BOURNE PARTNERS

MARKET INSIGHT

Biopharmaceutical CDMOs Analysis Update

August 2019

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INTRODUCTION – MARKET INSIGHT UPDATE AND M&A FOCUS

The primary purpose of this Market Insight update is to evaluate the current status of the biopharmaceutical Contract Development and Manufacturing ("CDMO") industry as of 1H 2019. This report serves to supplement and update the information provided in Bourne Partners' Biopharmaceutical CDMOs Analysis Market Insight report, which was circulated in February 2019. Moreover, this report aims to analyze the predictions set forth in the previous Market Insight report and expand upon the drivers and trajectory of the biopharmaceutical CDMO market. The overall trend of biopharmaceutical CDMO consolidation has continued throughout 1H 2019, with a number of high-profile acquisitions and investments. The increased industry consolidation has been primarily driven by broad growth across the biopharmaceutical sector.

Some of these topics are highlighted in additional detail throughout this Market Insight update. Based on market research and conversations with pharma executives, industry experts, and investors in the space, we touch upon a handful of trends we see driving the industry, as well as developments we expect will meaningfully impact the future of pharma services.

Exclusively focused in healthcare, Bourne Partners has a deep track record of transaction success in pharmaceuticals, pharmaceutical services, and consumer health M&A and financial advisory. We hope this market snapshot is a helpful reference and please feel free to reach out with any questions or to discuss ways we may be able to add value to your company.

Biologics Snapshot – Breakdown of drug sources

Cell Culture (Active Substance)

- Microbial Cells
- Mammalian Cell Culture
- Other (Insect Cell, Plant Cell, Viral Culture, Yeast)

Therapeutic Classes

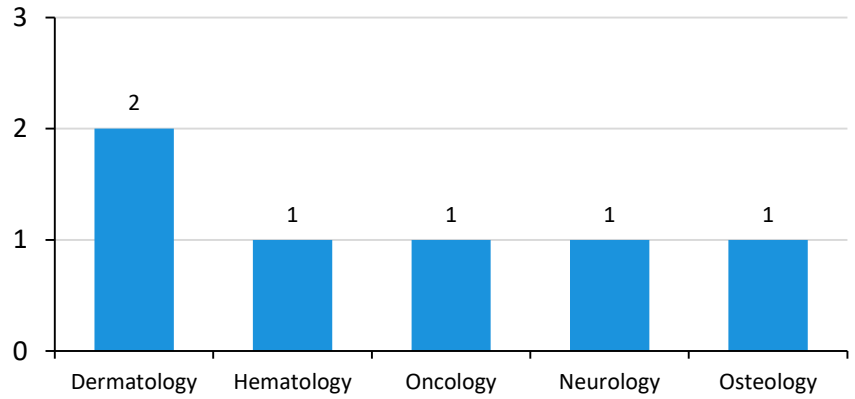
- Recombinant Proteins
- Vaccines
- Cell Therapy
- Viral Gene Therapy
- Tissue Engineering
- Monoclonal Antibodies
- Peptides

Indication

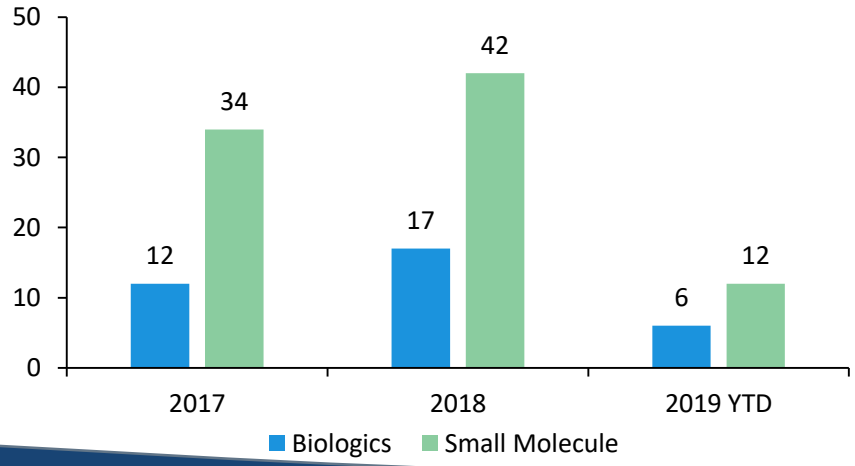
- Genetic
- Metabolic Disorders
- Neurological
- Immunosuppr-essants
- Hematological
- Infectious diseases
- Oncology
- Cardiovascular diseases

Biologics Drug Innovation[1]

1H 2019 Biologics Novel Drug Approvals



Biologics vs Small Molecule New Drug Approvals



1) FDA Novel Drug Approvals as of August 2, 2019

Biopharmaceutical CDMOs – Industry Trends and Drivers in 1H 2019

Surging demand for biopharmaceutical CDMOs

The rapid growth of the biologics market and the increase in novel drug approvals since 2017 has significantly contributed to the need for biologics manufacturing capabilities. Moreover, rising drug development costs and complex manufacturing processes for novel therapies, especially at-scale, have drawn biopharma companies to increasingly outsource production to CDMOs. This trend has only increased in 2019, as CDMOs provide faster scale-up capabilities, flexible technology, and drive down costs for their customers.

Capacity constraints increasing urgency to grow

Due to the rising demand and the challenges of scaling complex processes, the biologics market has seen a large capacity shortage. Manufacturers are unable to meet demand. The average waiting time for biopharma CDMO capacity ranges from 16-24 months, resulting in customers buying slots in production queues years in advance[1]. Many biopharma companies are beginning to establish in-house capacity to reduce the uncertainty of meeting future demand. That said, biopharma CDMO expansions come at the request of customers, and new capacity is quickly coming online. Any new capacity will be quickly absorbed by existing product backlog.

Competitive advantage via scale

In 1H 2019, nearly all large biopharma CDMOs have been scaling up capacity organically and/or through M&A, resulting in an anticipated 40% site capacity growth in the next few years. [1] The ability to scale is one of the key competitive differentiators of biopharma CDMOs. The market remains fragmented while a few major players hold large-scale production capabilities. In the US, Thermo Fisher, Lonza, and Catalent lead the industry in scalability. In China, WuXi Biologics and Samsung BioLogics are the key players with the larger capacity needed to meet customer demand.

Global outsourcing in Europe and China

In February, we noted that CDMOs are looking to China and Europe as regions for investment. This trend has continued throughout 1H 2019. Recently, WuXi Biologics has further expanded its development and commercial manufacturing sites in China. [2] In Europe, large-scale investments, such as Fujifilm's acquisition of Biogen's biologics facility in Denmark serve to underscore the globalization of outsourcing in the market.

Biosimilars set to breakout

In our February report, we noted that the growth of biosimilars would increase downward price pressure. This effect will accelerate in the US due to the FDA relaxing the criteria necessary to classify a biosimilar as "interchangeable." [3] Interchangeability implies that a biosimilar will achieve the same clinical result as the original biologic. For physicians, the "interchangeable" designation will entail more comfort in prescribing due to the fact that more than 40% of physicians said they would be motivated to prescribe biosimilars if they had the same efficacy as the original biologic. [4]

1) JP Morgan Research
2) Contract Pharma: WuXi Biologics to Build Mfg. Center in Southwest China
3) JD Supra: FDA Finalizes Guidance on Biosimilar Interchangeability, Reiterates Case-by-Case Approach to Data Requirements
4) PWC: Biosimilar Developers Gain Path for Interchangeability with their Branded Counterparts

Investment Activity – Biopharma CDMO M&A Landscape

Biopharma CDMO Transaction Comparables – YTD 2019

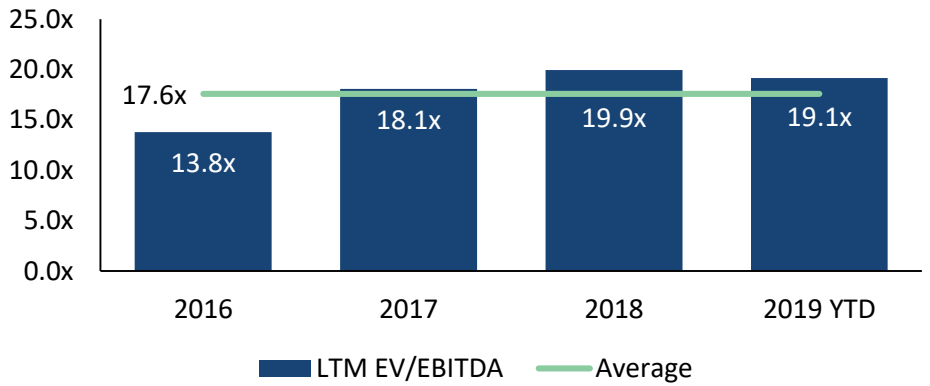
USD in millions

Announced Date	Target	Buyer	Geographic Location	Transaction Size	Transaction Description
Aug-19	Biogen Manufacturing Site	Fujifilm	Denmark	$890.0	Fujifilm completes the acquisition of Biogen (Denmark) Manufacturing ApS, a large-scale biologics manufacturing site located near Copenhagen, Denmark.
May-19	Vibalogics	Ampersand Capital Partners	Germany	NA	Acquisition of Vibalogics' capabilities will be used to meet rapidly growing industry demand for the development and manufacturing of complex viral products
Apr-19	Paragon Bioservices	Catalent Pharma Solutions	USA	1,200.0	Acquisition to expand Catalent's gene-therapy manufacturing capabilities as Paragon is a leading manufacturer of viral vectors
Mar-19	Brammer Bio	Thermo Fisher Scientific	USA	1,700.0	Brammer Bio's viral vector manufacturing capabilities will enhance Thermo Fisher's broader gene and cell-therapy manufacturing capabilities
Jan-19	apceth Biopharma	Hitachi Chemical	Germany	86.5	Expands Hitachi's global operations giving them the ability to manufacture complex cell and gene-therapies for clients in North America, Asia, and Europe
Jan-19	Capua BioServices	Olon	Italy	NA	Accelerates growth of new CDMO projects, making Olon a global leader in microbial fermentation

M&A Insight

- An increase in the outsourcing of cell and gene-therapy and viral vectors development continued to drive M&A within the CDMO space
- Early-stage development capabilities remain a key importance that give larger one-stop-shop CDMOs a cost advantage during the scale-up process
- Larger CDMOs also turned to M&A as they begin to establish themselves as not just domestic, but global leaders in the production of complex biologics
- The transactions above highlight some of the most relevant acquisitions where the buyers were looking to build or expand upon a biopharmaceutical platform

Biopharma CDMO LTM EV/EBITDA Trading Multiples



- Average 2019 LTM EV/EBITDA multiple trading slightly above the average multiples over last three and a half years

Notes:
NA – Not Available
Source: CapitalIQ as of August 2, 2019

Biopharma CDMO Constituents: *Avid Bioservices, Inc. (NasdaqCM:CDMO); Bachem Holding AG (SWX:BANB); Catalent, Inc. (NYSE:CTLT); Evotec SE (XTRA:EVT); Lonza Group Ltd (SWX:LONN)*

Investment Activity – Biopharma CDMO Capital Investments

Biopharma CDMO Capital Investments – YTD 2019

USD in millions

Announced Date	Investor	Geographic Location	Investment Size	Description
Jul-19	Merck	USA	$650.0	The investment wil enable Merck to meet growing demand for Gardasil and Gardasil 9 recombinant human papillomavirus (HPV) vaccine, which is used to prevent several cancers associated with HPV
Jun-19	Aldevron	USA	NA	Announcement to expand production of GMP nucleic acids, proteins, and mRNA with a new 189,000 sq. ft. facility coming online by 1Q 2021
May-19	WuXi Biologics	China	NA	Began construction of new 1.3 million sq. ft. integrated manufacturing center for innovative biologics in Chengdu, China. The new facility will have initial bioreactor capacities of 48,000 L
May-19	Sekisui Diagnostics	United Kingdom	1.9	Investment in a new BioProcess Innovation Centre by the end of 2019, following a $1.9 million investment
Apr-19	Goodwin Biotechnology	USA	NA	Largest ever round of financing that was used to double the amount of cGMP capacity that Goodwin will require for its biopharmaceutical manufacturing expansion plans
Apr-19	Paragon, Sarepta Therapeutics	USA	NA	Established dedicated facilities designed to handle the needs of gene-therapy products. The new campus expansion will have the potential for more than 425,000 sq. ft. of manufacturing space
Apr-19	Biotechpharma	Lithuania	56.6	Expansion to allow for increased mammalian cell culture production capacity at the 5000 L scale, as well as an additional process development laboratory
Mar-19	MilliporeSigma, GenScript	China	NA	Agreement to accelerate the industrialization and commercialization of cell and gene-therapy in China. GenScript looks to establish a global-standard platform of plasmid and virus manufacturing
Mar-19	BioVectra	Canada	110.0	Investment to support BioVectra's API manufacturing capacity as well as support the expansion of BioVectra's biologics capabilities, including a mammalian cell culture facility
Mar-19	Fujifilm Corporation	Denmark	890.0	Fujifilm will acquire Biogen's biologics manufacturing operations in Hillerød, Denmark, which includes a 90,000 L biologics production facility with assembly, labeling, and packaging capabilities
Feb-19	ABL Bio, WuXi Biologics	China	220.0	ABL Bio expanded its strategic collaboration with WuXi Biologics by acquiring the rights to use WuXi Biologics' discovery platforms to research, develop, and commercialize multiple bispecific antibodies
Jan-19	Fujifilm Corporation	USA	90.0	Expanding existing facilities in NC to support growing customer portfolio, including additional suites and single use cell culture manufacturing trains
Jan-19	MabPlex International	China	59.1	Secured series A funding from China's State Development & Investment Corp. and Shenzhen Venture Capital to support upgrades to technology platforms, Phase III, and commercial production expansion
Jan-19	Thousand Oak Biopharmaceutical	China	45.0	$45mm in Series A financing to advance its phase II CDMO operations while beginning construction of one of the largest cell culture facilities in China

- Expansion amongst the largest players persisted throughout 1H 2019 as manufacturers attempted to meet customer demand:
  - WuXi Biologics' new manufacturing center in Chengdu, China will provide WuXi with an initial bioreactor capacity of 48,000 L with potential for 144,000 L upon completion
  - Fujifilm's $890mm investment in Biogen's biologics facility sheds light on the overall industry strategy of acquiring scale-up capabilities to improve efficiencies within biologics manufacturing processes

Notes:
NA – Not Available
Source: CapitalIQ as of August 2, 2019

Investment Activity – Biopharma M&A Landscape

Biopharma Transaction Comparables – YTD 2019

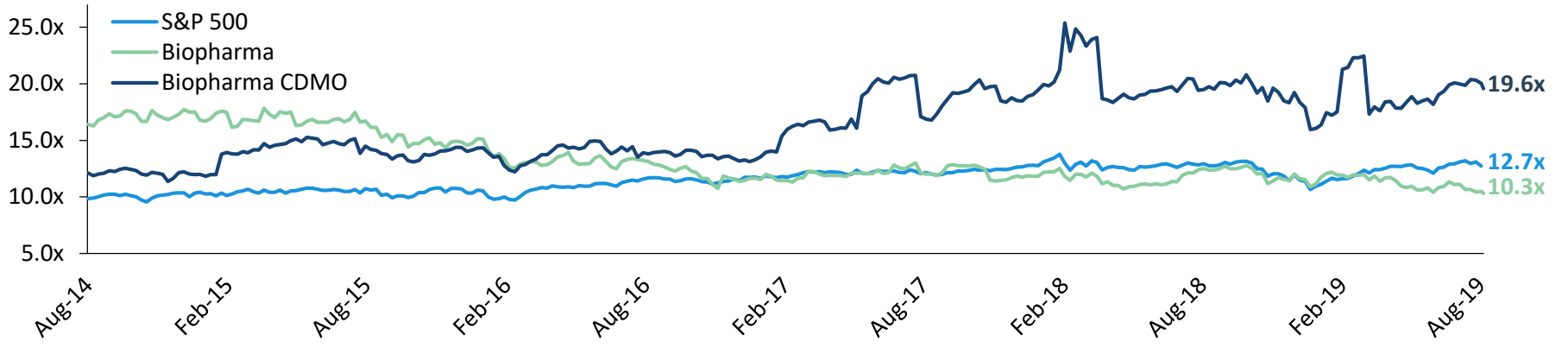
USD in millions

Announced Date	Target	Buyer	Geographic Location	Transaction Size	Transaction Description
Jun-19	Array BioPharma	Pfizer	USA	$11,494.6	Expands upon Pfizer's existing oncology pipeline, making Pfizer a potentially industry-leading franchise for colorectal cancer
Jun-19	Tilos Therapeutics	Merck & Co.	USA	773.0	Expands Merck & Co.'s pipeline of capabilities targeting the latent TGFβ complex through cancer, fibrosis, and autoimmune programs
Jun-19	Exonics Therapeutics	Vertex Pharmaceuticals	USA	1,000.0	Expansion of Vertex's gene editing capabilities to develop novel therapies for Duchenne Muscular Dystrophy and Myotonic Dystrophy Type 1
May-19	Peloton Therapeutics	Merck & Co.	USA	2,202.6	Acquisition to further pursue novel therapeutics and boost oncology pipeline
Apr-19	Cyto-Sen Therapeutics	Kiadis Pharma	USA	87.5	Kiadis will acquire Cyto-Sen and with it, its proprietary natural killer cell platform to enable therapy with broad anti-cancer potential
Mar-19	Vivet Therapeutics	Pfizer	France	51.1	Pfizer's partnerhsip with Vivet will expand Pfizer's commitment to accelerating their leading AAV-directed gene-therapy portfolio
Mar-19	Nightstar Therapeutics	Biogen	United Kingdom	877.4	The acquisition of Nightstar Therapeutics gives Biogen a clinical pipeline of gene-therapy candidates in opthalmology
Feb-19	Spark Therapeutics	Roche Holding	USA	4,851.2	Roche Holding acquired Spark Therapeutics as it expands its gene-therapy capabilities, more specifically those that treat hemophilia
Jan-19	Loxo Oncology	Eli Lilly and Company	USA	8,013.1	Eli Lilly has expanded its oncology-treatment portfolio and drug pipeline with the acquisition of Loxo Oncology
Jan-19	Celgene Corporation	Bristol-Myers Squibb	USA	74,000.0	Creates a specialty biopharma company that will address the needs of patients with cancer, inflammatory and immunologic disease, and cardiovascular disease

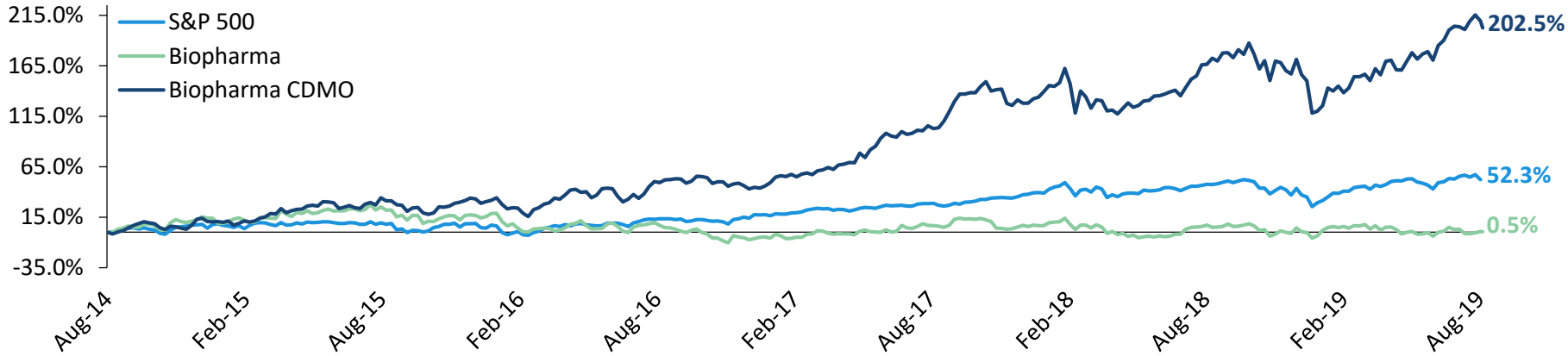
- Continued interest in developing the next breakthrough biologic technology has motivated deal activity for biopharma companies throughout 1H 2019
- Specifically, oncology and gene-therapy capabilities continued to be a top priority for larger players in the biopharma space
- The transactions above highlight the growing interest that larger biopharma companies have in acquiring capabilities that will make them leaders in the complex biologics market, both domestically and worldwide

Notes:
NA – Not Available
Source: CapitalIQ as of August 2, 2019

LTM EV / EBITDA Multiples – Past 5 Years



Equity Value Performance – Past 5 Years



- Since mid-2015, the Biopharma index has seen a decline in valuations largely due to pricing and reimbursement pressures and patent cliffs / biosimilars. However, despite the decline on the products side of Biopharma, the Biopharma CDMO index has experienced tremendous growth due to increased demand for outsourced biologics development and manufacturing services coupled with capacity shortages
- The Biopharma CDMO and Biopharma indices' LTM EV/EBITDA multiples are **19.6x** and **10.3x**, respectively
  - The Biopharma CDMO index's LTM EV/EBITDA multiple is 54.3% higher than the current S&P 500 multiple of **12.7x**
  - In the last five years, the Biopharma CDMO equity index value has increased **202.5%**

Source: CapitalIQ as of August 2, 2019

***Biopharma CDMO Constituents**: Avid Bioservices, Inc. (NasdaqCM:CDMO); Bachem Holding AG (SWX:BANB); Catalent, Inc. (NYSE:CTLT); Evotec SE (XTRA:EVT); Lonza Group Ltd (SWX:LONN)*
***Biopharma Constituents**: Alexion Pharmaceuticals, Inc. (NasdaqGS:ALXN); Biocon Limited (NSEI:BIOCON); Bristol-Myers Squibb Company (NYSE:BMY); Exelixis Inc. (NasdaqGS:EXEL); Incyte Corporation (NasdaqGS:INCY); Ionis Pharmaceuticals, Inc. (NasdaqGS:IONS); Novo Nordisk A/S (CPSE:NOVO B); PTC Therapeutics, Inc. (NasdaqGS:PTCT) Regeneron Pharmaceuticals, Inc. (NasdaqGS:REGN); Roche Holding AG (SWX:ROG); Vertex Pharmaceuticals Incorporated (NasdaqGS:VRTX); Amgen Inc. (NasdaqGS:AMGN); Biogen Inc. (NasdaqGS:BIIB); Celgene Corporation (NasdaqGS:CELG); Gilead Sciences, Inc. (NasdaqGS:GILD)*

Our Experience

Bourne Partners is an investment banking and strategic capital firm focused exclusively in the healthcare space, covering the full spectrum of Pharma Services including a significant focus on CDMOs, CMOs, clinical and non-clinical CROs, SMOs, analytical lab/testing; as well as labeling, packaging, distribution, and supply chain management services. We help companies execute M&A (selling their business or buying another) and raise capital to finance growth or recapitalize their business. Below is a snapshot of our recent industry deal experience:

2019

$252,000,000

Avista Pharma Solutions / Ampersand / Cambrex

Bourne Partners served as the exclusive financial advisor to Avista Pharma Solutions in its sale to Cambrex Corporation

BOURNE PARTNERS

Objective: Avista, a CDMO that offers differentiated services ranging from API and drug product development to analytical testing, engaged Bourne Partners to serve as its exclusive advisor in the sale of the company.
Process: Bourne Partners used its long-standing relationships and knowledge of the CDMO, analytical lab/testing, CMC services and pharmaceutical sectors to provide counsel to Avista throughout the process.
Result: Avista signed an agreement to be acquired by Cambrex at a value of $252 million.

2017

$1,620,000,000

The Carlyle Group / amri

Bourne Partners served as the exclusive buy-side advisor to The Carlyle Group in its acquisition of Albany Molecular Research, Inc.

BOURNE PARTNERS

Objective: Bourne Partners worked in partnership with and invested alongside The Carlyle Group on the 2017 acquisition of AMRI.
Process: Bourne Partners utilized its relationships and knowledge of the CDMO and pharmaceutical sectors to provide counsel to and invest alongside The Carlyle Group, contributing to the evaluation and negotiation of the AMRI transaction.
Result: Bourne Partners co-invested alongside The Carlyle Group and GTCR LLC who successfully acquired AMRI at a value of $1.62 billion.

2018

$32,000,000

accelovance / Clinical Development Partner Linical

Bourne Partners served as the exclusive financial advisor to Accelovance, Inc. in the sale of its clinical CRO business to Linical

BOURNE PARTNERS

Objective: Accelovance engaged Bourne Partners to identify an acquirer for the remaining clinical CRO business after the successful carve-out of Accelovance's SMO segment, Optimal Research, in late 2017.
Process: Bourne Partners used its international network to run a highly targeted process and structure a transaction that was ideal for all parties.
Result: With the advice of Bourne Partners, Accelovance signed a merger agreement with the Japanese CRO, Linical, to sell all remaining assets. The combined companies will now boast a strong international CRO presence reaching through North America, Europe, and Asia Pacific.

"I've known the Bourne Partners team for several years and enjoyed working with them on this project. Bourne Partners' experienced execution team and deep domain knowledge across pharma and pharma services, contributed in maximizing the value of Avista Pharma Solutions. I highly recommend them as a lead advisor to anyone exploring the sale of their company."

- Patrick Walsh

Chief Executive Officer, Avista Pharma Solutions

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Since 2001, Bourne Partners has been a thought leader in the healthcare investment banking space. Our team is a trusted resource for clients and our track record of success includes raising over $2 billion in equity and debt capital and executing more than $5 billion in M&A transactions.

Please contact us to talk about ways we may be able to add value to your company's strategic priorities.

BOURNE PARTNERS