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Outlook for Recovery from Biotech Bear Market 20
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XBI Biotech Index Rallied 4.3% Last Week

XBI down 16.7% for the year to date. Total global biotech market cap down 22.4% YTD.

Biotech Stocks Up Last Week

Return: Mar 25 to April 1, 2022
- Nasdaq Biotech Index: +3.3%
- Arca XBI Index: +4.3%
- Torreya Global Biotech (EV): +5.2%
- S&P 500: -0.6%

Return: Jan 1 to April 1, 2022
- Nasdaq Biotech Index: -9.9%
- Arca XBI Index: -16.7%
- Torreya Global Biotech (EV): -29.2%
- Torreya Global Biotech (MC): -22.4%
- S&P 500: -4.6%

VIX Down

Jan 3: 16.6%
Feb 11: 27.4%
Feb 18: 27.9%
Feb 25: 27.6%
Mar 4: 31.2%
Mar 19: 23.9%
Apr 1: 19.6%

10-Year Treasury Yield Up

Jan 3: 1.63%
Jan 28: 1.78%
Feb 18: 1.92%
Feb 25: 1.98%
Mar 4: 1.74%
Mar 19: 2.14%
Apr 1: 2.39%

* EV means enterprise value change; MC means market cap change.
The life sciences sector rallied in value by 1.8% last week. Biotech was up 5.2%. Diagnostics and HCIT both went up more than 5% for the week, although both sectors remain down more than 30% over the last 12 months.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Count</th>
<th>Enterprise Value (Apr 1, 2022, $millions)</th>
<th>Change in Last Week (percent)</th>
<th>Change in Last Month (percent)</th>
<th>Change in Last Year (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>API</td>
<td>82</td>
<td>$104,535</td>
<td>-1.6%</td>
<td>0.8%</td>
<td>9.9%</td>
</tr>
<tr>
<td>Biotech</td>
<td>892</td>
<td>$265,954</td>
<td>5.2%</td>
<td>5.7%</td>
<td>-44.7%</td>
</tr>
<tr>
<td>CDMO</td>
<td>42</td>
<td>$282,845</td>
<td>3.2%</td>
<td>4.3%</td>
<td>3.7%</td>
</tr>
<tr>
<td>Diagnostics</td>
<td>82</td>
<td>$297,251</td>
<td>5.8%</td>
<td>5.4%</td>
<td>-8.3%</td>
</tr>
<tr>
<td>OTC</td>
<td>33</td>
<td>$29,490</td>
<td>1.1%</td>
<td>3.2%</td>
<td>8.3%</td>
</tr>
<tr>
<td>Pharma</td>
<td>712</td>
<td>$5,887,943</td>
<td>0.9%</td>
<td>5.1%</td>
<td>8.2%</td>
</tr>
<tr>
<td>Services</td>
<td>42</td>
<td>$273,817</td>
<td>2.7%</td>
<td>4.9%</td>
<td>5.6%</td>
</tr>
<tr>
<td>Tools</td>
<td>54</td>
<td>$830,886</td>
<td>1.9%</td>
<td>3.8%</td>
<td>13.2%</td>
</tr>
<tr>
<td>Devices</td>
<td>186</td>
<td>$1,926,816</td>
<td>2.9%</td>
<td>0.6%</td>
<td>-3.2%</td>
</tr>
<tr>
<td>HCIT</td>
<td>12</td>
<td>$74,707</td>
<td>5.7%</td>
<td>1.0%</td>
<td>-33.4%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2137</td>
<td><strong>$9,974,384</strong></td>
<td><strong>1.8%</strong></td>
<td><strong>4.0%</strong></td>
<td><strong>2.4%</strong></td>
</tr>
</tbody>
</table>

Source: CapitalIQ
This chart shows the change in market cap of various microsectors of the life sciences industry. We calculated the percentage change in total market cap from Dec 31, 2021 close to March 31, 2022 share price close.

Few microsectors were spared the downdraft in the market. Diagnostic lab companies, biotech, animal health and biosimilars companies were hardest hit.

OTC, big pharma, Africa pharma, API pharma, Japan pharma and royalty players fared best.

If there is a theme, it is that more solid cash flowing companies did better.

In contrast, the valuations of lab companies like NeoGenomics and biotechs like CRISPR Therapeutics soared during the pandemic and came down to earth during Q1.

Source: CapitalIQ
## Top 20 Biggest Gainers in Dollar Value in Q1 2022

AbbVie delivered cash flow and a post-Humira® growth story in an otherwise very tough quarter for the industry. The greatest percentage gains in value in this chart came from three China API makers (Ausun, Menovo, Hicin). Cho performed well with its glycan technology which can enhance antibody performance.

<table>
<thead>
<tr>
<th>Company</th>
<th>HQ Country</th>
<th>Sector</th>
<th>Market Cap on Mar 31, 2022</th>
<th>Market Cap on Dec 31, 2022</th>
<th>YTD Change</th>
<th>YTD Return</th>
<th>One Year Return</th>
<th>Two Year Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>AbbVie</td>
<td>United States</td>
<td>Pharma</td>
<td>$286,332</td>
<td>$239,371</td>
<td>$46,961</td>
<td>19.6%</td>
<td>49.9%</td>
<td>154.5%</td>
</tr>
<tr>
<td>AstraZeneca</td>
<td>United Kingdom</td>
<td>Pharma</td>
<td>$206,365</td>
<td>$182,034</td>
<td>$24,330</td>
<td>13.4%</td>
<td>57.4%</td>
<td>75.0%</td>
</tr>
<tr>
<td>Bristol-Myers Squibb</td>
<td>United States</td>
<td>Pharma</td>
<td>$155,204</td>
<td>$138,395</td>
<td>$16,809</td>
<td>12.1%</td>
<td>10.1%</td>
<td>23.1%</td>
</tr>
<tr>
<td>Johnson &amp; Johnson</td>
<td>United States</td>
<td>Pharma</td>
<td>$466,047</td>
<td>$450,358</td>
<td>$15,688</td>
<td>3.5%</td>
<td>7.7%</td>
<td>34.8%</td>
</tr>
<tr>
<td>Merck</td>
<td>United States</td>
<td>Pharma</td>
<td>$207,401</td>
<td>$193,588</td>
<td>$13,812</td>
<td>7.1%</td>
<td>6.3%</td>
<td>6.3%</td>
</tr>
<tr>
<td>Eli Lilly</td>
<td>United States</td>
<td>Pharma</td>
<td>$258,405</td>
<td>$250,419</td>
<td>$7,986</td>
<td>3.2%</td>
<td>52.2%</td>
<td>105.4%</td>
</tr>
<tr>
<td>Amgen</td>
<td>United States</td>
<td>Pharma</td>
<td>$134,701</td>
<td>$126,718</td>
<td>$7,983</td>
<td>6.3%</td>
<td>-6.3%</td>
<td>12.7%</td>
</tr>
<tr>
<td>Wantai Biological Pharmacy</td>
<td>China</td>
<td>CDMO</td>
<td>$26,618</td>
<td>$21,166</td>
<td>$5,452</td>
<td>25.8%</td>
<td>65.8%</td>
<td>NA</td>
</tr>
<tr>
<td>Sanofi</td>
<td>France</td>
<td>Pharma</td>
<td>$128,320</td>
<td>$126,457</td>
<td>$1,862</td>
<td>1.5%</td>
<td>3.9%</td>
<td>16.5%</td>
</tr>
<tr>
<td>Ausun Pharmaceutical</td>
<td>China</td>
<td>API</td>
<td>$2,656</td>
<td>$1,645</td>
<td>$1,011</td>
<td>61.5%</td>
<td>100.7%</td>
<td>338.7%</td>
</tr>
<tr>
<td>Menovo Pharmaceutical</td>
<td>China</td>
<td>API</td>
<td>$1,790</td>
<td>$836</td>
<td>$954</td>
<td>114.1%</td>
<td>156.0%</td>
<td>186.4%</td>
</tr>
<tr>
<td>Ionis Pharmaceuticals</td>
<td>United States</td>
<td>Biotech</td>
<td>$5,248</td>
<td>$4,297</td>
<td>$951</td>
<td>22.1%</td>
<td>-17.1%</td>
<td>-20.3%</td>
</tr>
<tr>
<td>CHO Pharma</td>
<td>Taiwan</td>
<td>Biotech</td>
<td>$1,451</td>
<td>$554</td>
<td>$897</td>
<td>161.9%</td>
<td>533.5%</td>
<td>1397.8%</td>
</tr>
<tr>
<td>Apellis Pharmaceuticals</td>
<td>United States</td>
<td>Biotech</td>
<td>$5,401</td>
<td>$4,603</td>
<td>$798</td>
<td>17.3%</td>
<td>56.6%</td>
<td>167.7%</td>
</tr>
<tr>
<td>Ildong Pharmaceutical</td>
<td>South Korea</td>
<td>Pharma</td>
<td>$1,448</td>
<td>$671</td>
<td>$777</td>
<td>115.8%</td>
<td>331.6%</td>
<td>487.2%</td>
</tr>
<tr>
<td>Medigen Vaccine Biologics</td>
<td>Taiwan</td>
<td>Biotech</td>
<td>$3,044</td>
<td>$2,297</td>
<td>$747</td>
<td>32.5%</td>
<td>41.9%</td>
<td>997.1%</td>
</tr>
<tr>
<td>Qinghai Spring Medicinal Resources</td>
<td>China</td>
<td>API</td>
<td>$1,446</td>
<td>$779</td>
<td>$667</td>
<td>85.7%</td>
<td>160.8%</td>
<td>272.8%</td>
</tr>
<tr>
<td>Hicin Pharma</td>
<td>China</td>
<td>API</td>
<td>$1,041</td>
<td>$378</td>
<td>$663</td>
<td>175.6%</td>
<td>204.4%</td>
<td>154.6%</td>
</tr>
<tr>
<td>GlaxoSmithKline</td>
<td>United Kingdom</td>
<td>Pharma</td>
<td>$109,563</td>
<td>$108,945</td>
<td>$618</td>
<td>0.6%</td>
<td>23.7%</td>
<td>16.7%</td>
</tr>
<tr>
<td>Jincheng Pharmaceutical</td>
<td>China</td>
<td>API</td>
<td>$2,237</td>
<td>$1,758</td>
<td>$479</td>
<td>27.2%</td>
<td>66.2%</td>
<td>87.1%</td>
</tr>
</tbody>
</table>

Source: CapitalIQ
### Top 20 Biggest Decliners in Dollar Value in Q1 2022

Pfizer’s shares have declined 12.2% in Q1 due to the expected reduction in cash flow with the ebbing of the pandemic. Several of the larger biologics CDMOs have also suffered significant drops in value due to easing of capacity shortages with the ebbing of the pandemic.

<table>
<thead>
<tr>
<th>Company</th>
<th>HQ Country</th>
<th>Sector</th>
<th>Market Cap on Mar 31, 2022</th>
<th>Market Cap on Dec 31, 2022</th>
<th>YTD Change</th>
<th>YTD Return</th>
<th>One Year Return</th>
<th>Two Year Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pfizer</td>
<td>United States</td>
<td>Big Pharma</td>
<td>$291,121</td>
<td>$331,440</td>
<td>-12.2%</td>
<td>60.8%</td>
<td>60.8%</td>
<td></td>
</tr>
<tr>
<td>Abbott</td>
<td>United States</td>
<td>Big Pharma</td>
<td>$208,726</td>
<td>$241,365</td>
<td>-13.5%</td>
<td>50.0%</td>
<td>50.0%</td>
<td></td>
</tr>
<tr>
<td>Zoetis</td>
<td>United States</td>
<td>Animal Health</td>
<td>$88,977</td>
<td>$115,457</td>
<td>-22.9%</td>
<td>59.2%</td>
<td>59.2%</td>
<td></td>
</tr>
<tr>
<td>WuXi Biologics</td>
<td>China</td>
<td>Biologics CDMO</td>
<td>$35,000</td>
<td>$50,135</td>
<td>-30.2%</td>
<td>107.9%</td>
<td>107.9%</td>
<td></td>
</tr>
<tr>
<td>Roche</td>
<td>Switzerland</td>
<td>Big Pharma</td>
<td>$322,971</td>
<td>$336,558</td>
<td>-4.0%</td>
<td>16.6%</td>
<td>16.6%</td>
<td></td>
</tr>
<tr>
<td>Lonza</td>
<td>Switzerland</td>
<td>Biologics CDMO</td>
<td>$54,154</td>
<td>$62,059</td>
<td>-12.7%</td>
<td>74.6%</td>
<td>74.6%</td>
<td></td>
</tr>
<tr>
<td>Changchun High &amp; New Technology</td>
<td>China</td>
<td>Biosimilars</td>
<td>$10,693</td>
<td>$17,291</td>
<td>-38.2%</td>
<td>31.7%</td>
<td>-31.7%</td>
<td></td>
</tr>
<tr>
<td>Samsung Biologics</td>
<td>South Korea</td>
<td>Biologics CDMO</td>
<td>$45,046</td>
<td>$50,159</td>
<td>-10.2%</td>
<td>71.7%</td>
<td>71.7%</td>
<td></td>
</tr>
<tr>
<td>Avantor</td>
<td>United States</td>
<td>Tools</td>
<td>$20,629</td>
<td>$25,682</td>
<td>-19.7%</td>
<td>188.3%</td>
<td>188.3%</td>
<td></td>
</tr>
<tr>
<td>Innoven Biologics</td>
<td>China</td>
<td>Biotech</td>
<td>$5,045</td>
<td>$9,047</td>
<td>-44.2%</td>
<td>-10.9%</td>
<td>-10.9%</td>
<td></td>
</tr>
<tr>
<td>Kodiaki Sciences</td>
<td>United States</td>
<td>Biotech</td>
<td>$398</td>
<td>$4,350</td>
<td>-90.8%</td>
<td>-81.1%</td>
<td>-81.1%</td>
<td></td>
</tr>
<tr>
<td>Celltrion</td>
<td>South Korea</td>
<td>Biosimilars</td>
<td>$19,602</td>
<td>$23,164</td>
<td>-15.4%</td>
<td>-22.1%</td>
<td>-22.1%</td>
<td></td>
</tr>
<tr>
<td>Mirati Therapeutics</td>
<td>United States</td>
<td>Biotech</td>
<td>$4,562</td>
<td>$8,100</td>
<td>-43.7%</td>
<td>36.5%</td>
<td>36.5%</td>
<td></td>
</tr>
<tr>
<td>Bachem</td>
<td>Switzerland</td>
<td>Biologics CDMO</td>
<td>$8,183</td>
<td>$11,582</td>
<td>-29.3%</td>
<td>190.2%</td>
<td>190.2%</td>
<td></td>
</tr>
<tr>
<td>Intella Therapeutics</td>
<td>United States</td>
<td>Biotech</td>
<td>$5,426</td>
<td>$8,799</td>
<td>-38.3%</td>
<td>778.5%</td>
<td>778.5%</td>
<td></td>
</tr>
<tr>
<td>Bloomage BioTechnology</td>
<td>China</td>
<td>Biologics CDMO</td>
<td>$9,181</td>
<td>$11,734</td>
<td>-21.8%</td>
<td>77.4%</td>
<td>77.4%</td>
<td></td>
</tr>
<tr>
<td>Hualan Biological Engineering</td>
<td>China</td>
<td>Biosimilars</td>
<td>$5,844</td>
<td>$8,369</td>
<td>-38.4%</td>
<td>78.3%</td>
<td>78.3%</td>
<td></td>
</tr>
<tr>
<td>I-Mab</td>
<td>China</td>
<td>Biotech</td>
<td>$1,341</td>
<td>$3,647</td>
<td>-63.2%</td>
<td>78.3%</td>
<td>78.3%</td>
<td></td>
</tr>
<tr>
<td>Arrowhead Pharmaceuticals</td>
<td>United States</td>
<td>Biotech</td>
<td>$4,850</td>
<td>$6,930</td>
<td>30.0%</td>
<td>65.8%</td>
<td>65.8%</td>
<td></td>
</tr>
<tr>
<td>Vir Biotechnology</td>
<td>United States</td>
<td>Biotech</td>
<td>$3,403</td>
<td>$5,480</td>
<td>-37.9%</td>
<td>-9.6%</td>
<td>-9.6%</td>
<td></td>
</tr>
</tbody>
</table>

Source: CapitalIQ
140 Negative Enterprise Life Sciences Companies in First Week of April 2022

Note: Enterprise value is defined as market cap less cash plus debt. A company with negative enterprise value is trading at less than cash.

Source: CapitalIQ
Funds Flow Trends are Positive
After outflows in February, March saw money flow into biopharma funds tracked by EPFR.

Net Funds Flow by Month into Biopharm Funds Tracked by EPFR ($ millions)

- October 2021: $1,481 (Increase)
- November 2021: $685 (Increase)
- December 2021: $1,147 (Increase)
- January 2022: $2,105 (Increase)
- February 2022: $1,005 (Decrease)
- March 2022: $1,842 (Increase)

Source: EPFR Informa, April 1, 2022
Oil Prices Volatile in Last Week

April 1, 2022: The unprecedented decision by Biden to release 180 million barrels of oil from the country’s strategic petroleum reserve over the next six months has sent oil prices below $100. While plenty of upside risks remain, oil prices are on course to see their largest weekly decline in two years.

Sources: (chart) Federal Reserve Bank of St. Louis (FRED); (quote) https://oilprice.com/Energy/Oil-Prices/Bidens-SPR-Release-Sends-Oil-Prices-Below-100.html
Japan Economy Impacted by Fuel Prices

TOKYO, March 23 (Reuters) - Japan's ruling coalition on Wednesday agreed to compile a fresh stimulus package to cushion the economic blow from surging fuel and grain prices caused by the war in Ukraine.

Prime Minister Fumio Kishida, who heads the Liberal Democratic Party (LDP), said he will order the government to start compiling the package as early as next week.

"The government must carry out solid counter-measures for rising prices of oil, raw materials and (other) goods, to revive Japan's economy," he told reporters after meeting with Natsuo Yamaguchi, leader of the LDP's ruling coalition partner Komeito.

Germany — Europe's largest economy — has activated an emergency plan to deal with disruptions to its natural-gas supply after Russian President Vladimir Putin demanded payment in rubles.

Russian gas accounted for 55% of Germany's gas imports in 2021 and 40% of its gas imports in the first quarter of 2022, Reuters reported.

Germany is in the "early warning phase" of its emergency plan, with Berlin calling all consumers — from industry to households — to conserve energy and reduce consumption. If the situation worsens, the country may start rationing gas in the last of the three-stage plan, as outlined by Germany's economy ministry.

"There are no supply bottlenecks at present. Nevertheless, we need to step up our preventive measures in order to be ready to cope with any escalation by Russia," Robert Habeck, Germany's economy minister, said in a statement on Wednesday.

Key U.S. Bond Market Developments in Last Week

This week we look at term spreads and risk spreads in the bond market. For more on the yield curve’s meaning we recommend Investopedia’s article.

Inversion of the Yield Curve Portends Recession

U.S. Treasury Bond Yields

Risk spreads on corporates have returned to near historic lows

BofA BB US High Yield Index Option-Adjusted Spread

Source: Federal Reserve Bank of St. Louis (FRED)
Fed Arguing that Two-Year / Ten-Year Spread Not Very Relevant for Recession Risk

THE WALL STREET JOURNAL.

April 2, 2022: In some cases the Fed has reversed course during cycles of interest-rate increases and averted recession, as in 1998. It also reversed course in 2019, and might have averted recession had the Covid-19 pandemic not occurred.

Right now, the Fed officials say they have time before such concerns become relevant.

Yield curves can be measured using interest rates across a wide spectrum of maturities, from overnight to 30 years, and some inversions matter more than others. Though investors often look at differences between yields on two-year and 10-year Treasury notes, Fed researchers Eric Engstrom and Steven Sharpe concluded those weren’t the rates that actually mattered.

They found the relationship of rates over shorter horizons of less than two years was a more accurate measure of the risk of recession. They compare current three-month Treasury-bill rates to market expectations for three-month rates 18 months in the future. Using that approach, recession alarms aren’t ringing. Short-term rates are much lower than expected rates 18 months from now.

“There is no need to fear the 2-10 spread,” Messrs. Engstrom and Sharpe argued in a recent paper.

Fed Chairman Jerome Powell seemed to endorse the view in comments to the National Association for Business Economics in March. Like Mr. Engstrom and Mr. Sharpe, he said, “I tend to look at the shorter part of the yield curve.”

Very Strong U.S. March Jobs Report

<table>
<thead>
<tr>
<th>March jobs one-month net change</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Leisure and hospitality</td>
<td>+112K</td>
</tr>
<tr>
<td>Professional and business services</td>
<td>+102K</td>
</tr>
<tr>
<td>Retail trade</td>
<td>+49K</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>+38K</td>
</tr>
<tr>
<td>Health care and social assistance</td>
<td>+33.3K</td>
</tr>
<tr>
<td>Construction</td>
<td>+19K</td>
</tr>
<tr>
<td>Information</td>
<td>+16K</td>
</tr>
<tr>
<td>Financial activities</td>
<td>+16K</td>
</tr>
<tr>
<td>Wholesale trade</td>
<td>+7K</td>
</tr>
<tr>
<td>Government</td>
<td>+5K</td>
</tr>
<tr>
<td>Mining and logging</td>
<td>+3K</td>
</tr>
<tr>
<td>Transportation and warehousing</td>
<td>-500</td>
</tr>
<tr>
<td>Utilities</td>
<td>-1.2K</td>
</tr>
</tbody>
</table>

Reversal of Great Resignation Underway

But with Americans’ fears of the coronavirus falling, schools returning to in-person instruction, and surplus savings dwindling, some of the most significant factors fueling what has become known as the Great Resignation are starting to ease. The result is a small but significant bump up in the labor-force participation rate over the past six months and a slowdown in the share of Americans quitting their jobs—two dynamics economists expect to accelerate as the labor market, like much of U.S. society, lumbers toward a postpandemic normal.

Source: https://www.barrons.com/articles/great-resignation-51648145887
U.S. Inflation Unabated in March

The Fed’s preferred inflation gauge rose 5.4% in February, the highest since 1983

The Federal Reserve’s favorite inflation measure showed intensifying price pressures in February, rising to its highest annual level since 1983, the Commerce Department reported Thursday.

Excluding food and energy prices, the personal consumption expenditures (PCE) price index increased 5.4% from the same period in 2021, the biggest jump going back to April 1983.

Including gas and groceries, the headline PCE measure jumped 6.4%, the fastest pace since January 1982.

The core PCE increase actually was a touch lower than the 5.5% Dow Jones estimate. On a monthly basis, the gauge was up 0.4%, in line with estimates.

Surging prices dented consumer spending, which rose just 0.2% for the month, below the 0.5% estimate. Disposable personal income increased 0.4%, a touch below the 0.5% expectation, while real disposable income fell 0.2%. Savings nudged higher to $1.15 trillion, or a rate of 6.3%.

In other economic news Thursday morning, the Labor Department reported that initial jobless claims totaled 202,000 for the week ended March 26. That was an increase of 14,000 from the previous week and ahead of the 195,000 estimate, but still below the level that prevailed prior to the Covid pandemic.

Russian Forces Retreat From Areas Surrounding Kyiv

Major Setback for Russia, but U.S. Cautions Troops Could Be Regrouping

* Analysts said Russia was pulling away from areas around the Ukrainian capital, a significant turn in the sixth week of war.
* A humanitarian convoy was set to try again to deliver aid to the besieged city of Mariupol and help with the evacuation. Here's the latest.

How Kyiv Has Withstood Russia’s Attacks

Russia has more troops and more firepower. Why has it failed to seize the Ukrainian capital?

By stabilizing the ruble and threatening to cut off gas, Vladimir Putin proved he wields economic power — but at a cost.

In Vasylov, a town near Kyiv, outgunned residents fought off Russia in the war’s early days, entering Ukrainian lore.

With Russia’s invasion, Hungary’s far-right leader has softened his embrace of Moscow.

A tank’s giant U-turn at sea revealed strains in the market for Russian oil.

Pope Francis edged closer to directly blaming the war in Ukraine on Vladimir Putin, blaming it on a “potentate.”
Outlook for Recovery from Bear Market in Biotech
This Year is a Moment of Truth for Biotech

- M&A volume down big (so far). Less access to public market capital. IPO's very difficult to pull off.
- Investors we speak with are much more discerning. Favoring later stage assets. Some companies will not make it through 2022/23 period, particularly those with relatively weak stories / asset.
- This year is a moment of truth. Companies need to deliver on key milestones and data to prove the value of their assets. Thus far in 2022, biotech has not covered itself in glory (see lower right).
- Possibly, we will see an extended capital drought. Past downturns (2000 and 2007 followed by extended loss of access to capital – 2 to 5 year down periods).
- Companies that raised cash in 2020-21 will likely benefit from managing costs aggressively.
- Some industry observers worry that too many biotechs today are too slow reducing costs in light of less future access to capital.
- Further, some major long-only fund investors quite concerned about rates going higher than currently envisioned due to strength of inflation and election year dynamics, reducing the value of long-dated cash flows from innovation. These investors see early biotech as a highly risky place to invest. This suggests that earlier stage companies may be particularly vulnerable to a capital drought.
- We think its worth reviewing history. How much time has it taken for the follow-on, IPO and other markets to open broadly to biotech and other cash-flow negative life sciences companies?
- We take a look at balance sheet status and employment trends in the section to follow.

Bruce Booth twitter thread notes that biotech has not been doing a great job of delivering in 2022

https://twitter.com/LifeSciVC/status/1503421661370101766?s=20&f=tweet_99dfXAd7w4Nq5-CiFxw
Recovery Time Analysis: How Long Does it Take for the Market to Bounce Back from a Major Biotech Value Decline?

There are two historical analogues to the current situation (2000 and 2015). The average time for stocks to jump 50% from trough is 19.5 months. We are currently 8 months into a bear market. If history is a guide, there is a year to go before a robust recovery has taken hold. It’s important to note that there is high variability in the time it takes the market to recover from a downturn.

**NASDAQ Biotech Index (NBI), 1993-2022**

### The Genomics Bubble

The market peaked on Mar 6, 2000 surrounding the peak of interest in genomics. This episode feels most similar to what we have been through with the pandemic. The market dropped precipitously and had three major rallies through the Bear Market until bottoming on Jul 10, 2002 (28 months later). On Jul 10, the NBI was down 73.5% from its peak. The market was up 50% within eight months and 100% within eighteen months but didn’t return to its peak point for another ten years.

### Global Financial Crisis

Not comparable to current circumstances. At its worst, the NBI was only down 18% from peak.

### Patents & Hillary’s Tweet

The NBI quadrupled from 2010 to 2015. On Jul 20, 2015 the NBI hit 4166 and started to fall due to concerns on patents and drug pricing (augmented by Hillary’s famous tweet). By Feb 11, 2016 it bottomed at 2552 (-39%). The market recovered very slowly and was up 50% by Sep 27, 2018 (31 months).
Recovery Time Analysis: How Long Does it Take for the Follow-On Equity Market to Recover?

There are two historical analogues to the current situation (2000 and 2015). The average time for the follow-on equity market to recover is three to four years.

It's important to note that the follow-on equity issuance market never truly shuts but there are many biotech companies that have been caught unable to finance following severe market declines. The industry mantra that a company should keep three years of burn appears to be well founded.

Total Global Biopharma Market Follow-On Equity Issuance Activity, 1996 to 2022

The Genomics Bubble
The follow-on market never went away but volume was much reduced after 2000. We didn’t see follow-on volume recovery meaningfully until 2005. Issuers faced a much more difficult environment than before and many biotech companies were not able to finance and went out of business in the 2001 to 2005 period due to lack of equity finance.

Global Financial Crisis
The follow-on market collapsed in 2008 during the GFC and came back quickly in 2009.

Patents & Hillary’s Tweet
Follow-on market was down 54% from 2015 to 2016 and then bounced back nicely by 2018.
Recovery Time Analysis: How Long Does it Take for IPO Market to Recover?

This chart plots 44 years of U.S. biotech IPO history. The market is highly episodic and alternates between periods when the window is “open” and when it is fully or largely closed.

Following the market crashes of 1987, 2000 and 2008, it took the market on average four years to recover. By this metric, we could expect to see a normal IPO market in biotech return in 2025.

Source: IPO count data are from Stelios Papadopoulos’ IPO data from 1979 to 2016 and from CapIQ from 2017 to 2022.
Biotech Funding and Employment Trends
Unprecedented Access to Capital Built Balance Sheet
Strength in Biotech in Recent Years

By our calculations, biopharma companies raised $175 billion in equity in 2021, shattering the all-time previous record of $120 billion raised in 2020. An additional $9.6 billion was raised in the private debt and royalty monetization markets.

For 2022, we have taken Q1 totals and annualized them for the purpose of comparison. The equity privates market remains close to the level of issuance in 2021 and the debt privates market is at an all-time issuance level.

In contrast, the IPO market and the follow-on equity markets are down significantly from 2021 levels.

Source: CapitalIQ, Torreya internal databases and Crunchbase.
Q1 2022 Transaction Biopharma Sector Activity (Annualized) Versus Activity Levels in 2021 and 2019

The venture equity privates market continues to far surpass levels of 2019 and is on par with activity from 2021. The IPO market in 2022 looks similar in volume to the market in 2019. Follow-ons are down versus both prior years. Private debt is way up and M&A is way down versus both 2021 and 2019.

Change in Transaction Dollar Volume by Deal Type (Q1 2022 annualized vs prior years)

Source: CapitalIQ, Torreya internal databases and Crunchbase.
Median Net Cash Position of Public Biotech Declining Rapidly by Quarter

<table>
<thead>
<tr>
<th>Year</th>
<th>Median Net Cash Position of Biotech</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>$23</td>
</tr>
<tr>
<td>2017</td>
<td>$31</td>
</tr>
<tr>
<td>2018</td>
<td>$31</td>
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<tr>
<td>2019</td>
<td>$41</td>
</tr>
<tr>
<td>2020</td>
<td>$101</td>
</tr>
<tr>
<td>Sep-21</td>
<td>$127</td>
</tr>
<tr>
<td>Jan-22</td>
<td>$117</td>
</tr>
</tbody>
</table>

Cash positions for quarter ended March 31, 2022 have not yet been fully reported.

Assuming that burn has not changed we would expect to see median biotech cash among the top 500 biotechs now at around $97 million.

This is obviously high by historical standards but it is also clear that the "pandemic gift" to the industry's balance sheets is rapidly being spent.

Source: CapitalIQ
Public Biotech Balance Sheet Status

Aggregate Balance Sheet Position of Top 500 Global Biotechs
(Selected by Enterprise Value, Sep 1, 2021)

Summary Cash Position of Top 500 Global Biotechs
(by Enterprise Value, Sep 1, 2021)

Source: CapitalIQ, Biotechs were defined as companies in the biopharma sector that do not yet have a commercial product.
Public Biotech Spend Behavior

Biotechs have not restrained spend, on average, through end of year 2021. As a result, average median years of trailing burn on the balance sheet has rapidly declined to around 2X cash. We would expect that as of March 31, 2022 median years of burn would be well below 2X for the industry given current spend trends.

**Median Years of Burn Among Top 500 Global Biotechs**
(Selected by Enterprise Value, Sep 1, 2021, Including only companies that burn cash)

<table>
<thead>
<tr>
<th>Year</th>
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<td>1.8</td>
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<tr>
<td>2017</td>
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<td>2018</td>
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<td>2019</td>
<td>1.7</td>
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<tr>
<td>2020</td>
<td>2.7</td>
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<tr>
<td>Sep-21</td>
<td>2.7</td>
</tr>
<tr>
<td>Jan-22</td>
<td>2.1</td>
</tr>
</tbody>
</table>

**Big Burners Among Top 500 Global Biotechs**
(Selected by Enterprise Value, Sep 1, 2021)

- Burning over $100mm a Year
- Burning over $200mm a Year

Source: CapitalIQ, Biotechs were defined as companies in the biopharma sector that do not yet have a commercial product.
Employment Changes in Biotech: Layoff Stories Commonplace in Last Few Weeks

Online biotech news sites have prominently featured stories on layoffs in recent weeks. One could get the impression that the industry is going through a major slimdown in employment levels.

We have opted to track contemporaneous employment changes in biotech (and pharma) using LinkedIn. This business social networking site is heavily used in the U.S. as it’s a good place for employees to share information and be seen by recruiters. For U.S. domiciled companies with largely domestic operations LinkedIn gives a very good sense of employee count.

This is shown in the chart at right which compares Dec 31, 2022 employee count from LinkedIn by biotech and specialty pharma to the count provided in each company’s 10K report. The correlation between the two was 0.996 and the counts were not biased.

LinkedIn is used less by employees outside the U.S. and Europe. It is also used less by blue collar employees who traditionally avoid inter-company networking and job seeking facilitated by the site. Because there is no automated method to collect LinkedIn data we have opted to collect a sample of employment data on 78 biopharma companies rather than to collect data on every company. We have attempted to oversample companies that are in the news with layoffs. This data will give a good picture of what is going on.

It is worth noting that LinkedIn data may understate the scale of layoffs as employees often do not update their profile until they find a new job even if they have been terminated from prior employment.

Source: CapitalIQ and LinkedIn.
## Listing of 78 Companies Included in Employment Study

<table>
<thead>
<tr>
<th>Big Pharma</th>
<th>Large Pharma</th>
<th>Smaller Pharma</th>
<th>MidCap Biotech</th>
<th>Small Cap Biotech</th>
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<td>ENTERPRISE VALUE $10BN to $100BN</td>
<td>ENTERPRISE VALUE &lt; $10BN</td>
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<td>Zai Lab</td>
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<td>Intellia</td>
<td>Passage Bio *</td>
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<td>Silverback *</td>
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<td>Zentalis Pharma</td>
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Study approach: We selected all U.S. and EU publicly listed companies in the big and large cap pharma categories. We randomly chose nine names from the small pharma list; 29 names from the midcap biotech list and 15 names from the small cap list. We then selected four additional small cap biotechs that are in the news (noted with an asterisk) for making layoffs with the goal of illustrating the actual effect of layoffs on employment.
Slightly over 90% of public reporting life sciences companies provide information on employee count at the end of their last fiscal year (most often, Dec 31, 2022). All of the top 40 companies in the industry by enterprise value disclose employee count. As a result, the data here should give a good picture of employment patterns in the life sciences sector.

Commercial pharma is the largest employer by far with over 3.4 million employees. Devices companies have over 1.3mm while tools, pharma services, API and diagnostics are all important.

The biotech sector accounts for 113,873 jobs – important but modest in the greater scheme of the industry. The reporting public companies listed here employ over 6 million people in total.
Employment Grew by 12% Across Biopharma in the Last Two Year

In the sample of 78 biopharma companies, total employment has been rising over time. We have seen employment rise in 2022 alone so far by 22,000 jobs.
Biotechs are Not Massively Shedding Employees

In this sample of 47 small and mid-cap biotechs, the group has added employees overall since the start of the year. In the last two weeks there has been a 0.3% decline in employee count.

Put differently, the frequent news stories of layoffs hide a reality that the industry as a whole is not cutting employees in any meaningful way. Importantly, we attempted to oversample companies in the news with layoffs and still count find little evidence of radical change in employment patterns.

Source: LinkedIn, April 2, 2022
Biotech companies in our sample are not aggressive in managing down costs until they have less than a year of remaining cash. Even then, they keep most of their employees.

Percent Change in Employee Count, Dec 31, 2021 to April 1, 2022 by Years of Remaining Balance Sheet Cash and Investments as of Dec 31, 2021 (last reporting period, sample of 47 biotechs using employment data from LinkedIn)

-27.1% Less than a year of cash
- 2.9% One to two years of cash
- 9.2% Two to three years of cash
- 4.4% Three or more years of cash

Source: LinkedIn, April 2, 2022
The war for talent never ends in the life sciences industry. As employees leave small biotech, everyone else is scooping up the new talent on the market.

Source: LinkedIn, April 2, 2022
Back to Pharma. Two Big Pharmas are Hiring Heavily During the Biotech Swoon

*AbbVie and AstraZeneca have both been aggressively stepping up hiring now that the life sciences labor market is easing up a bit.*

*New Hires Per Month, AstraZeneca, April 2020 to March 2022*

- Senior management

*New Hires Per Month, AbbVie, April 2020 to March 2022*

- Senior management

Source: LinkedIn, April 2, 2022
Sequoia’s Letter to Portfolio Companies in 2008

Sequoia’s partners encouraged portfolio companies to cut cash quickly to enhance survival.

Click here to download.
WASHINGTON — President Biden’s “moonshot” biomedical research agency will be housed within the National Institutes of Health, according to two sources familiar with the decision-making process. The decision marks the end of a lengthy debate in Washington about whether the new agency, known as ARPA-H, should be independent or exist as a wing of the NIH.

But there’s a twist: Instead of reporting to the NIH director, the new agency’s leader will report directly to the secretary of health and human services.

Health secretary Xavier Becerra began to communicate the decision to Capitol Hill on Wednesday, just hours ahead of a congressionally imposed deadline. It comes on the heels of a last-ditch lobbying campaign by research advocates desperate for ARPA-H to escape the shadow of the notoriously bureaucratic and slow-moving NIH.

Source: https://www.statnews.com/2022/03/31/arpa-h-part-of-nih-with-twist/
With a 6-4 vote, the group of independent advisers to the agency narrowly concluded that results from another clinical trial are needed to assess whether the therapy, called AMX0035, can help patients.

**New A.L.S. Treatment Lacks Evidence of Benefit, F.D.A. Panel Finds**

*New York Times – March 30, 2022:* “By a narrow margin, a federal panel of independent medical experts concluded Wednesday that there is not yet enough evidence that an experimental therapy for amyotrophic lateral sclerosis, commonly known as A.L.S., is effective in treating the devastating and fatal neurological disorder.

The 10-member advisory panel to the Food and Drug Administration voted 6 to 4 that available scientific data on the therapy, a two-drug combination conceived by two college students, was insufficient to show it could help patients by slowing the progression of A.L.S., a ruthless disease that impairs people’s ability to move, speak, eat and ultimately breathe.

The nonbinding vote on the therapy, AMX0035, supported the F.D.A.’s own analysis. The agency will decide whether to approve the drug in the coming months.

Groups representing patients have waged an impassioned campaign for approval, given the dearth of medications for A.L.S., also called Lou Gehrig’s disease, which often causes death within two to five years.”

Source: [https://www.nytimes.com/2022/03/30/health/als-treatment-amx0035.html](https://www.nytimes.com/2022/03/30/health/als-treatment-amx0035.html)
What is the future of immunotherapy?

BY PADMANEE SHARMA, M.D., PH.D.

Immunotherapy represents a new paradigm in cancer care. It's really an entirely new mechanism for treating cancer. We're not targeting the tumor cells; instead, we're targeting the immune system. This approach has had tremendous success and has allowed us to think of the word 'cure' more often for patients with metastatic cancers.

However, we're not curing every patient yet. We know there's room for improvement. Now, with the launch of MD Anderson’s James P. Allison Institute, we will be focused on learning how we can fully bring the immune system into play and bring the benefits of immunotherapy to all patients.

Building immunotherapy from a foundation of basic science

The benefits we're now seeing with immunotherapy are possible because of basic scientific discoveries. We've wanted to incorporate the immune system into cancer care for more than 100 years. But we couldn't do it successfully because we didn't have the basic understanding.

Source: https://www.mdanderson.org/cancerwise/what-is-the-future-of-immunotherapy.h00-159538167.html
IQVIA Webinar on R&D Productivity

View the Webinar

https://www.iqvia.com/events/2022/03/global-trends-in-r-and-d

Report Summary


Key Topics

1. Record funding, trial activity, biotech importance
2. Lower productivity
3. Lessons learned during the pandemic
4. Greater use of outsourcing
5. Importance of China and South Korea
6. Key industry regulatory issues in 2022
March 31, 2022: Since its initial release in 2000, the human reference genome has covered only the euchromatic fraction of the genome, leaving important heterochromatic regions unfinished. Addressing the remaining 8% of the genome, the Telomere-to-Telomere (T2T) Consortium presents a complete 3.055 billion-base pair sequence of a human genome, T2T-CHM13, that includes gapless assemblies for all chromosomes except Y, corrects errors in the prior references, and introduces nearly 200 million base pairs of sequence containing 1956 gene predictions, 99 of which are predicted to be protein coding. The completed regions include all centromeric satellite arrays, recent segmental duplications, and the short arms of all five acrocentric chromosomes, unlocking these complex regions of the genome to variational and functional studies.

Source: https://www.science.org/doi/10.1126/science.abj6987
Vertex Has Positive Data on Nav1.8 Target for Pain

Vertex Announces Statistically Significant and Clinically Meaningful Results From Two Phase 2 Proof-of-Concept Studies of VX-548 for the Treatment of Acute Pain

- Treatment with the NaV1.8 inhibitor VX-548 met the primary endpoint in both Phase 2 proof-of-concept acute pain studies following abdominoplasty or bunionectomy surgery -
- VX-548 was generally well tolerated -
- Results further highlight NaV1.8 as a new mechanism that could create an alternative to opioids for the treatment of pain -

BOSTON--(BUSINESS WIRE)--Mar. 31, 2022-- Vertex Pharmaceuticals Incorporated (Nasdaq: VRTX) today announced positive results from two Phase 2 proof-of-concept (POC) studies that investigated treatment with the selective NaV1.8 inhibitor VX-548 for acute pain following abdominoplasty surgery or bunionectomy surgery. Treatment with an initial dose of 100 mg followed by 50 mg every 12 hours of VX-548 (high-dose) compared to placebo resulted in a rapid, statistically significant and clinically meaningful improvement in the primary endpoint of the time-weighted Sum of Pain Intensity Difference over 48 hours (SPID48), which was consistent in both trials. The study also included an active reference arm of the opioid hydrocodone bitartrate/acetaminophen (HB/APAP) to support the evaluation of the VX-548 treatment effect.
The Senate is in the process of forging an agreement that would provide $10 billion in new funding for COVID-19-related aid. “We are working diligently to finalize language, scoring and a final agreement on what should be funded in the final COVID package, both domestic and international,” said Senate Majority Leader Chuck Schumer.

Food and Drug Administration chief Dr. Robert Califf admitted that the agency’s reputation took a hit after the controversial approval of Biogen’s Alzheimer’s drug Aduhelm. “It’s pretty clear that the controversy around this has temporarily impacted the trust in the FDA by people who pay attention to these things,” Califf said.

More than four in 10 teenagers reported a decline in mental health and one in five said they have contemplated suicide, according to new data from the Centers for Disease Control and Prevention. The agency is warning of a mental health crisis among young people exacerbated by the pandemic.

Source: https://www.mmm-online.com/home/channel/roundup/five-things-for-pharma-marketers-to-know-friday-april-1-2022/
Pandemic Update
COVID-19 Case Load Dropping

1,406,584
New cases reported worldwide, April 3, 2022

6,151,255
Total deaths reported worldwide

> 10 Billion
Vaccinations delivered in 183 countries

COVID caseload continues to decline. Widespread immunity across the planet.

Source: Johns Hopkins Database, April 3, 2022
Global Deaths from COVID-19 Are Down Substantially

The number of daily deaths has not been this low since May of 2020. Despite widespread infection with the Omicron BA1.2 variant, fatalities have been few.

Source: Johns Hopkins Database, Apr 3, 2022.
UK hits record COVID-19 levels with nearly 5 million people infected

LONDON (AP) — The prevalence of COVID-19 in the U.K. has reached record levels, with about 1 in 13 people estimated to be infected with the virus in the past week, according to the latest figures from Britain's official statistics agency.

Some 4.9 million people were estimated to have the coronavirus in the week ending March 26, up from 4.3 million recorded in the previous week, the Office for National Statistics said Friday. The latest surge is driven by the more transmissible omicron variant BA.2, which is the dominant variant across the U.K.

Hospitalizations and death rates are again rising, although the number of people dying with COVID-19 is still relatively low compared with earlier this year. Nonetheless, the latest estimates suggest that the steep climb in new infections since late February, when British Prime Minister Boris Johnson scrapped all remaining coronavirus restrictions in England, has continued well into March.

Source: https://www.pbs.org/newshour/world/uk-hits-record-covid-19-levels-with-nearly-5-million-people-infected
Shanghai is Shut Down due to COVID in Early April

April 3, 2022 - Shanghai on Sunday ordered its 26 million residents to undergo two more rounds of tests for COVID-19 as public anger grows over how authorities in China's most populous city are tackling a record coronavirus surge. Residents should self-test on Sunday using antigen kits and report any positive results, Shanghai government officials told a news conference, while a nucleic acid test would be conducted citywide on Monday.

"The main task is to completely eliminate risk points and to cut off the chain of transmission so that we can curb the spread of the epidemic as soon as possible," said Wu Qianyu, an inspector from Shanghai Municipal Health Commission. Essentially all of China's financial capital is locked down after the city began curbing movement in its eastern districts last Monday, extending the restrictions to the entire city days later.

Shanghai’s lockdown has massively disrupted daily life and businesses, even as healthcare workers and volunteers work round the clock trying to test the entire population and supply residents with groceries. China's COVID caseload remains low by international standards, but spikes in places like Shanghai are testing its previously successful approach of stamping out the virus through strict curbs and aggressive testing and tracing.

Public Equity Offerings
Last week saw two IPOs in China. The U.S. and EU IPO markets remain shut.
Biopharma IPO Volume ($ million), Monthly, June 2020 to March 2022

**Q1 2022 IPO volume was down by 52% versus Q1 2021. If China deals are taken out, the decline would be far higher.**

Source: CapitalIQ
Last week saw very weak follow-on market issuance volume. The largest deal was a $200mm raise by IGM on the back of its deal with Sanofi.
Monthly Equity Follow-On Volume (Worldwide, Biopharma Sector)

Equity Follow-On ($volume, $mm), June 2020 to March 2022

Q1 2022 equity follow-on volume was down by 76% versus Q1 2021.

Source: Data from CapitalIQ
As shares skyrocket on Sanofi deal, IGM Biosciences looks to bag $200M

Endpoint News, March 29, 2022: IGM Biosciences didn’t skip a beat capitalizing on all the new love pouring in for its stock. Just hours after unveiling a deal with Sanofi worth up to $6.15 billion — including $150 million in immediate cash — the biotech is out to raise $200 million in a public offering. Devoted to developing the class of antibodies it gets its name from, IGM said the proceeds will fund ongoing clinical work, new discovery efforts and manufacturing buildout. It’s also putting out an option for underwriters to purchase up to $30 million more.

Sanofi has indicated an interest in buying up to $100 million of shares, the company noted. While IGM’s current candidates are all in the cancer space, it has ambitions to take the IgM platform into infectious diseases as well as autoimmune and inflammatory diseases, on top of the oncology and immunology programs it’s developing for Sanofi. Carrie Brodmerkel, formerly global head of exploratory biology and scientific strategy at J&J’s Janssen R&D, is jumping on board as CSO of IGM Autoimmunity and Inflammation. Compared to IgG antibodies — which is typically what people think of when talking about therapeutic antibodies — IgM boasts many more binding sites.

“You can think of an IgM in very rough terms as five IgGs arranged around in a pizza-like structure,” CEO Fred Schwarzer said in an investor call Tuesday morning. “If you take the sixth bite of the pizza out, that’s where a linking protein called the joining chain, or the J chain, converts the IgM into a pentamer. IgM has 10 binding units as compared to the two binding units of IgG antibody and that gives the IgM antibody a strong advantage and total binding power.”

Source: https://endpts.com/as-shares-skyrocket-on-sanofi-deal-igm-biosciences-looks-to-bag-200m/
Private Capital Markets Environment
We saw $1 billion in private venture equity placements complete last week. This was a solid performance given market conditions.

Source: Data from CapitalIQ, Crunchbase.
March 14, 2022: CAMBRIDGE, Mass., March 29, 2022 /PRNewswire/ -- ConcertAI, LLC (ConcertAI), the leader in enterprise AI and real-world data (RWD) solutions for life sciences and healthcare, announced the close of its $150 million Series C investment from Sixth Street, a leading global investment firm, at a $1.9 billion valuation.

From its startup just five years ago, ConcertAI has emerged as one of the fastest-growing companies providing high-value software-as-a-service (SaaS) and data solutions to life sciences and biopharma companies, leading healthcare providers, contract research organizations, medical societies, and regulators in the US, Europe, and Japan.

In the past 36 months, the company has expanded its customer base and partnerships to more than 45 life sciences companies and contract research organizations (CROs) with SaaS solutions across the product lifecycle: supporting approximately 40 new product launches, improving time on therapy by 10%, and reducing time for study design and projected clinical trial execution times up to 25%. The leading oncology biopharma companies, including Janssen and BMS, are multi-product strategic partners.

“Our Series C represents another milestone in our emergence as the leader in accelerating biomedical innovations through AI SaaS clinical trial solutions and improved patient outcomes through the generation of real-world evidence for peer-review publications, regulatory decisions, and clinical interpretation. Our solutions now span the entire lifecycle of therapeutics with our data-as-a-service and AI SaaS solutions for biopharma through to our TeraRecon solutions for clinical decision support, confederating an ecosystem of leading biomedical innovators and healthcare providers – all in assurance of best possible clinical outcomes for patients.”


Jeff Elton
CEO, ConcertAI
The Count of Venture Privates in Biotech, AI, Diagnostics at an All-Time Record Level in Q1 2022

Number of Biopharm and Diagnostics Venture Privates by Year

Source: CapitalIQ, Crunchbase, Torreya databases
C-Bridge Healthcare Fund V Closes with $1.67 billion

Healthcare firm CBC eyes global expansion after closing flagship above hard-cap

CBC, which made its name in Chinese healthcare, will open two international offices this year amid plans to become a 'one-stop' healthcare asset management shop, CEO Wei Fu tells PEI.

We build and empower transformational healthcare companies by pushing innovation boundaries and forming operating platforms

V-Bio Ventures raises EUR 110 million for its second fund and expands team

GHENT, BELGIUM, March 31, 2022 /EINPresswire.com/ -- Together with their first fund, V-Bio Fund 1, V-Bio Ventures will have over EUR 185 million under management, putting it in a very good position to fund promising innovative companies. Almost all limited partners of their first fund are participating in this second fund, as are multiple new investors. V-Bio Ventures is a venture capital company that focuses specifically on the segment of young pioneering biotech companies and its strategy to invest in transformational companies in the medical and agricultural sector will remain unchanged in this second fund. V-Bio Fund 2 will also maintain its fruitful relationship with VIB, Europe’s leading life sciences institute, to access deals from the renowned research center that has spun out multiple successful biotech companies such as Ablynx.

V-Bio Ventures is expanding their team from seven to nine experienced investment professionals with a scientific background and a wealth of experience from biotech companies and investment funds. Shelley Margetson joined the fund as Managing Partner, bringing her expertise as senior executive in multiple European biotechnology companies, including Nasdaq-listed Merus (MRUS). In addition to expanding the team, Ward Capoen, who has been with V-Bio Ventures since the start of the first fund, is being promoted to Partner.

Recent portfolio successes of V-Bio Ventures include Syndesi Therapeutics, which was acquired earlier this year by AbbVie for up to $1bn, as well as Agomab and Precirix having raised EUR 63m and 80m respectively from international investment syndicates. Since its inception in 2015, V-Bio Ventures has invested in nineteen companies, has co-created seven of them, and has helped to advance eight therapies into clinical development and closer to patients.

Solid Quarter for New Venture Capital Funds

Q1 capital raised was down from recent quarters but still robust by any historical standard.

Source: news reports, press releases, Torreya internal database.
Long-Term Perspective on Venture Fund Capital Raising

This year is on track to be the third highest in history for new capital raised in healthcare venture capital funds.

Source: news reports, press releases, Torreya internal database.
We saw four credit placements last week in a market that continued to be brisk.

Source: S&P CapitalIQ
VectivBio Announces Japan License Deal and Loan Facility Agreement, Providing up to $117 Million to Fuel the Company Through Key Catalysts

BASEL, Switzerland, March 30, 2022 (GLOBE NEWSWIRE) -- VectivBio Holding AG ("VectivBio") (Nasdaq: VECT), a clinical-stage biopharmaceutical company pioneering novel transformational treatments for severe rare conditions, today announced that it has entered two agreements that will strengthen the company’s balance sheet, bolster the company’s operations and expand apraglutide’s commercial potential beyond VectivBio’s core markets in the US and EU. The two agreements, together with VectivBio’s cash and cash equivalents as of December 31, 2021 of $103 million, provides up to $220 million in operating capital.

The company entered into an exclusive licensing agreement with Asahi Kasei Pharma Corporation ("Asahi Kasei Pharma") to develop and commercialize apraglutide, a next-generation, long-acting GLP-2 analog, for the treatment of short bowel syndrome with intestinal failure (SBS-IF), steroid-refractory acute graft-versus-host disease (aGVHD) and future indications in Japan. Under the terms of the agreement, VectivBio will receive an upfront cash payment of approximately $30 million ($5 million of which is the first installment of Asahi Kasei Pharma's development cost-sharing) and eligibility for up to approximately $170 million in milestone payments if certain development, regulatory and commercial events are achieved. VectivBio is also eligible to receive tiered, double-digit, escalating royalties on sales of apraglutide in Japan. Asahi Kasei Pharma has a right to participate in the development of new indications and lead and fund all development, registration and commercialization activities in Japan.

Mergers and Acquisitions Environment

Source: S&P, CapitalIQ

Last week saw a consortium of PAI and Carlyle acquire Theramex and Eagle Pharma acquire Acacia Pharma. Both targets were UK based.
Eagle Pharmaceuticals to Acquire Acacia Pharma for €94.7mm

WOODCLIFF LAKE, N.J., March 28, 2022 (GLOBE NEWSWIRE) -- Eagle Pharmaceuticals, Inc. (Nasdaq: EGRX) (“Eagle” or the “Company”) today announced it has reached agreement on the terms of a transfer of the entire issued and to be issued share capital of Acacia Pharma Group plc (“Acacia Pharma”) (EURONEXT: ACPH) to Eagle by way of a scheme of arrangement under Part 26 of the United Kingdom’s Companies Act 2006 (the “Scheme”).

The terms of the proposed transaction value Acacia Pharma’s existing issued and to be issued share capital at approximately €94,700,000, or the equivalent of €0.90 per share. Each shareholder of Acacia Pharma would receive, as consideration for each share of Acacia Pharma held by such shareholder, €0.68 in cash and 0.0049 shares of common stock of Eagle. The terms of the proposed transaction also provide for Eagle to guarantee approximately €25.0 million of debt within the Acacia Pharma group. In connection with the proposed transaction, (i) the Company and Acacia Pharma entered into a co-operation agreement (the “Cooperation Agreement”) on March 27, 2022 and (ii) certain shareholders and directors owning shares in the capital of Acacia delivered to the Company and Acacia deeds of irrevocable undertaking. The proposed transaction has been approved by the boards of directors of both companies and is expected to close in late Q2 2022, subject to approval by Acacia Pharma’s shareholders and the sanction of the High Court of England and Wales and customary closing conditions for transactions of this type. There is no assurance that the proposed transaction will be consummated on the proposed terms or timing or at all.

A consortium of Carlyle and PAI Partners to acquire Theramex from CVC Funds

London – Global investment firms PAI Partners and Carlyle (NASDAQ: CG) today announce that they have agreed to acquire Theramex, the leading global specialty pharmaceuticals company focused on women’s health, from CVC Capital Partners VI (“CVC”).

Theramex was created following the carve-out of a portfolio of women’s health pharma products in 2018, and has subsequently developed into one of the largest specialty pharma platforms dedicated to women and their health. The company provides patient-focused solutions across contraception, fertility, menopause, and osteoporosis with the aim of providing patients with products that can support them through their life journey. Under CVC Funds’ ownership, Theramex has focussed on building loyal relationships with physicians through its dedicated sales force, investing in digital capabilities and executing a successful M&A agenda to bring new products to market in the future, resulting in double-digit revenue and EBITDA growth since 2018. The company now serves more than six million women in 57 countries across EMEA, APAC and South America, and employs approximately 480 people (~60% of whom are women).

With the support of Carlyle and PAI Partners, Theramex will seek to expand its diverse suite of products across existing and adjacent therapeutic areas and accelerate international expansion. The investment in Theramex builds on Carlyle’s long-term global focus on Healthcare, a sector in which the firm has invested $15 billion to date. Carlyle has significant expertise in scaling global Pharma businesses, such as iNova, Curia and PPD, and specifically in women’s health, through its investment in Millicent Pharma. Similarly, PAI will utilise its deep sector experience in healthcare to support Theramex’s growth trajectory. Healthcare is one of PAI’s four core sectors of focus, in which the firm has made ten investments, including in pharmaceutical companies, Ethypharm and Ipsen.
Private equity deals in the life sciences sector were worth nearly $26 billion in 2021, the highest amount in a decade.

Medical devices and supplies deals were worth nearly $44 billion last year, which was also the highest value over the last decade — by far.

Private equity has invested more than $280 billion into the sectors over the last decade, according to the report.

Source: https://www.axios.com/pharmaceuticals-private-equity-medical-devices-drug-prices-d97c8510-d8c7-4b47-9e91-9bf3e68b84b1.html
March 29, 2022: TYME Technologies, Inc. (Nasdaq: TYME) (the Company or TYME), an emerging biotechnology company developing cancer metabolism-based therapies (CMBTs™), today announced that its Board of Directors has decided to explore potential strategic options to enhance stockholder value. The Company has engaged Moelis & Company LLC as its financial advisor and Faegre Drinker Biddle & Reath LLP as its legal advisor.

On January 26, 2022, TYME announced the discontinuation of a randomized Phase II/III trial of SM-88 in combination with methoxsalen, phenytoin, and sirolimus (MPS) for patients with metastatic pancreatic cancer upon learning that the trial sponsor terminated the study arm due to futility. Notwithstanding the discontinuation of its most advanced clinical trial, the Company believes there are additional opportunities that could enhance value for TYME stockholders. TYME believes that being well-capitalized affords it the ability to consider a wide range of strategic options and therefore has commenced a formal process with Moelis & Company LLC.

Source: https://www.biospace.com/article/releases/tyme-technologies-inc-announces-exploration-of-strategic-options/
Axsome Therapeutics to Acquire Sunosi® from Jazz Pharmaceuticals, Expanding Axsome’s Leadership in Neuroscience

NEW YORK, March 28, 2022 (GLOBE NEWSWIRE) -- Axsome Therapeutics, Inc. (NASDAQ: AXSM), a biopharmaceutical company developing novel therapies for the management of central nervous system (CNS) disorders, today announced that the Company has entered into a definitive agreement to acquire Sunosi® (solriamfetol) from Jazz Pharmaceuticals (NASDAQ: JAZZ). Sunosi is a dual-acting dopamine and norepinephrine reuptake inhibitor (DNRI) indicated to improve wakefulness in adult patients with excessive daytime sleepiness (EDS) due to narcolepsy or obstructive sleep apnea (OSA).

Upon closing, the transaction will accelerate Axsome’s transition to a global commercial entity, leverage Axsome’s first-in-class Digital Centric Commercialization™ platform ahead of potential near-term launches of AXS-05 in depression and AXS-07 in migraine, and strengthen Axsome’s industry-leading neuroscience portfolio.

Sunosi was approved by the U.S. Food and Drug Administration (FDA) in 2019 and by the European Medicines Agency (EMA) in 2020. Sunosi is the first and only DNRI approved to treat EDS in adults living with narcolepsy or OSA. Sunosi net sales were $57.9 million in 2021, representing year-over-year growth of 104%. In addition to further growth potential in the current indication for Sunosi, there are opportunities to pursue new high-value indications in psychiatry and neurology.

Under the terms of the agreement, Axsome will receive from Jazz worldwide commercial, development, manufacturing, and intellectual property rights to Sunosi, except for certain Asian markets. Jazz will receive from Axsome a total upfront payment of $53 million, a high single-digit royalty on Axsome’s U.S. net sales of Sunosi in the current indication, and a mid single-digit royalty on Axsome’s U.S. net sales of Sunosi in future indications.

Axsome will also assume the commitments of Jazz to SK Biopharmaceuticals (SK) and Aerial Biopharma (Aerial). SK is the originator of Sunosi and retains rights in 12 Asian markets, including China, Korea, and Japan. In 2014, Jazz acquired from Aerial worldwide rights to Sunosi excluding those Asian markets. The assumed commitments to SK and Aerial include single-digit tiered royalties based on Axsome sales of Sunosi, and up to $165 million in revenue milestones and $1 million in development milestones.

M&A Volume Down Substantially from Levels in 2020 and 2021

Q1 2022 M&A volume was down by 57% versus Q1 2021.

Source: S&P, CapitalIQ
Q1 2022 Was an Exceptionally Slow M&A Quarter by Historical Standards

Global Biopharmaceuticals M&A Volume, Q1 2014 to Q1 2022

Source: S&P, CapitalIQ
Total Global M&A Volume Down Slightly in 2021

On an annualized basis, M&A volume in 2022 is on pace to make this year the slowest for M&A in eight years.

Biopharma M&A Volume by Year ($ Billions)

Source: S&P CapitalIQ, Torrey database of M&A deals.
Why the M&A Drought?

We are hearing a very consistent message from large pharma on M&A. Seller valuation expectations have yet to adjust to the current market reality.

Albert Bourla, CEO, Pfizer, Mar 29, 2022

Small and midcap management expectations on valuations for companies that have good assets have not come down. Source:

Torreya Discussion with Head of M&A of a leading biopharma company, Mar 20, 2022

“Management teams and boards have unrealistic expectations of value. They are looking at their 52-week high as a benchmark for value. That's not going to fly with us”
Shifting from megamergers to strategic collaboration: M&A predictions for biopharma

In 2021 we saw deals move away from the massive megamergers of 2019 to smaller collaboration and partnership agreements. In this article, European Pharmaceutical Review’s Hannah Balfour discusses the key deals of last year, whether the trend of high volume but small value will continue in 2022, and the motivations underpinning the recent changes in merger and acquisition (M&A) contracts with Subin Baral, EY Global Life Sciences Deals Leader.

“We never say never to mega deals – there is always potential for megamergers… But when we look at the trend, we expect volume: the collaboration activities, the partnership activities, the bolt-on acquisitions will be preferred in the coming years.” – Subin Baral, EY Global Life Sciences Deals Leader.

Through the last two years of the COVID-19 pandemic, a mainstay of the drug development community’s response has been collaboration. We have seen it in a variety of forms, including between Big Pharma and smaller companies, such as the Pfizer/BioNTech collaboration which led to the Comirnaty® messenger RNA (mRNA) vaccine for COVID-19, drug developers and regulators or government, increasing num

Source: https://www.europeanpharmaceuticalreview.com/article/169807/shifting-from-megamergers-to-strategic-collaboration-ma-predictions-for-biopharma/
Biotech M&A will increase in April. There are an increasingly large number of motivated boards who will consider lower valuations.

The volume of background conversations is unusually high. But pharma is generally working hard to drive for value creation.

Big pharma remains flush with cash and M&A firepower and is increasingly active in looking at better M&A targets.

Hot areas right now include differentiated mid/late-stage oncology stories, nucleic acid delivery and therapeutics and commercial specialty pharma.

We believe that the M&A lull seen in Q1 is unlikely to persist, although the trend towards collaborations and partnership will likely continue.
Torrey Update
Torreya is a Global Life Sciences Investment Bank

We are known for:

- **Deep Relationships**
  We have strong personal relationships across the pharmaceutical and healthcare sectors.

- **Operating Perspective**
  Many of our senior colleagues come from industry and bring decades of experience.

- **Deal Excellence**
  Torreya is known as a firm that gets tough deals done. Our team is skilled in highly structured transactions.

- **Healthcare Focus**
  Our healthcare focus spans pharma, biotech, bioproduction, pharma services, physician services and HCIT.

### Representative Transaction Work

#### Mergers & Acquisitions

<table>
<thead>
<tr>
<th>Company</th>
<th>Transaction</th>
<th>Amount</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Navilun Bio</td>
<td>Advisor in its merger with Panacea</td>
<td>$1.5 billion</td>
<td>October 2020</td>
</tr>
<tr>
<td>Sawai</td>
<td>Acquisition of generics business of Upsher-Smith</td>
<td>$1.05 billion</td>
<td>June 2017</td>
</tr>
<tr>
<td>CHIAMA</td>
<td>Sale to AMRYT Pharmaceuticals</td>
<td>$260 million</td>
<td>August 2021</td>
</tr>
<tr>
<td>Santen</td>
<td>Acquisition of EyeVance</td>
<td>$225 million</td>
<td>September 2020</td>
</tr>
<tr>
<td>Piramal</td>
<td>Sale of generics business of Generic Pharma</td>
<td>$203 million</td>
<td>March 2017</td>
</tr>
<tr>
<td>Specialty Pharma</td>
<td>Acquisition of Intrathecal business from Piramal</td>
<td>$766 million</td>
<td>+ milestones</td>
</tr>
<tr>
<td>Specialty Pharma</td>
<td>Acquisition of Opportunity Therapeutics</td>
<td>Up to $1.5 billion</td>
<td>+ milestones</td>
</tr>
<tr>
<td>Specialty Pharma</td>
<td>Sale of E7777 to Citius Pharmaceuticals</td>
<td>$40 million + $76mm milestones</td>
<td>August 2021</td>
</tr>
<tr>
<td>Specialty Pharma</td>
<td>Strategic collaboration to develop novel therapies for metabolic disorders with Selaya</td>
<td>Up to $1.0 billion</td>
<td>December 2021</td>
</tr>
<tr>
<td>Specialty Pharma</td>
<td>Sale to Specialty Pharma</td>
<td>Up to €97.5 million + royalties</td>
<td>July 2021</td>
</tr>
<tr>
<td>Specialty Pharma</td>
<td>Funding round to calliditas</td>
<td>Up to $100 million + royalties</td>
<td>July 2021</td>
</tr>
</tbody>
</table>

#### Licensing, Asset Sales & JVs

<table>
<thead>
<tr>
<th>Company</th>
<th>Transaction</th>
<th>Amount</th>
<th>Year</th>
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<tbody>
<tr>
<td>Mailinckrodt Pharmaceuticals</td>
<td>Sale of Intrathecal business to Piramal</td>
<td>$203 million</td>
<td>March 2017</td>
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<tr>
<td>OTO Therapeutics</td>
<td>Acquired by Philip Morris International</td>
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<td></td>
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<tr>
<td>Regor Therapeutics Group</td>
<td>Strategic collaboration to discover and develop novel therapies for metabolic disorders with Selaya</td>
<td>Up to $1.5 billion</td>
<td>+ milestones</td>
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<tr>
<td>Dr. Reddy's Laboratories</td>
<td>Sale of E7777 to Citius Pharmaceuticals</td>
<td>$40 million + $76mm milestones</td>
<td>August 2021</td>
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<td>Specialty Pharma</td>
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<td>July 2021</td>
</tr>
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#### Growth Equity, Structured Financings & Venture Raises

<table>
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<tr>
<th>Company</th>
<th>Transaction</th>
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<tr>
<td>Indegene</td>
<td>Equity investment from Carlyle</td>
<td>$200 million</td>
<td>February 2021</td>
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<tr>
<td>Rubicon</td>
<td>Sale of majority stake to General Atlantic</td>
<td>$125 million</td>
<td>April 2019</td>
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<tr>
<td>Tris</td>
<td>Debt recapitalization &amp; acquisition of NextWave Pharmaceuticals from Prius Capital</td>
<td>$125 million</td>
<td>September 2018</td>
</tr>
<tr>
<td>Roslin Biotechnologies</td>
<td>Investment by Series E equity financing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Binx</td>
<td>Series E equity financing</td>
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<td></td>
</tr>
</tbody>
</table>

- **Biotech**
- **Generic Pharma**
- **Specialty Pharma**
- **Pharma Services**
- **Generics**
- **Specialty Pharma**
- **Pharma Services**
- **Diagnostics**
Torreya: Active Global Presence With 40+ Professionals Focused on the Pharma and Life Sciences Sector

- 32 people based in New York
- 9 people based in London
- 5 people based in Mumbai
- 1 person in Tokyo

- We cover Latin America, South Africa and parts of Asia through affiliate relationships
- 4 people cover the China market from a home base in the United States

Top Investment Banks in Pharma Industry Strategic Deals
Jan 1, 2021 to March 30, 2022 by Deal Count and Total Value
(Includes Announced, Pending and Closed Transactions)

<table>
<thead>
<tr>
<th>Advisory Firm</th>
<th>Deal Count</th>
<th>Total Value ($mm)</th>
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<tbody>
<tr>
<td>Torreya</td>
<td>20</td>
<td>$1,444</td>
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<tr>
<td>Centerview</td>
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<td>$34,266</td>
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<tr>
<td>Goldman Sachs</td>
<td>15</td>
<td>$24,082</td>
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<tr>
<td>Jefferies</td>
<td>12</td>
<td>$5,746</td>
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<tr>
<td>JP Morgan</td>
<td>11</td>
<td>$14,909</td>
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<tr>
<td>Morgan Stanley</td>
<td>8</td>
<td>$22,928</td>
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<tr>
<td>Lazard</td>
<td>8</td>
<td>$5,239</td>
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<td>Rothschild</td>
<td>8</td>
<td>$6,576</td>
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<td>MTS Health</td>
<td>7</td>
<td>$1,299</td>
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<tr>
<td>Credit Suisse</td>
<td>6</td>
<td>$11,948</td>
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<tr>
<td>Barclays</td>
<td>6</td>
<td>$4,924</td>
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<td>BAML</td>
<td>5</td>
<td>$7,029</td>
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<tr>
<td>SVB Leerink</td>
<td>5</td>
<td>$2,298</td>
</tr>
<tr>
<td>RBC</td>
<td>5</td>
<td>$1,110</td>
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<td>Evercore</td>
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<td>$10,079</td>
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<td>Moelis</td>
<td>4</td>
<td>$2,302</td>
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<tr>
<td>Leerink</td>
<td>3</td>
<td>$985</td>
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<tr>
<td>William Blair</td>
<td>3</td>
<td>$321</td>
</tr>
<tr>
<td>Guggenheim</td>
<td>2</td>
<td>$6,614</td>
</tr>
</tbody>
</table>

Source: CapIQ and Torreya calculations. Notes: Transactions are included in the pharmaceutical sector, the OTC sector and pharmaceutical manufacturing. Only transactions larger than $10mm included. SPAC deals excluded. When multiple advisors are present the deal credit is divided by the number of groups present to apportion deal value. Contingent payments are discounted by 75%.

* Key affiliate partners are Kybora in Africa and MidEast; Novus Capital in Russia; Natixis in China and Korea; Panarea in Latin America; and GCA in Japan.
Delivering Results For Clients

Great outcomes for clients from recent engagements

**RoslinCT**

Investment by GHO Capital

January 2022

GHO’s investment will help scale Roslin’s high-quality cell therapy development and manufacturing capabilities in a rapidly growing advanced therapy sector.

**Binx**

Series E equity financing

$104 million

June 2021

Binx raised $104 million as a pre-IPO financing from a range of investors led by Orbimed, Parius and Arrowmark. Heavily over subscribed.

**Regor Therapeutics**

Metabolic Disease Program License to Lilly

Up to $50 million + $1.5 billion in milestones

December 2021

Regor’s AI technology will allow Lilly to accelerate innovation and deliver novel therapies in obesity and diabetes. Regor kept China rights.

**Sirion BioTech**

Acquired by PerkinElmer

$95 million + $85 million in milestones

September 2021

Sirion’s gene therapy vectors were gaining traction, especially in the lentiviral area. Perkin Elmer pursued this growth business in gene therapy.

**Chiasma**

Sale to Amryt

$340 million

August 2021

Chiasma had brought Mycapssa® to market for acromegaly. Amryt was looking to grow its platform while realizing synergies in the combination.

**Amryt**

License to Regor’s AI technology

Sale of 100% equity stake to Piramal Pharma Solutions

$106 million + milestones

June 2021

Regor kept China rights.

**Hemmo**

Sold 100% equity stake to Piramal Pharma Solutions, through its financial sponsor The Carlyle Group

$106 million + milestones

June 2021

Hemmo sold its 100% equity stake to acquired by Piramal Pharma Solutions.
Torreya has a superb track record in advising on science-based early-stage transactions between biotech and leading biopharma companies.

Torreya brings deep scientific knowledge, broad industry relationships and excellent deal skills to clients in biotech. In the last decade, Torreya has advised more than 50 biotechs on achieving successful partnering and M&A outcomes with well funded pharma partners.

* Torreya acted as principal for this transaction
Case Study: Medigene Transaction with BioNTech

BioNTech and Medigene Announce Global Collaboration to Advance T Cell Receptor Immunotherapies Against Cancer. Torreya advises Medigene.

Feb 21, 2022: BioNTech SE (Nasdaq: BNTX, "BioNTech") and Medigene AG (FSE: MDG1, Prime Standard, "Medigene"), a clinical-stage immuno-oncology company focusing on the development of T cell immunotherapies, today announced that they have entered a multi-target research collaboration to develop T cell receptor (TCR) based immunotherapies against cancer. The initial term of the collaboration is three years.

Medigene will contribute its proprietary TCR discovery platform for the development of TCRs against multiple solid tumor targets nominated by BioNTech. Medigene’s automated, high throughput TCR discovery platform is designed to bypass central tolerance to yield high affinity TCRs. T cell therapy has become a disruptive medical innovation in the treatment of patients with cancer. Engineered TCR-modified T cells (TCR-T cells) are reprogrammed to express a TCR that can recognize specific antigens only present on tumor cells, thereby enabling a precise and potent immune response to attack a patient’s tumor.

Under the terms of the agreement, Medigene will receive EUR 26 million upfront, as well as research funding for the period of the collaboration. BioNTech will be responsible for global development and hold exclusive worldwide commercialization rights on all TCR therapies resulting from this research collaboration. Medigene will be eligible to receive development, regulatory and commercial milestone payments up to a triple digit million EUR amount per program in addition to tiered deferred option payments on global net sales for products based on TCRs arising from the collaboration and royalties on products utilizing at least one of the licensed technologies.

“This collaboration with Medigene expands our cell therapy portfolio and TCR discovery capabilities, and further strengthens our ability to be a leader in the rapidly emerging field of engineered cell therapies. We look forward to working closely with Medigene to develop new treatments which address solid tumors with high unmet medical need.”

– Ugur Sahin, MD
CEO, BIONTECH
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