QMB Innovation Centre

QUEEN MARY BIOENTERPRISES

H2 2018

# Discovery

## NEWS, VIEWS AND EVENTS AT QMB

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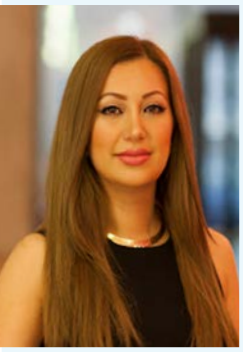
# EDITOR'S WELCOME



**Welcome to the latest issue of QMB's Newsletter.**

Innovation, and its commercial applications, drives long-term economic growth in the UK and around the world. While industry energises innovation through research and development, the impetus that fuels knowledge-based growth lies in academic research.

Universities provide the seed for creating knowledge that fosters scientific and technology-based economic development. U.S. universities are often held up as the prime example in how to commercialise intellectual property.

The University of Utah has evolved into one of the most prestigious research universities in the U.S. with a strong emphasis on commercialising its research. Utah consistently ranks high across all indicators; patents, licenses, licensing income, and start-ups in both absolute size and normalised by research expenditures, often beating its larger, well known rivals.

Based on 2017 research from the Milken Institute, from 2012 to 2015, Utah generated $211.8 million in licensing income. Over the same period, Utah recorded 69 start-ups. This is a remarkable achievement as the university is based in Salt Lake City, a relatively small metropolitan area. But Utah has a strong entrepreneurial culture and an incentive system that makes it attractive for research faculty and students alike.

So how can UK universities reach the same level of investment, and what can the public and private sectors do to help foster a more entrepreneurial culture in our universities? In this issue we speak to George Palikaras, the Chief Executive of Metamaterials Inc and the founder of QMB tenant Mediwise, who tells us how, while undertaking his post-doc research at Queen Mary University of London, he built his business.

In other news, ADC Therapeutics (ADCT), which specialises in the development of proprietary Antibody Drug Conjugates (ADCs) targeting major cancers, has dosed its first patient in its Phase II clinical trial, intended to support the submission of Biologics License Application (BLA) to the U.S. Food and Drug Administration (FDA), evaluating the efficacy and safety of ADCT-402 in patients with relapsed or refractory diffuse large B-cell lymphoma.

QMB tenant Biorelevant also has a new product coming out early next year, which represents the final step in offering complete coverage of the three main sections of the gastrointestinal tract. We spoke to Biorelevant's Michael Barnes to find out more.

**We're eager to hear your views too, so please share your feedback in the comments section on our website, or join the conversation on our Twitter page. For more updates and the latest news from QMB, please visit our website.**

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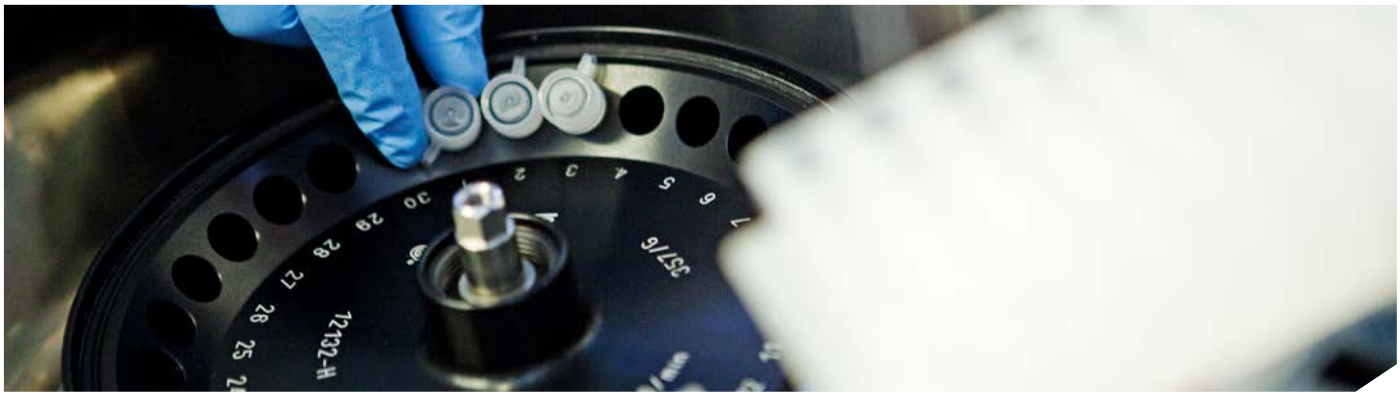


# Biorelevant to offer fed gastric medium in early 2019

**Biorelevant says it will release a fed gastric medium in early 2019, which is the final step in offering complete coverage of the three main sections of the gastrointestinal tract.**

This will allow users to test for potential food effects on their drug products as they move through the gastrointestinal tract in both the fed and fasted prandial states.

The gastrointestinal tract is a highly complex and variable environment, made up of three main sections: the stomach, the small intestine and the large intestine. Each of these sections represent different stages of digestion and absorption. The gastrointestinal juices in each section have varying pHs and different levels of bile fluids and enzymes.

At Biorelevant, the team simulate these gastrointestinal juices in vitro, allowing customers to gain a clearer understanding of how their drug products will behave in vivo through dissolution testing.

"After a meal, the quantities of bile fluids and lipids are much higher, the pH of the stomach increases, and gastric emptying time is slower," said Michael Barnes from Biorelevant.

Michael added: "This massively influences the rate of dissolution and absorption of a drug. This influence is referred to as a food effect and is essential to test during drug development."


## What are the food effects?

Food effects on the dissolution of drugs take three main forms; pH changes, increased levels of bile fluids, and physiological changes.

In the fasted state, the pH of the stomach is around 2, and immediately after a meal it rises to roughly 5/6. In contrast, the intestine has a pH of approximately 6.5 in the fasted state, and after food it decreases to roughly 6. These are all approximate values however, and are subject to high variability, which is precisely why it is important to investigate the resulting effects.

Such pH changes are important when the drug product is an acid or a base, as its solubility is pH dependent. For example, ibuprofen is acidic (pKa = 4.9), and so we would expect that it has a lower solubility in the fasted stomach compared to the fed, and vice versa in the intestine.

Secondly, an important factor in the dissolution of a compound is its solubility in water compared to lipids. The comparison of these two solubilities can be quantified with the 'LogP' value which is a partition coefficient that measures the lipophilicity of the drug.

After eating, the levels of lipids and bile fluids in the gastrointestinal juices sharply increases, which means that highly lipophilic/hydrophobic drugs will become much more soluble in the fed state.

Finally, eating food induces physiological effects on the gastrointestinal tract, an example of which is slowed gastric emptying and intestinal transit. This means that when taken with food, a drug is likely to take longer to reach the site of absorption (small intestine), and therefore have a delayed $T_{max}$ (time at which max. plasma concentration is reached).

By considering the range of different effects that food can have on the dissolution and solubility of a drug, it is clear why it is essential to test for them during formulation. With the introduction of fed gastric medium in 2019, Biorelevant users will be able to quantitatively test for food effects in vitro, for all three main gastrointestinal sections. This allows a much clearer insight into how food effects will influence their drug in vivo, as it passes through the gastrointestinal tract.

# QMB Profile: George Palikaras, Founder and CEO of Metamaterial Technologies Inc.

George Palikaras, Founder & CEO - MTI

**In 1999 a curiosity and interest in ham radio and wireless communications, and a dream of working in the British telecommunications industry, saw a young George Palikaras leave his native Greece for England.**

He did his undergraduate degree at Portsmouth University, his Masters in Digital Communication Systems at Loughborough University, where he also did his PhD studies, before heading to Queen Mary University of London (QMUL) to work with Prof. Clive Parini (FRES) and Prof. Yang Hao, pioneers in Wearable and Implantable sensor research.

It was during his Masters that he developed an interest in metamaterials, the field that would lead him to found two companies: Metamaterial Technologies Inc. (MTI), a smart materials and photonics company that is changing the way we use, interact and benefit from light, and Mediwise Ltd, a medical research and development company that is pioneering cutting edge wireless devices in medical diagnostics and monitoring, which is based in QMB.

"What amazed me about metamaterial technology was it allowed you to make things smaller and more efficient, without losing performance. So this was a very powerful thing, I fell in love with the science and the potential applications," George told QMB.

The Imperial College theoretical physicist, Sir John Pendry, known for his research into negative refractive indices and the creation of the first practical "Invisibility Cloak", proved that you can bend light around an object to make it invisible, was a big influence on George.

"Every year during my Masters and PhD, physicists and engineers were re-writing the book on what could be possible. It was a very exciting time. And then I started thinking how I could apply this to real life applications," George said.

Following his research on antennas and electromagnetics using metamaterials, George moved to QMUL, where he entered a new research field into wearable and implantable sensors.

"But my true passion came after what was a sad and worrying time for my family, as my wife was diagnosed with breast cancer. She's a survivor and all clear now, but I questioned what I was doing with my life. I wanted to apply what I was learning and use it to improve medical diagnostics," George said.

He took his business idea to QMUL and launched his first company, Mediwise Ltd, with Dr. Themos Kallos (PhD in Plasma Physics), Dr.Panos Kosmas (PhD in Medical Physics and Computational Electromagnetics), a reader at Kings College, and his wife Dr. Nadine Geddes (PhD in Ergonomics).

## Transition to business

The path from academia to business started with support from QMUL. Palikaras was encouraged by his professor to go to business networking events and take the time to go on entrepreneurial courses to expand his commercial knowledge.

"I got a bit of training in how to write a business plan. I won the QMUL business plan competition and received £1,000 prize in 2008. I used that money to buy a laptop, which I could use for coding and software, and then I continued working on a new version of the business plan, which won €5,000 at a European Business Plan competition called STARTENT. I used that money to apply for our first patent," George said.

This was followed, in 2012, by being selected to go on a "mini-MBA" programme called 10,000 Small Businesses, run by Goldman Sachs, in collaboration with UCL and Oxford's Saïd Business School, which showed participants how to scale their business. His team won an MIT-sponsored competition in 2014 called Building Global Innovators, worth $200,000.

From there, the company went from strength to strength. Palikaras says he is not as involved in R&D as he used to be, but is the product visionary and he spends a lot of time forging relationships and advancing the business.

"It just so happened that I became the guy that did more of the external facing business. There was a lot of studying and internal pitching before I was confident enough to take my ideas on the road," said George.

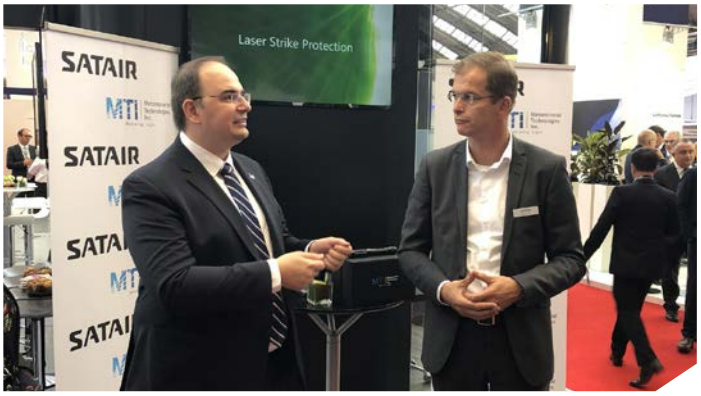
## Growth

MTI acquired Mediwise Ltd., the other company founded by Palikaras, earlier this year. Like MTI, Mediwise develops metamaterials and specialises in medical applications.

The start-ups Palikaras has led have developed strong IP portfolios with over 90 patent applications and 33 patents granted. He has authored over 40 journals and conference publications and has successfully raised in excess of $20m in venture, angel and non-dilutive capital.

What has been the biggest challenge in terms of transitioning from scientist to businessman?

"You need to be able to build relationships, deliver on promises and know your numbers perfectly. If you don't know the numbers then don't even bother showing up to a pitch or business meeting. And you have to be able to tell the story and answer why you are different. I am extremely passionate about nanotechnology and smart materials so it shows when I'm in front of a customer or an investor. I deeply care about making a difference and bringing the benefits of nanotechnology to the macro world. It's not just about making money. Of course, investors want to make a big return but, in people's lives, everyone knows someone with diabetes or cancer, so there is a genuine social need that goes beyond the financial return," said George.




## Commercialisation

Commenting on what British universities need to do to commercialise their intellectual property, George points to what North American universities do so well: building ecosystems around their start-ups and really backing them, win or lose.

"One of the things the government does in North America is, if they see industry come to work with a university, then the government will take a chance and invest alongside the university and the industrial partner to succeed. In England, industry is expected to finance the research in a larger extent. That means the level of investment that goes into real science is of a different order of magnitude in North America. So they will take a larger risk with a larger amount of money," said George.

George cites the example of a Senior Lecturer friend at a British university going through the review stage of an EPSRC research project, which had more than £1 million in industry support.

"At the review stage, one reviewer said that they'd had so much money from industry that they didn't need any money from the EPSRC. In fact, the opposite is true. Government should bet on projects that have as much industry support as possible and make sure there is a viable commercialisation plan for research outcomes. Also, an industrial partner during the early R&D phase would typically prefer to take less risk, not 100%. The Cambridge ecosystem is a great example of how it can be done well, we need more clusters of innovation across the UK surrounding local Universities assisting start-ups with friendly services and most importantly, local talent" George said.

George reckons British universities should engage their alumni a lot more to see if they'd like to fund new research, and meet the investment half way.

"In the US, nearly every university has that strength. You have to create the momentum and create the incentives for the benefit of the university and UK Plc," said George.

# Mediwise
## eyeing strategic technology partner for commercialisation

**Mediwise is looking to team up with a telecommunications company to collaborate on its innovative Glucowise handheld non-invasive glucose monitor.**

Speaking to QMB, George Palikaras, the Founder and CEO of Metamaterial Technologies Inc, the parent company of Mediwise Ltd., said he is looking for a strategic partner on the manufacturing side.

"We're looking for a strategic partnership with a company who manufactures mobile phones and RF modules for the telecommunications industry, who have the production capability to take what we have developed and miniaturise it into our designed form factor device".

George said the company is now looking to shrink the technology for a push into the mass market.

"Once you have the capability to mass produce our devices, you can get 1,000 devices made up and then conduct much bigger human trials across the UK, US and China. It'll change our ability to showcase statistically significant results," said George, noting that it was common knowledge that Apple, Samsung, Fujitsu, Sony and LG are all working towards a non-medical application for glucose monitoring.

Commenting on Apple, George said: "Apple was the first to bring out an app approved by the FDA, "so that app could do more than glucose towards improving quality of life of the elderly and aging population, who are already comfortable using a smart phone.."

George says he would be "very interested" in working with these telcos to bring a level of new functionality to their devices to help enable their customers take control of their health outcomes.

George also confirmed that Mediwise is preparing for another human trial for its glucose application early next year, the fourth for its prototype Glucowise product.

Successful animal trials on pigs allowed the company to measure the extremity of glucose levels, from low glucose concentration you can measure to how high.

George said: "A pig's natural glucose level would have most human beings in a hypoglycaemic state or comatose state. We were asked by investors to show that we could achieve very high sensitivity even for low concentrations, and then we repeated the same tests in a human trial,"

"The last trial was a great success. We published our results in Nature Scientific Reports last year, and the feedback we received was very positive," George said.

# hVIVO signs three new RSV contracts and reports 2018 half year results with strong operational progress

**Half year results for the six months ended 30 June 2018.**

It has been a period of steady progress for hVIVO as it executes on its long-term growth strategy, focussing on its core fee-for-service challenge study services in clinical development in airways diseases.

For the six month period, revenue was £4.9 million (H1 2017: £3.9 million; 2017: 10.9 million) an increase of 23.6% against H1 2017, and gross profit of £1.2 million (H1 2017: £1.0 million; 2017: £3.6 million), from client challenge studies completing in H1 2018. Loss before tax was £5.3 million (H1 2017: £9.1 million; 2017: £14.8 million) and loss after tax for the period was £4.4 million (H1 2017: £7.7 million; 2017: £12.9 million).

Dr Trevor Phillips, Executive Chairman, commented: "We have made a good start to the first half of 2018 reflecting our leading position in human disease models based upon viral challenge. We are experiencing a lot of interest from leading pharmaceutical companies for the development of new challenge models in RSV, asthma and COPD and we expect to be able to convert a number of these into contracts that will further enhance our service offerings."

Dr Trevor Phillips, hVIVO Executive Chairman

## Progress across contracted pipeline

hVIVO has announced the signing of three new contracts. Two with a leading global biopharmaceutical company for the provision of respiratory syncytial virus (RSV) human challenge studies that are projected to deliver a total of c.£9m in revenue, with most of the revenue being recognised in 2019.

A third RSV human challenge study contract, with a large research and development-focused biotechnology company for the value of £11.9m, and the revenue from this study is also expected to be fully recognised by the end of 2019.

Dr Trevor Phillips said: "These recent significant new contract wins reinforce our leading position in human disease models based upon viral and allergen challenge and are a testament to our industry leading RSV-human challenge model. We have the strongest sales pipeline we have had for several years. We remain actively engaged in several discussions with other pharmaceutical companies for contracting studies across our current challenge portfolio, including allergen, asthma, human rhinovirus, influenza and RSV."

hVIVO also confirmed that the National Institutes of Health (NIH) presented partial preliminary results from the Phase I first-in-man study of AGS-v, a Universal mosquito-borne diseases vaccine candidate and one of the assets of Imutex Ltd, hVIVO's joint venture with SEEK Group.

Commenting on the results, Dr Phillips said: "The presentation of these partial preliminary results by NIH is encouraging regarding safety and immunogenicity responses. We look forward to seeing the full data when the NIH completes the sample analyses in due course, at which point, a full assessment of the trial results will be possible."

## People

Chief Financial & Business Officer Graham Yeatman has decided to step down from his position and will leave the board at the end of December 2018. Shelley Fraser, vice president for finance, has been appointed as finance director.

Jaime Ellertson, a Non-Executive Director, has also stepped down from the Board. Jaime joined hVIVO as Non-Executive Chairman on 12 June 2014 and was succeeded by Trevor Phillips as Executive Chairman on 13 November 2017, but remained as a Non-Executive Director.

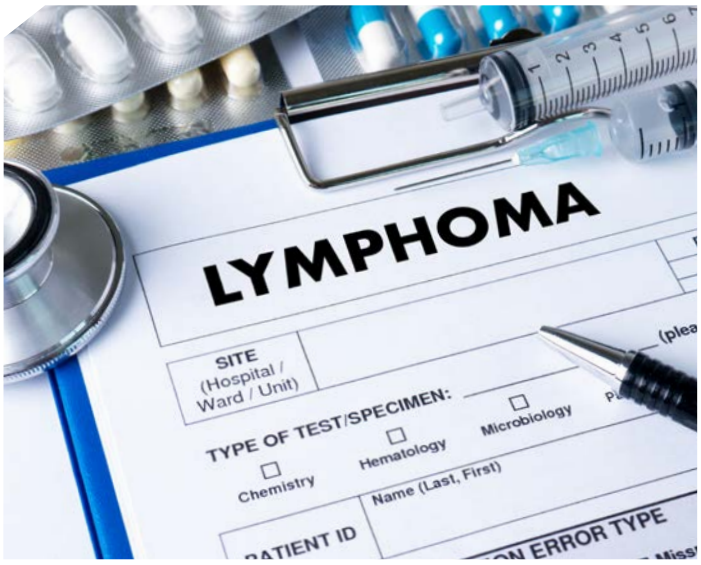
Trevor Phillips, Executive Chairman of hVIVO, said: "On behalf of the Board, I would like to thank Jaime for his contribution and advice over the past four years. We wish him well for the future in pursuing his significant other interests."

# ADC Therapeutics doses first patient in pivotal Lymphoma clinical trial

**ADC Therapeutics has dosed its first patient in its Phase II clinical trial, intended to support the submission of Biologics License Application (BLA) to the U.S. Food and Drug Administration (FDA). The clinical trial is evaluating the efficacy and safety of ADCT-402 (loncastuximab tesirine) in patients with relapsed or refractory diffuse large B-cell lymphoma (DLBCL).**

Last year, at the 2017 American Society of Hematology (ASH) Annual Meeting, the Company presented interim Phase I data on ADCT-402 in 138 evaluable, heavily pre-treated lymphoma patients who had failed, or were intolerant to, any established therapy known to provide clinical benefit.

The Phase I clinical trial of ADCT-402 in non-Hodgkin lymphoma showed significant activity in patients with DLBCL and an acceptable safety profile, so the next step will be a Phase II trial, enrolling approximately 140 patients with relapsed or refractory DLBCL, at multiple centres in the USA and Europe.




Jay Feingold, MD, PhD, Chief Medical Officer and Senior Vice President of Clinical Development at ADC Therapeutics, said; "We are pleased to have dosed the first patient in our registrational Phase II clinical trial, evaluating ADCT-402 in patients with DLBCL who have relapsed and have refractory disease, after two or more multi-agent treatment regimens.

Feingold added: "Unfortunately, there is no effective treatment for patients with multiple relapsed and refractory DLBCL, so we are excited about the potential to improve outcomes in these patients with ADCT-402 in a single-arm trial. We anticipate reporting results from the Phase II trial in the third quarter of 2019 and are hopeful that the data will support our submission of a BLA to the FDA."

Alex Spira, MD, PhD, FACP, Director of Virginia Cancer Specialists Research Institute and Clinical Assistant Professor of Oncology at Johns Hopkins School of Medicine, said: "Patients with DLBCL who have relapsed or are refractory after second-line chemotherapy face a very poor prognosis. There is a significant unmet need for an effective new treatment option for this patient population, and we believe ADCT-402 has the potential to help impact patient outcomes in this disease."

# QMUL supports MedTech accelerator programme

Research England

**QMI is calling on Research Fellows, Early Career Researchers (ECRs), Postdocs, PhD and Masters students to sign up for the 'MTSC Challenge Accelerator' programme, which gives participants the opportunity to work within and build a multi-disciplinary team to fast-track the development of early stage MedTech concepts and technologies.**

During the six month programme, each successful participant will receive a monthly stipend and, on a per team basis, access to £60,000 for consumables and product development, a dedicated advisor, a structured product development plan and mentoring support.

"We're not just looking for applicants with technical expertise, but also individuals with a passion for building teams, businesses, operational skills, design disciplines and everything in between - people with the driving force to create solutions and successful ventures from just an idea," with Graeme Brown, Director of Technology Transfer at QMUL and Executive Director at QMI.

The programme received government funding of £5 million through Research England's Connecting Capability Fund.

David Sweeney, Executive Chair of Research England, said: "These projects demonstrate the commitment of universities to work together to strengthen the R&D and technological capabilities of the UK, building upon our successful Higher Education Innovation Fund (HEIF). In the Industrial Strategy, the Government asked us to improve our ability to turn exciting ideas into commercial products and services.

Sweeney added: "Universities have stepped forward in these projects to show that they can do world class commercialisation, alongside world class science. I believe these projects present important innovations that should inform our strategic approach to commercialisation in UK Research and Innovation for the future."

As well as Queen Mary University of London, the MTSC harnesses the entrepreneurial ecosystem and commercialisation expertise of seven partner institutions: Imperial, Bucks New University, The Francis Crick Institute, Royal College of Art, Royal College of Music, Institute of Cancer Research and Royal Veterinary College.

## Application timetable

Step 1: Submit a completed application (closing date 20th Jan 2019 11:59pm)

Step 2: Join the hackathon weekend (Starts Fri 1st Feb 6pm, to Sun 3rd Feb 6pm)

Step 3: Pitch your team's solution to a panel of judges (Sun 3rd Feb 2019)

Step 4: Winning Teams start the six month accelerator programme (Mon 4th, Mar 2019)

To apply for a place, please go to: www.medtechsuperconnector.com

# PwC: Global pharma & life sciences deals insights for Q3 2018

**A lack of megadeals in Q3 2018 led to the lowest deal value since Q4 2016. Despite the significant interest in getting deals done, high valuations have led to fewer larger deals, according to new research from PwC.**

PwC said that while M&A volumes increased to their highest level since Q1 2017, a lack of megadeals resulted in a meaningful decline in deal values relative to the prior two quarters. Meanwhile, the Pharmaceutical sub-sector led in deal volume, building on the strength shown in Q2 2018.

After a strong 2017, the Other/Services sub-sector, which includes CROs and CMOs, continued to see lighter activity in Q3 2018 similar to the levels experienced in the first half of the year.

PwC noted that corporate divestitures continue to be a primary driver of deal activity, as companies seek to rebalance their product portfolios and monetise certain assets.

## Number of announced transactions increase, values decline in Q3 2018

Deal volume increased in Q3 2018 for the second consecutive quarter, following the steady declines experienced since 2016. While deal volume increased by double digits, Q3 was the second lowest quarter of the last eight in terms of deal volume. Deal value was down as well at $22.6Bn, which is significantly less than the previous two quarters.

"The sector did not see any megadeals this quarter, representing a significant change from Q1 and Q2 2018 which saw megadeals totalling approximately $11Bn and $82Bn in deal value, respectively. The deal volume of Q3 2018 has returned to the deal volume levels of Q4 2016 and Q1 2017," PwC said.

## Big Pharma

PwC said Big Pharma maintained its leading position with the highest deal volume of any subsector for the third time in the last four quarters. Divestitures continue to be a focus for Big Pharma as they seek to rebalance portfolios by monetising certain assets to further invest in their long-term pipeline, either internally or through acquisition.

**Strategics** continue to face challenges from Private Equity buyers that are taking a more active role in bidding for the same targets, while Biotech had the highest deal value of any sub-sector and represented four of the ten largest deals in the quarter. The largest transaction of the period was the acquisition of China Biologic Products Holdings, Inc. by a Chinese investment group for $3.9Bn.

**Biotechs** continue to evaluate the impact of a changing regulatory environment, including the recently announced United States Mexico-Canada-Agreement (USMCA), which may provide longer protection of exclusivity for certain biosimilars within the North American market.

"The impact on digital technologies on the R&D process may drive further M&A activity as companies strive to ensure they possess the right competencies to succeed in an evolving sub-sector. While the larger Biotechs have stayed quiet for several quarters, there continue to be signs to suggest consolidation as a key possibility," said PwC.

**Medical Devices** had the second highest deal volume during Q3 2018, highlighted by Medtronic's acquisition of Mazor Robotics and Stryker's acquisition of K2M Group.

Moving forward, PwC said it expects an increased presence from Private Equity, as well as a greater number of new entrants, as industrial products companies, among others, look to capitalise on the broader healthcare tailwinds and leverage their manufacturing expertise.

Spin offs from GE and Siemens indicate divestitures will likely continue to be a central piece of M&A activity within the sub-sector, said PwC.

**Specialty Pharma** stayed active in the M&A market with an emphasis on smaller acquisitions. The trends of increased focus on joint ventures, partnerships and alternative forms of deal consideration are expected to likely continue as buyers to compete for targets without committing to large, up-front investments.

**The Other/Services** sub-sector, saw another slow quarter in Q3 2018 as participants re-evaluated the impacts of significant consolidation and Private Equity interest experienced in 2017.

"While deal values may not increase back to the levels experienced last year, we expect continued interest from Private Equity to drive higher deal volumes in upcoming quarters. Activity within the other sub-sectors could spur additional deals for CMOs and CROs as new entrants to the PLS sector look to leverage the specialized knowledge and capabilities offered by the Services sub-sector," PwC said.


**PLEASE CONTACT OUR MANAGEMENT TEAM WITH ANY FEEDBACK OR NEWS STORY IDEAS:**

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