ARROWHEAD
BUSINESS AND INVESTMENT DECISIONS

# Due Diligence and Valuation Report

| | |
|---|---|
| Arrowhead Code: | 69-06-08 |
| Coverage initiated: | June 19, 2018 |
| This document: | April 14, 2020 |
| Fair share value bracket: | EUR 1.68 and EUR 3.52 |
| Share price (April 13, 2020): | EUR 0.84[i] |


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EURONEXT

DEINOVE
The deinococcus way

| | |
|---|---|
| Company: | DEINOVE |
| Ticker: | ALDEI |
| Headquarters: | Grabels, France |
| CEO | Dr. Charles Woler |
| Director of R&D | Georges Gaudriault |
| Website: | www.DEINOVE.com |

## Market Data

| | |
|---|---|
| 52-Week Range: | EUR 0.48 – EUR 1.46[ii] |
| Average Daily Volume (3M Avg.): | 177,376[iii] |
| Market Cap (April 13, 2020): | EUR 16.6 million (mn) |

## Financial Forecast (in EUR) (FY Ending – Dec.)

| EUR '000 | '19E | '20E | '21E | '22E | '23E | '24E |
|---|---|---|---|---|---|---|
| High Revenue | 1,604 | 3,926 | 6,903 | 10,197 | 26,522 | 40,909 |
| High EPS (EUR) | (0.53) | (0.83) | (0.57) | (0.57) | (0.11) | 0.24 |
| Low Revenue | 1,546 | 3,796 | 6,575 | 9,753 | 23,252 | 35,059 |
| Low EPS (EUR) | (0.54) | (0.83) | (0.60) | (0.58) | (0.19) | 0.10 |

**Company Overview:** Founded in 2006 and headquartered in France, DEINOVE SA (DEINOVE) is a biotech company that discovers, develops and produces compounds originating from rare bacteria that are of significance for the health, nutrition and cosmetics industries. DEINOVE has a unique collection of 6,000 rare and yet untapped bacteria, notably of the *Deinococcus* genus. In addition, DEINOVE has a proprietary screening and genetic, metabolic and fermentation engineering platform that enables it to transform these micro-organisms into natural micro-factories and produce on an industrial scale.

**H1 2019 Results:** DEINOVE reported a net loss of EUR 5.4 mn in H1 2019, a 43.5% year-on-year (YoY) increase over the EUR 3.8 mn net loss recorded in H1 2018, majorly attributable to an increase in external R&D costs as a result of progress in services provided by Clinical Research Organizations (CROs) accompanying DEINOVE on the DNV3837 project. Research and Development (R&D) costs accounted for 82.1% of the total operating costs. Also, operating expenses increased by 29.9% from EUR 5.1 mn in H1 2018 to EUR 6.6 mn in H1 2019. Purchases and external expenses increased by 79.3% on YoY basis from EUR 2.0 mn in H1 2018 to EUR 3.6 mn in H1 2019. A decrease in manpower led to a YoY fall in salaries and wages by 6.2% in H1 2019.

The net cash position amounted to EUR 1.9 mn as on June 30, 2019, versus with EUR 3.9 mn on December 31, 2018.

**Key Highlights: (1)** DEINOVE completed the second key milestone of the AGIR program in March 2020 and triggered a milestone payment of EUR 1.5 mn to be received from Bpifrance; **(2)** BIOME Oléoactif®, co-developed by DEINOVE and HALLSTAR, to be launched commercially in April 2020; **(3)** DEINOVE is planning to launch its new cosmetic ingredient in April 2020 through digital means; **(4)** Collaboration agreement with Sharon Laboratories for marketing of bio-based ingredients did not materialize; **(5)** DEINOVE and Paris Institute of Industrial Physics and Chemistry (ESPCI) received an EUR 300k grant from the French National Research Agency (ANR); **(6)** Emmanuel Petiot resigned as CEO of the company on December 31, 2019; **(7)** DEINOVE enhanced its prowess in genetic engineering by integrating the advanced CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) technology with its technology platform; **(8)** The company received EUR 2.1 mn as pre-funding for its R&D Tax Credit receivable from Society General Factoring (SGF); **(9)** DEINOVE strengthened its cash position by EUR 1 mn by issuing the second tranche of notes convertible into shares as per the previous agreement with European Select Growth Opportunities Fund for financing by issuing notes convertible into shares for a maximum amount of EUR 15 mn.

**Key Risks:** (a) DEINOVE's antibiotic drug candidates face regulatory and clinical trial failure risk (b) The company may not receive grant payments if it fails to meet the milestones (c) The company will have to raise capital through equity issuance which will be dilutive to earnings.

**Valuation and Assumptions[iv]:** Based on due diligence and valuation estimates, Arrowhead believes that DEINOVE's fair share value lies in the EUR 1.68 – EUR 3.52 bracket. We have valued the company using the Blended method, with equal weightage to Discounted Cash Flow (DCF) method and EV/Sales multiple based valuation. Our DCF model suggests a fair value bracket of EUR 2.79 to EUR 6.41, while relative valuation provides a fair value of EUR 0.57 to EUR 0.62.



See important disclosures on page 53 of this report

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## 1. Summary and Outlook

We are updating coverage on DEINOVE. The Company, discovers, develops and produces compounds originating from rare bacteria for health, nutrition and cosmetics industries.

**Key Highlights[v]:**

1) DEINOVE and ESPCI raised funding (from ANR) to develop the Deinodrop technology to accelerate the discovery and identification of bacteria producing new antibiotics. Both DEINOVE and ESPCI have jointly received an EUR 300k grant from ANR. The two-year project aims to develop a technology for sorting bacteria into droplets and conducting screening at very high rates. The project is expected to support and increase the success rate of the AGIR program.

2) DEINOVE received EUR 2.1 mn from SGF in April 2020. The company received this amount to pre-finance its R&D Tax Credit receivable. This pre-funding is expected to strengthen the short-term cash position of the company. This amount is likely to account for around 84% of the estimated receivables for FY 2019.

3) DEINOVE completed the second key milestone in March 2020 and triggered a milestone payment of EUR 1.5 mn to be received from Bpifrance, under the AGIR program supported by Investments for the Future Program for discovery of new antibiotics.

4) DEINOVE announced that BIOME Oléoactif®, the first oil-based active ingredient co-developed with HALLSTAR for skin care treatment, would be launched in April 2020.

5) The company is in the process of finalizing the development of its second proprietary cosmetic active ingredient for an official launch in April 2020. The new ingredient is produced through fermentation and is an original carotenoid. It is meant to restore the skin's radiance and vitality. The launch will now happen through digital means unlike the earlier planned launch at In-cosmetics tradeshow which is now postponed following the steep escalation of COVID-19.

6) The collaboration with Israeli group Sharon Laboratories, with which Deinove has been in discussion since the beginning of February 2020, has come to a halt as the health crisis created because of COVID-19 has led to wide economic and industrial uncertainty. The collaboration had been planned for the development of a range of cosmetic ingredients. However, DEINOVE will retain USD 200k received consequent to the Memorandum of Understanding (MoU) signed in February this year.

7) Emmanuel Petiot stepped down as CEO of the company on December 31, 2019. Dr. Charles Woler (currently chairman of the Board of Directors), is acting as interim CEO until a new CEO gets appointed. However, Emmanuel Petiot would continue to serve as a director of the company.

8) DEINOVE reinforced its expertise in genetic engineering with the integration of an advanced tool, the CRISPR-cas9 technology (known as "molecular scissors'), which has revolutionized genetic engineering in recent years. The technology enhanced the ability of the company to optimize various microorganisms. The company seeks to directly manipulate the strains producing antimicrobial activities or to transfer these activities into phylogenetically close frames. Overall, this technology will enhance the ability of the company to encash the opportunities in the identification of and improvement in the production of new antibiotic structures.

9) DEINOVE is developing an innovative bio-based carotenoid for the cosmetics market, which will be produced using an exclusive bacterial fermentation process. This is the Company's 2nd proprietary carotenoid-based cosmetic active ingredient, after Phyt-N-Resist®. It had planned to market the new carotenoid in 2019.

10) In April 2020, DEINOVE has issued the second tranche of EUR 1 mn of notes convertible into shares (OCA) which has strengthened its cash position. This tranche comprises 100 OCA with a value of EUR 10,000 each. Previously, in July 2019, DEINOVE and European Select Growth Opportunities Fund entered into an agreement to issue notes which are convertible into new shares. The notes will be issued for a maximum amount of EUR 15 mn (@6.5% facial discount), with no interest obligation and no stock subscription warrants attached, and for a maximum period of 2 years. Objectives of this fund raising are stated below:

- Finance Working capital
- Continue the development and marketing of natural cosmetic active ingredients
- Kick start the Phase II clinical trial of DNV3837 (pro drug of DNV3681) in the US (for treatment of gastrointestinal infections caused by Clostridiodes difficile)
- Discover new antibiotic leads

11) DEINOVE developed Phase II clinical trials in the first half of the year on its antibiotic candidate DNV3837 (pro drug of the DNV3681 molecule) which had shown a promising efficacy and tolerance in Phase I trials for the treatment of Clostridioides. Simultaneously, DEINOVE has kicked off the production of the first DNV3837 batch, which will be used to prepare the drug needed for conducting the Phase III trial. The DNV3837 program was also the subject of a scientific paper at the 29th Annual Congress of the European Society of Clinical Microbiology and Infectious Diseases (ECCMID). The first patient for the Phase II trial was enrolled in January, 2020.

12) Results related to DNV3681 against Bacillus anthracis and Francisella were presented at American Society for Microbiology Microbe 2019. A US Army Medical Research Institute of Infectious Diseases (USAMRIID) team examined the effectiveness of DNV3681 by measuring the minimum concentration necessary to hinder the growth of 90% of a set of bacterial isolates. The results were positive as this value was 0.015 µg/ml against Bacillus anthracis, proving it a more effective molecule than Ciprofloxacin.

13) DEINOVE and DOW formed a collaboration for developing a cosmetic ingredient derived from one of DEINOVE's collection of bacterial extracts. DEINOVE plans to develop and implement a proper production process for the developed cosmetic active ingredient. DOW is looking forward to qualifying its cosmetic active ingredient and fusing it into its product and receiving commercial exclusivity worldwide.

14) In 2018, DEINOVE raised EUR 8.8 mn through a private placement (EUR 6 mn), TVM Capital (2 mn) and EUR 0.8 mn from Kepler Cheuvreux equity line funding. In February 2019, the Group received EUR 2.4 mn receivables corresponding to the research tax credit in 2017. However, as the company has entered into an agreement with European Select Growth Opportunities Fund, it has committed to give up the equity line funding with Kepler Cheuvreux within a time period of 2 years from the signing of the agreement or on the date on which OCAs get fully converted.

15) DEINOVE's capital shareholder structure strengthened as TVM Capital Investment fund which is one of the major venture capital firms in the life sciences sector in Canada, the US and Europe became a stakeholder in DEINOVE in May 2018 after the acquisition of BIOVERTIS.

16) In March 2018, DEINOVE expanded its antibiotic portfolio by signing a license option agreement with REDX PHARMA for its first-in-class* anti-infective program, Novel Bacterial Topoisomerase Inhibitor (NBTI), targeting gram-negative infections. In January 2019, DEINOVE announced that it will not exercise the option on the NBTI program because the data collected during the evaluation phase did not meet the expectations.

17) DEINOVE entered into strategic partnerships with UNIVAR and SOLVAY in 2018 to leverage their local presence and expertise for the distribution of PHYT-N-RESIST® worldwide.

18) DEINOVE announced its collaboration with Calibr (a division of the Scripps Research, a California non-profit corporation) for the exploration of the anti-infectious potential of its bacterial collection. DEINOVE will share the bacterial extracts from the collection of rare microorganisms with Calibr. In return, Calibr will assist the Company to identify new antibiotic structures under the AGIR program and explore the potential of these bacteria for the treatment of neglected parasitic and infectious diseases, such as tuberculosis or malaria, not targeted by DEINOVE.

19) DEINOVE has collaborated with bioMérieux, a major player in in-vitro diagnostics, to explore new strains and multiply opportunities to discover new antibiotics. bioMérieux will provide DEINOVE with more than 250 strains (130 species) for screening of antibiotic and antifungal activities. This collaboration comes under the scope of the AGIR program that is aimed at diversifying the bacterial strain profiles studied to maximize the opportunities for discovering new antibiotic structures.

20) DEINOVE acquired the Austrian company Biovertis and its German subsidiary MORPHOCHEM through a pay-in-kind deal. The company acquired the property of the first-in-class antibiotic program MCB3837, which MORPHOCHEM has developed. MORPHOCHEM developed the clinical-stage (Phase I completed) antibiotic compound MCB3837 which aims to treat severe gastrointestinal infections caused by Clostridium difficile (CDI), a priority pathogen according to the World Health Organization (WHO) and the Center for Disease Control and Prevention (CDC). The drug has been granted the Qualified Infectious Disease Product (QIDP) status and Fast track designation.

21) DEINOVE and GREENTECH announced the launch of HEBELYS®, the first cosmetic active ingredient resulting from their collaboration, in Q2 2018. HEBELYS® is marketed effectively by GREENTECH.

22) DEINOVE and partner AVRIL validated the 3rd milestone of the COLOR2B program focused on developing a process for producing natural additives for animal feed. The final producer strain showed its performance to be comparable to petrochemical products in use at present. The COLOR2B program is therefore on track to achieve the commercial launch of a competitive natural alternative in the farmed animal feed market. The selected strain was evaluated for a broader testing phase and the tests confirmed the efficiency of the ingredient at the selected dosage and it could compete with reference products. The company plans to market the product as raw material for animal feed. Also, the regulatory and industrial stages are ongoing for marketing purposes. An industrial-scale batch will be tested in real conditions by the end of 2019, which will be followed by the launch of the product by late 2020.

23) The AGIR Antibiotics Program, headed by DEINOVE Group and the Charles Viollette Institute, will receive EUR 14.6 mn financing (2017-2022) since it was selected by the Investments for the Future Program, under the R&D Projects Strengthening Competitiveness call for proposals. DEINOVE is expected to receive its share of EUR 10.4 mn in 5 tranches starting 2018.

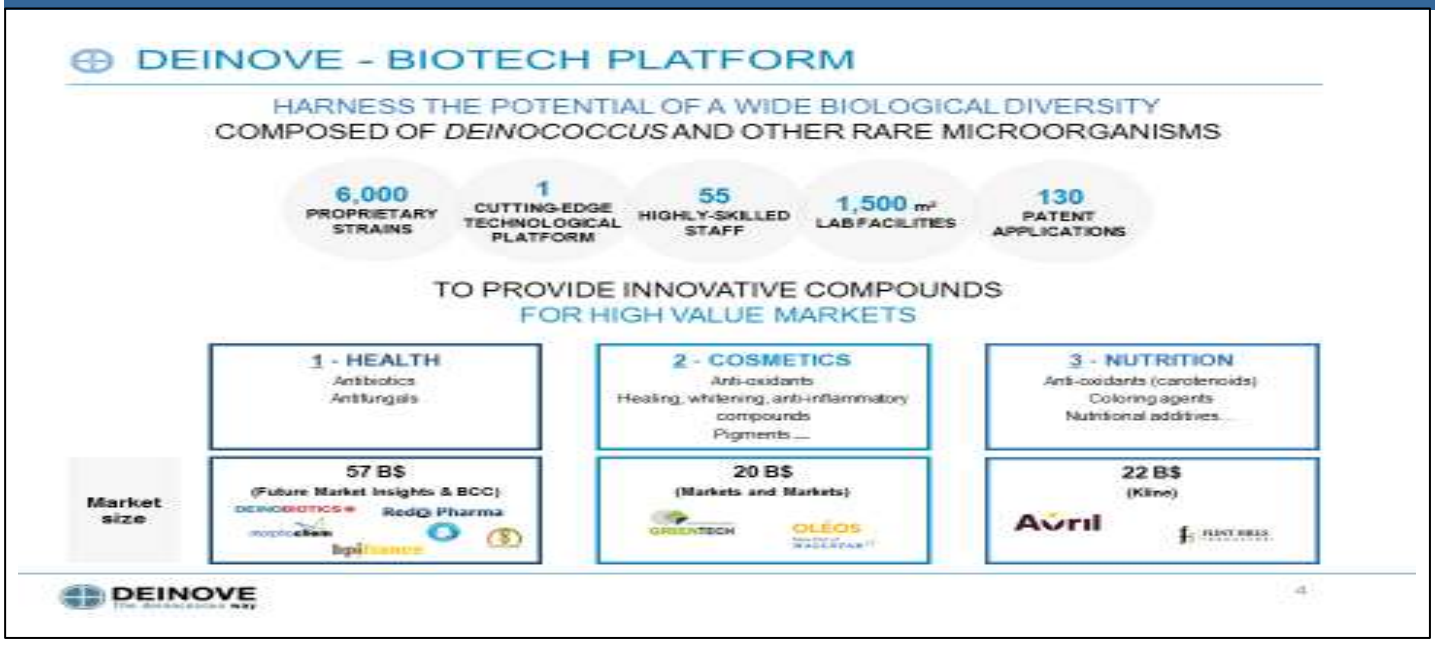
**Key risks:** a) DEINOVE's antibiotic drug candidate faces regulatory and clinical trial failure risk. (b) The company might not receive grant payments if it fails to meet set milestones. (c) The company will have to raise capital through equity issuance which will be dilutive to earnings.

## 2. Business Overview[vi]

DEINOVE, founded in 2006, is a France-based biotech company that discovers, develops and produces high-added-value compounds from rare microorganisms for use in the fields of health, nutrition and cosmetic markets. Depending on the molecules produced and application markets it decides to employ various economic development methods.

DEINOVE has a unique library of 6,000 rare or unexploited bacterial strains which are selected based on their UV resistance, mainly of the *Deinococcus* genus. DEINOVE is the only company in the world that exploits the untapped genetic and metabolic potential of the *Deinococcus* bacterial genus for industrial purposes. This bacterium, discovered by chance in 1956, has exceptional properties.

**Exhibit 1: DEINOVE At a Glance[vii]**

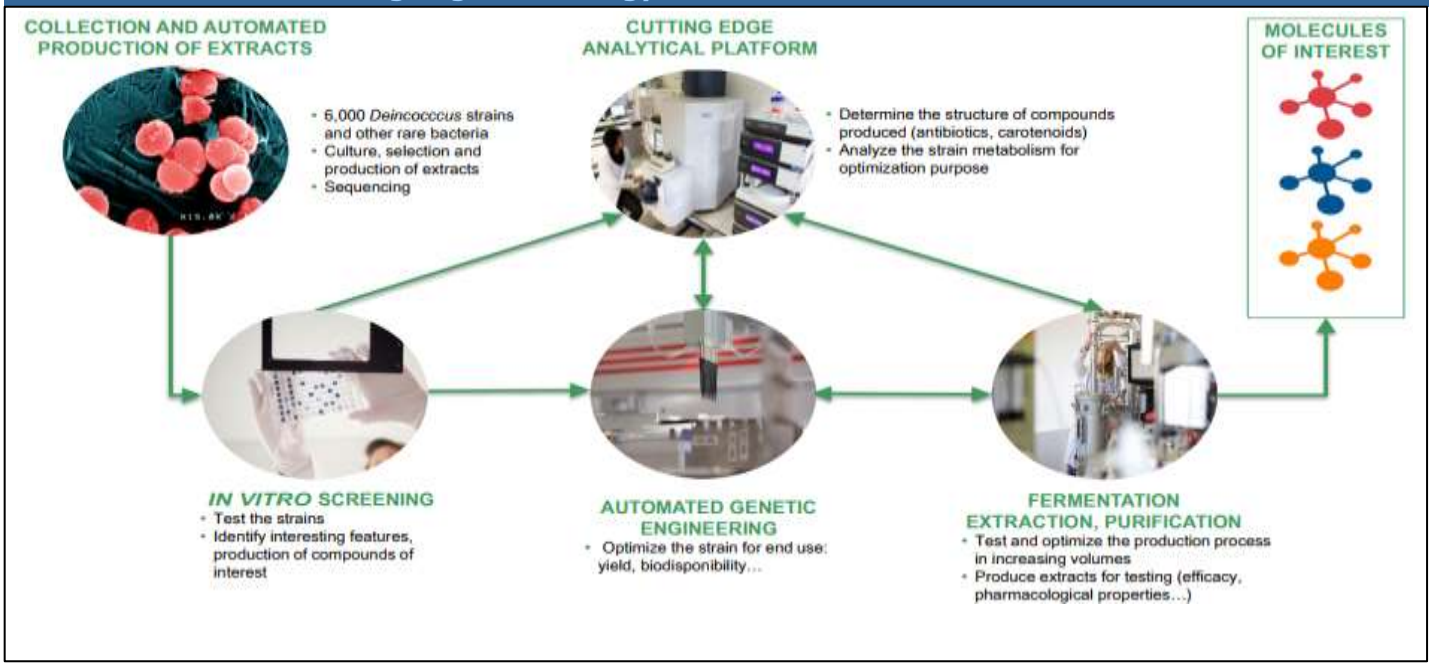



DEINOVE's core expertise lies in its ability to screen its bank to identify the strains that produce compounds of interest naturally and which may be extracted and exploited on an industrial scale.

The company's second area of expertise lies in selecting bacteria with industrial-potential properties and optimizing their natural capacities through genetic and fermentation engineering to hyper-produce a given compound.

DEINOVE has a genetic, metabolic and fermentation engineering platform capable of customizing these natural "micro-factories" to transform them into new industrial standards.

**Exhibit 2: DEINOVE Cutting Edge Technology[viii]**



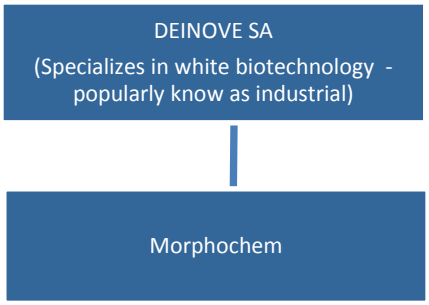

## 2.1 Financial Overview[ix]:

The company reported operating revenue of EUR 405,000 in H1 2019, which was generated largely from the operating subsidy received from Bpifrance under the AGIR (Antibiotics against Resistant Infectious Germs) program, as compared with EUR 715,000 in H1 2018. Operating expenses increased by 29.9% in H1 2019 to EUR 6.6 mn from EUR 5.1 mn in H1 2018, because of a spike in external R&D costs which are predominantly attributable to the services provided by CROs in relation to DNV3837. Operating loss increased by 41.9% to EUR 6.2 mn in H1 2019 from EUR 4.4 mn in H1 2018, as a result of high operating costs. On June 30, 2019, the company had cash and cash equivalents of EUR 1.9 mn, compared with EUR 3.9 mn on June 30, 2018. DEINOVE received EUR 1.5 mn in repayable advances and subsidies under the AGIR program as well as EUR 2.5 mn under the 2017 CIR (R&D Tax Credit), in the first half of 2019. The company also issued bonds of EUR 2.2 mn to European Select Growth Opportunities Fund (ESGO fund) in July 2019.

The company reported a turnover of EUR 39,000 in FY 2018, compared with EUR 73,000 in FY 2017. Operating revenue increased substantially to EUR 759,000 in FY 2018 from EUR 214,000 in FY 2017, due to higher grants received under the AGIR program. DEINOVE received an EUR 678,000 grant from BPI France in February 2018 as first payment under the ACT project; and a further EUR 20,000 grant as the first payment of an Occitan region grant in July 2018. Operating expenses increased 13.4% YoY to EUR 11.2 mn in FY 2018 from EUR 9.8 mn in FY 2017, mainly due to integration of acquired companies - Morphochem and Biovertis. Operating loss expanded by 8.1% YoY to EUR 10.5 mn in FY 2018 from EUR 9.7 mn in FY 2017. On December 31, 2018, the company's cash stood at EUR 3.9 mn, compared with EUR 4.9 mn on December 31, 2017. During FY 2018, DEINOVE raised EUR 8.0 mn from private placement, of which EUR 2.0 mn was from TVM capital and EUR 0.8 million was raised from Kepler Cheuvreux (recently suspended). In addition, the group received EUR 2.5 mn under the 2017 R&D Tax Credit and EUR 1.5 mn for the second payment from the PIA (Investment for the Future Program) for the AGIR antibiotic project.

## 2.2 Corporate Structure

**Exhibit 3: Corporate Structure[x]**



## 2.3 Company Milestones

| Exhibit 4: DEINOVE Milestones[xi] | |
|---|---|
| **Year/ Period** | **Event** |
| **2006** | • Incorporated in the year 2006 by Philippe Pouletty and Miroslav Radman<br>• Fund raising of EUR 300, 000 from TRUFFLE CAPITAL funds and scientific founders in December |
| **2008-2009** | • Fund raising of EUR 1.5 mn from TRUFFLE CAPITAL funds in January 2008<br>• Fund raising of EUR 1.5 mn from TRUFFLE CAPITAL funds in May 2009 |
| **2010-2012** | • IPO on NYSE Alternext Paris in April 2010 and raised more than EUR 12 mn<br>• Set up of subsidiary DEINOBIOTICS for developing innovative antibiotics from Deinococcus<br>• DEINOVE was awarded Innovative Company status by Office for Science and Technology of the Embassy of France in the US (OSEO) |
| **2013-2015** | • DEINOCHEM project was selected for 'Investments for the Future' funding of around EUR 6 mn based on meeting specified milestones<br>• The company initiated a new medium-term financing solution, in the form of an equity funding guarantee line, with Kepler Cheuvreux, with a maximum amount of EUR 15 mn |
| **2016** | • DEINOVE decided to focus its research and resources on high value-added compounds, essentially carotenoids and antibiotics<br>• Decision to suspend second generation biofuels research program (DEINOL) due to low oil prices |
| **2017** | • First new antibiotic structure patented in January<br>• DEINOBIOTICS became a fully owned subsidiary after a minority shareholding acquisition<br>• Partnership with Greentech to co-develop and market a first cosmetic ingredient by the end of 2018<br>• First patent in animal nutrition, issued in China<br>• Antibiotics project granted EUR 14.6 mn by 'Invest for the Future' Program<br>• Launch of the industrial production of its first carotenoid in December, 2017 |
| **2018** | • DEINOVE launched its first in-house carotenoid product Phyt-N-Resist® for skincare in Q2 2018<br>• DEINOVE and GREENTECH announce the launch of HEBELYS®, the first cosmetic active ingredient resulting from their partnership in Q2 2018<br>• DEINOVE acquired from REDX PHARMA an option for a license on a series of molecules about to enter preclinical development<br>• DEINOVE acquired MORPHOCHEM's clinical-stage antibiotic compound targeting CDI |
| **2019** | • DEINOVE integrated the CRISPR technology into its technology platform to strengthen its expertise in Genetic Engineering<br>• DEINOVE entered into an agreement with European Select Growth Opportunities Fund (the "Investor") for the financing by issuance of notes convertible into new shares (the "OCA") for a maximum nominal amount of EUR 15 mn<br>• DEINOVE entered into an agreement with DOW for the development of new cosmetic ingredient |
| **2020** | • DEINOVE completed the second key milestone of the AGIR program, which triggered a payment of EUR 1.5 mn to be received from Bpifrance |

## 2.4 Business Model

DEINOVE selects pertinent bacteria for the target application, exploring the bacteria to identify its genetic heritage and metabolic pathways, developing a metabolic engineering and fermentation platform to improve its performance then establishing processes to industrially exploit the micro-organism in an economically competitive manner. The Company's aim is to supply industrial players with innovative compounds or compounds made with innovative production processes that present favorable economic conditions compared to traditional production methods.

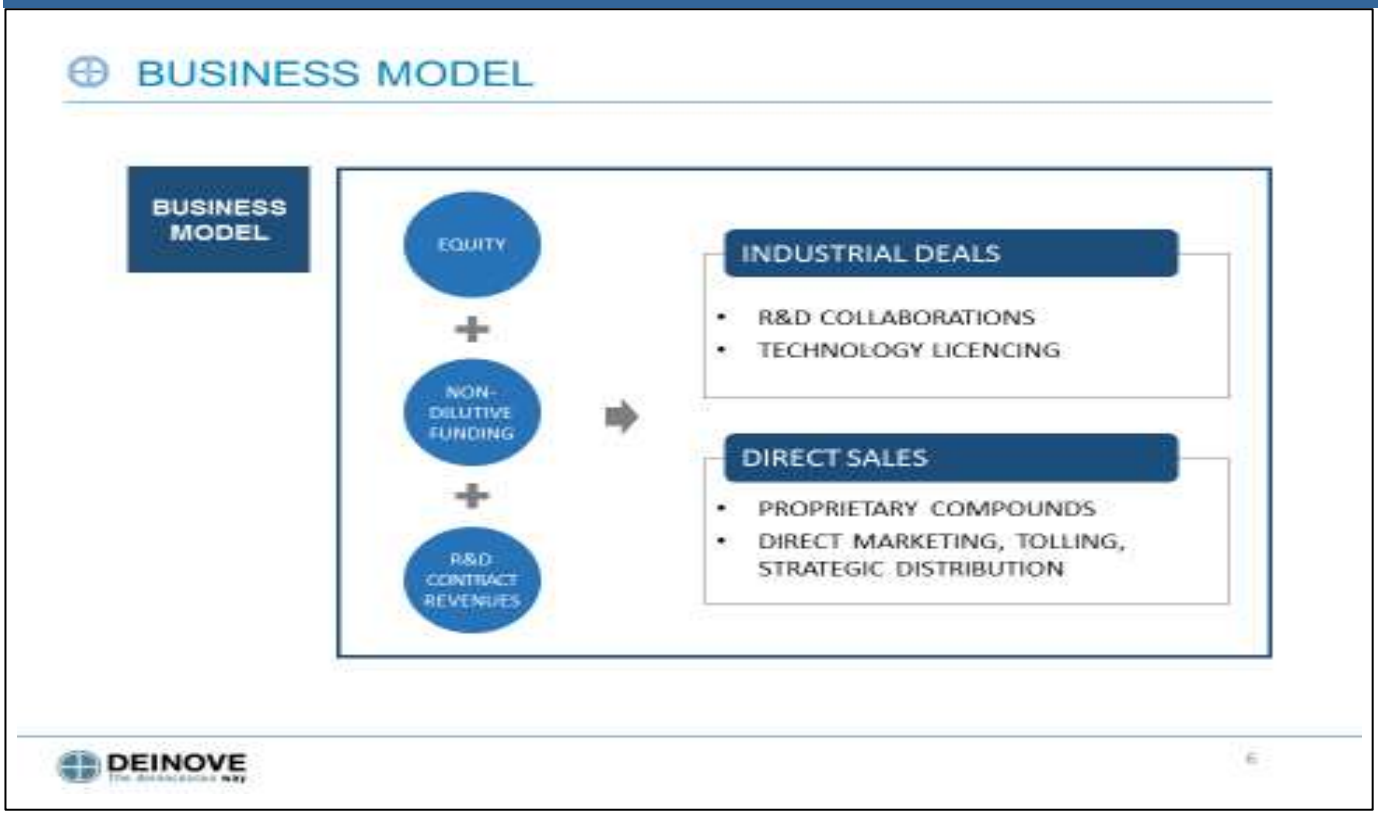
This comprises carotenoids, with powerful antioxidant properties that are currently oil-based, as well as antibiotics, a market in need of innovation. The production of these compounds relies on biotechnological techniques, namely the use of micro-organisms, as well as fermentation techniques.

DEINOVE is targeting 3 industries for its products, which include 1) Healthcare 2) Nutrition and 3) Cosmetics.

The company looks to generate revenue from four different areas:

- The industrial partner partially or fully covers the research efforts undertaken as part of the R&D project
- Public financing in the form of grants/repayable advances granted by organizations supporting the research, such as Bpifrance and ADEME, etc.
- An upfront payment on the completion of milestones followed by royalties received from product sales resulting from DEINOVE processes under licensing agreements
- Turnover from the sale of molecules to industrial actors (B to B)

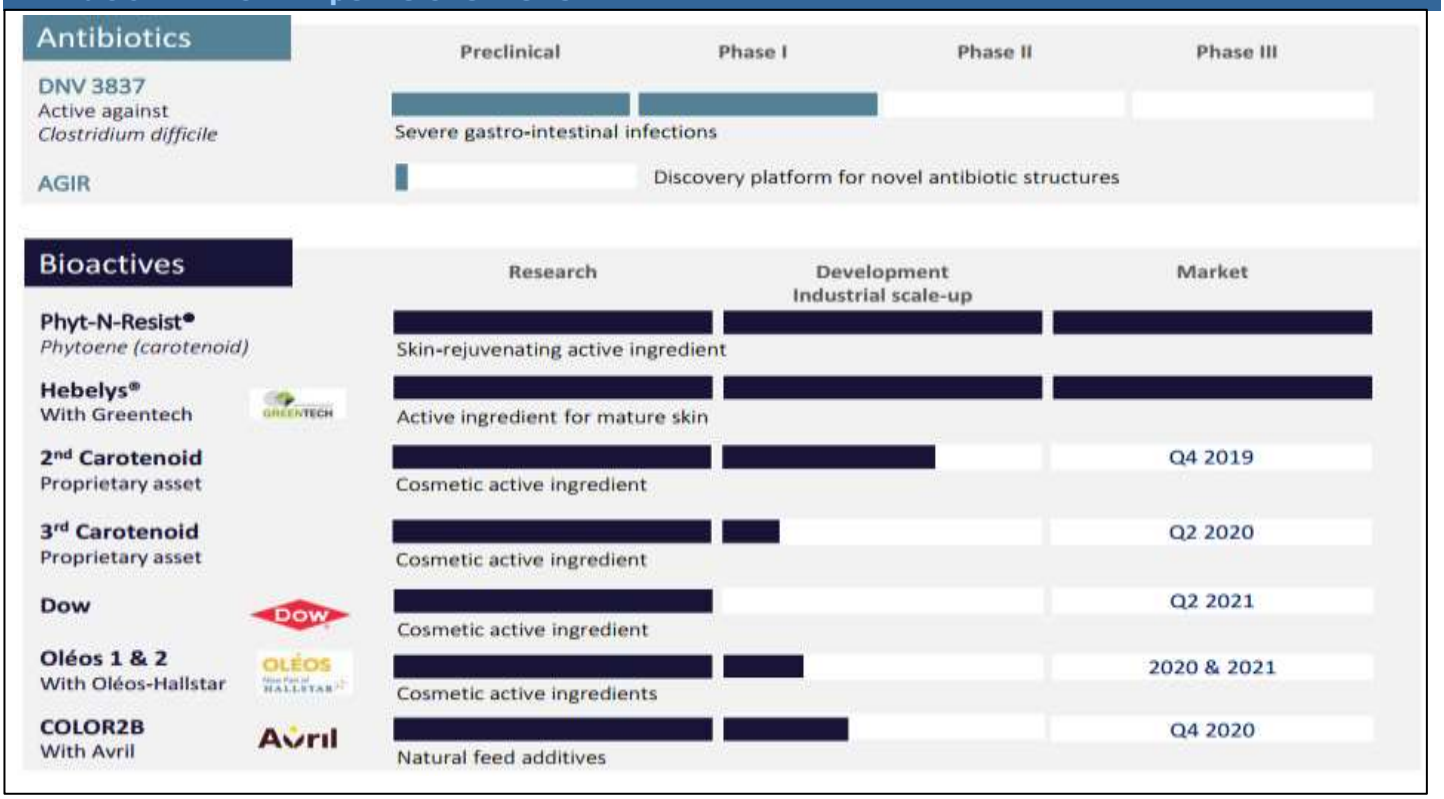
**Exhibit 5: DEINOVE's Business Model[xii]**



### 2.5 Key On-going Programs

DEINOVE is running several R&D programs and studies to explore opportunities in the field of Health, Nutrition and Cosmetics. The company runs these programs in-house as well as on partnership basis. Mentioned below are key programs run by DEINOVE:

**Exhibit 6: DEINOVE Pipeline Overviews[xiii]**




The company plans the official launch of its second carotenoid, which is proprietary and developed by DEINOVE. The launch earlier slated to happen at trade show in-Cosmetics Global for cosmetic ingredients will now be launched through digital means in April 2020 as the trade show is postponed until October 2020. The new cosmetic ingredient produced by fermentation has the ability to absorb blue light responsible for premature skin ageing. Tests carried out on human skin explants have confirmed the ingredient's antioxidant properties. The tests have also revealed the ingredient's ability to play an active role in skin lightening. The active ingredient was being clinically tested in February when the news was released. The data are expected to be available at the time of its official launch.

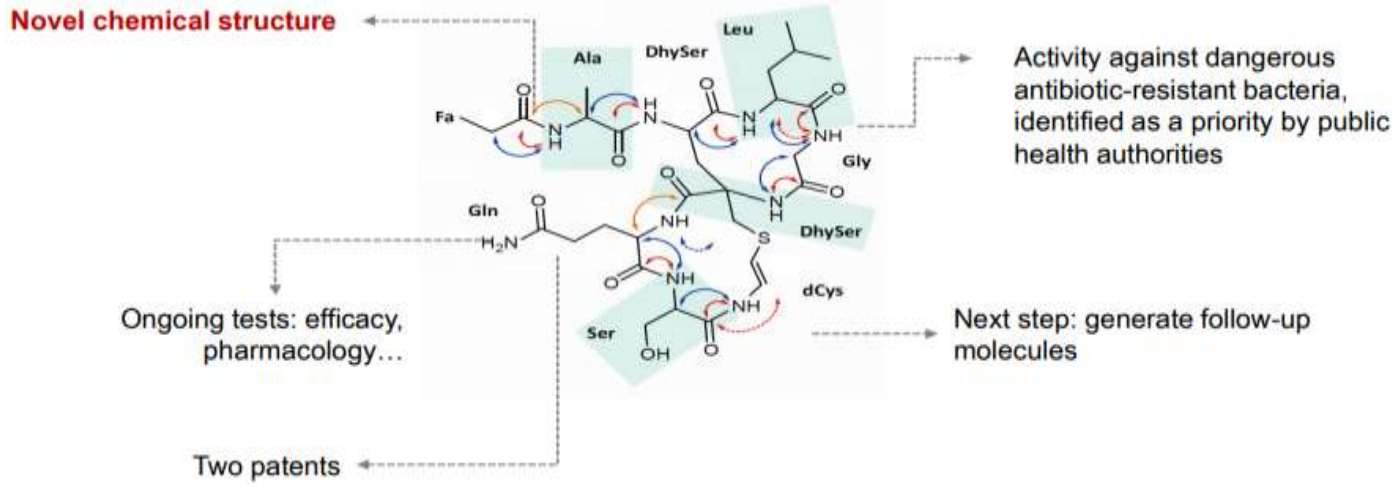
#### 2.5.1 Antibiotics Program (Healthcare)

DEINOVE is the one of the few companies in the world exploring medical opportunities in the antibiotic space with uncommon bacteria's abilities for producing antimicrobials, antibiotics and antifungals. This is clearly highlighted by the fact that there has been no innovation in antibiotics since 2010 and only 3 have come to market since 2005. Based on several years of research, DEINOBIOTICS identified several strains of interest and filed two applications for patents in January 2017 pertaining to a new antibiotic structure. Other compounds, from other strains and derivatives of this initial molecule, are currently being explored.

The AGIR Program being conducted by DEINOVE Group and the Charles Viollette Institute aims to identify novel antibiotic structures from rare bacterial strains by developing new collection, culture, screening, optimization, and evaluation methods to contribute to the development of treatments for responding to medical emergencies.

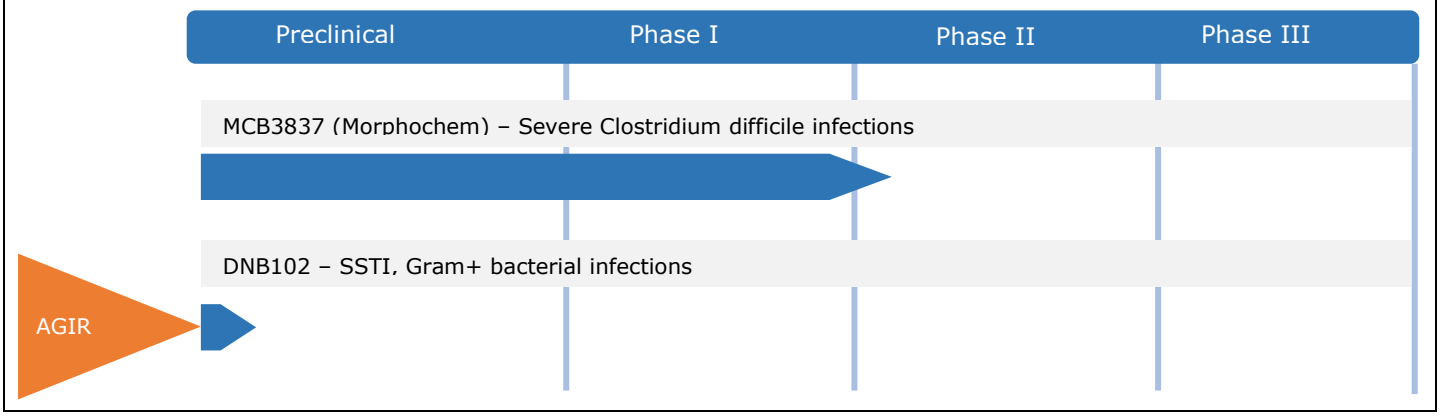
- In 2017, the program received EUR 14.6 mn financing support for the next five years for a total investment of EUR 25.0 mn from 'Investments for the Future' by the General Investment Commission (CGI) and operated by Bpifrance. The funding was expected to accelerate the ramp-up of the platform, enrich the portfolio of molecules, and contribute to the development of new antibiotics for responding to a major medical emergency
- The DEINOVE Group was to receive EUR 10.4 mn while the Charles Viollette institute was to receive EUR 4.2 mn
- Received a grant of EUR 0.7 mn in 2018 and a milestone payment of EUR 1.5 mn in March 2019. The company will receive the remaining amount in the form of tranches till 2023 based on fulfillment of certain condition
- The company completed the second key milestone of the AGIR program in March 2020 and triggered a milestone-related payment of EUR 1.5 mn, in the form of repayable advances and subsidies.

**Exhibit 7: Novel Antibiotic drug candidate[xiv]**




DEINOVE and its subsidiary DEINOBIOTICS aim to identify and develop a portfolio of drug candidates, then to optimize these candidates through agreements with pharmaceutical companies. At present, DEINOVE is running 1 in-house program and 2 partnered agreements within the antibiotics space. DNB101 is the in-house potential (Investigational) drug in the drug optimization phase that confirms the potential of the platform. The company has filed five families of patents for this drug. The company estimates this drug candidate to take around 2 years to eventually move into the pre-clinical phase. DEINOVE expects they can fund part of clinical trial expenses through grants received by agencies which are funding antibiotic programs.

**Exhibit 8: DEINOVE's Antibiotic pipeline[xv]**




In 2018, DEINOVE concluded several collaborative agreements and one acquisition to accelerate its development and strengthen its product portfolio.

**Partnership Agreements**

- **bioMérieux Agreement**: DEINOVE collaborated with bioMérieux, a major player in *in-vitro* diagnostics, to explore new strains and multiply opportunities to discover new antibiotics. bioMérieux was to provide DEINOVE with more than 250 strains (130 species) for screening of antibiotic and antifungal activities. This collaboration came under the scope of the AGIR program aimed at diversifying the bacterial strain profiles studied to maximize the opportunities for discovering new antibiotic structures.
- **NAICONS Agreement:** An exclusive research license agreement with Italian biopharmaceutical company NAICONS, with a view to broaden its current strain library and increase opportunities for the discovery of new antibiotics.
    - NAICONS specializes in the research of innovative antibiotics.
    - As part of its AGIR program, DEINOVE was to have access to 400 strains where it was to use the power of its own robotic technology platform to detect and characterize the antibiotic activities of these strains. In case of discovery of a strain of interest, DEINOVE was to be able to acquire it either via a commercial license or in full ownership, in order to initiate the development of drug candidates.
- **Institute Pasteur Agreement:** DEINOVE is to collaborate with Institute Pasteur, a renowned player in the area of research on infections. As per the agreement, the institute will provide selected strains to DEINOVE, and the company will conduct assessment on the strains' antimicrobial properties on its technology platform. This agreement complies with DEINOVE's AGIR program, which aims at studying a range of bacterial strains to optimize opportunities for discovering novel antibiotic structures.

**Biovertis AG Acquisition (Morphochem)**

In April 2018, DEINOVE acquired Austrian company Biovertis AG and its wholly owned German subsidiary company Morphochem AG in a contribution-in-kind transaction from specialized investment funds managed by TVM Capital. Through this acquisition, it gets access to the clinical-stage antibiotic compound "MCB3837", which was about to start its Phase II. The compound targets the treatment of severe gastrointestinal CDI generally related to a disruption of the gut microbiota in weakened patients.

The CDC recently identified CDI as one of the leading causes of healthcare-associated infections. In 2011, about half a mn Americans were infected and more than 29,000 patients died within 30 days[xvi] following the diagnosis. In 2021, experts predict 1.5 mn cases of CDI in the US and Europe combined.

Until now, no effective antibiotic treatment is available for severe gastrointestinal infections because of the very nature of the disease: oral treatments struggle to reach the intestine because of the pathological state of the patient (reduced gastrointestinal motility, intubation, intestinal perforation, etc.).

The MCB3837 compound (rebranded DNV3837), developed by the German biotechnology company MORPHOCHEM, is a first-in-class antibiotic effective on Gram-positive bacteria and more particularly on CDI. In addition to its spectrum of activity, its interest lies mainly in the way the product is administered and distributed in the body, which makes it particularly interesting in the treatment of severe gastrointestinal infections: MCB3837 is an antibiotic administered by intra-venous infusion and able to cross the gastrointestinal barrier. It precisely targets the infection site.

Key highlights of the under-development MCB3837 compound, which make it attractive for DEINOVE include:

- It is a **first-in-class** antibiotic effective on Gram-positive bacteria and more particularly on *CDI*.
- In 2016, was granted the QIPD designation as well as Fast Track status from the US Food and Drug Administration (FDA).
- Several Phase I trials (on healthy volunteers) have demonstrated an acceptable tolerance profile.
- First patient enrolment for the Phase II trial was done recently to kick off the trial
- IV administration of MCB3837 could bring a new effective therapeutic option.
- The acquisition was approved at the shareholders meeting on May 23, 2018. TVM Capital, one of the most prominent European life science venture capital funds, is now one of DEINOVE's shareholders.

**Collaboration with CALIBR**

DEINOVE collaborated with CALIBR, part of Scripps Research which is a US based renowned biomedical research company. CALIBR is a non-profit drug discovery platform which is into evaluation of treatment of the anti-infectious potential diseases. As per the collaboration, DEINOVE will provide bacterial extracts from its collection of rare microorganisms to CALIBR, to explore the potential of these bacteria for the treatment of parasitic and neglected infectious diseases such as tuberculosis and malaria, not targeted by DEINOVE.

### 2.5.2 Carotenoids Program / DEINOCHEM (Cosmetics)

The focus for DEINOVE is on industrial biotech developments on the carotenoid family. Carotenoids are organic pigments produced by plants and algae and widely used in the markets as dietary supplements or incorporated into skincare treatments because of their antioxidant properties, as dyes in the nutrition sector, etc. DEINOVE's priority applications deal with:

- Dietary supplements
- Cosmetic ingredients (antioxidants, UV protection)
- Dyes for human and animal foods (pigments)

DEINOVE aims to provide a competitive bio-sourced alternative for industrial groups by developing a range of natural carotenoids and offering significant advantages in terms of supply stability, consistent quality, conservation of natural resources and costs. Several hundred *Deinococcus* strains naturally produce carotenoids which have innovational structures. DEINOVE introduced the first carotenoid to the market in April 2018 and is working on the following ones.

DEINOVE develops the whole production process but subcontracts industrial production: large-scale fermentation, extraction, purification and formulation.

Its first in-house developed innovative bioactive ingredient named Phyt-N-Resist® with anti-aging properties was launched at In-cosmetics Global event at Amsterdam in April 2018. The carotenoid, focused on the cosmetics market, possesses powerful antioxidant and healing properties, and therefore combats the effects of aging on the skin.

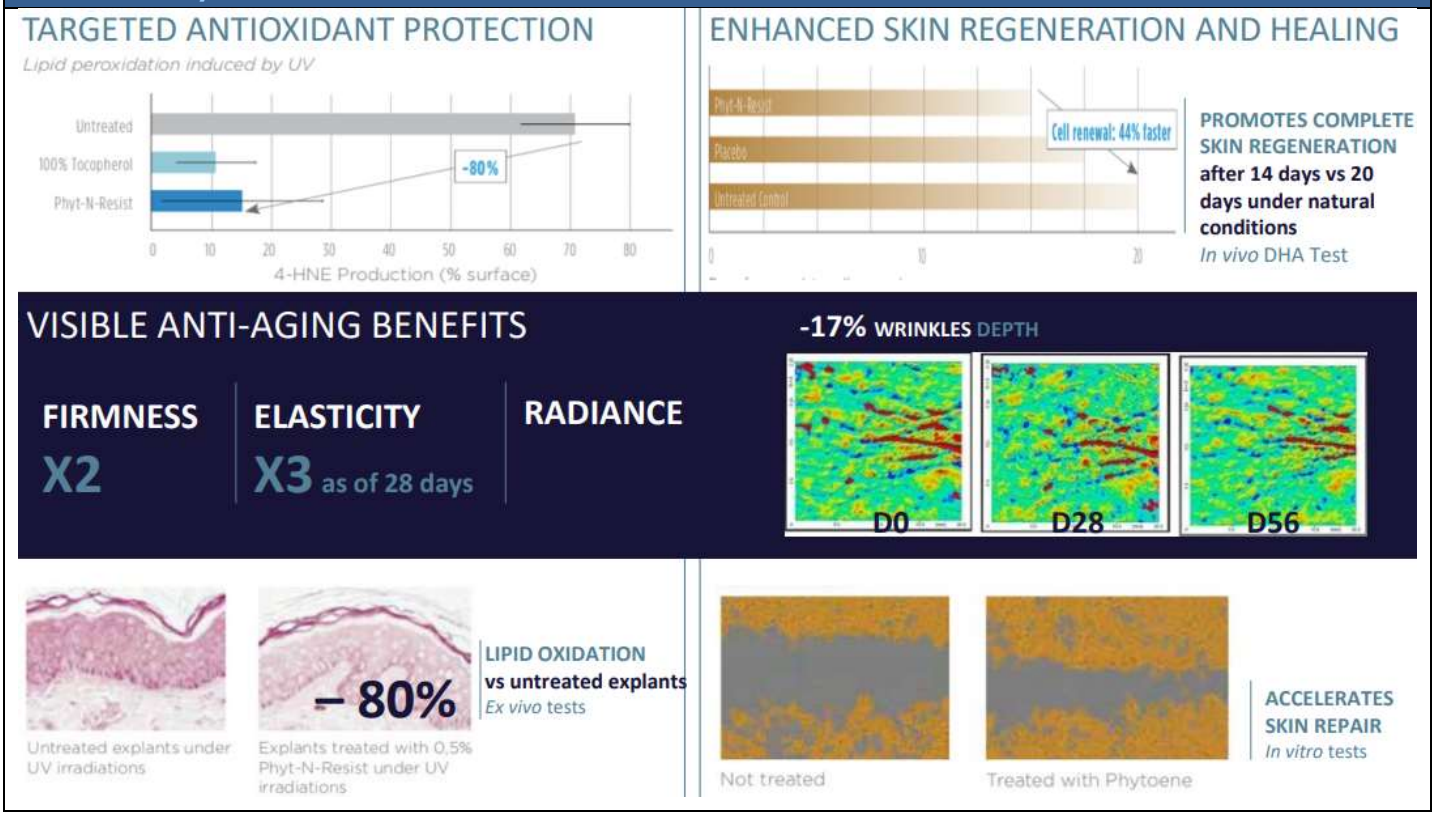
**Exhibit 9: Phyt-N-Resist® - First 100% DEINOVE – made active[xvii]**


To achieve this output, DEINOVE scientific platform has designed an exclusive *Deinococcus* fermentation process to deliver the first pure Phytoene for application in the beauty industry. Phytoene is a colorless carotenoid produced through fermentation of natural sugars by *Deinococcus geothermalis*, an extremophile bacterium. Skin care formulas have been developed to demonstrate its ease of formulation; additionally, its stability at high temperatures makes it a candidate for makeup applications as well.

**Exhibit 10: Phyt-N-Resist® - Key Product Features**

| | |
|---|---|
| INCI | Simmondsia chinensis (Jojoba) seed oil and C30-45 Olefin |
| Compliance | China Compliant |
| High-Performance Anti-aging active molecule | • Sharper approach to cell anti-oxidant protection<br>• Clinically tested skin regeneration |
| Formulation – friendly | • Colorless & stable carotenoid<br>• Consistent process and product quality<br>• A concentrated ingredient, low incorporation rate<br>• Easy to formulate |
| Rich narrative material | • Advanced biotech science<br>• Exclusive patented innovation<br>• Ancient and highly resilient micro-organism surviving in extreme environments<br>• Biomimetic solution<br>• Supplementation of the skin's natural defenses<br>• Made in France |

**Exhibit 11: Phyt-N-Resist® - Proven Clinical Benefits[xviii]**




First sales from Phytoene were expected to start by the end of 2019.

In addition to its in-house progress on the cosmetic activities, the company has signed two partnerships with Greentech and Oleos for the development of natural cosmetic active ingredients from the DEINOVE bacterial strain bank.

- **GREENTECH Partnership:** DEINOVE has partnered with GREENTECH to co-develop and market new active ingredients for skin care. As part of the collaboration, DEINOVE and GREENTECH launched their first cosmetic active ingredient HEBELYS® in April 2018 at the In-cosmetics Global show at Amsterdam. HEBELYS® is a natural active ingredient produced by the fermentation of *Sphingomonas*, a bacterium belonging to the DEINOVE proprietary strain library. HEBELYS® is marketed by GREENTECH.
    - GREENTECH presently markets around 100 active ingredients to cosmetics manufacturers in more than 30 countries. A major player in the production and distribution of active ingredients from biotechnology has technical-commercial teams that will be valuable assets for the success of the project

- **HALLSTAR OLÉOS Partnership:** DEINOVE is working with OLEOS to develop cosmetic ingredients and expects to bring two products in market in 2020 and 2021. A licensing deal, the natural cosmetic active ingredient will be DEINOVE's third cosmetic active ingredient to be launched. The company announced the launch date of BIOME Oléoactif®, the first oil-based active ingredient obtained by extracting rare branched fatty acids from a wild extremophile microorganism (from DEINOVE's collection) into a blend of jojoba liquid wax and oat oil. The ingredient, which is a probiotic extract with a prebiotic effect, is extracted using Hallstar France's patented oleo-eco-extraction process. The ingredient is scheduled for launch in April 2020.

- **DOW and DEINOVE Partnership:** In 2019, DEINOVE collaborated with DOW for the development of a cosmetic ingredient derived from its collection of bacterial extracts. Dow has selected one extract from DEINOVE's collection of bacteria. DEINOVE intends to develop and optimize a proper production process by ensuring industrial transposition and production of the developed cosmetic active ingredient. The commercial launch of the product is scheduled for early 2021.

These partnerships have been negotiated based on the results generated by the Deinoscreen program.

**Deinoscreen Program**: DEINOVE, in collaboration with the laboratory FLUOFARMA, initiated an extensive *in vitro* screening of its bacteria strain bank to identify new compounds for the cosmetics and health fields. This has led to identifying dozens of strains demonstrating:

- Antioxidant properties, with anti-aging, firmness or anti-UV power.
- Anti-inflammatory properties, particularly for soothing effects (for sensitive skin, and for post-surgery cosmetics).
- Healing properties for injured or damaged skin, for post-surgery applications, for restorative, anti-aging actions, etc.
- Action on lipolysis by eliminating excess weight and cellulite.
- Action on lipid storage which can be used to provide a plumping and/or moisturizing effect, etc.

This catalog of strains with various and identified properties allows DEINOVE to fuel the discussions and open up new opportunities with the industrial stakeholders, beyond Greentech and Oleos.

**Exhibit 12: Catalog of Cosmetic Active Extracts[xix]**


### 2.5.3 Animal Nutrition (Nutrition)

DEINOVE has been working since 2014 to develop applications for its biotechnologies in the animal nutrition market. The aim is to identify from its bacterial collection the strains that produce compounds with nutritional or organoleptic benefits. The company received its first patent for the focus on the use of *Deinococcus* as a source of ingredients for animal nutrition in May 2017.

DEINOVE has two ongoing partnership programs within its animal nutrition segment with Avril and Flint Hills Resources.

- **Avril Partnership – COLOR2B Program:** COLOR2B program aims to develop a process for the production of natural additives for animal nutrition. The second phase of the project validated the efficacy and bioavailability of the compounds produced from the seven strains selected by DEINOVE in the first phase. One strain was selected. The tests continue to validate the optimal dosage and have been extended to several animal species. The product is planned to be launched by end of 2020 as a raw material for animal feed. The regulatory and the industrial stages are ongoing for marketing purposes and an industrial-scale batch will be tested by the end of 2019.

- **Flint Hills Resources Partnership:** Presently in its second phase, the program initiated in 2015 is aimed towards developing nutritional additives for animal feed. In the second phase, the program aims to produce the additives in sufficient quantity to test their beneficial effect on the targeted animal species and analyze the results obtained. The program is entirely funded by Flint Hills Resources.

## 2.6 Corporate Strategy and Future Outlook

### 2.6.1 Strategy[xx]

DEINOVE is mainly focusing on developing active ingredients from *Deinococcus* genus and other uncommon/extremophile bacteria for application in the Health, Nutrition and Cosmetics industry. Presently, the company has two in-house programs on-going in the areas of antibiotics and carotenoids, in addition to a few key programs being conducted jointly with its partners.

The company's strategy in the three stated segments includes:

- **Healthcare:** It has the first-mover advantage in a market with a strong medical need, where the focus area includes antibiotics. The strategy includes finding out a new antibiotic candidate to develop and possibly partner with a large pharma through licensing or other arrangements to bring the drug to the market. The company's most advanced molecule is about to enter Phase II clinical development.

- **Nutrition (Animal Health):** It has 2 partnership programs in animal feed that are progressing on track. In animal health, the company plans to develop a process or a compound in partnership with a manufacturer and then grant licensing contracts. This is precisely the objective of the partnerships with Avril and Flint Hills Resources.

- **Cosmetics:** In the cosmetics segment, DEINOVE looks to develop a process for directly marketing the compounds produced, such as certain innovative carotenoids. This approach is reserved to a few niche markets in which prices are higher and volumes are smaller. Two cosmetic active ingredients have been launched on the market in the beginning of 2018.

**Exhibit 13: Target markets[xxi]**


### 2.6.2 Outlook

DEINOVE's business outlook for 2019 looks promising as the company is looking forward to expanding its market for existing products and launch new products. Firstly, it kicked off clinical Phase II trial in mid-2019 to confirm the clinical effectiveness of DNV3837 (pro drug of DNV3861 molecule) and started the production of the first batch of DNV3837 which will help prepare the drug required for Phase III trials. Secondly, DEINOVE will be launching its second cosmetic active owner, an innovative carotenoid derived from its research. Also, DEINOVE and DOW formed a collaboration agreement for the development of a cosmetic ingredient. The commercialization of the product is expected in 2021.

## 2.7 Company Premiums[xxii]

**A unique strain bank holding more than 6,000 strains:** DEINOVE has a unique collection of 6,000 rare and untapped bacteria notably of the *Deinococcus* genus and selected based on their UV resistance. DEINOVE is the only company in the world that exploits the untapped genetic and metabolic potential of the *Deinococcus* bacterial genus for industrial purposes.

**A world-class screening and metabolic engineering platform**: Proprietary screening and genetic, metabolic and fermentation engineering platform that enables the company to transform micro-organisms into natural micro-factories.

**Management with extensive R&D experience**: DEINOVE's Director of R&D and DEINOBIOTICS CEO together have more than 55 years of R&D experience and knowledge in pharma and biotech.

**Sound intellectual property**: DEINOVE is developing a one-of-a-kind intellectual property and cutting-edge bioprocess portfolio which currently involves more than 300 patent applications submitted internationally.

**Partnerships for key R&D program**: DEINOVE has strong R&D partnership programs which have started to show results with a product launch in 2018. DEINOVE partnered with GREENTECH for cosmetic active ingredients and successfully launched its first product in Q2 2018. DEINOVE also partnered with HALLSTAR OLÉOS to develop a cosmetic ingredient and expected to bring the product on market in April 2020. The natural cosmetic active ingredient will be DEINOVE's third cosmetic active ingredient to be launched.

In the Animal Nutrition space, DEINOVE has partnered with Avril and Flint Hills Resources to develop and launch products in the future.

## 2.8 Company Risks[xxiii]

**Clinical trial Risk:** The biggest risk to a biotech company comes from clinical trial failure. If a potential drug candidate fails to achieve expected results in clinical trials phase I, II or III, then the company might have to scrap the entire program. Biotech companies generally face binary event situations with their drugs' clinical results, which results in significant volatility in share prices.

**Regulatory Risk:** Biotech and Pharma industries also face a major risk from the regulatory authorities. Regulatory bodies can stop the trials if they see adverse events involving a product or find out a company is not maintaining current good manufacturing practices (cGMP).

**Loss of Key Personnel:** Biotech companies face risk from the departure of key personnel since, if key personnel leave the entire R&D vision might need a re-look and there might be loss of shareholder value due to a study failure or a drug dropping from the pipeline of products.

**Funding Risk:** The company faces funding risk in future if its products are not successful and fail in trials. It may also face funding risk in case the products are delayed due to regulatory hurdles.

## 2.9 Shareholding Pattern

The company had 18,029,958 shares of common stock issued and outstanding on April 14, 2020.

**Exhibit 14: Shareholding Pattern (as on April 14, 2020)[xxiv]**

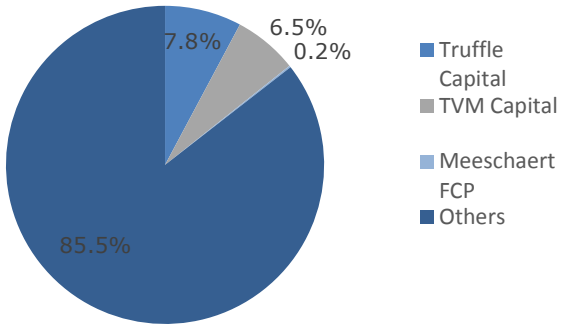



**Exhibit 15: Shareholding Pattern**

| Shareholders | No. of Shares | % of total |
|---|---|---|
| Truffle Capital | 1,409,943 | 7.8% |
| TVM Capital | 1,175,553 | 6.5% |
| Meeschaert FCP | 30,651 | 0.2% |
| Other/ Free Float | 15,413,811 | 85.5% |
| **Total Shares Outstanding** | **18,029,958** | **100.0%** |

## 2.10 Listing and Contact Details[xxv]

DEINOVE is listed on Euronext Stock Exchange (EPA-ALDEI)

### Company Contacts

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Contact No: +33 448 190 100
Fax: +33 499 232 450
Website: www.DEINOVE.com

## 3. News[xxvi]

- **DEINOVE Issues second tranche of Convertible Notes:** On April 03, 2020, the company announced that it has issued the second tranche of convertible notes (the OCA) and has raised an amount of EUR 1 mn in this round of financing. The financing is part of the agreement entered into with European Select Growth Opportunities Fund in July 2019, relating to financing through OCA the maximum amount of EUR 15 mn, with a 6.5% discount upon conversion to shares.

- **DEINOVE received EUR 2.1 mn from SGF:** On April 01, 2020, the company announced that it has received EUR 2.1 mn from SGF to pre-fund its R&D Tax Credit receivable. This amount accounts for 84% of the estimated receivable for FY 2019.

- **Collaboration agreement with Sharon Laboratories not to be signed:** On March 30, 2020, DEINOVE announced that the collaboration with Israeli group Sharon Laboratories for marketing of bio-based ingredients from DEINOVE's platform, will not be signed due to current economic and financial uncertainty created by the COVID-19 pandemic. However, the company will retain USD 200k received at the time of signing the MOU on February 6, 2020, when it was first announced.

- **Announcement of launch of BIOME Oléoactif®**: On March 18, 2020, DEINOVE announced that BIOME Oléoactif®, the first oil-based cosmetic active ingredient, developed in collaboration with Hallstar France, will be launched in April 2020.

- **Completed the second key milestone of the AGIR program**: On March 11, 2020, DEINOVE announced that it had reached the second key milestone of the AGIR program. The achievement of the second key milestone of the program triggered the payment of EUR 1.5 mn in repayable advances and subsidies from Bpifrance.

- **DEINOVE Expanded its range of Cosmetic Active Ingredients:** On February 19, 2020, DEINOVE announced that it expected its second innovative carotenoid having the feature of absorbing blue light responsible for premature skin ageing, to be officially launched at in-Cosmetics Global trade show, in Barcelona.

- **Enrolment of first patient in Phase II trial of DNV3837**: On January 27, 2020, DEINOVE announced the enrolment of the first patient for the Phase II trial and testing of DNV3837. The objectives of the trial are to evaluate the efficacy of DNV3837 in pathological conditions, along with the safety and pharmacokinetic data of the antibiotic candidate.

- **Announcement of production of new batch of Phyt-N-Resist®**: On January 22, 2020, DEINOVE announced that it had launched the production of a new batch of Phyt-N-Resist® to meet the needs of its distributors and future customers.

- **DEINOVE and ESPCI Paris raised funding from the French Research Agency (ANR) to develop the Deinodrop technology:** On December 09, 2019, the company announced that it had jointly (along with ESPCI Paris) received a grant of EUR 300k from ANR for the co-development of an innovative system for the isolation, culture and screening of bacteria.

- **Change in governance:** On December 06, 2019, the company announced that Emmanuel Petiot would resign as CEO of DEINOVE and his duties would end on December 31, 2019. Dr. Charles Woler, the current chairman of the Board of Directors, would act as the interim CEO of the company with effect from January 01, 2020.

- **DEINOVE to present its second novel carotenoid at the In-Cosmetics Asia exhibition:** On November 04, 2019, DEINOVE announced that it will present its second novel carotenoid at the In-Cosmetics Asia exhibition to be held from November 05, 2019 to November 07, 2019 in Bangkok.

- **DEINOVE integrated the CRISPR-cas9 technology to strengthen its expertise in Genetic Engineering:** On September 23, 2019, DEINOVE announced that it had strengthened its expertise in Genetic Engineering by integrating the CRISPR-cas9 technology to expedite the discovery of innovative antibiotics.

- **Publication of Article on the effectiveness of Hebelys®:** On September 18, 2019, DEINOVE announced the publication of an article in the August edition of International Journal of Cosmetic Science on the benefits of

Sphingomonas hydrophobicum extract, the active substance of Hebelys®, a cosmetic ingredient co-developed by DEINOVE and Greentech. As per the results, Sphingomonas reduces cellular senescence and delays skin aging process, in addition to enhancing the mechanisms for skin restructuring.

- **DEINOVE started Phase II clinical trials for its antibiotic compound DNV3837:** As per the half-yearly report of the company, trials of Phase II of the company's most advanced antibiotic, DNV3837, started in the first half of the year. Also, the production of the first batch of DNV3837, to be used for preparing the drug required for the Phase III of the trials, commenced.

- **Issuance of notes convertible into shares:** On July 09, 2019, the company announced that it had entered into an agreement with European Select growth Opportunities Fund for the financing of a maximum of EUR 15 mn (@6.5% facial discount) by issuing notes which can be converted into shares.

- **DEINOVE and AVRIL completed the development of a natural feed additive:** On June 11, 2019, the company announced the development of its collaboration program with Avril. The program is focused on the development of a new range of ingredients for animal feed. Tests have shown the potency of the ingredient at a competitive dosage. Also, further developments related to regulation and industrialization are underway for marketing stages.

- **DEINOVE & Dow signed a collaboration agreement for the development of a new cosmetic active ingredient:** On June 05, 2019, DEINOVE announced a collaboration with DOW for the development of a new cosmetic active ingredient derived from its collection of bacterial extracts. The commercialization of the product is planned for early 2021.

- **Anne Abriat-Hemmendinger appointed to the Board of Directors of DEINOVE:** On May 21, 2019, the company announced the appointment of Anne Abriat-Hemmedinger as a member of the Board of Directors. She has more than 30 years of experience in the industry and has worked with brands such as L'Oréal and Coty Group.

- **DEINOVE exceptional activity against bioterrorist threats presented at ASM Microbe 2019:** Data on the in vitro assessment of DNV3681 against pathogens (high-priority bioterrorist threats) were presented at ASM Microbe in San Francisco on June 21, 2019.

- **DEINOVE ready to start Phase II clinical trial for its antibiotic compound DNV3837 (prodrug of DNV3861:** On May 16, 2019, DEINOVE announced that the phase II trial for its DNV3837 for the treatment of CDIs around mid-year is as planned and all the conditions are well-placed.

- **Innovative Phytoene mechanism promoted at NYSCC Suppliers' day:** On May 13, 2019, DEINOVE announced that its partner SOLVAY had introduced the innovative Phytoene mechanism of cell regeneration at the 40th Annual Congress of the New York Society of Cosmetic Chemists. SOLVAY promotes this product in North America and Asia on an exclusive basis under the ReGeN-oPhyt® brand.

- **DEINOVE invited to present at the 29th Congress of the European Society of Clinical Microbiology and Infectious Diseases:** On April 12, 2019, DEINOVE announced that its scientific director, Georges Gaudriault, would give a presentation on DNV3837 antibiotic program at 29th Annual Congress of the European Society of Clinical Microbiology and Infectious Diseases.

- **DEINOVE signed an agreement with Institute Pasteur:** On April 09, 2019, DEINOVE announced that it had signed an agreement with Institute Pasteur to explore the potential of new targeted strains. As per the agreement, the institute would provide selected strains which would be used by DEINOVE for the evaluation of their antibiotic and antifungal activities.

- **DEINOVE announced FY 2018 annual results:** On March 28, 2019, DEINOVE announced its annual results for FY 2018. The group's net loss increased to EUR 8.7 mn in FY 2018 from EUR 7.3 mn in FY 2017, because of the progress on the AGIR program and the integration of the DNV3837 clinical program.

- **DEINOVE passed the first milestone of the AGIR program, and received EUR 1.5 mn:** On March 21, 2019, DEINOVE announced that it had successfully crossed the first key milestone of the AGIR program supported by the Investments for the Future Program. This milestone triggered a payment of EUR 1.5 mn.

- **DEINOVE's new website highlighted its disruptive innovation strategy:** On January 10, 2019, DEINOVE announced the online release of its new website. The new website features a refreshed presentation of corporate activities and visual identity. It also illustrates the disruptive approach that DEINOVE is implementing to develop novel antibiotics and bio-based active ingredients for cosmetics and nutrition.

- **DEINOVE announced licensing deal with REDX Pharma:** As disclosed in the 2018 Annual Report, DEINOVE was not to exercise its option on NBTI program (REDX Pharma) as the data collected during the evaluation phase did not meet the expectations. Previously, in March 2018, DEINOVE announced a license option deal with REDX PHARMA for the acquisition of its first-in-class anti-infective program aimed at treating the most lethal gram-negative infections.

- **DEINOVE would market a 2nd proprietary carotenoid-based cosmetic active ingredient in 2019:** On December 22, 2018, DEINOVE confirmed that it was developing an innovative carotenoid for dermo-cosmetic use, produced using an exclusive bacterial fermentation process. The company's R&D teams have developed and optimized a proprietary strain for the optimal production of this new carotenoid and the efficacy tests have shown promising results. DEINOVE has been targeting the launch of this active ingredient for marketing in 2019.

- **DEINOVE confirmed its financing options by renewing its equity line:** On November 11, 2018, DEINOVE announced the set-up of a new equity line with KEPLER CHEUVREUX for a maximum amount of EUR 12 mn over 36 months. The Company had raised EUR 9.4 mn (net of associated costs) under the previous equity line and expects to maintain the financial flexibility provided by this mechanism through the new equity line. With the ceiling of issuing only 2,100,000 new shares, the Company could increase its capital by only EUR 4.1 mn until the next Annual General Meeting. The issuance of the remaining shares was to be subjected to a resolution put to vote in the 2019 General Meeting.

- **DEINOVE to collaborate with CALIBR to explore the anti-infectious potentials of its bacterial collection:** On October 24, 2018, DEINOVE announced a collaboration with Calibr for the exploration of the anti-infectious potential of its bacterial collection. DEINOVE will share the bacterial extracts from the collection of rare microorganisms with Calibr. In return, Calibr will help the Company to identify new antibiotic structures under the AGIR program and explore the potential of these bacteria for the treatment of neglected parasitic and infectious diseases, such as tuberculosis or malaria, not targeted by DEINOVE.

- **DEINOVE formed a strategic partnership with UNIVAR for the distribution of PHYT-N-RESIST® in the EMEA region and with SOLVAY for distribution in North America and Asia:** On October 02, 2018, DEINOVE announced that it had signed an agreement with UNIVAR for the distribution of PHYT-N-RESIST® in the EMEA region. UNIVAR is among the world leaders in the distribution of ingredients and raw materials and is the second European leader in the sector. SOLVAY was chosen to market PHYT-N-RESIST (under the name ReGeN-oPhyt) in North America and Asia.

- **DEINOVE's COLOR2B project with Avril, confirmed progress and outlook:** The selected strain in COLOR2B project, focusing on natural feed additives, showed comparable performance to existing petrochemical products and the tests continued to validate the optimal dosage and have been extended to several animal species. Avril plans to test these feed additives on different animal species to expand its commercial potential.

- **DEINOVE acquired MORPHOCHEM:** On April 13, 2018, DEINOVE announced the acquisition of MORPHOCHEM's clinical-stage (Phase-2-ready) antibiotic compound MCB3837 which aimed to treat severe gastrointestinal infections caused by *Clostridium difficile*, a priority pathogen according to the WHO and the CDC.

- **DEINOVE launched first cosmetic Active Ingredient in Q2 2018:** On April 10, 2018, DEINOVE introduced its first in-house carotenoid product Phyt-N-Resist®, the first pure phytoene for skincare in Q2 2018. The product had antioxidant and healing properties, which were particularly attractive for cosmetic applications, especially the anti-aging segment, which accounted for half of the skin care market.

- **DEINOVE and GREENTECH announced the launch of HEBELYS®:** On April 16, 2018, DEINOVE announced the launch of the first cosmetic active ingredient resulting from its collaboration with GREENTECH in Q2 2018. HEBELYS® is marketed effectively by GREENTECH. GREENTECH is a French company specialized in producing and marketing high-tech active ingredients originating from the plant, marine and microbial worlds to cosmetics manufacturers in more than 30 countries.

- **DEINOVE successfully raised EUR 8.5 mn in capital:** In June 2018, DEINOVE issued 3,148,149 new shares, each with a par value of EUR 0.40, with a unit price of EUR 2.70, including the issue premium, for a total of EUR 8.5 mn. Investment funds managed by TVM have contributed to this capital increase at a level of EUR 2 mn, bringing its stake in the company to 7.42%.

- **DEINOVE announced H1 2018 results:** For the first half of 2018, operating sales were recorded at EUR 715,000 compared with EUR 140,000 in H1 2017. This was driven by higher grants received under AGIR. Operating expenses increased 3.5% YoY to EUR 5.1 mn mainly due to the integration cost of a subsidiary. Net loss increased 11.7% to EUR 3.7 mn in H1 2018 vs EUR 3.3 mn in H1 2017.
  **Financial Position:** The net cash position amounted to EUR 9.9 mn on June 30, 2018, compared with EUR 4.9 mn on December 31, 2017. DEINOVE believes that it has the necessary cash resources to guarantee its financing until the end of the Q1 2019.

- **DEINOVE partnered with bioMérieux to discover new antibiotics:** On June 28, 2018, DEINOVE announced a collaboration with bioMérieux, a major player in in vitro diagnostics, to explore new strains and multiply opportunities to discover new antibiotics. bioMérieux was to provide DEINOVE with more than 250 strains (130 species) for screening of antibiotic and antifungal activities. This collaboration was in line with the scope of the AGIR program which aimed to diversify the bacterial strain profiles studied to maximize the opportunities for discovering new antibiotic structures.

- **DEINOVE partnered with Naicons to discover new antibiotics:** On March 8, 2018 DEINOVE announced the collaboration with Naicons. DEINOVE expanded the antibiotic project's field of investigation for the discovery of novel antibiotic structures by accessing the strain bank of rare bacteria selected by NAICONS. The company will have access to 400 strains carefully selected for their potential and will use its robotic technology platform to detect and characterize the antibiotic activities of these strains.

- **DEINOVE and Hallstar to create new bacterial extracts:** DEINOVE and HALLSTAR'S OLEOS group collaborated to develop two new active ingredients for skin care from DEINOVE-developed bacterial strains with the patented Oleo-Eco-Extraction Oleos technology. The products will be introduced in 2020.

- **DEINOVE's AGIR Antibiotics Program granted EUR 14.6 mn:** AGIR headed by DEINOVE and the Charles Viollette Institute was to receive EUR 14.6 mn financing (2017-2022) as it was selected by the Investments for the Future Program, to develop new antibiotics. DEINOVE is expected to receive its share of EUR 10.4 mn in 5 tranches starting 2018, out of which it has received EUR 0.7 mn.

## 4. Management and Governance[xxvii]

The management and governance team have vast experience in the field of R&D in biotech and pharmaceuticals along with managing operations and finance for multiple businesses. The team also has extensive sales and business development experience.

**Exhibit 16: Management and Governances**

| Name | Position | Past Experience |
|---|---|---|
| Charles WOLER | Chairman and CEO | • Dr. Charles Woler holds MD and MBA from the University of Paris and PhD in clinical pharmacology from the University of Lyon.<br>• He has 35+ years of experience in the pharma, biotech and medtech industries in Europe and the US.<br>• He has served as CEO at Inserm Transfert Initiative, Endotis Pharma SA, CADUS Pharmaceuticals, Roche France SAS.<br>• He also co-founded Neuro3d S.A in September 2000 and served as its Chairman and CEO.<br>• He joined as Chairman of the Board at DEINOVE SA in 2017.<br>• Appointed interim CEO as of January 01, 2020. |
| Georges Gaudriault | Director of R&D | • Georges holds a PhD in molecular pharmacology and a degree in molecular biology and biochemistry.<br>• He has nearly 20 years of experience in drug R&D and has authored several patents and numerous publications.<br>• He served as chief scientific officer at MedinCell for 9 years.<br>• He joined DEINOVE as Director of R&D in March 2017. |
| Julien Coste | Director of Finance and Administration | • He completed his graduation from Grenoble Graduate School of Business.<br>• Coste holds a master's degree from Paris Dauphine University.<br>• He has nearly 15 years of experience.<br>• He has worked with companies such as Public Healthcare Communications Group, Neuro3d, Antalis and International Masters Publishers. |
| Marie Bézenger | Director of Operations | • Marie holds a PhD in Biochemistry, Cell & Molecular Biology and a degree in Food Sciences.<br>• She has nearly 20 years of experience in food and health supplementary industry.<br>• She worked at different leadership positions in CHR Hansen Group for over 20 years.<br>• She joined DEINOVE as Director of Operations in October 2015. |

# 5. Industry Overview

## 5.1 Industry Definition

Biotechnology covers the process of using living organisms to make useful products. According to the *Organization of Economic Co-operation and Development,* it is the application of scientific and engineering principles to the processing of materials by biological agents[xxviii].

Antibiotics and carotenoids are considered to be important parts of the biotechnology market, as they are highly demanded for the development of medicines for human, plant and animal health.

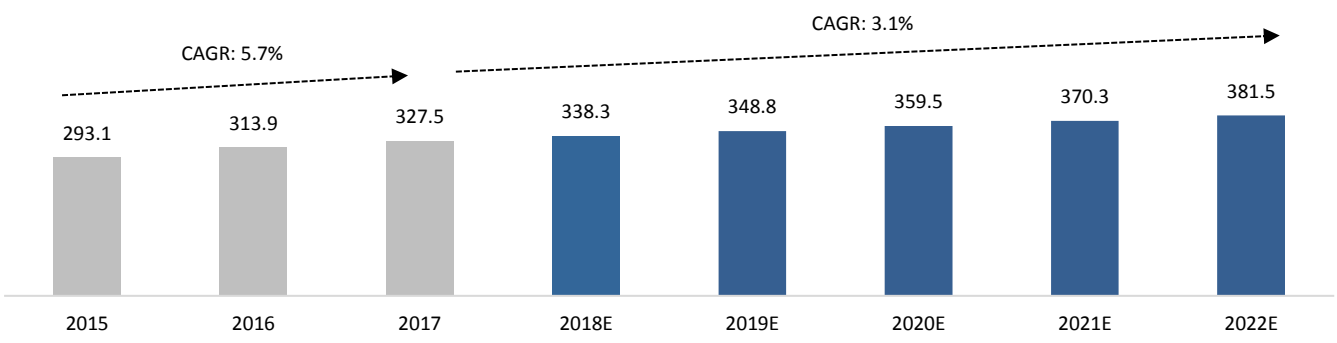
Antibiotics are chemical compounds used to fight bacterial infections and kill or slow down the growth of bacteria. They are also termed as antibacterial drugs as they represent the antibacterial compounds of microbial origin.

Carotenoids are mostly required for nutrition and production of cosmetics globally. They are organic pigments found in vegetables and fruits and are responsible for the bright colors of fruits and vegetables. These act as antioxidants and protect the human body against chronic diseases, cellular damage and the effects of aging.

## 5.2 Global Market Size

### 5.2.1 Global biotechnology industry market size

**Exhibit 17: Global Biotechnology Industry – Size (USD billion) (bn)**




According to the Global Biotechnology Report by IBIS World, the global biotechnology industry was valued at USD 327.5 bn in 2017. The industry is expected to grow at a CAGR of 3.1% to reach approximately USD 381.5 bn in 2022[xxix].

Of the total market, health (red) biotechnology, industrial (white) biotechnology and agricultural (green) biotechnology accounts for the majority share. Of all the segments, industrial biotechnology is expected to grow at the fastest CAGR of 10.2% until 2024.[xxx]

Growth in this market can be attributed to i) high incidence of several rare chronic conditions, such as hepatitis B, cancer, and other orphan disorders (rare disorders), ii) increasing food demand due to a growing population, iii) depleting natural resources, and iv) decreasing prices of DNA sequencing, encouraging researchers and manufacturers to increase R&D initiatives targeted at understanding genetic variations and developing therapeutic solutions for chronic diseases.

However, ethical issues pertaining to implementation of clinical trials, consumer preference for traditional foods, seasonality of agricultural weather and long R&D lead time are the major factors that might limit the market growth during the forecast period .

### 5.2.2 Global Antibiotics and Carotenoids industry market size

**Exhibit 18: Global Antibiotics Industry– Size (USD bn)**

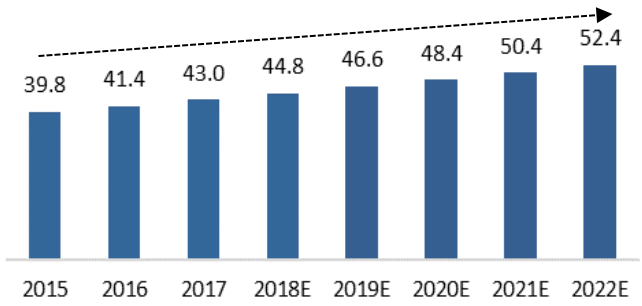
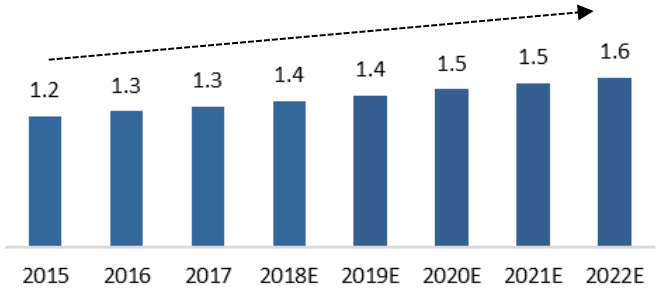



**Exhibit 19: Global Carotenoids Industry – Size (USD bn)**




According to a Grandview Research report on antibiotics, the industry was valued USD 43.0 bn in 2017 and is expected to reach USD 52.4 bn by 2022, a CAGR of 4%. The growth will be supported by development of advanced products. According to an article published by the Pew Charitable Trust in 2016, about 37 promising molecules were under investigation within the US market and in phase II clinical trials. The majority of the trials were anticipated to hit the market between 2018-2020. Similarly, nanobiotechnology finds major application in drug delivery therapies for chronic disorders such as cancer. Growing R&D, carried out in various companies for discovering new avenues such as micro-fabricated systems and devices used in the treatment of several acute ailments, is a key driving factor.

Overall, cell-based assay and DNA sequencing segments are predicted to witness a strong positive growth till 2020, owing to R&D initiatives taken by biotechnological and pharmaceutical companies globally.

**Exhibit 20: Top 10 Antibiotic Drugs[xxxi]**

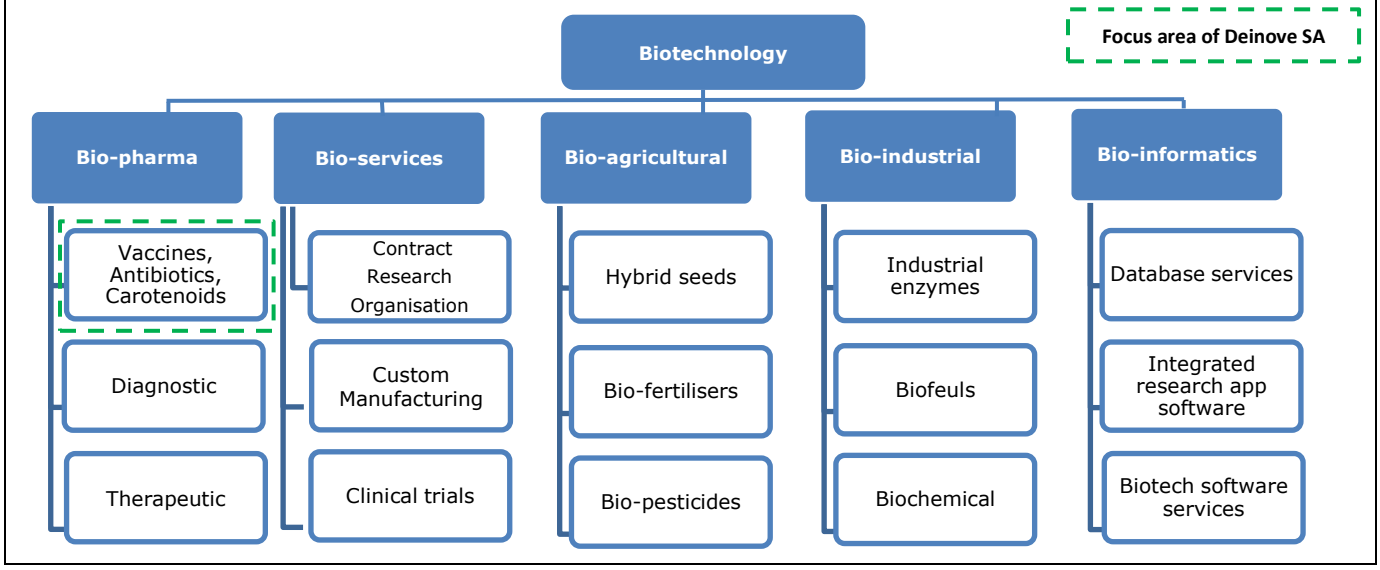
| Generic Drugs | Branded Drugs |
|---|---|
| Amoxicillin | Augmentin |
| Doxycycline | Flagyl, Flagyl ER |
| Cephalexin | Amoxil |
| Ciprofloxacin | Cipro |
| Clindamycin | Keflex |
| Metronidazole | Bactrim, Bactrim DS |
| Azithromycin | Levaquin |
| Sulfamethoxazole/trimethoprim | Zithromax |
| Amoxicillin/clavulanate | Avelox |
| Levofloxacin | Cleocin |

### 5.3 Segments in Biotechnology Industry

According to Biotechnology Innovation Organization (BIO), biotechnology develops products by harnessing cellular and biomolecular processes that help to improve lives and health and provides products to combat rare diseases. The global biotechnology market is segmented by products, technologies and application areas.

### 5.3.1 Product Segmentation

**Exhibit 21: Product Segments in the Biotechnology Industry[xxxii]**




*Based on the products and services, the biotechnology market is classified into the Bio-pharma, Bio-services, Bio-agricultural, Bio-industrial, and Bio-informatics segments.*

**Bio-pharma** are medical drugs produced using biotechnology. These drugs include proteins (antibodies) and nucleic acids used for diagnostic purposes and are produced by means other than direct extraction from a native biological source. Bio-pharma also focuses on therapeutic drugs, vaccines, insulin, monoclonal antibodies, generic and branded drugs.

**Bio-services** market is segmented into contract research organizations, custom manufacturing and clinical trials. The industry is growing at a faster pace in emerging economies such as India and China.

**Bio-agricultural** offers hybrid seeds, bio-fertilizers and bio-pesticides for development of organic farming. The segment focuses on production of bio-chemicals that can be used for farming with no synthetic fertilizers. The segment also includes genetically modified crops used for food production.

**Bio-industrial** market includes industrial enzymes, biofuels, biochemicals and biomaterials with major application in food and feed additives, and chemical production processes. Bio-industrial technology uses micro-organisms such as mold, yeast and enzymes that are degradable and useful for a wide range of industrial applications.

**Bio-informatics** is a hybrid science that links biological data with techniques for information storage, distribution, and analysis to support multiple areas of scientific research, including biomedicine. It comprises database services, integrated research applications and biotech software services. Bio-informatics is fed by high-throughput data-generating experiments, including genomic sequencing.

### 5.3.2 Segmentation by Technologies and Applications[xxxiii]

**Exhibit 22: Segmentation of Global Biotechnology Industry - by Technologies, 2017 (100% = USD 327.5 bn)**

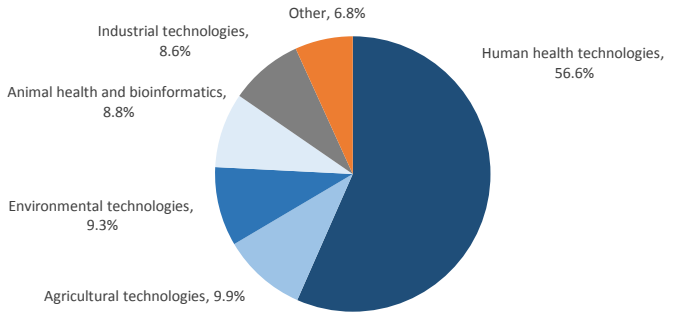
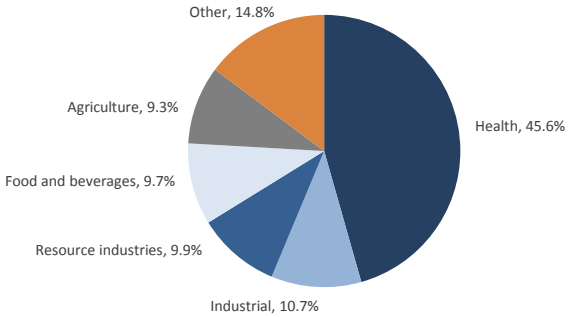



**Exhibit 23: Segmentation of Global Biotechnology – by End-Use Applications, 2017 (100% = USD 327.5 bn)**




#### 5.3.2.1 Segmentation by technology

**Health technology,** also known as the 'red biotechnology' segment, accounts for 65.4% of the global industry activity with human health technologies making up 56.6% of the industry's revenue. Companies in this industry include small R&D intensive organizations that license out technologies or develop products in conjunction with larger entities, and all major pharmaceutical or chemical operators.

The US and Europe have the highest activity rate for health applications, followed by China. Emerging markets, such as India, Brazil, Russia, Mexico, South Korea and Turkey, are experiencing strong industry growth, driven by rising incomes and increased demand for high-quality healthcare.

R&D activities related to human health are broadly directed at therapeutics (e.g., biopharmaceuticals such as biotechnology-derived proteins, antibodies, enzymes and genetic therapies), medical diagnostics (e.g., tests for specific gene or protein markers) and preventives (e.g., new vaccines developed through recombinant DNA methods).

Most commercial **Agricultural Biotechnology** products have production-enhancing traits that complement or replace traditional agricultural chemical inputs. Crops are designed to be herbicide-tolerant or resistant to pests, viruses or fungi. Soybean is the largest biotech crop (in planted acre terms) in the world, followed by maize, cotton and canola. More than 90% of farmers growing biotech crops are located in emerging nations, although the US still dominates in terms of biotech crop area. Further, Argentina, the US, Brazil and Canada have the highest percentage of arable land planted with genetically modified crops.

**Animal Health technologies** account for a small portion of the segment's revenue. Biotechnology applications related to animal health are largely the same as in human health, including applying advances in genetics and molecular biology to discovering and creating new and more powerful therapeutic products (proteins, antibodies, enzymes, genetic therapies), diagnostic tools (e.g., for gene or protein markers of disease conditions) and preventive measures such as vaccines.

**Industrial Biotechnology,** also known as 'white biotechnology', is a relatively new approach to pollution prevention, resource conservation and cost reduction. It involves working with nature to maximize and optimize existing biochemical pathways that can be used in manufacturing. Industrial biotechnology also has the potential to benefit nations' economies by permitting for the substitution of liquid biofuels for conventional liquid fuels, potentially reducing crude petroleum imports and stimulating the development of rural economies as a result of increased agricultural feedstock consumption.

#### 5.3.2.2 Segmentation by applications

The **Healthcare sector** and its related industries account for 45.6% of the industry's operations. Companies in the pharmaceutical industry often require the use of organisms, processes or other technologies, including drugs and products that have been developed by smaller biotechnology entities. Small biotech companies may also discover and patent technology that is then licensed to pharmaceutical producers for use in medicines.

Pharmaceutical companies have struggled to develop new, safer and cheaper drugs and most major product lines are challenged by the sale of less expensive generic products (when the patent expires), especially in areas of the world where intellectual property is less well protected. As a result, biotech drugs have been the main drivers of growth, particularly in developed markets such as the US.

Outside of pharmaceutical manufacturers, public health expenditures and large healthcare organizations are primary markets for the industry's products. In most developed countries, the public sector spends significant sums on public health. According to a *2016 Key Biotechnology Indicators report by the Organization for Economic Co-Operation and Development*, South Korea has the highest level of public sector expenditure on biotechnology R&D (21.8% of the country's total public R&D expenditure), followed by Spain (15.4%) and the Czech Republic (11.3%).

The **Industrial sector** accounts for a 10.7% share in the biotechnology industry, helped by the rising demand for biofuels. Biotechnology products and processes are used in the chemical and fuel sectors to develop new materials. The target industry includes oil majors exploring ways through which biotechnology can reduce dependence on fuel. Using biotechnology, ethanol can be made from things ranging from wood chips to corn and promises to be a viable alternative to petroleum in the future.

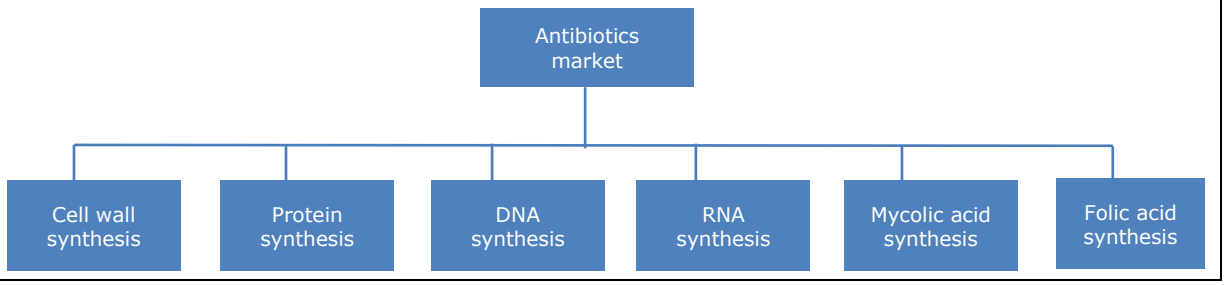
In the **Food and Beverage** sector, manufacturers use many biotechnology products to modify the nutritional value of food or to extend shelf life. In the past five years, demand from agricultural and food producers has increased; however, the segment's growth is limited by legislative and regulatory approval of products and public acceptance of genetically modified foodstuffs. As a result, the segment's share of the total industry revenue has marginally diminished.

The **Agriculture sector** focuses on purchase of genetically modified crop seeds that increase yields, reduce the cost of farming by cutting expenditure on insecticides and protect against crop failure due to adverse environmental conditions. The market for genetically modified crops is highly globalized and is especially prevalent in Latin America and other emerging economies. The agriculture sector is also a major buyer of animal health products and other drugs that increase disease resistance and improve meat quality.

### 5.3.3 Segmentation of Global Antibiotic Market by Mechanism

The chart below shows the segmentation of the global antibiotic market based on mechanism of action:

**Exhibit 24: Segmentation of Global Antibiotics Market - by Mechanism**

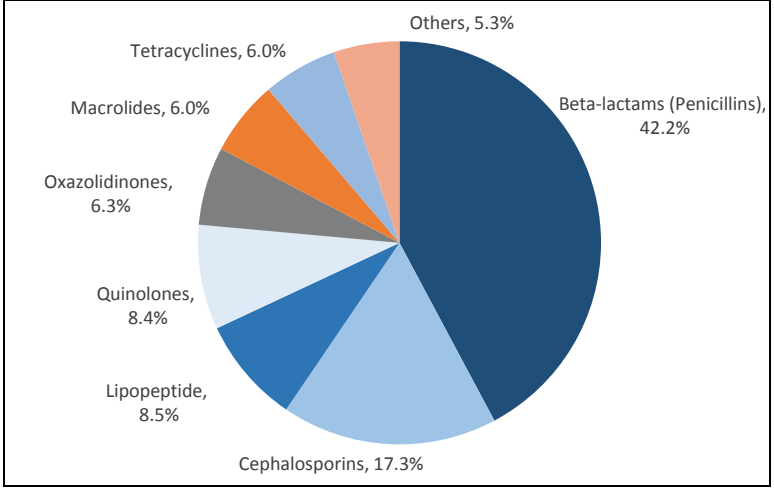



Antibiotics for inhibition of **cell wall synthesis** include compounds such as penicillin, cephalosporin, bacitracin and vancomycin. The **protein synthesis inhibitors** include chloramphenicol, erythromycin, tetracycline, streptomycin. Similarly, **DNA synthesis** drugs include nalidixic acid, ciprofloxacin, norfloxacin, whereas **RNA synthesis** drugs include rifamycins. The drugs shown to inhibit **mycolic acid biosynthesis** are isoniazid, ethionamide, isoxyl, thiolactomycin, and triclosan. The sulfa drugs and trimethoprim are synthetic, broad-spectrum, bacteriostatic antibiotics inhibiting **folic acid synthesis**.

Cell wall synthesis inhibitors dominate the mechanism outlook, whereas folic acid inhibitors sulfa drugs are anticipated to witness growth in future due to their wide application.

The chart below shows the market share of **top antibiotics** globally in 2017:

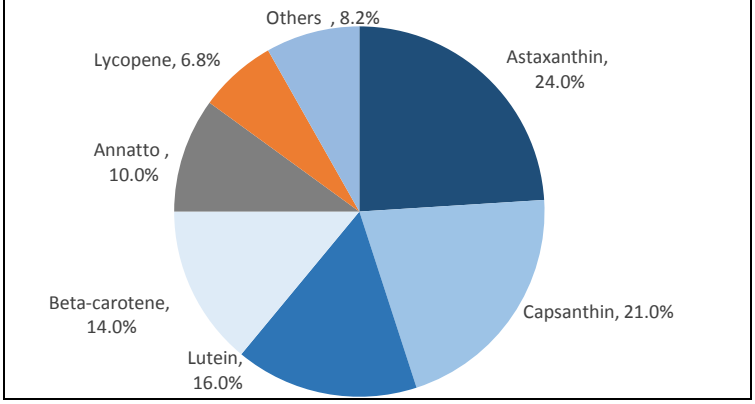
**Exhibit 25: Segmentation of Global Antibiotics Market - by Classes, 2017 (100% = USD 43.0 bn)[xxxiv]**




Of the total market, beta-lactams dominate the segment followed by cephalosporin, lipopeptide and others because of the increasing R&D funding for development of antibiotics and the increasing demand of antibiotics for human, animal and plant health.

### 5.3.4 Segmentation of Global Carotenoid Market by Products

**Exhibit 26: Segmentation of Global Carotenoid Market - by Product, 2017 (100% = USD 1.30 bn)**




Carotenoids are commercially available in several forms including beta-carotene, lutein, lycopene, astaxanthin, zeaxanthin, annatto, and canthaxanthin. These products find considerable usage in human food, animal feed, dietary supplements, pharmaceuticals, and cosmetics as they offer excellent health benefits, which in turn, will fuel market expansion. The market for beta-carotene is expected to grow at a higher pace compared to the other product segments due to the considerable medicinal properties and effectiveness of beta-carotene.

Carotenoids can be obtained from both synthetic and natural sources; however, synthetic sources are projected to witness slower growth on account of growing consumer preference for naturally sourced products. Natural sources include flowers, plant leaves, bird feathers, fruits, crustacean shells, and fish flesh. Growing consumer awareness regarding health benefits and the advantages associated with natural products is expected to fuel industry demand.

Carotenoids are used in the feed, food, supplements, pharmaceuticals and cosmetics industries. The animal feed segment is the most prominent for demand of carotenoids due to animals' requirement for carotenoids as their body cannot produce essential nutrients. Therefore, these nutrients are added to animal feed as they provide immunity against disease.

Likewise, dietary supplements are expected to witness significant gains owing to rising health consciousness and changing lifestyles of the consumers. Carotenoids are key additives used in human health supplements because of their benefits which include immunity enhancement and richness in vitamins.

### 5.4 Demand Drivers

The key factors driving demand in the markets are as discussed below:

#### 5.4.1 High incidence of several rare chronic conditions due to an ageing population

Population ageing is poised to become one of the most significant social transformations of the 21st century. Globally, the population of people aged 60 and above is growing faster than all younger age groups.

The world's population is ageing at such a rate that those aged 60 or above account for over 10% currently and are likely to rise to more than 20% by 2050[xxxv]. According to the data from *World Population Prospects: the 2017 Revision*, the number of older people (those aged 60 years or over) is expected to more than double (2.1 bn) by 2050 and to more than triple (3.1 bn) by 2100[xxxvi].

The constantly rising geriatric population is primarily driving the growth of the antibiotics, carotenoid and biotechnology markets since people aged above 60 years are at a higher risk of developing chronic and rare disease such as hepatitis B, cancer and other orphan disorders.

#### 5.4.2 Technological advancements

Rising demand for new technologies such as DNA sequencing, nanobiotechnology, recombinant technology, fermentation, tissue engineering, and development of generic drugs is driving the industry along with antibiotics and carotenoids. Furthermore, decreasing prices of DNA sequencing technologies are encouraging researchers and manufacturers to increase R&D initiatives targeted at understanding genetic variations and developing therapeutic solutions for chronic diseases.[xxxvii]

Similarly, nanobiotechnology finds major application in drug delivery therapies for chronic disorders such as cancer. Growing R&D, carried out in various companies for discovering new avenues such as micro-fabricated systems and devices used in the treatment of several acute ailments, is a key driving factor.

Overall, cell-based assay and DNA sequencing segments are predicted to witness a strong positive growth till 2020, owing to R&D initiatives taken by biotechnological and pharmaceutical companies globally.

#### 5.4.3 Favorable government initiatives

The biotechnology sector, including antibiotics and carotenoids, with its huge growth potential in the fields of life sciences, agriculture, industries and information technology, is expected to play a pivotal role as a novel manufacturing hub. The sector is seeing a lot of innovation and is on a high growth trajectory. Therefore, globally, governments have taken initiatives to improve the growth prospects of the sector as well as offer enough scope for research in this field. For example, governments are encouraging the research activities by raising funds in the field of proteomics.

The presence of organizations such as the Human Proteome Organization, National Cancer Institute (NCI), and Genomic Health Inc. promotes funding to support R&D and product development exercises pertaining to the field of proteomics[xxxviii].

The growing need to understand chronic diseases at a molecular level and develop therapeutic solutions is expected to encourage these organizations to fund R&D programs.

#### 5.4.4 Rise in demand for food

Due to the burgeoning population across the globe, the task of feeding the world has become a challenge. Rising demand for food for meeting the unmet needs of the incessantly growing population across the globe is fueling the growth of the biotechnology industry. Biotechnology and antibiotic drugs help generate higher crop yields and to reduce the usage

of pesticides. The 'green biotechnology' promotes and develops crops with enhanced nutrition value, free of allergens and toxins such as mycotoxin.

### 5.4.5 Growing awareness of the various diseases and their treatment

The increased awareness of the various infections and their treatment options are leading to an increased use of drugs for the treatment of these diseases in the initial stages. This helps to prevent the aggravation of the disease and helps in the early-stage treatment. The awareness of these health issues can be increased by the presence of various programs. For instance, November 18, 2014, was celebrated as European Antibiotic Awareness Day to raise awareness of antibiotic resistance and promote judicious use of antibiotics. The Health and Human Services has developed "Healthy People 2020" program which aims at the prevention and treatment of infectious diseases. Such awareness programs about the disease and the available treatment options increase the treatment-seeking population, thus driving the growth of the global antibiotics market.

### 5.4.6 Inadequate supply of natural non-renewable resources

Declining oil reserves, volatility in oil prices and political instability in the Middle East have prompted an increased focus on energy independence and accelerated the research on biofuels such as ethanol and biodiesel. Biofuels are fuels produced from biomass. Biomass is an organic matter produced from animals and plants. It includes wood, agricultural crops and products, aquatic plants, forestry products, waste and residues, and animal wastes. Biofuels can even be used as substitutes for jet fuel. This can help reduce greenhouse gas emissions and is driving the adoption of biofuels across the world.[xxxix]

## 5.5 Market Trends

The following are the key trends shaping up the market:

### Current Trends

### 5.5.1 Rising R&D investment

R&D for a product development in biotechnology and antibiotic industry typically increases if it is likely to be cost-effective and profitable. The industry players invest in R&D if the expected return covers the cost of the investments and the return on investment is acceptable.

The government seeks to make R&D profitable by offering incentives to private companies and public organizations alike, such as tax exemptions and grants. The market players engage in R&D activities if they can easily patent technology and earn money through licensing the patented technology. Furthermore, branded pharmaceutical companies are attracted to invest in the development of biologic drugs because they are more difficult for generic pharmaceutical manufacturers to replicate.

Industry players are also investing for social benefits, namely improving an individual's quality of life through advances in health or environmental knowledge. For example, biotechnology companies develop genetically modified crops that are resistant to pests and weather, thus increasing agricultural yields.

### 5.5.2 Rising demand for biotechnology products (carotenoids) in the cosmetics industry

The cosmetics industry has demand for compounds such as antioxidants and carotenoids. Most existing carotenoids are made from petrochemical sources and are known for their coloring, antioxidant and photochemical properties. Carotenoids are used in food supplementation and cosmetics as coloring agents. Although carotenoids can be extracted from plants, the process is costly, and the yields remain low. Industry players are aiming to produce carotenoids using biotechnology as it can offer advantages in terms of quality and stability of supply, conservation of resources and costs.

According to a report by Euromonitor, the global market for cosmetics is expected to reach USD 131 bn by 2019 with significant growth due to a growing and ageing population and increasing global affluence[xl].

### 5.5.3 Increase in M&A activity

The biotechnology industry has witnessed a new trend of consolidation with pharmaceutical companies. The pharma companies evaluated their R&D cost to be huge with expiring patents, thereby acquiring or merging with biotech and antibiotic manufacturing companies with innovative products and research pipelines. In 2017, life sciences M&A totaled around USD 200 bn globally, dominated by Johnson & Johnson's USD 30 bn purchase of Actelion and Gilead's USD 12 bn acquisition of Kite, and 2018 was expected to witness a surge in M&A deals between the pharma and biotech companies[xli]. In 2014, Merck acquired Cubist Pharmaceuticals, an antibiotic manufacturing company for USD 8.4 bn and during 2016, AstraZeneca sold its antibiotics division to Pfizer.

**Upcoming Trend**

### 5.5.4 Augmentation of R&D with Artificial Intelligence

Artificial intelligence has the potential to impact the whole drug discovery and development process. The biotechnology industry loses 50% of compounds in Phase II and Phase III trials for lack of efficacy. Artificial intelligence is helping biotech players to access and analyze huge swathes of data — far more than human minds could manage in a lifetime[xlii]. It is helping the R&D segment to achieve a higher success rate through its natural language processing, which builds a knowledge graph and shows the complex pattern of interactions between various molecular entities and diseases. For instance, BenevolentBio, a London-based biotech company, is using artificial intelligence and machine learning to accelerate and improve the drug discovery process.

## 5.6 Market Risks

Some of the key factors inhibiting growth of the global biotechnology, antibiotics and carotenoids market are high cost of raw materials, mainly steered by demand and supply, lack of skilled human resources, and stringent regulatory policies in developed and developing countries.

In addition, ethical implementation of clinical trials for biotechnology-based products and applications is anticipated to restrict the market's growth. The regulatory framework pertaining to approval processes has always been a restraining factor in the pharmaceutical, biotechnology and medical technology industries. Regulatory authorities have enforced strict product approval procedures to ensure patient safety, which has extended the product approval timelines. The existing stringent regulatory framework might impact the growth of the biotechnology market impacting antibiotics and other drug development segments.

Further, the R&D period for development of biotech products and compounds is very long. According to the EY biotechnology industry report, Beyond Borders, published in 2017, globally 36% of drugs don't make it past the preliminary stage of drug development, another 68% don't go past the intermediate stage, and another 40% get eliminated in the final stage, at which point a lot of money has already been invested in R&D[xliii].

Industrial biotechnology is highly dependent on the petrochemical industry. However, cyclicality of the petrochemical industry due to changing market demand and prices, impacts the supply, thus restricting growth of the biotechnology industry. Synthetic carotenoids require petroleum products and their rising prices may lead to deviation in cosmetic products.

## 5.7 Future Outlook

The impact of factors driving the market and huge global investment in biotechnology and in its respective sub segments, particularly in emerging economies, is expected to surpass the impact of market constraints. During 2017-22, the industry is expected to grow at a CAGR of 3.1% to reach approximately USD 381.5 bn.

Despite the rising proliferation of biosimilars, which are analogous versions of biologic drugs (which undercut patent protection by changing the formula slightly), biotech products and biopharmaceuticals especially, are becoming increasingly difficult to duplicate and will prompt operators to prioritize biotechnology-based product development over the next five years in an effort to protect their monopolies under limited patent protection periods.

Further, the industry will continue to invest heavily in technology to reduce labor inputs and meet evolving technical specifications and regulations. However, the labor shortage will lead to both an increase in spending on training, which is needed to bring less-skilled workers up to the requisite level to operate increasingly complex technology, and a rise in wages to reflect supply shortages.

Technological advancements pertaining to the penetration of artificial intelligence in drug discovery are anticipated to fuel growth. The companies will be engaged in unleashing machine learning in order to understand individual chronic cases, while recommending clinical trials for biotechnology and antibiotic products developed.

Although most of the industry's activities take place in the US, there has been a shift toward emerging regions. IMS Health forecasts that over the next five years, growth in health product sales in emerging economies, such as China, Brazil, Mexico, South Korea, India, Turkey and Russia, will outpace growth in the established markets of the US, the European Union (EU) and Japan[xliv].

## 5.8 Clinical Pipeline of Global Antibiotic Drugs

As of May 2017, a total of 51 antibiotics (including combinations) and 11 biologicals were in the clinical pipeline to target priority pathogens such as M. tuberculosis and C. difficile. There were 33 new chemical entity antibiotics and combinations for critical and high priority pathogens in the pipeline. Of these, 12 were expected to be active against at least one of the three critical priority carbapenem-resistant pathogens, P. aeruginosa, A. baumannii and Enterobacteriaceae. Seven antibiotics were in trials for M. tuberculosis and C. difficile infections.[xlv]

In addition, 11 biological treatments were in phase-1 and phase-2 development, targeting mainly S. aureus, but also P. aeruginosa and CDI. Only two agents, GSK-3342830 (phase-1) and cefiderocol (phase-3), were expected to be active against all three critical priority pathogens. Furthermore, two monoclonal antibodies were being developed against the P. aeruginosa pathogen.

Sixteen agents were active against multiresistant Gram-positive pathogens, mainly against resistant S. pneumonia and/or MRSA. Seven of the sixteen were biological agents against S. aureus (monoclonal antibodies and endolysins). A few of the agents had been tested for activity against vancomycin-resistant Enterococcus spp. Two agents of new chemical classes had completed phase-2 trials for gonococcal infections.

Of 14 Priority Pathogens List (PPL) antibiotics in phase-1 trials, 10 targeted at least one of the Gram-negative critical priority pathogens, however, conclusive data on the activity of many of these drugs was still lacking, as they were only in clinical phase-1 and were thus categorized as "possibly active". Eight of these potential anti-Gram-negative agents were β-lactams or β-lactam + BLI combinations. Fifteen of the PPL antibiotics were being developed as oral formulations, but only one was expected to be active against at least one critical priority pathogen.

The table below shows key antibiotic drugs currently in development with their approval status[xlvi]:

**Exhibit 27: Clinical Pipeline of Antibiotics Development***

| Drug Name | Development Phase | Company | Drug Class | Expected Activity Against WHO Critical Threat Pathogen | Potential Indications |
|---|---|---|---|---|---|
| **Baxdela (delafloxacin)** | Approved June 19, 2017 (US FDA) | Melinta Therapeutics Inc. | Fluoroquinolone | No | Approved for: Acute bacterial skin and skin structure infections; other indications: community-acquired bacterial pneumonia and complicated urinary tract infections |
| **Vabomere (Meropenem + Vaborbactam)** | Approved Aug. 30, 2017 (US FDA) | Rempex Pharmaceuticals Inc. | β-lactam (carbapenem) + β-lactamase inhibitor (cyclic boronate) | Yes | Approved for: Complicated urinary tract infections including pyelonephritis; other potential indications: complicated intra-abdominal infections, hospital acquired bacterial pneumonia |
| **CRS3123** | Phase 1 | Crestone Inc. | Diaryldiamine | Yes (C. difficile) | Yes (C. difficile) |

| | | | | | |
|---|---|---|---|---|---|
| **DS-2969** | Phase 1 | Daiichi Sankyo | Unknown | Yes (C. difficile) | Bacterial enteritis |
| **Brilacidin** | Phase 2 | Innovation Pharmaceuticals Inc. | Defensin mimetic | No | Acute bacterial skin and skin structure infections |
| **CG400549** | Phase 2 | Crystal Genomics Inc. | Benzyl pyridinone | No | Acute bacterial skin and skin structure infections |
| **Ceftobiprole** | Phase 3 | Basilea Pharmaceutica | β-lactam | No | Acute bacterial skin and skin structure infections, community-acquired bacterial pneumonia |
| **Sulopenem** | Phase 3 | Iterum Therapeutics Ltd. | β-lactam | No | Complicated urinary tract infections, uncomplicated urinary tract infections, and complicated intra-abdominal infections |

*The list is indicative and not exhaustive

## 5.9 Markets in Europe, Asia Pacific and North America[xlvii]

The charts below highlight the geographic segmentation of biotechnology establishments globally producing antibiotics and carotenoids and other drugs:

**Exhibit 28: Number of Biotechnology Establishments Globally – by Region, 2017 (100% = 9,613)**

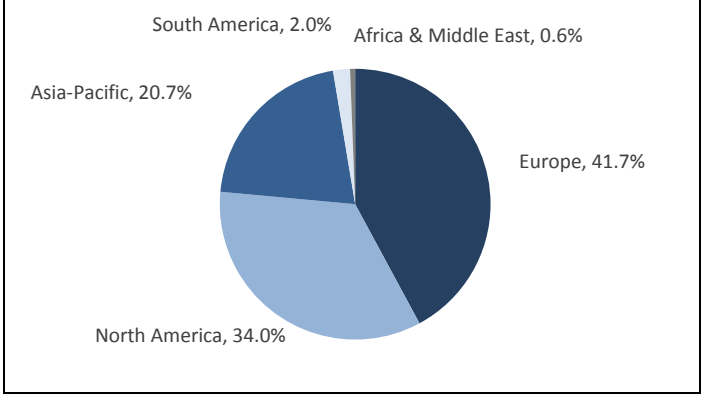
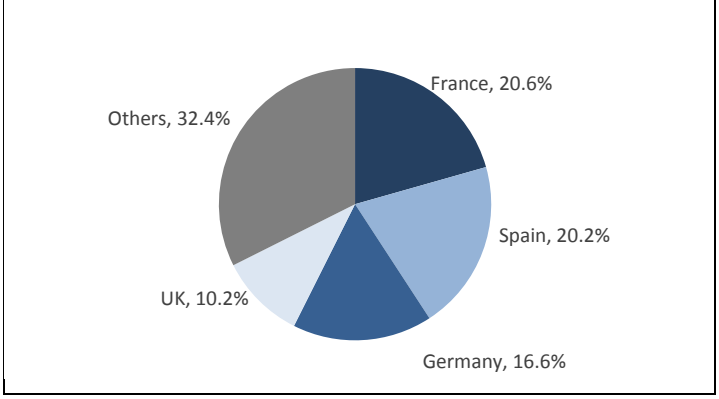



**Exhibit 29: Number of Biotechnology Establishments in Europe – 2017 (100% = 4,037)**




### 5.9.1 Market in Europe

The European biotechnology industry accounts for 41.7% of the industry's establishments. The European industry follows the clustering model with major centers in London, Edinburgh and Dublin, in addition to Continental Europe, Medicon Valley, Biovalley, BioAlps, and BioRhine, BioTech Munich and BioCon Valley.

France hosts renowned healthcare product manufacturers producing biotherapies, including vaccines and therapeutic antibodies, along with cell and gene therapies, which require talent and expertise that can be found in abundance in France's industrial ecosystem. The country has seven healthcare sector innovation clusters that lead to the emergence of innovations, products and services offering high-quality personalized healthcare. With more than EUR 1.6 bn of funds raised (all forms of venture capital), Euronext (Paris) is the leading stock market in Europe for biotechnology firms and in the world for medical technology firms[xlviii].

France holds the largest share of industry establishments in the region, with 20.6%, followed by Spain (20.2%), Germany (16.6%) and the UK (10.2%). The industry is at different stages of its economic life cycle across the continent, while being the most matured in Germany and the UK. In these countries, the number of enterprises has fallen in recent years as companies merge or are acquired by other biotech or pharmaceutical companies. However, growth has been strong in the Iberian Peninsula, Italy, Belgium and Ireland, which has been one of the most prominent marketers of the industry to foreign investors.

Europe, the largest market for carotenoids, is expected to witness steady revenue growth at a CAGR of 3.8% from 2016 to 2025 due to rising demand for health supplements and animal feed.[xlix] A well-established cosmetics industry, owing to the presence of key manufacturers such as L'Oréal, Unilever, Beiersdorf, and Henkel is anticipated to be a major factor influencing growth in the region.

### 5.9.2 Market in Asia Pacific[l]

Biotechnology companies in Asia have been growing at a fast rate. Driven by aging populations, rising incomes and demand for quality healthcare, emerging markets offer growth opportunities to industry operators. In developed countries, such as Japan, Taiwan and South Korea, biotechnology is viewed as the next generation of technological innovation, after the commoditization of telecommunications and computer equipment.

The market in the Asia Pacific has expanded significantly over the past few years and its value has increased mainly due to generics, drug discovery and research. Several international companies have invested in Asian biotech, research and pharmaceutical companies. Agricultural biotechnology is one of its most widespread applications, but industrial and medical biotechnologies have become vital sectors in some countries, with economic growth, developing human resources, a growing market, increasing innovation and emphasis on research into basic life sciences driving strong and sustained growth.

Countries such as China, Japan, Australia and South Korea lead the biotech sector and have contributed massively to its expansion. India, Singapore and Malaysia are also making significant strides due to their growing middle classes and rapidly improving standards of living. India’s biotechnology sector has grown mainly due to government support, especially in the establishment of research-related infrastructure to help maintain the robust performance of the bio-pharmaceutical, bioinformatics and agricultural biotechnology segments. At present, India’s biotech industry accounts for 2% of the global market and is the third-largest in the Asia-Pacific region.

Among major regions, Asia Pacific dominated the antibiotics market with the highest market share of more than 42% in 2016, followed by the Americas and Europe, Middle East and Africa. The high market share in Asia Pacific is due to the availability of a large patient pool and the rise in geriatric population.

Also, Asia Pacific is expected to show high gains in carotenoids market on account of growing usage of these additives in feed, supplement, food, pharmaceutical, and cosmetic applications. The carotenoid industry is anticipated to be driven by technological advancements, industrial growth, economic growth, and low costs of production in countries such as China, Japan and India.

### 5.9.3 Market in North America

North America continues to be the largest regional market for biotechnology. Metropolitan areas where most of the biotechnology industrial activities are clustered include New York City, Boston, San Diego, San Francisco, Washington DC, Chicago, Los Angeles, Philadelphia and Raleigh. The industry is characterized by the presence of federal government agencies, universities, international agencies, industry associations and biotech-related policy "think tanks" and major corporations.

Continuous improvement in regulatory framework for biotechnology and antibiotic products is anticipated to drive the growth of the US biotechnology market. The simultaneous developments of next-generation sequencing, personalized medicine and companion diagnostics in the country is the highest impact rendering factor for the growth of the biotechnology space.

According to EY estimates, US R&D expenditures on new medicines, a key indicator of the future health of the industry, reached an all-time high of USD 45.7 bn in 2016, up 12% compared with expenditures in the previous year.[li]

Bio-agriculture is an important sub-sector that grew rapidly over the two decades leading up to 2016. Globally, the US had the largest area of biotech crops in 2016 (72.9 mn hectares), up 2.82% from 2015. Similarly, the global area of biotech crops increased by 1% in 2016, from 179.7 mn hectares in 2015 to 181.5 mn hectares in 2016, according to the *International Service for the Acquisition of Agri-Biotech Applications*.

The Canadian biotechnology sector is continuously evolving due to the large appetite of the investors for investing in early-stage and growth-oriented public companies. Major discoveries, new therapies, strong product pipelines and a flexible M&A market has restored investor confidence and is expected to boost the sector's growth in the near future.

### 5.10 Regulatory Framework

The global biotechnology industry is highly regulated. The biotech drugs are authorized based on a scientific risk assessment undertaken by a national agency, such as the FDA in the US or the European Food Safety Authority. However, there is no global standard for industry products and their applications, which means that operations may differ significantly from nation to nation.

Ultimately, if a product is found to be safe for human, animal or plant life and health, as well as the environment, it will be passed for use and sale. In cases where scientific evidence is insufficient, inconclusive or uncertain and where possible risks are judged unacceptable, regulators generally rule on the side of caution. Procedures for authorization in major biotech producing countries are generally predictable, efficient and transparent. In line with the speedy adoption of technology and technological processes used by the industry, guidelines in the US, EU and Japan are frequently amended to encourage biotechnological expansion and discovery within the context of humanitarian and environmentally responsible operations.

Biotechnology patents are usually awarded by the US Patent and Trademark Office (USPTO) in the Department of Commerce, the European Patent Office and the Japan Patent Office. A patent application is generally judged on four criteria. The invention must be useful, novel, nonobvious and enabled (the invention must be described in sufficient detail to enable one skilled in the field to use it for the stated purpose). DNA usually becomes patentable when it has been isolated, purified or modified to produce a unique form not found in nature, as in the case for major agricultural products like seedless watermelons or hybrid fruits like a pluot (a mix between an apricot and a plum). Patents are enforced and protected for 20 years from the filing date and patent priority is based on the 'first to invent' principle: whoever made the invention first (and can prove it) is awarded property and monopoly rights for the 20-year period. Patents are especially crucial for the burgeoning biopharmaceutical aspect of industry operations since healthcare costs can be extremely high in some countries like the US.

Genetically modified organisms (GMOs), for both human food and animal feed, are particularly widespread in the US and many less-developed countries, primarily in Latin America. Regulation in the US is currently not prohibitive to commercial operations. However, regulation of GMO products is more stringent in the EU. The European Food Safety Authority is responsible for approving GMOs and putting them to market. An approval remains valid for 10 years.

Moreover, the compulsory labeling of all GMO products in most nations, including those intended for animal feed, is intended to inform the consumer and to ensure that the product is traceable throughout the food chain. Still, this labeling may deter some consumers from purchasing industry products because of the potential for detrimental health effects (although scientific opinion is uncertain as to whether GMOs are in fact detrimental to one's health).

#### 5.10.1 Regulatory body in Europe

In the EU, national authorities approve and authorize any new drug discovered. Every pharmaceutical, biotechnology or medical technology company that currently sells or sponsors products in the EU is affected by IDMP, an enhanced Eudra Vigilance System, a new Clinical Trials Regulation, the Falsified Medicines Directive. Regulation (EC) No 726/2004 lays down community procedures for the authorization and supervision of medicinal products for human and veterinary use.

Regulation (EC) No. 1830/2003 in the EU broadens the concept of GMO foodstuff to include all types of foodstuff containing or produced from GMOs, including proteins derived from GMOs, and incorporates additives and flavorings for human consumption, previously subject to specific legislation, as well as GMO animal feed.

### 5.10.2 Regulatory body in the US

In the US, biotechnology products are regulated by the FDA, the US Department of Agriculture's (USDA's) Animal and Plant Health Inspection Service (USDA-APHIS), and Environmental Protection Agency (EPA). FDA is responsible for ensuring the safety and proper labeling of all plant-derived food and feed, including those developed through genetic engineering. FDA ensures that food and feed manufacturers meet their obligations through its enforcement authority under the Federal Food, Drug, and Cosmetic Act[lii].

The Biopesticides and Pollution Prevention Division of the Office of Pesticide Programs, under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), regulates the distribution, sale, use and testing of pesticidal substances produced in plants and microbes. Generally, Experimental Use Permits are issued for field testing.

APHIS is responsible for protecting agriculture from pests and diseases. Under the Plant Protection Act, USDA-APHIS has regulatory oversight over products of modern biotechnology that could pose such a risk.

### Special regulatory designations

The increased rate of development of multidrug-resistant pathogens, coupled with the limited number of drugs available for treatment, led to the development of GAIN Act by the US FDA (passed in 2012). According to the Act, any drug being developed for the treatment of "qualified infectious disease" will be granted a QIDP designation. This QIDP designation helps in the attainment of fast track designation and priority review for the drug. Thus, the drug will be developed at a faster rate and released into the market.

### 5.10.3 Regulatory body in Asia Pacific

In India, Department of Biotechnology, which includes Recombinant DNA Advisory Committee (RDAC), Regulatory Committee on Genetic Manipulation (RCGM) and Institutional Biosafety Committee (IBSC), monitors and approves the biotech activities. The government has proposed to set up the National Biotechnology Regulatory Authority (NBRA) to provide a single-window clearance mechanism for all bio-safety products to create efficiencies and streamline the drug approval process[liii].

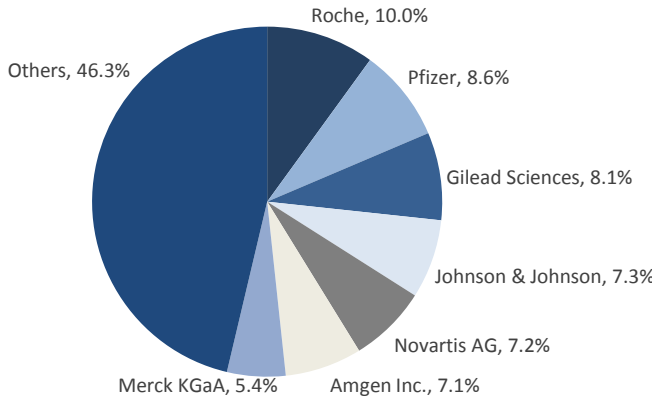
The government of China is in the process of revising laws and regulations governing biotechnology. In May 2015, the Ministry of Agriculture (MOA) released a draft amendment to the Administrative Measures for Safety Assessment of Agricultural Genetically Modified Organisms for public comments. The amendment would remove timelines for approvals and add economic and social factors to the approval process for the first time[liv].

Japan remains one of the world's largest per capita importers of foods and feeds that have been produced using modern biotechnology. The Ministry of Health, Labor and Welfare (MHLW) is responsible for the food safety of genetically engineered products, while the Ministry of Agriculture, Forestry and Fisheries (MAFF) is responsible for feed and environmental safety. The Food Safety Commission (FSC) is an independent risk assessment body that performs food and feed safety risk assessments for MHLW and MAFF.

## 5.11 Competitive Landscape[lv]

The industry is moderately concentrated at the top as the leading six players account for almost half of the market share globally. It is fragmented at the bottom with the presence of many small and emerging players. Some key players in the market are Roche, Pfizer, Gilead Science, Novartis, Amgen and Merck KGaA. The key strategies adopted by the players to increase their market share in the global biotechnology market share include M&A and strategic collaborations. For instance, in 2015 Roche collaborated with Janus Biotherapeutics, a US-based biotechnology company, to develop treatment for autoimmune disease, while Celgene acquired Quanticel, a biotechnology company, to increase its focus on cancer drug discovery.

**Exhibit 30: Market Share of Key Players – by Revenue, 2017[lvi] (100% = USD 327.5 bn)**




### 5.11.1 Roche Holding AG

Founded in 1896 and headquartered in Basel, Switzerland, Roche develops and manufactures medicines for oncology, virology, inflammation, metabolism and the central nervous system. Roche is a leader in tissue-based cancer diagnostics and a pioneer in diabetes management.

Considered one of the founders of biotechnology, Genentech, a subsidiary of Roche, uses genetic information to discover, develop, manufacture and commercialize medicines to treat patients with serious or life-threatening medical conditions. Genentech is headquartered in California and employs more than 11,000 people.

Roche mainly focuses on cancer treatments, a particularly lucrative market without a conclusive cure that requires months, if not years, of treatment. Over the five years leading up to 2016, Roche produced a steady flow of new drugs and diagnostic tests in key therapeutic areas by leveraging its strengths in biotechnology and vitro-diagnostics and investing nearly 21% of its annual revenue in R&D activities in 2018. The company's R&D investments focused on oncology, diabetes, inflammatory and autoimmune diseases and neuroscience. In 2013, Roche gained market approval in the US and EU for two innovative cancer drugs, Kadcyla and Perjeta, which bolstered its financial performance.

### 5.11.2 Pfizer Inc.

Headquartered in New York, US, Pfizer was founded in 1849. The firm discovers, develops, manufactures, and sells healthcare products worldwide. Pfizer develops and manufactures medicines and vaccines for a range of medical uses including immunology, oncology, diabetes, neurology, cardiology and endocrinology, among others. The company operates in the industry through its innovative health business which focuses on developing drugs.

While the company already has a large portfolio of biosimilar and biologic pharmaceuticals, Pfizer has focused its efforts on acquiring the intellectual property rights for more drugs to expand its market share. For example, in 2015, Pfizer purchased the rights to two meningitis drugs from GlaxoSmithKline, and in 2016, it acquired Anacor Pharmaceuticals, which expanded its portfolio of inflammation and immunology treatment options. Outside of acquisitions, the company has aggressively pursued innovative treatment options, dedicating 15% of its revenue to R&D costs in 2018.

### 5.11.3 Gilead Sciences Inc.

Founded in 1987, Gilead is a biopharmaceutical company with a rapidly expanding product portfolio, growing pipeline of investigational drugs and about 11,000 employees in offices across 130 countries. Headquartered in Foster City, CA, the company's therapeutic areas of focus include HIV/AIDS, hepatitis, serious respiratory, cardiovascular and metabolic conditions, cancer and inflammation. While Gilead is much newer and smaller than most of its competitors, it has been successful over the five years to 2017 through some strategic product launches and acquisitions.

Gilead generates nearly three-quarters of its annual revenue from its US operations. In recent years, the company has also been expanding, partially through acquisitions, enabling it to commercialize biotech products that have reached late-stage development without needing to invest heavily in R&D (23% of revenue). The largest of these acquisitions

was Pharmasset in 2012 for USD 11.2 bn, which provided Gilead with the opportunity to commercialize Sovaldi. More recently, Gilead acquired Phenex Pharmaceuticals to focus on liver diseases and Epi Therapeutics for cancer gene transcription treatment options in 2015. In 2017, the company announced its intention to acquire Kite Pharma and Cell Design Labs.

### 5.11.4 Johnson & Johnson

Established in 1886 and headquartered in New Jersey, Johnson & Johnson is a multinational medical device, pharmaceutical and consumer-packaged-goods manufacturing enterprise. The company has over 250 subsidiaries with operations in more than 60 countries and markets its products in nearly 200 nations.

Johnson & Johnson operates in the global biotechnology industry through its pharmaceuticals segment, with over two-thirds of its drugs being industry-relevant, classified as (biologic or biosimilar) biopharmaceuticals including Edurant, Olysio, Darzalex, Procrit and Risperdal, among others. The company invested around 13% of its revenue into R&D costs in 2018. In addition to organic growth, the company is very focused on inorganic growth as well. While most acquisitions were focused on its consumer product and medical device operating segments, its pharmaceutical arm grew in 2016 through the acquisition of Actelion for USD 30 bn, which was spun off to create R&D NewCo, a biopharmaceutical subsidiary in Switzerland.

### 5.11.5 Novartis AG

Novartis International AG is a Swiss multinational pharmaceutical company that develops and manufactures prescription, generic and biologic and biosimilar drugs. Founded in 1996 and headquartered in Basel, Switzerland, Novartis has released numerous successful drugs, including Clozaril, Voltaren, Lamisil and Ritalin, among others. While dominant in the prescription drug sphere, its generic subsidiary, Sandoz, is one of the largest generic drug manufacturers globally. Therefore, Novartis can capitalize on its patent monopoly and continue generating a consistent revenue stream by manufacturing the generic formulas as well. Employing 130,000 employees in 2018, the company operates in the industry through its Innovative Medicine and Sandoz operating areas.

Innovative Medicine includes newly developed drugs which are increasingly focused on biopharmaceuticals which garner higher profit margins and are often more effective against many chronic and rare conditions. As of 2016, only about 10% of its generic drugs are biopharmaceuticals and therefore Sandoz only reflects a small portion of its industry-relevant revenue. Still, its innovative medicines business includes a litany of biologic and biosimilar drugs which are industry-relevant.

### 5.11.6 Amgen Inc.

Established in 1980, Amgen is a biotechnology company focusing on discovering, developing, manufacturing and marketing human therapeutics based on advances in cellular and molecular biology. The company concentrates on human therapeutics products in the areas of nephrology, supportive cancer care and inflammatory disease. Amgen maintains sales and marketing forces primarily in the US, Europe and Canada. Amgen is headquartered in Thousand Oaks, CA, and employs nearly 21,500 staff members worldwide.

Amgen's strong focus on R&D activities helps the company remain one of the leading innovators in the identification, isolation, production and use of human proteins as therapeutic agents. The company has major R&D centers in various locations across the US and the UK, as well as other research centers in Germany and Canada, and smaller development facilities throughout Europe, Australia, Mexico, India and Hong Kong.

Although Amgen operates subsidiaries and factories globally, the company derives most of its revenue (73% in 2018) from its US operations. Such concentration creates a higher risk of market volatility for Amgen compared with its competitors, which have greater geographical presence and more diversified service offerings. In addition, there are some potential threats to Amgen's rapid international expansion, including pressure from generic biosimilars to key drugs Epogen and Neupogen. While the company has managed to successfully battle many of these generics in recent years, they could slow international expansion in future.

### 5.11.7 Merck KGaA

The Germany-based Merck Group, which employs 54,042 people worldwide, currently operates within the global biotechnology industry through two of its major operating segments: Merck Serono and Merck Millipore. Merck entered the biotechnology market via its acquisition of Switzerland-based Serono, the largest biotech company in Europe. Merck bought Serono in January 2007 for USD 13 bn, which represented one of the largest pharma takeovers of biotech companies in history. Thereafter, Serono merged with the former division of Merck to form the new industry-relevant Merck Serono division, which focuses on recombinant genetic engineering to develop drugs. Serono is best known

globally for its two main products, Rebif and Erbitux, which treat multiple sclerosis and colorectal cancer, respectively, and together generate about half of the division's revenue.

Merck Serono's is headquartered in Geneva, Switzerland. As the largest division of Merck, Merck Serono's robust product pipeline and new product development provide the company with significant market opportunity, helping Merck increase its revenue and profitability. Merck Serono's strong focus on R&D activities resulted in the development of its well-known brand covering various therapeutic areas such as oncology, neurodegenerative diseases, fertility, endocrinology and cardiometabolic care.

### Other Players

Globally, biotechnology is a growing industry, characterized by the presence of a large number of establishments. Still, most of these companies are small players that are struggling to stay afloat during their regulatory approval periods, when many companies operate at a deficit with the anticipation of sales after approval in domestic or international markets. Some of the other notable companies, apart from those mentioned above, are:

### 5.11.8 Monsanto

Monsanto is a biotechnology company with a strong focus on plant biotechnology, genomics and molecular breeding technology. Following many divestments, Monsanto is now devoted purely to agriculture in two operating segments, seeds and genomics (industry relevant) and agricultural productivity. Monsanto has operations in more than 50 countries. The company sells its products to a variety of consumers in the agricultural sector, including individual growers, seed companies, distributors, independent retailers and agricultural cooperatives, as well as to other major agricultural chemical producers.

Monsanto holds numerous licenses in connection with its genomics program. For example, Monsanto holds a perpetual license to certain genomics technologies for use in the areas of plant agriculture and dairy cattle, and perpetual licenses to patents expiring between 2018 and 2023 for classes of proprietary genes for the development of commercial traits in crops. Monsanto also holds perpetual licenses to functional characterizations of the company's proprietary genes, as well as perpetual licenses to certain genomic sequences and certain genomics technologies. The company obtained perpetual licenses to chemicals used to make Harness herbicides and to manufacturing technology for Posilac bovine somatotropin.ssss

### 5.11.9 Biogen Idec Inc.

Biogen Idec Inc. is a global biotechnology company that specializes in discovering and developing products that address medical needs for rare diseases in the areas of oncology, neurology and immunology. The company has headquarters in the US (Massachusetts) and Switzerland as well as offices in Australia, Canada, Japan and Europe. In addition, Biogen has a commercial presence in more than 29 markets and a distribution network in more than 70 other markets, including emerging markets such as India, China, Central and Eastern Europe and Brazil.

The company continues to expand its production capacity for its growing pipeline of products, including the construction of a large-scale biologics manufacturing facility in Denmark. Two of the company's best-known medicines are Avonex and Tysabri, which treat multiple sclerosis. In 2016, revenue generated from sales of the company's multiple sclerosis portfolio accounted for 89.8% of the company's total revenue. Tecfidera, the company's treatment for people with relapsing multiple sclerosis, was approved in the US in 2013 and in the EU in early 2014.

### 5.11.10 Key Antibiotics and Carotenoids Players Globally

The players mentioned below are indicative and not exhaustive:

**Exhibit 31: Key Antibiotics Players Globally**

| Company Name | Headquarters | Revenue, 2018 (USD mn) | Employees, 2018 | Product Examples (Antibiotics) |
|---|---|---|---|---|
| **Bayer HealthCare AG** | Germany | 46,756 | 104,771* | Baytrill, Zelnate |
| **Roche** | Switzerland | 58,121 | 94,442 | Bactrim |
| **Eli Lilly and Co.** | US | 24,556 | 33,910* | Inteprity |
| **GlaxoSmithKline** | UK | 41,149 | 96,851 | Neosprin |
| **Pfizer** | US | 53,647 | 92,400 | Tygacil, Zosyn/Tazocin |
| **Novartis AG** | Switzerland | 53,605 | 130,000 | Sandoz |
| **Merck KGaA** | Germany | 17,523 | 54,042* | Bleocin, Steritest, Geobacillus, Nigericin |

* Numbers are as on 30 September 2019

**Exhibit 32: Key Carotenoids Players Globally**

| Company Name | Headquarters | Revenue, 2018(USD mn) | Employees, 2018 | Product Examples (Carotenoids) |
|---|---|---|---|---|
| **BASF SE** | Germany | 74,027 | 118,648* | Lutavit, Natuphos E |
| **Royal DSM N.V.** | Netherlands | 10,946 | 22,204* | Redivivo® Lycopene, Actilease, OPTISHARP® Natural Zeaxanthin |
| **Chr. Hansen A/S** | Denmark | 1,316* | 3,420* | NUTRIPHY, Beta carotene |
| **Lycored Ltd.** | Israel | NA | NA | Alpha Carotene, Beta Carotene, Lutein, Lycopene, Lycomato, Astaxanthin |

* 2019 numbers

### 5.11.11 Comparison with listed Peers[lvii]

**Exhibit 33: Peer companies**

| Company Name | Market Cap (in EUR mn) | EV | Sales 2021e | EV/SALES (2021) | Drug Status |
|---|---|---|---|---|---|
| Paratek Pharmaceuticals Inc | 181 | 224 | 135.2 | 1.7x | Phase 2 |
| Spero Therapeutics Inc | 146 | 78 | 14.3 | 5.4x | Phase 1 |
| Nabriva Therapeutics PLC | 45 | -1 | 28.6 | 0.0x | Phase 2 |
| Basilea Pharmaceutica AG | 577 | 641 | 151.5 | 4.2x | Phase 3 |
| Robertet SA | 1,902 | 1,925 | 582.0 | 3.3x | - |

## 6. Valuation

The Fair Market Value for all the Company shares stands between EUR 30.3 mn and EUR 63.4 mn (using blended price) as of April 14, 2020. The Fair Market Value for Company's one publicly traded share stood between EUR 1.68 and EUR 3.52 as of April 14, 2020, using blended valuation (Discounted Cash Flow and EV/SALES Multiple).

### 6.1 Discounted Cash Flow Method

| Valuation | |
|---|---|
| **WACC** | |
| Risk-free rate | 0.38%[lviii] |
| Beta | 0.6[lix] |
| Equity Market return | 9.50%[lx] |
| Additional Premium | 1.0%[lxi] |
| Cost of Equity | 7.1% |
| Cost of Debt (after tax) | 0.4% |
| Terminal Growth Rate | 1.0% |
| WACC (Discount Rate) | 7.1% |

| Year Ending- Dec | 2020E | 2021E | 2022E | 2023E | 2024E | 2025E | 2026E | 2027E |
|---|---|---|---|---|---|---|---|---|
| **FCFF (Low)** | | | | | | | | |
| Net cash from operating activities | **(14,875)** | **(12,565)** | **(12,382)** | **(5,504)** | **2,347** | **5,022** | **9,011** | **9,675** |
| Capital expenditure | (759) | (657) | (975) | (1,395) | (1,402) | (1,849) | (1,921) | (1,994) |
| Free cash flow to firm | **(15,634)** | **(13,222)** | **(13,358)** | **(6,899)** | **944** | **3,173** | **7,091** | **7,682** |
| Discount factor | 0.95 | 0.89 | 0.83 | 0.78 | 0.72 | 0.68 | 0.63 | 0.59 |
| Present value of FCF | (14,890) | (11,760) | (11,095) | (5,352) | 684 | 2,147 | 4,480 | 4,532 |
| **FCFF (High)** | | | | | | | | |
| Net cash from operating activities | **(14,673)** | **(12,132)** | **(12,166)** | **(3,606)** | **5,224** | **8,913** | **13,906** | **14,817** |
| Capital expenditure | (785) | (690) | (1,020) | (1,591) | (1,636) | (2,199) | (2,284) | (2,370) |
| Free cash flow to firm | **(15,459)** | **(12,822)** | **(13,185)** | **(5,197)** | **3,588** | **6,714** | **11,622** | **12,447** |
| Discount factor | 0.95 | 0.89 | 0.83 | 0.78 | 0.72 | 0.68 | 0.63 | 0.59 |
| Present value of FCF | (14,723) | (11,404) | (10,952) | (4,032) | 2,599 | 4,542 | 7,343 | 7,344 |

| **Arrowhead Fair Value Bracket** | **High** | **Low** |
|---|---|---|
| Terminal Value (TV) | 250,132 | 156,467 |
| Present Value of TV | 120,199 | 75,189 |
| Present Value of FCF | 3,134 | -17,182 |
| Net Debt | 7,775 | 7,775 |
| **Equity Value Bracket** | | |
| Shares O/s (000's) | 18,030 | 18,030 |
| **Fair Share Value Bracket (EUR)** | **6.4** | **2.8** |
| Current Market Price (EUR) | 0.84 | 0.84 |
| Upside/(Downside) | 664.8% | 232.5% |
| Current Market Cap. (EUR 000) | 15,109 | 15,109 |
| **Target Market Cap. Bracket (EUR '000)** | 115,558 | 50,232 |

## Sensitivity Analysis

| Sensitivity Table - High | | WACC (%) | | | | |
|---|---|---|---|---|---|---|
| | | 6.1% | 6.6% | 7.1% | 7.6% | 8.1% |
| GROWTH RATE (%) | 0.0% | 7.2 | 6.2 | 5.4 | 4.7 | 4.1 |
| | 0.5% | 7.9 | 6.8 | 5.9 | 5.1 | 4.4 |
| | 1.0% | 8.7 | 7.5 | 6.4 | 5.5 | 4.8 |
| | 1.5% | 9.7 | 8.2 | 7.0 | 6.0 | 5.2 |
| | 2.0% | 11.0 | 9.2 | 7.8 | 6.6 | 5.7 |

| Sensitivity Table - Low | | WACC (%) | | | | |
|---|---|---|---|---|---|---|
| | | 6.1% | 6.6% | 7.1% | 7.6% | 8.1% |
| GROWTH RATE (%) | 0.0% | 3.3 | 2.7 | 2.2 | 1.7 | 1.4 |
| | 0.5% | 3.7 | 3.0 | 2.5 | 2.0 | 1.6 |
| | 1.0% | 4.2 | 3.4 | 2.8 | 2.2 | 1.8 |
| | 1.5% | 4.8 | 3.9 | 3.2 | 2.6 | 2.1 |
| | 2.0% | 5.6 | 4.5 | 3.7 | 2.9 | 2.4 |

## Approach for DCF Valuation

**Time Horizon:** The Arrowhead fair valuation for DEINOVE is based on a DCF method. The time-period chosen for the valuation is 117 months (2020E-2030E).

**Terminal Value**: Terminal value is estimated using terminal growth rate of 1.0%.

**Prudential nature of valuation:** It should be noted that this Arrowhead Fair Value Bracket estimate is a relatively prudential estimate, as it discounts the eventuality of any new products being launched in the market or any significant change in the strategy.

## 6.2 Relative Valuation Method

The Fair Market Value of one of DEINOVE's publicly traded regular shares stands between EUR 0.57 and EUR 0.62 as on April 14, 2020, according to the relative valuation method.

**Exhibit 34: Relative Valuation Method**

| Company Name | Market Cap (in EUR Mn) | Current Enterprise Value (in EUR Mn) | SALES 2021e | EV/SALES (2021) | Drugs status |
|---|---|---|---|---|---|
| Paratek Pharmaceuticals Inc | 181 | 224 | 135.2 | 1.7x | Phase 2 |
| Spero Therapeutics Inc | 146 | 78 | 14.3 | 5.4x | Phase 1 |
| Nabriva Therapeutics PLC | 45 | -1 | 28.6 | 0.0x | Phase 2 |
| Basilea Pharmaceutica AG | 577 | 641 | 151.5 | 4.2x | Phase 3 |
| Amyris Inc | 349 | 473 | 330.3 | 1.4x | FDA approved |
| Robertet SA | 1,902 | 1,925 | 582.0 | 3.3x | - |
| **Average** | | | | **2.7x** | |

| (All figures are in EUR 000, except per share data) | High | Low |
|---|---|---|
| Deinove Sales FY2021 | 6,183 | 5,891 |
| PEER EV/Sales | **2.7x** | **2.7x** |
| Relative valuation discount / premium | 15% | 15% |
| Adjusted EV/Sales | **3.1x** | **3.1x** |
| **Enterprise Value (EV) (EUR mn)** | 18,989 | 18,089 |
| | | |
| Adjustment | | |
| Less: Net Debt | 7,775 | 7,775 |
| Less: Minority Interest | 0 | 0 |
| **Implied Equity Value** | 11,214 | 10,314 |
| Shares o/s ('000s) | 18,030 | 18,030 |
| | | |
| **Intrinsic Value per share EUR** | 0.62 | 0.57 |
| Current market Price EUR | 0.84 | 0.84 |
| Upside / (Downside) | -25.8% | -31.7% |

## 6.3 Blended Valuation

The Fair Market Value of one of DEINOVE's publicly traded regular shares stands between EUR 1.68 and EUR 3.52 as on April 14, 2020 according to the blended valuation method.

**Exhibit 35: Blended Valuation**

| | High | Low |
|---|---|---|
| DCF | 6.41 | 2.79 |
| Relative Valuation | 0.62 | 0.57 |
| **Blended Value** | **3.52** | **1.68** |

### Important information on Arrowhead methodology

The principles of the valuation methodology employed by Arrowhead BID are variable to a certain extent depending on the subsectors in which the research is conducted, but all Arrowhead valuation research possesses an underlying set of common principles and a generally common quantitative process.

With Arrowhead Commercial and Technical Due Diligence, Arrowhead extensively researches the fundamentals, assets and liabilities of a Company, and builds solid estimates for revenue and expenditure over a coherently determined forecast period.

Elements of past performance, such as price/earnings ratios, indicated as applicable, are present mainly for reference purposes. Still, elements of real-world past performance enter the valuation through their impact on the commercial and technical due diligence.

Elements of comparison, such as multiple analyses may be to some limited extent integrated in the valuation on a project-by-project or asset-by-asset basis. In the case of this DEINOVE report, there are no multiple analyses integrated in the valuation.

### Arrowhead BID Fair Market Value Bracket

The Arrowhead Fair Market Value is given as a bracket. This is based on quantitative key variable analysis, such as key price analysis for revenue and cost drivers or analysis and discounts on revenue estimates for projects, especially relevant to those projects estimated to provide revenue near the end of the chosen forecast period. Low and high estimates for key variables are produced as a tool for valuation. The high-bracket DCF valuation is derived from the high-bracket key variables, while the low-bracket DCF valuation is based on the low-bracket key variables.

In principle, an investor who is comfortable with the high-brackets of our key variable analysis will align with the high-bracket in the Arrowhead Fair Value Bracket, and likewise in terms of low estimates. The investor will also take into account the Company intangibles – as presented in the first few pages of this document in the analysis on strengths and weaknesses and other essential Company information. These intangibles serve as supplementary decision factors for adding or subtracting a premium in the investor's own analysis.

The bracket should be understood as a tool provided by Arrowhead BID for the reader of this report and the reader should not solely rely on this information to make his decision on any particular security. The reader must also understand that on one hand, global capital markets contain inefficiencies, especially in terms of information, and that on the other hand, corporations and their commercial and technical positions evolve rapidly: this present edition of the Arrowhead valuation is for a short to medium-term alignment analysis (one to twelve months). The reader should refer to important disclosures on page 53 of this report.

# 7. Appendix

## 7.1 DEINOVE's Financial Summary

**Exhibit 36: Financial Summary**

*Low Bracket Estimates*

| *Year Ending Dec* | 2019E | 2020E | 2021E | 2022E | 2023E | 2024E | 2025E | 2026E | 2027E |
|---|---|---|---|---|---|---|---|---|---|
| Revenue (EUR '000) | 1,546 | 3,796 | 6,575 | 9,753 | 23,252 | 35,059 | 46,217 | 48,015 | 49,840 |
| Operating Profit (EUR '000) | (12,220) | (17,096) | (13,894) | (13,790) | (5,279) | 3,319 | 9,934 | 10,567 | 11,219 |
| Net Income (EUR '000) | (9,738) | (15,054) | (11,852) | (11,844) | (3,970) | 2,290 | 7,282 | 7,761 | 8,280 |
| EPS (EUR) | (0.54) | (0.83) | (0.60) | (0.58) | (0.19) | 0.10 | 0.32 | 0.34 | 0.37 |
| EBITDA (EUR '000) | (11,021) | (16,168) | (12,955) | (12,757) | (4,109) | 4,650 | 11,452 | 12,301 | 13,179 |
| **Growth rates (%)** | | | | | | | | | |
| Revenue | 104% | 145% | 73% | 48% | 138% | 51% | 32% | 4% | 4% |
| Operating Profit | NM | NM | NM | NM | NM | NM | 199% | 6% | 6% |
| Net Income | NM | NM | NM | NM | NM | NM | 218% | 7% | 7% |
| EPS | NM | NM | NM | NM | NM | NM | 218% | 7% | 7% |
| EBITDA | NM | NM | NM | NM | NM | NM | 146% | 7% | 7% |
| **Margins (%)** | | | | | | | | | |
| Gross Margins | 84% | 81% | 69% | 69% | 78% | 82% | 84% | 84% | 84.3% |
| Operating Profit Margin | NM | NM | NM | NM | (23%) | 9% | 21% | 22% | 22.5% |
| Net Profit Margin | NM | NM | NM | NM | (17%) | 7% | 16% | 16% | 16.6% |
| EBITDA Margins | NM | NM | NM | NM | (18%) | 13% | 25% | 26% | 26.4% |
| **Ratios** | | | | | | | | | |
| ROA | NM | NM | NM | NM | (28%) | 16% | 37% | 30% | 26% |
| ROE | NM | NM | NM | NM | N.A | N.A | N.A | N.A | N.A |
| Debt/Equity | (2.0x) | (1.3x) | (1.1x) | (1.0x) | (1.0x) | (1.5x) | (2.0x) | (3.1x) | (7.4x) |
| Interest Coverage | (153.9x) | (71.6x) | (48.2x) | (36.7x) | (12.6x) | 6.6x | 27.1x | 28.9x | 30.7x |

**Exhibit 37: Financial Summary**

*High Bracket Estimates*

| *Year Ending Dec* | 2019E | 2020E | 2021E | 2022E | 2023E | 2024E | 2025E | 2026E | 2027E |
|---|---|---|---|---|---|---|---|---|---|
| Revenue (EUR '000) | 1,604 | 3,926 | 6,903 | 10,197 | 26,522 | 40,909 | 54,986 | 57,101 | 59,251 |
| Operating Profit (EUR '000) | (12,006) | (16,942) | (13,458) | (13,600) | (3,092) | 7,544 | 16,178 | 17,122 | 18,059 |
| Net Income (EUR '000) | (9,524) | (14,900) | (11,414) | (11,647) | (2,347) | 5,429 | 11,933 | 12,666 | 13,426 |
| EPS (EUR) | (0.53) | (0.83) | (0.57) | (0.57) | (0.11) | 0.24 | 0.52 | 0.55 | 0.58 |
| EBITDA (EUR '000) | (10,804) | (16,010) | (12,510) | (12,553) | (1,896) | 8,926 | 17,780 | 18,983 | 20,187 |
| **Growth rates (%)** | | | | | | | | | |
| Revenue | 111% | 145% | 76% | 48% | 160% | 54% | 34% | 4% | 4% |
| Operating Profit | NM | NM | NM | NM | NM | NM | 114% | 6% | 5% |
| Net Income | NM | NM | NM | NM | NM | NM | 120% | 6% | 6% |
| EPS | NM | NM | NM | NM | NM | NM | 120% | 6% | 6% |
| EBITDA | NM | NM | NM | NM | NM | NM | 99% | 7% | 6% |
| **Margins (%)** | | | | | | | | | |
| Gross Margins | 84% | 81% | 72% | 71% | 80% | 83% | 85% | 85% | 85.1% |
| Operating Profit Margin | NM | NM | NM | NM | (12%) | 18% | 29% | 30% | 30.5% |
| Net Profit Margin | NM | NM | NM | NM | (9%) | 13% | 22% | 22% | 22.7% |
| EBITDA Margins | NM | NM | NM | NM | (7%) | 22% | 32% | 33% | 34.1% |
| **Ratios** | | | | | | | | | |
| ROA | NM | NM | NM | NM | (15%) | 29% | 45% | 35% | 29% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ROE | NM | NM | NM | NM | N.A | N.A | N.A | N.A | 169% |
| Debt/Equity | (2.1x) | (1.3x) | (1.2x) | (1.0x) | (1.0x) | (1.9x) | (4.0x) | 36.1x | 3.1x |
| Interest Coverage | (151.2x) | (71.0x) | (46.7x) | (36.2x) | (7.4x) | 15.0x | 44.2x | 46.8x | 49.3x |

## 7.2 DEINOVE's Balance Sheet Forecast

**Exhibit 38: Consolidated Balance Sheet**

All figures in EUR '000, unless stated differently

*Low Bracket estimates*

| *Year Ending Dec* | 2019E | 2020E | 2021E | 2022E | 2023E | 2024E | 2025E | 2026E | 2027E |
|---|---|---|---|---|---|---|---|---|---|
| Total current assets | 8,512 | 14,050 | 14,359 | 11,245 | 10,350 | 14,232 | 22,337 | 29,803 | 37,898 |
| Total non-current assets | 6,140 | 5,746 | 6,794 | 7,018 | 7,350 | 7,560 | 7,725 | 7,756 | 7,644 |
| **TOTAL ASSETS** | **15,504** | **20,649** | **22,006** | **19,117** | **18,552** | **22,645** | **30,916** | **38,412** | **46,395** |
| Total current liabilities | 3,604 | 5,297 | 3,209 | 3,521 | 5,313 | 6,616 | 7,604 | 7,340 | 7,042 |
| Total non-current liabilities | 18,509 | 37,016 | 50,772 | 58,932 | 60,253 | 45,450 | 45,450 | 45,450 | 45,450 |
| **TOTAL LIABILITIES** | **22,114** | **42,313** | **53,980** | **62,453** | **65,566** | **52,066** | **53,054** | **52,790** | **52,492** |
| Total shareholder's equity | (6,610) | (21,664) | (31,974) | (43,337) | (47,014) | (29,421) | (22,138) | (14,378) | (6,097) |
| **TOTAL LIABILITIES & EQUITY** | **15,504** | **20,649** | **22,006** | **19,117** | **18,552** | **22,645** | **30,916** | **38,412** | **46,395** |

**Exhibit 39: Consolidated Balance Sheet**

All figures in EUR '000, unless stated differently

*High Bracket estimates*

| *Year Ending Dec* | 2019E | 2020E | 2021E | 2022E | 2023E | 2024E | 2025E | 2026E | 2027E |
|---|---|---|---|---|---|---|---|---|---|
| Total current assets | 8,751 | 14,404 | 15,146 | 12,206 | 13,156 | 20,298 | 33,080 | 45,161 | 58,135 |
| Total non-current assets | 6,172 | 5,799 | 6,872 | 7,263 | 7,846 | 8,326 | 8,758 | 9,026 | 9,121 |
| **TOTAL ASSETS** | **15,776** | **21,056** | **22,871** | **20,322** | **21,855** | **29,478** | **42,691** | **55,040** | **68,109** |
| Total current liabilities | 3,662 | 5,336 | 3,266 | 3,588 | 5,771 | 7,376 | 8,656 | 8,339 | 7,983 |
| Total non-current liabilities | 18,509 | 37,016 | 50,772 | 58,932 | 60,253 | 45,450 | 45,450 | 45,450 | 45,450 |
| **TOTAL LIABILITIES** | **22,171** | **42,352** | **54,038** | **62,520** | **66,024** | **52,826** | **54,106** | **53,789** | **53,433** |
| Total shareholder's equity | (6,395) | (21,296) | (31,167) | (42,198) | (44,169) | (23,349) | (11,415) | 1,251 | 14,676 |
| **TOTAL LIABILITIES & EQUITY** | **15,776** | **21,056** | **22,871** | **20,322** | **21,855** | **29,478** | **42,691** | **55,040** | **68,109** |

## 8. Analyst Certifications

I, Natasha Agarwal, certify that all the views expressed in this research report accurately reflect my personal views about the subject security and the subject Company, based on the collection and analysis of public information and public company disclosures.

I, Sumit Wadhwa, certify that all the views expressed in this research report accurately reflect my personal views about the subject security and the subject Company, based on the collection and analysis of public information and public company disclosures.

### Important disclosures

Arrowhead Business and Investment Decisions, LLC has received fees in 2018 and 2019 and will receive further fees in 2020 from DEINOVE for researching and drafting this report and for a series of other services to DEINOVE including distribution of this report and networking services. Neither Arrowhead BID nor any of its principals or employees own any long or short positions in DEINOVE. Arrowhead BID's principals have received a mandate for investment banking services from DEINOVE and intend to receive compensation for investment banking activities for DEINOVE in 2020 or 2021.

Aside from certain reports published on a periodic basis, the large majority of reports are published by Arrowhead BID at irregular intervals as appropriate in the analyst's judgment.

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Investors must make their own investment decisions based upon their specific investment objectives and financial situation utilizing their own financial advisors as they deem necessary.

Investors are advised to gather and consult multiple sources of information while preparing their investment decisions. Recipients of this report are strongly advised to read the Information on Arrowhead Methodology section of this report to understand if and how the Arrowhead Due Diligence and Arrowhead Fair Value Bracket integrate alongside the rest of their stream of information and within their decision-making process.

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## 9. Notes and References

[i] Source: Bloomberg, retrieved on April 14, 2020
[ii] Source: Bloomberg: 52 weeks to April 14, 2020
[iii] Source: Bloomberg: 3 months to April 14, 2020
[iv] Source: Arrowhead Business and Investment Decisions Fair Value Bracket-AFVBTM. See information on valuation on pages 47 of this report and important disclosure on pages 52 of this report
[v] Source: Company Fillings, Company Website and Press Releases
[vi] Source: Company Website and Company Fillings
[vii] Source: Company Fillings
[viii] Source: Company Fillings
[ix] Source: Company Fillings and Press Releases
[x] Source: Company Fillings
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