venture debt⁽¹⁾ continued to be an attractive source of capital

Market Overview

- Following four consecutive years of US venture debt activity exceeding \$30 billion, 2023 saw a drop to an estimated \$12 billion, primarily due to higher interest rates and overall risk aversion
- Demand for venture debt increased over the year as companies looked for alternative financing instead of raising a down round and setting a lower valuation
- Cash interest rates for venture loans remained relatively stable, even as base rates have continued to rise
 - Credit investors have been able to utilize several different structural “levers” to achieve their desired yield without increased impact on cashflow
- We continue to observe prolonged diligence processes due to elevated underwriting standards and increased scrutiny of company performance and asset quality
 - Broad pipelines, strong management teams, and the ability to raise additional capital remain key diligence areas
- With a significant amount of dry powder available, venture debt remains an attractive source of capital in 2024

2H 2023 New Venture Debt⁽¹⁾ Financings for Public Biopharma Companies

(\$ in millions)										
Date	Company	Available at Close	Total Facility ⁽²⁾	Interest Rate	LTM at Close ⁽³⁾		Market Cap at Close	Debt / Mkt Cap	Facility / Mkt Cap	Phase of Development
					Revenue	EBITDA				
12/28/23	enGene Holdings	\$23	\$50	10.40%	\$0	(\$22)	\$188	12.0%	26.6%	Phase I/II
11/13/23	Acumen Pharmaceuticals	\$30	\$50	9.65%	\$0	(\$57)	\$118	25.5%	42.5%	Phase I
11/02/23	Aquestive Therapeutics	\$45	\$45	13.50%	\$48	(\$20)	\$96	46.8%	46.8%	Marketed
10/02/23	Amicus Therapeutics	\$400	\$400	11.92%	\$372	(\$104)	\$3,206	12.5%	12.5%	Marketed
09/06/23	Cumberland Pharmaceuticals	\$20	\$20	8.16%	\$41	\$0	\$24	83.8%	83.8%	Marketed
09/05/23	Olema Pharmaceuticals	\$25	\$50	8.50%	\$0	(\$101)	\$522	4.8%	9.6%	Phase II
08/17/23	Valneva SE	\$50	\$200	9.95%	\$405	(\$107)	\$910	5.5%	22.0%	Marketed
08/14/23	Mind Medicine	\$15	\$50	11.45%	\$0	(\$78)	\$178	8.4%	28.2%	Phase I
08/03/23	X4 Pharmaceuticals	\$23	\$115	11.65%	\$0	(\$100)	\$282	8.0%	40.7%	Filed
07/24/23	Verrica Pharmaceuticals	\$50	\$125	13.41%	\$9	(\$23)	\$214	23.4%	58.4%	Marketed
07/14/23	Nutriband	\$5	\$5	7.00%	\$2	(\$4)	\$25	19.8%	19.8%	Preclinical
07/11/23	Armata Pharmaceuticals	\$25	\$25	14.00%	\$4	(39)	\$42	59.4%	59.4%	Phase I/II
07/05/23	COMPASS Pathways	\$30	\$50	10.00%	\$0	(\$108)	\$406	7.4%	12.3%	Phase III
Mean (N=14)		\$57	\$91	10.74%	\$68	(\$59)	\$478	24.4%	35.6%	
Median		\$25	\$50	10.40%	\$2	(\$57)	\$188	12.5%	28.2%	
Minimum		\$5	\$5	7.00%	\$0	(\$108)	\$24	4.8%	9.6%	
Maximum		\$400	\$400	14.00%	\$405	\$0	\$3,206	83.8%	83.8%	

Source: CapIQ, PitchBook Data, Inc., and SEC filings as of December 31, 2023.

(1) “Venture debt” defined here as debt to borrowers who do not yet have positive cash flow.

(2) Represents total commitment and includes undrawn revolvers and additional tranches of debt / delayed draw facilities.

(3) LTM financials at time of close are as calculated by CapIQ.

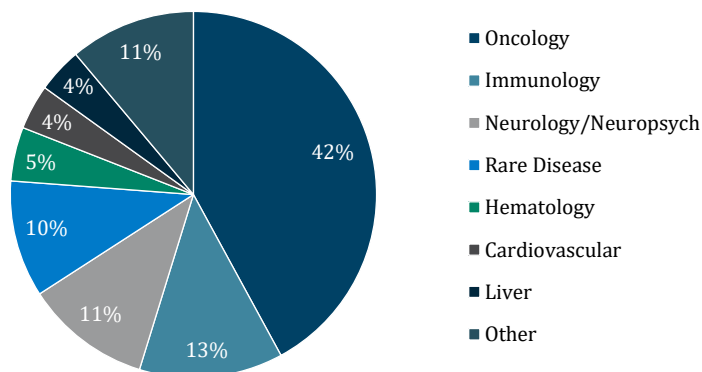
Q4 2023 Clinical Catalysts Analysis

- Several highly anticipated catalysts to close out the quarter significantly missed expectations, despite hitting their primary endpoint, including Lantheus/POINT SPLASH data and Structure's obesity data
- 5 of the top 10 movers successfully raised catalyst-driven follow-on offerings concurrent with or post-data
- Only quarter in 2023 with total cumulative market cap lost amongst all clinical catalysts

Key Takeaways

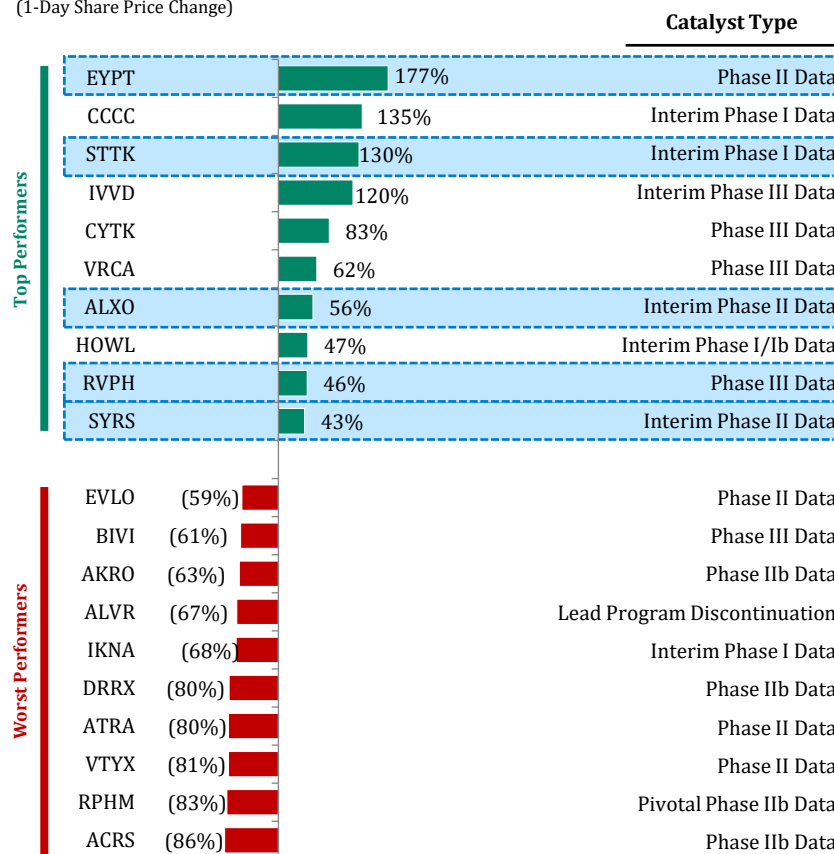
- William Blair analyzed 126 key clinical data readouts in Q4 2023 for U.S.-listed biopharma companies with a market cap between \$10M-\$30B
- Average stock price performance for “positive” clinical data (N=107):
 - 1-day performance: **+3.3%**
 - 1-week performance: **+3.9%**
- Average stock price performance for “negative” clinical data (N=19):
 - 1-day performance: **(43.5%)**
 - 1-week performance: **(42.4%)**
- 18 Phase III trial readouts in Q4 2023 (of which 11 were positive)
- ~\$13.1 billion in cumulative market cap **lost** across all clinical catalyst, driven by two pivotal trial misses by argenx as well as key negative readouts from Sarepta and Akero

Breakdown of Clinical Catalysts by Therapeutic Area



Top 10 Positive/Negative Movers

(1-Day Share Price Change)



 Executed Equity Follow-on Concurrent With or Post-Data

2023 Clinical Catalysts – Top Winners and Losers (By Market Cap)

- Phase II or Phase III readouts comprise 90% of top 10 winners and losers
- 3 of the top 10 negative movers were driven by “positive” clinical data
- 1-day market cap change for the top 10 winners and losers effectively negate each other, with argenx leading the way on both sides of the equation

Top 10 Winners by Market Cap

#	Company	TA	Asset	Catalyst Type	Catalyst Date	1-Day Market Cap Change	2023 Performance
1	argenx	I&I/Rare Disease	VYVGART Hytrulo	Pivotal Phase II Data	7/17/23	\$5,895	+2%
2	Cytokinetics	Cardiovascular	Aficamten	Phase III Data	12/27/23	\$3,700	+82%
3	moderna	Oncology	mRNA-4157 (V940)	Additional Phase IIb Data	12/14/23	\$2,772	(45%)
4	IMMUNOVANT	I&I	IMVT-1402	Phase I Data	9/26/23	\$2,572	+137%
5	bridgebio	Cardiovascular	Acoramidis	Phase III Data	7/17/23	\$2,218	+430%
6	LEGEND BIOFTECH	Oncology	Carvykti	Phase III Data	4/18/23	\$1,694	+21%
7	immun-gen	Oncology	ELAHERE® (mirvetuximab)	Phase III Data	5/3/23	\$1,596	+224% ⁽¹⁾
8	BIONTECH	Oncology	BNT316/ ONC-392	Interim Phase I/II Data	6/2/23	\$966	(30%)
9	MoonLake	I&I	Sonelokimab	Phase II Data	6/26/23	\$876	+475%
10	bridgebio	Rare Disease	Infigratinib	Phase II Data	3/6/23	\$855	+430%

Total: \$23B

Top 10 Losers by Market Cap

#	Company	TA	Asset	Catalyst Type	Catalyst Date	1-Day Market Cap Change	2023 Performance
1	argenx	I&I/Rare Disease	VYVGART Hytrulo	Phase III Data	12/20/23	(\$6,716)	+2%
2	SAREPTA	Musculo-skeletal/ Rare Disease	ELEVIDYS	Phase III Data	10/30/23	(\$3,774)	(26%)
3	argenx	I&I/Rare Disease	VYVGART Hytrulo	Phase III Data	11/28/23	(\$2,979)	+2%
4	akero	Liver/NASH	Efruxifermin	Phase IIb Data	10/10/23	(\$1,690)	(57%)
5	ACELYRIN	I&I	HiSCR75	Phase IIb/III Data	9/11/23	(\$1,468)	(68%)
6	LANTHEUS	Oncology	77Lu-PNT2002	Phase III Data	12/18/23	(\$1,400)	+22%
7	VIR	Infectious Disease	VIR-2482	Phase II Data	7/20/23	(\$1,387)	(60%)
8	FibroGen	Respiratory	Pamrevlumab	Phase III Data	6/26/23	(\$1,302)	(95%)
9	STRUCTURE	Metabolic	GSBR-1290	Phase IIa Data	12/18/23	(\$1,175)	+57%
10	Revolution Medicines	Oncology	RMC-6236	Interim Phase I/Ib Data	10/23/23	(\$1,052)	+20%

Total: (\$23B)

Note: Includes biopharma companies listed on major U.S. exchanges with market capitalization >\$10M and <\$30 billion at the time of catalyst.

Source: FactSet, Company press releases, SEC Filings and William Blair analysis as of December 31, 2023.

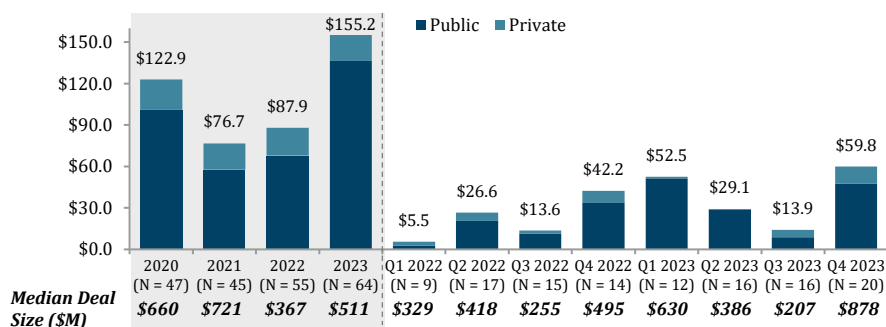
(1) Immunogen stock performance measured from November 29, 2023, prior to AbbVie's announcement on November 30, 2023 that it would acquire the company.

Biopharma M&A Recap

- M&A activity rebounded emphatically in 2023, driven by a flurry of meaningful deal activity in Q4 2023 and Pfizer's \$43 billion acquisition of Seagen which closed in December 2023
- 2023 saw an uptick in structured transaction volume compared to 2022, with 58% of all public and private M&A transactions involving milestone payments, compared to 44% in 2022

Total Deal Value & Volume

(\$ in billions)



Key Takeaways

- Median total deal values and milestones in 2023 were considerably higher vs. 2022, while median upfront payments were largely in line with 2022 values
 - **Total Deal Value:** \$511M in 2023 (vs. \$367M in 2022)
 - **Upfront (cash+equity):** \$248M in 2023 (vs. \$249M in 2022)
 - **Milestones:** \$200M in 2023 (vs. \$126M in 2022)
- Large M&A deals (total deal value > \$1B) rebounded in 2023 compared to years past (25 deals in 2023 vs. 16 in 2022 and 18 in 2021)
 - Increased acquisitions for late-stage/commercial assets, with 45% (29/64) of deals involving either Phase III, NDA/BLA filed or commercial assets
- Heightened activity across I&I, neurology, and metabolic diseases, as well as radiopharma and ADC modalities in 2023
 - 44% (28/64) of all M&A deals this year involved I&I, neurology, and metabolic disease targets vs. 31% (17/55) in 2022 M&A deals
 - 6 total significant ADC/radiopharma deals in 2023 vs. none in 2022
- Cell and gene therapy/editing M&A was down in 2023, with only 5 deals announced in 2023 vs. 9 total deals in 2022

2023 Top M&A Transactions by Total Deal Value

(\$ in millions)

Top Public M&A Deals

Announced Date	Target	Acquiror	Total Deal Value	Total Upfront	Premium to Last Unaffected Price	Stage	Therapeutic Area	Modality
03/13/23	Seagen	Pfizer	\$43,000	\$43,000	42%	Marketed	Oncology	ADC
12/22/23	KARUNA PHARMACEUTICALS	Bristol Myers Squibb	\$14,000	\$14,000	53%	Filed	Neurology	Small Molecule
04/16/23	Prometheus Biosciences	MERCK	\$10,800	\$10,800	75%	Phase II	Immunology	Antibody
11/20/23	immunogen	abbvie	\$10,100	\$10,100	95%	Marketed	Oncology	ADC
12/06/23	cerevel	abbvie	\$8,700	\$8,700	73%	Phase III	Neurology	Small Molecule

Top Private M&A Deals

Announced Date	Target	Acquiror	Total Deal Value	Total Upfront	Stage	Therapeutic Area	Modality
10/23/23	Telavant	Roche	\$7,250	\$7,100	Phase III	Immunology	Antibody
12/03/23	CARMOT THERAPEUTICS	Roche	\$3,100	\$2,700	Phase II	Metabolic	Peptide
07/14/23	Versanis	Lilly	\$1,925	ND	Phase IIb	Metabolic	Antibody
08/10/23	inversago	novo nordisk	\$1,075	ND	Phase II	Metabolic	Small Molecule
07/17/23	DTX PHARMA	NOVARTIS	\$1,000	\$500	Preclinical	Neurology	siRNA

Note: 2023 data as of December 31, 2023. M&A activity includes biopharma deals with disclosed total deal value of \$20M+. NA = Not Applicable. ND = Not Disclosed.
Source: PitchBook Data, Inc., Company press releases and websites.

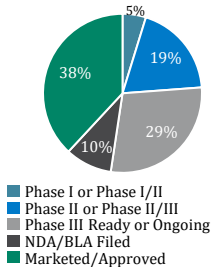
2023 Public Company M&A Deep Dive: What is Big Pharma Hunting For?

- William Blair analyzed 21 public company M&A deals announced in 2023 with deal values greater than \$1 billion
- Typical public company M&A target phenotype: commercial or late-stage with unencumbered U.S. commercial rights
- 100% of deals catalyzed by unsolicited bids; processes becoming more competitive
- Meaningful increase in the use of CVR structures in public company M&A

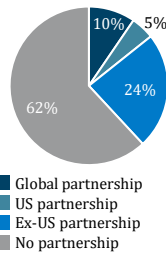
Target Phenotype

- Median total deal value of \$2.9 billion (100% cash)
 - One-third of deals had CVR structures (compared to almost none during 2020-2022), with a median CVR value of \$262 million
 - Median 73% premium to last unaffected trade price
- Heavy weighting towards late-stage/commercial assets, with 76% (16/21) of deals Phase III or later
- Strong preference for wholly-owned assets, with 62% (13/21) of lead assets unpartnered at announcement
- Top three therapeutic areas were oncology (33%), neurology (14%), and I&I (14%)
- Despite IRA headwinds, high interest in small molecules, which represented 48% (10/21) of deals

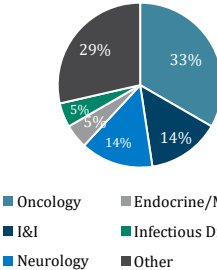
Stage of Development



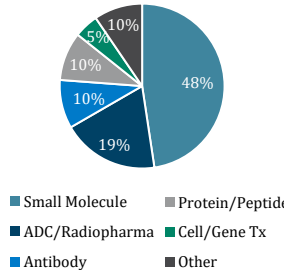
Lead Asset Partnered⁽²⁾



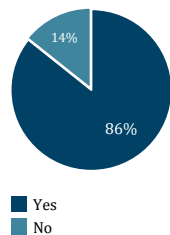
Therapeutic Area



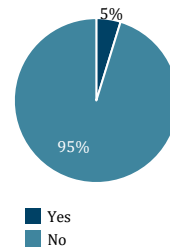
Lead Asset Modality



Unencumbered U.S. Lead Asset



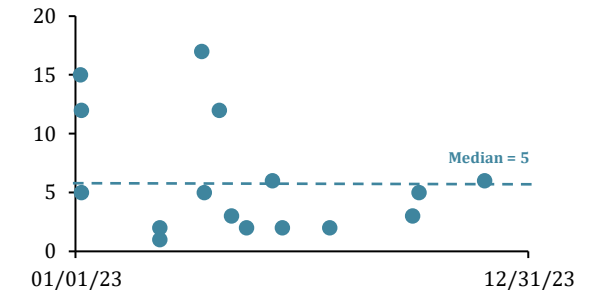
Existing Partnership with Acquirer



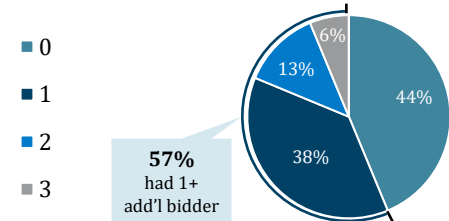
Bid/Process Dynamics⁽¹⁾

- 100% of deals analyzed were catalyzed by an unsolicited bid
- Median total parties engaged in outreach was 5, with 56% of deals involving multiple bidders (compared to the vast majority with only one bidder in 2020-2022 timeframe)
- Over 80% of deals experienced a 10% or greater increase in offer price from the initial IOI, with a median increase across all deals of 20%
- Deals rapidly consummated after initial IOI, with median time from IOI to announcement of 1.7 months

Number of Total Parties Engaged



Number of Parties That Bid (Ex-Acquirer)



FTC Second Reviews: A Growing Trend That's Here to Stay?

- Public biopharma M&A has been a key area of focus for the FTC in 2023
- Pfizer/Seagen acquisition faced a second review request from the FTC to assess the legality of the transaction
 - Successfully closed in December 2023 and was the largest biopharma M&A deal since BMS/Celgene (\$80.4 billion total deal value) and AbbVie/Allergan (\$63.0 billion total deal value) in 2019
- With many large pharma's facing LOEs over the coming decade, William Blair expects a robust M&A market to continue into 2024, though FTC second reviews and scrutiny is likely here to stay










Source: CapIQ, Company Press Releases as of December 31, 2023. Includes strategic acquisitions with a public biotech target for greater than \$1 billion in total deal value since the start of 2023.

(1) Bid dynamics based on transactions where relevant SEC documentation (Schedule 14D-9 / Schedule 14A) was available as of December 31, 2023.

(2) Lead asset partnerships include development/commercialization licenses and co-promotion agreements. Excludes clinical trial collaborations, supply/distribution agreements, and academic collaborations.

Summary of Investor Capital Returned from Q4 2023 Public Biopharma Acquisitions

Public biopharma acquisitions announced in Q4 2023 free up an estimated \$29 billion in institutional investor capital; the majority of capital returned through the acquisition of Karuna, Immunogen, and Cerevel

(\$ in millions)		Total Estimated ⁽¹⁾ Capital Returned to Fund									
#	Institution										
1	Fidelity Management & Research Co.	\$3,263.4	✓		✓	✓	✓	✓		✓	✓
2	The Vanguard Group, Inc.	\$2,483.0	✓		✓	✓	✓	✓		✓	✓
3	BlackRock Fund Advisors	\$1,487.7	✓	✓	✓	✓	✓	✓		✓	✓
4	T. Rowe Price Associates, Inc.	\$1,456.0	✓			✓	✓	✓			✓
5	Capital Research & Management Co.	\$1,316.9		✓			✓				
6	Wellington Management Co. LLP	\$1,275.7	✓			✓	✓	✓			✓
7	T. Rowe Price Investment Management	\$1,059.6	✓		✓		✓				
8	SSgA Funds Management, Inc.	\$947.1	✓		✓	✓	✓	✓		✓	
9	Viking Global Investors LP	\$788.5					✓				✓
10	Redmile Group LLC	\$663.3				✓					✓
11	RA Capital Management LP	\$589.2		✓	✓	✓					
12	Janus Henderson Investors US LLC	\$535.5	✓			✓	✓	✓		✓	
13	Perceptive Advisors LLC	\$502.5	✓								✓
14	Geode Capital Management LLC	\$486.7	✓	✓	✓	✓	✓	✓		✓	✓
15	Avoro Capital Advisor LLC	\$429.7	✓					✓			
16	RTW Investments LP	\$396.9						✓			✓
17	Rock Springs Capital Management LP	\$383.0	✓		✓	✓	✓	✓			
18	EcoR1 Capital, LLC	\$333.4		✓				✓			
19	Morgan Stanley & Co. LLC	\$281.1	✓	✓	✓	✓	✓	✓	✓	✓	✓
20	Invus Public Equities Advisors LLC	\$273.1	✓			✓		✓			✓
21	Fairmount Funds Management LLC	\$261.7				✓					✓
22	D. E. Shaw & Co. LP	\$241.9		✓		✓	✓	✓		✓	
23	AllianceBernstein LP	\$219.5	✓		✓	✓	✓	✓		✓	✓
24	Avidity Partners Management LP	\$214.7	✓			✓	✓				✓
25	Paradigm BioCapital Advisors LP	\$210.7	✓					✓			
26	Eventide Asset Management LLC	\$209.6	✓			✓	✓	✓			
27	Millennium Management LLC	\$206.9	✓	✓		✓	✓	✓		✓	✓
28	Citadel Advisors LLC	\$201.5	✓	✓	✓	✓	✓	✓	✓	✓	✓
29	Pictet Asset Management SA	\$191.2				✓	✓	✓			
30	Charles Schwab, Inc.	\$182.2	✓		✓	✓	✓	✓		✓	

(1) Total estimated capital in millions returned to fund based on the cumulative \$ value position of all target companies.

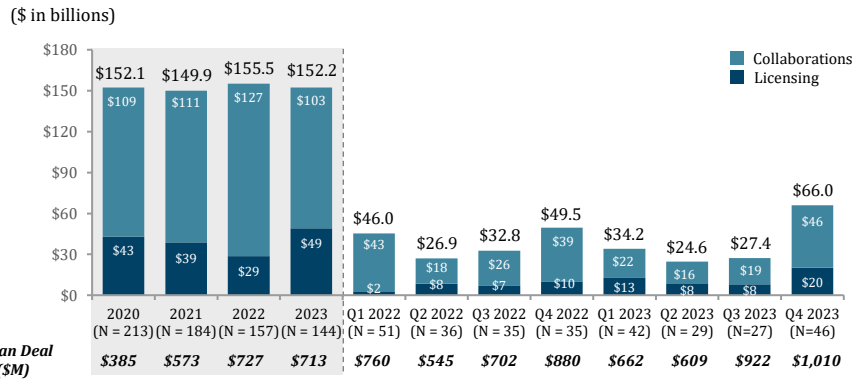
\$ value position calculated based on Q3 2023 publicly disclosed institutional ownership of target company multiplied by publicly disclosed latest announced per share acquisition price, excluding contingencies. Excludes transactions with deal values <\$250mm. The following outlines acquisition prices utilized in the analysis: Eli Lilly's acquisition of POINT Biopharma for \$12.50/share, Kyowa Kirin's acquisition of Orchard Therapeutics for \$16/share, Bristol Myers Squibb's acquisition of Mirati Therapeutics for \$58/share, AbbVie's acquisition of ImmunoGen for \$31.26/share, AbbVie's acquisition of Cerevel Therapeutics for \$45/share, AstraZeneca's acquisition of Icosavax for \$15/share, Bristol Myers Squibb's acquisition of Karuna Therapeutics for \$330/share, AstraZeneca's acquisition of Gracell Biotechnologies for \$10.00/ADS, and Bristol Myers Squibb's acquisition of RayzeBio for \$62.50/share.

Source: FactSet and William Blair Analysis as of September 30, 2023. Note: The analysis does not include retail, management, strategic investors, and non-filers.

2023 Biopharma Partnership Trends

- Partnering activity slowed slightly in 2023, with 144 deals this year vs. 157 in 2022; however, Q4 2023 reached a 5-year high in quarterly deal value driven by the Daichii/Merck collaboration for \$22 billion
- For the first time, the FTC challenged an early-stage partnership, resulting in Sanofi terminating its deal with Maze

Total Deal Value and Volume



Top 5 Partnerships by Total Upfront in 2023

(\$ in millions)

Date	Licensor	Licensee	Total Deal Value	Total Upfront	Milestones	Phase	Therapeutic Area	Modality
10/19/23	Daichi-Sankyo	MERCK	\$22,000	\$1,500	\$20,500	Pivotal Phase II	Oncology	ADC
12/12/23	SYSTEMIMUNE	Bristol Myers Squibb	\$8,400	\$800	\$7,600	Phase I	Oncology	ADC
10/4/23	teva	sanofi	\$1,500	\$500	\$1,000	Phase II	Inflammatory	mAb
1/23/23	HUTCHMED	Takeda	\$1,130	\$400	\$730	Phase III	Oncology	Small Molecule
7/24/23	Ainlyam	Roche	\$2,800	\$310	\$2,490	Phase II	Cardiovascular	RNA

2023 most active partners: Eli Lilly (N=10), AstraZeneca (N=8), and Novartis (N=7)

Key Takeaways

Licensing (N=69)

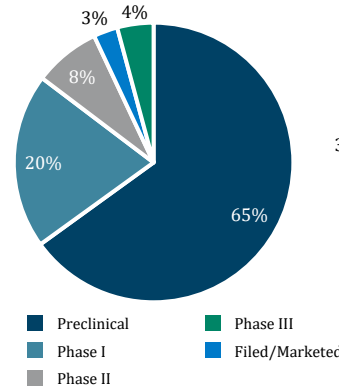
- Median deal terms for licensing agreements in 2023:
 - **Total Deal Value:** \$680M in 2023 (vs. \$260M in 2022)
 - **Upfront (Cash+Equity):** \$40M in 2023 (vs. \$22M in 2022)
 - **Milestones:** \$595M in 2023 (vs. \$265M in 2022)
- Partnerships with Asian licensors reached a 2-year high of ~44% in Q4 2023, underscoring the importance of the region as a source of innovation
- ADC-focused deals have accounted for ~26% of all licensing in 2023, a meaningful increase from only 10% in 2022

Collaborations (N=75)

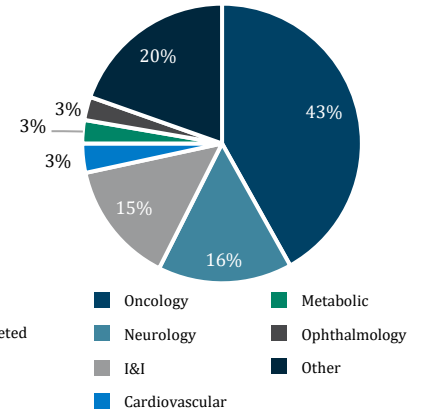
- Median deal terms for collaborations in 2023:
 - **Total Deal Value:** \$771M in 2023 (vs. \$1,020M in 2022)
 - **Upfront (Cash+Equity):** \$53M in 2023 (vs. \$45M in 2022)
 - **Milestones:** \$1,000M in 2023 (vs. \$1,000M in 2022)
- Early-stage transactions comprised 95% of all collaborations in 2023, in line with prior years
- Interest in asset-based collaborations (as opposed to platform deals) increased, accounting for 24% of collaborations in 2023 compared to 17% in 2022

Breakdown of Partnerships in 2023 (N=144)

Stage of Development



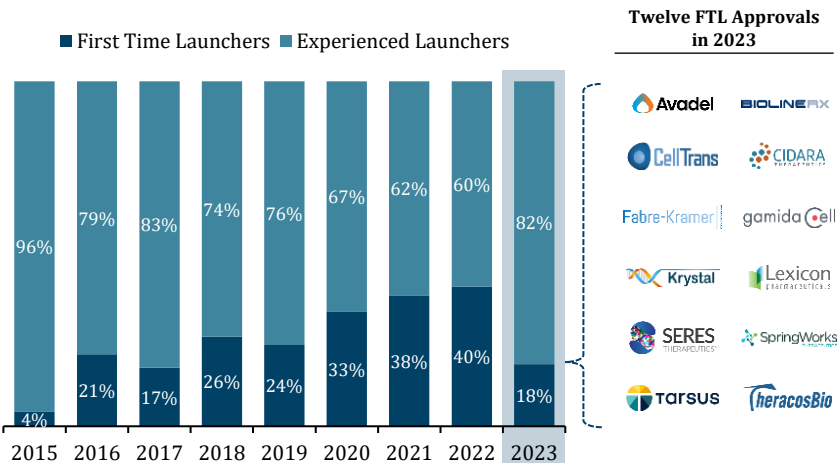
Therapeutic Area



2023 SMID-Cap Approval Trends and 2024 Outlook

- 12 drugs by first time launchers (FTLs) were approved in 2023, a lower proportion of total approvals vs. previous years
- 22 upcoming PDUFAs for private or SMID-cap biopharma companies currently expected in 2024

Annual First Time Launcher Trends



2023 SMID-Cap CRL Recap



Upcoming Select 2024 SMID-Cap PDUFA Dates

Company	Product	PDUFA Date	Company	Product	PDUFA Date
Novan/Ligand	Berdazimer	1/5/24	Aquestive Therapeutics	Libervant	4/28/24
Iovance Biotherapeutics	Lifileucel	2/24/24	Day One Biopharma	Tovorafenib	4/30/24
Minerva Neurosciences	Roluperidone	2/26/24	X4 Pharma	Mavorixafor	4/30/24
Eyenovia	APP13007	3/4/24	Ascendis Pharma	Transcon PTH	5/14/24
Madrigal Pharma	Resmetirom	3/14/24	Abeona Therapeutics	Pz-cel	5/25/24
Orchard Therapeutics	OTL-200	3/18/24	Genfit/Ipsen	Elafibranor	6/10/24
Akebia Therapeutics	Vadadustat	3/27/24	Geron Therapeutics	Imetelstat	6/16/24
CRISPR Therapeutics/Vertex	Exa-cel	3/30/24	Verona Pharma	Ensifentrine	6/26/24
Rocket Pharma	Kresladi	3/31/24	Phathom Pharma	Vonoprazan	7/19/24
Supernus Pharma	SPN-830	4/5/24	Vanda Pharma	Tradipitant	9/18/24
Immunity Bio	Anktiva	4/23/24	Karuna Therapeutics	KarXT	9/26/24

Source: FDA.gov, Company press releases, SEC Filings, and William Blair analysis as of December 31, 2023.

Note: Reflects approvals, CRLs and PDUFAs of NCEs that are submitted via BLA/NDA (excluding biosimilars, generics and 505b2s). PDUFAs do not include sNDAs or label extensions.

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