Digital Health

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Deep Dive: Digital Health

There's so much happening in digital health right now that we could probably run an issue of Deep Dive on it every month. With innovations coming thick and fast, it's important that pharma focuses in on the innovations that will have a meaningful impact on their organisations and the patients they serve.

It's fair to say that AI has been one of the most talked-about technology revolutions of the past five years, and we've recruited several experts to tell us exactly how it may impact pharma.

Our own Richard Staines runs through the latest news in AI for pharma R&D, and Paul Tunnah speaks with IBM Watson's Christina Busmalis for a broader view of the technology. Meanwhile, Matthew Van Wingerden and Pini Ben-Or from Aktana tell us what true AI should actually look like and how it can be applied to commercial teams.

But while AI might be the most headline-grabbing technology at the moment, there are still thousands of other digital health innovations being worked on, many of which also have the potential to change healthcare and pharma as we know it.

Elsewhere in this issue, Matt Lowe from performance.io tells us why pharma is lacking in its performance marketing efforts, based on techniques such as search engine optimisation (SEO); we speak to Roche Diabetes Care's Michael Goetzl about combined digital-pharmaceutical approaches to diseases; and we have an exclusive interview with Almirall's chief digital office Francescsa Wuttke, who is looking to completely transform her organisation's approach to digital and foster startups that the company can learn from.

I hope you enjoy the issue.

Kind regards,

George Underwood
Editor, Deep Dive

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How big pharma and startups can learn from each other

Francesca Wuttke's varied career has taken her from research roles to private equity and now to the role of chief digital officer at Almirall. She spoke with Paul Tunnah about her plans to embed a digital mindset across the company, and how Almirall hopes to encourage true collaboration with startups through its new 'Digital Garden' project.

You've been involved with both the science and the investment side of the industry – what has that taught you and how has it shaped your focus now?

My driving force has always been to accelerate drug development and drug discovery. When I was working on my thesis on HIV drug discovery, I realised it would likely be 20 years before something would come to market. I tend not to be the most patient person!

I went into private equity because I felt that when you can fund valuable products, you can often get them to patients sooner.

The way to accelerate benefit to patients changes over time as technology improves and innovation becomes more cutting edge. I've always looked for the more cutting-edge projects because, quite frankly, they're just more intellectually stimulating for me. I like being on the vanguard where there are more questions than answers.

Obviously, digital is the current way to approach patients and improve their lives through patient-centric solutions. The democratisation and consumerisation of medicine, certainly in the US and increasingly in Europe, is causing patients to take greater control over their own healthcare. You can now have a prescribed software that's a therapeutic via your phone. That's pretty amazing to me.

How did Almirall's Digital Garden come about?

I joined Almirall with the mandate to transform the entire enterprise end-to-end. That includes back-office process automation, AI, clinical trials solutions, and creating the data architecture to support advanced analytics and machine learning platforms.

The line through all of that is cultural transformation of the organisation. Almirall is a deeply innovative company by DNA, and this shift towards more of a digital mindset and outlook has certainly been well received by the teams and has been the genesis for the creation of the Digital Garden.

We wanted to bring innovation to our teams and give them a sense of how startups think and work differently, by creating a space where we're teaching each other.

The startups will learn from in-house experts, and our colleagues here at the company will learn from the startups and bring back with them a slightly different way of thinking and working. The intent is that this will help spread that entrepreneurial spirit throughout the organisation.

We're looking to have a shortlist of 10 startups, who we'll invite to Frontiers Health. There we'll be selecting the five that we'll invite into the Digital Garden, which will be housed in the Barcelona Health Hub at the Sant Pau site.

We'll be creating a bespoke curriculum for the startup, using a gap analysis to understand what they need. Then we will pair the right experts with the right startup so that they can provide mentorship and support to the community.

We're also very interested in having the startups collaborate, co-create and share ideas. That's why we want them all to be housed in the same space.

As you can see, this is a very different way to work with startups!

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How is the Digital Garden different to other initiatives people have seen, especially from a mentorship and collaboration perspective? I feel that's often the piece that's forgotten because people think that technology on its own is going to solve problems.

That has been one of the many problems with a lot of the pharma accelerators that I've seen – many of them have been very buzzworthy but little has come from them, often because the KPIs and metrics have been based on operational success. And many of them are not of sufficient size or scale to really add to the bottom line for most companies.

We're endeavouring to help grow the companies and graduate them into venture capital funding through hosting investor days.

We want to let them understand how pharma, as a stakeholder, works. They'll also be able to use our partner hospitals in Barcelona as a testbed to pilot their solutions and services. Then once they've grown to a sufficient size and scale, there will be a chance for us to collaborate with them commercially.

Our vision is a bit longer-term than others, in terms of the operational value that the startup can bring. In the shorter-term we're looking at what I hope is going to be a radical change in culture within the organisation.

A lot of companies are doing innovation initiatives. How would you position the USPs of Digital Garden?

We're focused on solutions that can benefit patients with medical dermatological disorders as well as big data that could help us to understand our patients' needs.

The biggest differentiator is the mentorship component. I've seen that lacking in many other accelerators. The idea is that we're really going to embed our internal experts with the startups and help them along the way. Their objectives and their performance will be linked to the success of the startup.

We're creating bespoke programmes both for the startups and for our employees, all of whom have an interest in learning more about digital, but also have the agility to take this on as part of their work. It's not in addition to their current job, it will become part of their work with their manager's approval and full buy-in. That level of dedication to the growth of the startups is a key USP for the Digital Garden.

It sounds like you've got support from the management team of Almirall for that longer-term transformation and vision over time.

Yes, absolutely. The management team is certainly backing this. Sitting on the management board, I have visibility across the whole organisation, and I'm able to see where digital can add value rather than just applying tech to problems, which I'm strongly opposed to.

What we were fearful of doing, as a management board, was throwing a lot of consultants at the problem. We don't want to have really nice PowerPoints but nothing that people can actually execute and lead. We really want our team members to lead the change and experience an entrepreneurial spirit first-hand. Then they can take that back to their corners of the organisation and implement it in their own projects and programmes.

In terms of the type of startups you're working with, are there particular stages of development for those you're looking at?

We're looking for companies that can benefit from our advice! If they're already fully formed and have lots of employees, they probably don't need us.

What would you say are the common pitfalls that digital health startups fall into?

When I was an investor, one of the most common things I came across was startups having really cool technology that wasn't solving a problem for anyone.

The first question we always start out with in our internal teams is 'What's keeping you up at night?' or 'What's the job to be done that you can only do with a digital solution?'

Likewise, the first question I always ask the startup is, 'Are you solving a problem that exists in the industry or is it just something cool?' Because very often, you'll ask them about their market and they'll give you the usual, 'There are five million people with this, it will be helpful to treat 20%'. That's not always the right approach. Is this something that people need? Are there other groups already doing this and are you different enough from them to survive?

Is there anything from beyond the pharma industry that has inspired you or you think we can emulate?

I think pharma has been a bit slow on the uptake, in part because it's such a regulated industry and also because there's a certain degree of patience within pharma because drug development takes so long. So I'm inspired by the agility and the experimentation with which the big tech giants operate.

I think some of that experimentation is what we're trying to teach by providing, through the Digital Garden, a safe sandbox where you can try things and fail – hopefully in a reasonable and cost-effective way – and not doing pilots that lead to nothing. Pilots are rampant in the industry, but they can be really damaging to the startup ecosystem. I always encourage startups to contract for a much larger project, using the pilot as a gating mechanism to scale, which is how it's done in most other industries except for pharma.

Similarly, it's important to bring in people from outside the industry for roles such as data analytics – because when compliance says, 'You can't do that', they can say, 'Why not?' Asking ourselves that question is really powerful, and we need to be doing it much more.

About the Interviewee
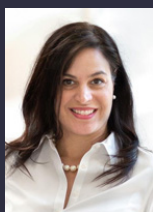
Francesca Domenech Wuttke, Ph.D. is the chief digital officer of Almirall. Dr Wuttke brings with her broad drug development and healthcare expertise in both the US and Europe, with over 20 years of clinical, commercial, strategic and transactional experience. She has worked with diverse organisations including startups, consulting, large and specialty pharma as well as academia. Most recently, she led European investments as managing director for the MSD Global Health Innovation Fund.

Previously Dr Wuttke led Almirall´s Corporate Development Strategy team to transact on both med device and pharma M&A opportunities with a new and targeted focus for the company. Before that, she worked at Novartis where she was responsible for two cell and gene therapy opportunities that were successfully brought into the organisation as well as managing the strategy and commercialisation for the existing portfolio of cell therapy assets.

About the Author

Dr Paul Tunnah founded pharmaphorum in 2009, which is a content and communications company offering industry leading publications (www.pharmaphorum.com) and a strategic consultancy (www.pharmaphorumconnect.com). He is a recognised author, speaker and industry advisor on content marketing, communications and digital innovation, having worked with many of the world's leading pharmaceutical companies and the broader ecosystem of healthcare organisations.

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Could AI create a brave new world of pharma R&D?

Barely a week goes by without one big pharma or biotech announcing that it is using AI to develop new medicines. Richard Staines looks at the progress already made thanks to this potentially revolutionary technology, and how it could change the fortunes of a beleaguered pharma industry.

Artificial Intelligence (AI) has become the latest buzz word in drug R&D, and many of the world's biggest pharma companies claim to be using it to drive forward the process of scientific discovery.

The concept is that using AI's capabilities, the previously unpredictable process of drug development can become much more predictable, and as a result less expensive.

While it is still early days, AI in its many guises can be used at many points during the drug research process.

It's far too costly to develop drugs, which are becoming more and more difficult to find as scientists attempt to tackle diseases that are poorly understood.

It is also tough to find drugs that are significant improvements over existing medicines in more common diseases, and those which already have well-established treatments.

Companies are turning to AI from the very beginning of the R&D process, when they are looking for that needle in a haystack that is the ideal drug candidate for a particular disease.

Already this year there have been two major developments in early drug R&D. In September, Hong Kong's Insilico Medicine found a way to use AI and deep learning techniques to design, synthesise and validate a novel drug in 46 days – 15 times faster than the best pharma companies.

And later that month, AI therapeutics firm Deep Genomics claimed a world first after using artificial intelligence to identify a therapeutic drug candidate.

These developments were hailed as pivotal moments for AI in drug R&D and suggest that there is much more to come as computers become more powerful, and the way that AI is used becomes more nuanced.

Fooling the computer

Insilico pioneered the use of cutting edge techniques such as Generative Adversarial Networks (GANs) and Reinforcement Learning for drug discovery and biomarker development.

GANs are based around the concept of two neural networks arguing with each other to create an ever-more accurate depiction of reality.

A GAN based system has already created artwork that is eerily similar to that drawn by humans. Last year Christie's sold a fictional portrait generated by a GAN-based AI algorithm "artist" called min/G max/D E_x [log⬜(Dx)) E_z [log⬜(1-D(G(z)))] for $432,500.

The portrait, called Edmond de Belamy, from La Famille de Belamy, is incredibly realistic, with only the bizarre artist's signature and the slightly off-centre position of the "painting" providing the clue about its real author.

A GAN-based development model with this degree of realism could lead to new medicines that the pharma industry needs to create the next generation of drugs.

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GANs work using two networks – Generator and a Discriminator – where the former generates data and the latter evaluates the data for authenticity.

The Discriminator is first fed real-world and fake data, then the Generator attempts to fool the Discriminator network into thinking that its images are real.

After many thousands of attempts, and the Discriminator is fooled, the image is created – and it's hoped that GAN technology such as that created by Insilico could create an ideal drug instead of a fake painting.

And while the sum raised by the Sotheby's sale was impressive, and nearly 45 times more than expected, a drug to treat an incurable condition such as Alzheimer's is worth billions to the pharmaceutical industry.

Deep Genomics

September became an undeniably pivotal month for pharma AI when Deep Genomics followed Insilico's achievement by using the technology to identify a therapeutic drug candidate.

Many companies are using AI as a guide – but the Canadian firm's CEO Brendan Frey revealed at the Elevate festival that this was the first time an AI platform had confirmed the multiple genetic variants that cause Wilson's disease, and found a drug candidate that matches the target.

While Insilico used AI for virtual screening, Deep Genomics' 'AI Workbench' system did all the work, including suggesting the disease target.

Wilson disease is a rare condition causing an excess of copper to build up in organs, and has been targeted by specialist pharmas such as Alexion.

Deep Genomics will develop the candidate DG12P1 to treat the disease, which is caused by a genetic mutation that impairs the body's ability to excrete copper.

The scale of the task was immense: Deep Genomics' AI scanned over 2,400 diseases and more than 100,000 disease-causing mutations while searching for good drug development opportunities.

After all this number-crunching, the system was able to predict the precise disease-causing mechanism of the Met645Arg mutations that cause Wilson disease.

The AI was able to pin the disease to loss of function in the ATP7B copper-binding protein, and identify 12 lead candidates from thousands of potential compounds, accounting for factors such as in vitro efficacy and toxicity.

The result was DG12P1, which works by correcting the exon skipping mechanism of Met645Arg, which Deep Genomics selected on the basis of tolerability experiments.
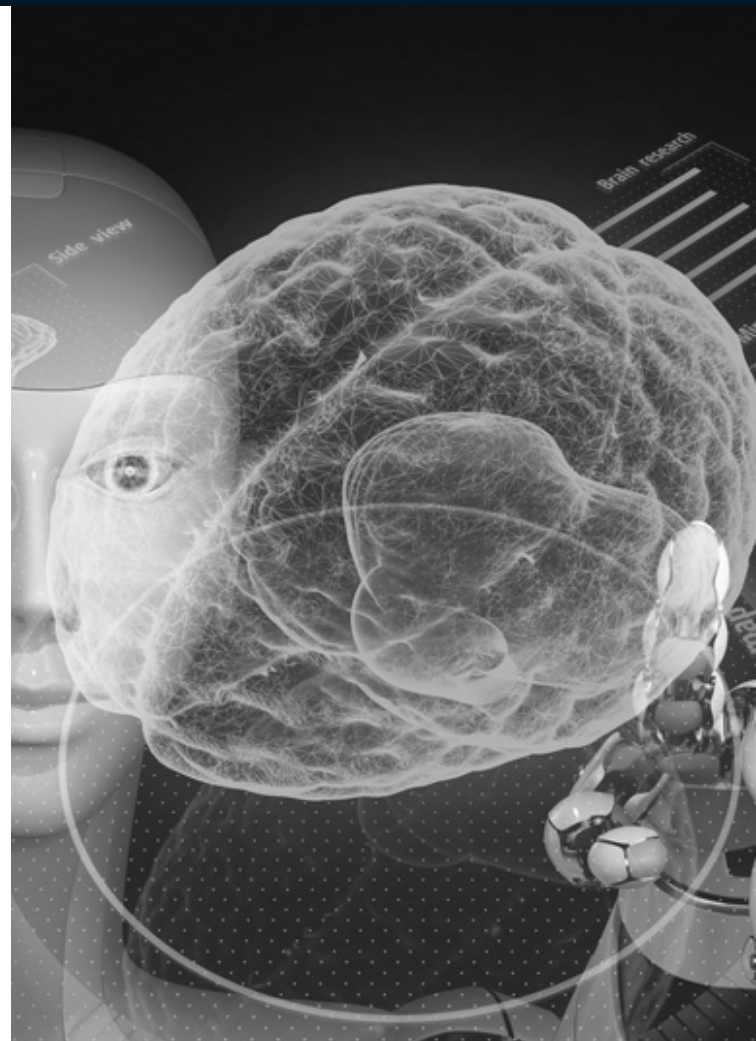
Natural selection

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AI is already used to interact with patients and could be a vital tool further along the process, helping with clinical trial design, patient recruitment, and monitoring to boost adherence and cut dropout rates.

The technology could also be used in helping doctors with diagnosis, and helping to pinpoint relevant patient populations for trials by analysing data such as handwritten forms and digital medical imagery.

There are also potential drawbacks though: data privacy, security and accessibility are issues in all health technology, including AI.

And technology such as GANs are only as accurate as the information they are fed, and there are concerns that the human inputs that help to shape the initial system could lead to biases when it comes to issues such as diagnoses.

Recently an AI doctor app from Babylon Health came under fire for giving out differing diagnoses for the same set of symptoms, depending on whether a patient is a man or a woman.

The Times reported that doctors found its algorithm gave advice to a 60-year old female smoker reporting a sudden onset of chest pain, saying the probable cause was a panic attack or pain caused by inflammation.

However a 60 year-old male smoker with the same symptoms was told that he may be having a heart attack, and was advised to go to A&E.

Meanwhile the female patient was told to contact her GP within six hours if the symptoms persisted.

Babylon defended the differing diagnoses, saying that it uses clinical data about most likely causes of symptoms, rather than the process of elimination that a GP would use to rule out serious conditions like a heart attack.

While there could be a degree of self-interest in GPs' concerns about Babylon – the system could be seen as a competitor to traditional GP practices – the episode does highlight that AI does not always "think" in the same way as a human might.

It also shows how the human creators of AI systems can influence it from the start, and the results may not always be well received.

There is also the famous "black box" problem with AI in that it is not always clear how complex systems have arrived at a decision or recommendation, an issue that could slow implementation in the highly conservative world of healthcare.

A better future?

But even with these caveats the likelihood is that AI could have a pivotal role to play in the pharma and healthcare industries.

Optimists will hope that the work of Insilico and Deep Genomics have opened a doorway to potential therapies for previously untreatable diseases.

AI could help transform the fortunes of a pharma company, by helping to find drugs to halt or reverse the progress of Alzheimer's, something that has eluded human scientists.

This leads to the question about who should receive the recognition for any AI-related success, especially something as transformative as a disease-modifying drug for Alzheimer's.

In the art world, there is a debate about whether the Edmond de Belamy painting should be attributed to the AI, or Obvious, the group of artist-computer programmers that helped to create it.

In the world of pharma this could have implications for who owns intellectual property, and who lays claims to scientific achievements.

If the technology is as successful as some hope it could be, it creates the tantalising possibility the Nobel prize could one day be awarded to something with a name like min/G max/D E_x [log (Dx)) E_z [log(1-D(G(z)))].

About the Author
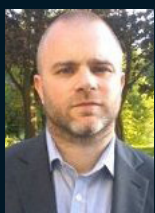
Richard Staines is senior reporter at pharmaphorum. He has been a journalist since the 1990s and has written for websites, newspapers and magazines. He has always had an interest in health, and has been focusing on the pharma industry since 2010, interviewing industry leaders and covering stories on topics including regulation, mergers and acquisitions, and the latest clinical developments.

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From narrow AI to broad AI

As director of global life sciences at IBM Watson Health, Christina Busmalis is well placed to know how AI is set to transform life sciences. Paul Tunnah sat down with her to discuss how AI is developing in unexpected and exciting ways.

Historically everything was about clinical data, but now we're starting to see Big Data and real world evidence come in. How do you see that balance shifting and how do you see that changing the R&D process?

I think we are actually no longer in the Big Data world. We're in what we call a 'broad data' world. You may hear the term 'deep data' as well.

For us, broad data is about having myriad data types. In clinical you might have genomic data, phenotype data, medical scientific literature, electronic health record data, patient reported outcomes – there's tonnes of data, and you need to be able to bring all that data together to drive insights.

That's where we need to tap into AI, but it is not where most organisations are today from an AI perspective.

Where do you see AI going in the future then?

The goal of bringing all these data points together is being able to answer a lot of those questions faster and easier.

For example, we're doing some work with the Broad Institute in the US around cardiovascular disease. By bringing together genomic data and electronic health records, we're seeing if we can predict the likelihood of cardiovascular diseases earlier for a doctor and deliver a more robust genetic risk scoring.

That brings together very different types of data. In what I would call 'narrow AI', that would involve doing one thing with a slice of genomic data and doing something else with electronic health records. That's valuable, you can get some power out of that, but you can't scale it. Bringing those two data types together and being able to build artificial intelligence around extended data types allows you to reason and learn faster, which brings more advanced, in-depth insights to market.

The idea is that while you might have all this different data, you need to use it effectively – for example at the beginning of clinical trials. Protocol development is ripe for reinvention through data.

It's a very artificial system.

Definitely. People don't really know if the protocol you're creating is the right protocol, one that's going to last for your six-year clinical trial.

Again, by using lots of different data points, you can change that. You can use data to understand your inclusion exclusion criteria better, what works and what doesn't work. You can reduce the amount of endpoint modifications you have to make, and also get the right patients to your trial by targeting it accurately.

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Where do you see that balance between artificial intelligence and human intelligence going in the future?

At IBM, we call AI 'Augmented Intelligence'. Augmented intelligence is really about AI helping humans do things more effectively. It's not about replacing humans, it's about marrying the two together.

Technology is quite good at endless capacity. It's good at looking at thousands of different endpoints. Humans are very good at learning and coming up with decisions, but sometimes they don't have the capability to learn everything. Bringing those two together can be very powerful.

We can also look at bringing in different components to reduce human bias.

At IBM Research, we have something we call Project Debater. It wasn't developed because we wanted to build a debater tool with AI. It was developed to prove that we can help humans reason and make well-informed decisions.

It is basically able to take a data-driven approach to generating a speech, and present that speech eloquently and with purpose. It can listen and comprehend another speech for a long period of time and rebut what it has heard. It's able to think like a human does as far as dilemmas go – it can look at how a human reasons and comes up with arguments based on a situation.

We tested it in one debate on whether preschool should be subsidised in the US. Project Debater, who we refer to as a 'she', went against one of the top debaters in the world – Project Debater was for subsidising preschools, and he was against it. They had 15 minutes. The human had nothing in front of him, but Project Debater had about 10 billion text statements in her system that she could use. She wasn't trained on the topic, but these 10 billion articles had some content related to it. In that 15 minutes, she was able to crawl through all that information, understand it and create a four-minute speech about why preschool should be subsidised.

Then her opponent came back and did a four-minute speech arguing the opposite. Project Debater's speech was very factual because again it's very evidence-based. His was more opinionated. Then Project Debater came back and rebutted that for four minutes.

You can watch the video to see who won, but it proved the concept that Project Debater was able to give more factual information in her speech. People said they learned a lot about subsidising preschool from her.

Imagine you're in the emergency room, where doctors and nurses are always making last minute critical decisions. To be able to have a trusted system that you could have a dialogue with, that you could argue with, will help you make more informed decisions. It's not going to make your decision for you, but it's going to help you reason more effectively.

The reasoning side of AI is becoming increasingly important. When we brought Watson and other solutions to market, narrow AI was an emerging technology.

With narrow AI you can quickly get very good results from a thin slice of data, but narrow AI can be very complex as well. We did some work with Roche where we developed a model to predict the early risk of chronic kidney disease in diabetic patients leveraging real world data. It had 79% accuracy under the curve. That's still narrow AI because we were able to use very good data – half a million patient records – to build an algorithm to predict the likelihood of an outcome.

But to take that and do it for something like the likelihood of a mental illness episode, you need to almost completely start from scratch. Your narrow AI is tied to your data – it's very powerful but it's not scalable. As we start to work with things like Project Debater we need to move away from that narrow set to a broad set, and actually have the system adapt itself when the data changes.

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Even so, there are still a couple of areas where I can see AI displacing the current systems significantly. One of those is diagnosis. The other is the fundamental sales and marketing process within pharma. Where do you see things heading in those two areas? Is it going to radically change pharma?

I don't think we're near the stage where we're using technical systems completely stand-alone to diagnose at a global scale. It can provide a recommendation but then it's still up to a human expert to make the diagnosis and decide how to go forward. Even if the technology has achieved this ability, I don't think that humans and society are ready for it. You have to demystify AI first.

In sales and marketing, I still think people like to talk to each other to some extent. You're still going to get that.

Nevertheless, do we need thousands of sales reps running around? No. We've done a lot of projects in the past around segmentation and targeting of doctors – based on how they prescribe and what they do. This is not necessarily using AI, but using advanced analytics. That's also important to remember – not everything is AI nor does it need to be.

When you started out with the IBM Watson journey, was there a belief that the narrow AI would be much more scalable than perhaps it was?

It's been a journey through the evolution of the technology. I come from a technical background – I started programming when I was very young. I was one of those very rare female programming geeks in the '80s. To make a line across the screen was hundreds of lines of code. Nowadays you can build a whole app with 10-15 lines. Technology advances and that's also the case with AI. We're not done – there are a lot of ways it can still go.

How does the explosion of personal tracking data from digital health devices play into this?

We developed a solution with Medtronic called Sugar.IQ which is a good example of going from narrow AI to broad. It's a personalised recommendation engine for someone with diabetes.

It's taking in lots of different data types already. It's taking in insulin information, the continuous glucose monitoring system, it's taking in what you're eating, how you're sleeping, what sports you're doing, where you're living, what the weather is like. All those things are being brought in to give you information to help you decide on what you should eat, when you may want to do some exercise, etc.

It can predict with about 89% accuracy if you're going to have a hypoglycemic event two to four hours in advance using algorithms that were developed by Watson Health. It's quite powerful.

I do think that as more and more devices enter the market we will get more broad data, but a lot of what they're bringing is noise. You have to get away from some of that noise.

Most digital health innovations are probably going to get wiped out in the next few years because they're not generating proper evidence for what they're doing, while at the same time regulators are getting smarter.

Yes, and I think that's a good thing actually.

How can companies coming in from outside healthcare find the balance between bringing in fresh ideas and understanding such a complex industry?

People have asked the question, "Does IBM want to become a pharma company?" Actually, we are a healthcare IT company but we don't want to become a pharma company – we want to work with our clients to bring them what we're good at. We believe we're good at applying disruptive technology, like AI or blockchain, and bringing clinical expertise with it.

Life science is prime for disruption. It has such complex data and you can do so much with it.

About the Interviewee

Christina Busmalis is director at IBM Watson Health, and global life sciences go-to-market leader Europe & Asia Pac. Prior to this role Christina was the global director of technology for the IBM account team, working with Novartis since 2006 where she focused on identifying and leveraging disruptive technologies to address complex business challenges across the life sciences value chain. She is also a member of IBM's Academy of Technology. She has over 25 years of consulting, business development and project management expertise across Europe, US, and Asian markets and is based in Zurich, Switzerland.

About the Author

Dr Paul Tunnah founded pharmaphorum in 2009, which is a content and communications company offering industry leading publications (www.pharmaphorum.com) and a strategic consultancy (www.pharmaphorumconnect.com). He is a recognised author, speaker and industry advisor on content marketing, communications and digital innovation, having worked with many of the world's leading pharmaceutical companies and the broader ecosystem of healthcare organisations.

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AKTANA

Harnessing the potential of AI in commercial life sciences

Artificial intelligence (AI) has gained significant momentum in life sciences over the past few years. With the promise of making data more consumable and actionable, and providing deep insights into individual customer behaviour, AI technology has the potential to change the life sciences commercial model as we know it. But where do we start and how do we sustain success?

In their report 'Life Science CIOs Can Accelerate Commercial Effectiveness With New Applications of Artificial Intelligence', Gartner notes that: "The designation 'artificial intelligence' is overused to describe myriad technologies, adding confusion and apprehension when life science CIOs are considering which AI investments to make."

While companies are making significant investments in AI, the technology is evolving rapidly, and there are many bold claims about what value these systems can bring. Interpretations of how exactly AI can help life sciences commercial teams can differ between, or even within, companies.

One of the most common misconceptions is the idea of AI as an all-seeing, all-knowing programme – one that can answer questions it wasn't asked. Although AI technology can answer a lot, teams must first have a clear problem to solve and processes to test.

To effectively use AI in pharma commercial and to continue to be successful with it, companies must understand AI, the value it can bring, and how best to implement it into their organisation.

Understanding AI

Much of the confusion surrounding AI stems from the fact that deep learning, machine learning, and artificial intelligence are often used interchangeably. However, these terms each have critical differences and it is important to understand their true definitions as you begin incorporating AI into your organisation.

ARTIFICIAL INTELLIGENCE
Technology that can make judgements and decisions, similar to the judgements and decisions humans make, designed to improve impact in business context.

MACHINE LEARNING
A large family of software algorithms that learn from data and produce automaticallyother algorithms that can make judgements and decisions.

DEEP LEARNING
A subset of machine learning, inspired by natural networks.

DATA SCIENCE
Extracting knowledge and insights from structured and unstructured data.

At a high level, deep learning is a subset of machine learning, which is a subset of artificial intelligence.

- Artificial intelligence refers to technology (mostly software) that can make judgements and decisions, similar to the judgements and decisions humans make, designed to improve impact in a business context (contrasted with a scientific study of human or animal intelligence)

- Machine learning refers to a large family of software algorithms that learn from data and automatically produce other algorithms that can make judgements and decisions

- Deep learning refers to a subset of machine learning inspired by natural neural networks

- Data science is a multidisciplinary field that uses scientific methods, data, processes and algorithms and systems to extract knowledge and insights from structured and unstructured data.

Identifying the distinctions between these terms is an important first step in understanding AI technology. Through these distinctions, you can begin to understand the inner workings of this technology, how to harness it for your benefits, and, more importantly, understand how to adjust your working style to incorporate it.

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Eliminating fear to get value out of AI

Different companies will have varying levels of readiness for adoption. The good news, though, is that the technology itself is almost never a barrier for a business. However, there is often a fear that AI will ultimately replace all human jobs. It's important to remember that life sciences marketing and sales is inherently a person-to-person industry with a lot of important analogue, non-digital interactions, and decisions made by humans. It is impossible to do away with those.

Rather than fear AI, companies should understand the balance between human intelligence and artificial intelligence, and structure their teams' tasks to utilise this technology most efficiently.

AI technology follows predefined rules and parameters. With this knowledge, it is easier to shift our mindsets to eliminate that fear. In its current state, to deliver high-impact value, AI requires a human control element which is equally, if not more important. This understanding helps tackle organisational barriers and reassure users that their input remains crucial. For some, a peek behind the curtain can help foster an appreciation for how roles may change when AI is introduced.
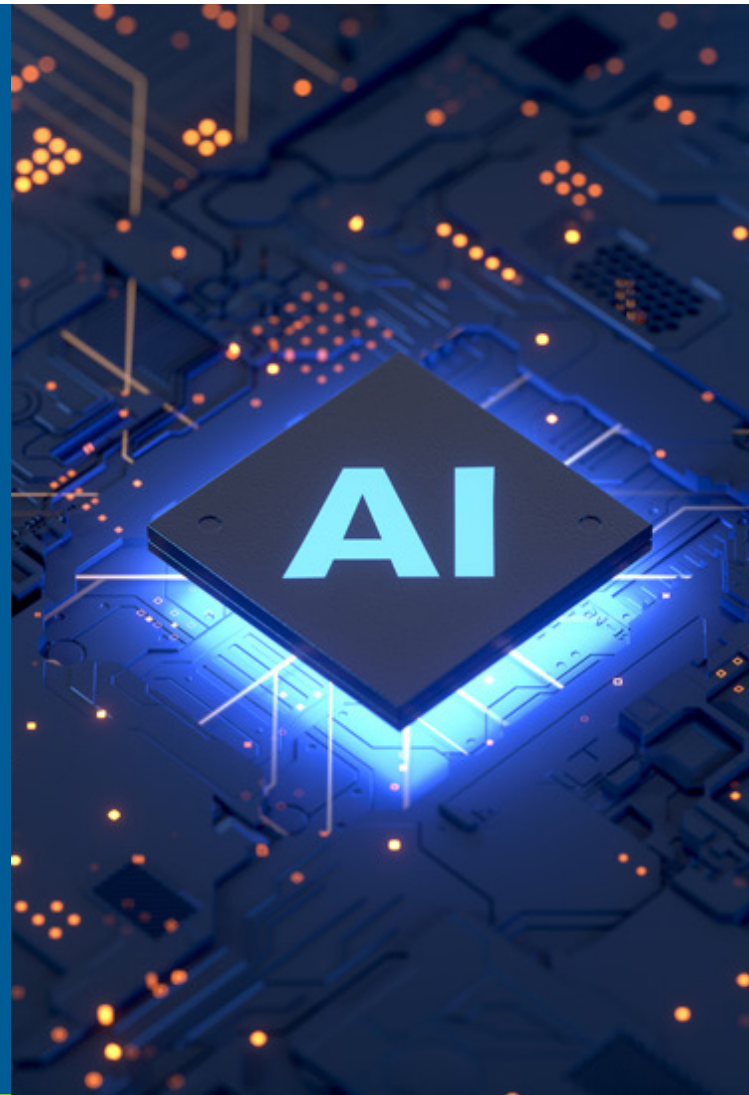
It is important to set realistic expectations for AI so that people have a clear understanding of what they can do with the technology. Educating teams to ensure they are clear about the problem they are looking to solve and to provide the correct input before implementation gives organisations the crucial tools to use AI technology efficiently. We will expand on this point in the next section of this paper.

As with any new technology, implementation will create ripple effects that businesses should be prepared for. Rather than replacing humans, AI encourages a more advanced role by automating the lower hanging fruit of the job. Therefore, to be successful, users need to think through how moving one part of their business to operate with AI technology changes the rest of the organisation.

At the end of the day, AI is just another technology, and success will come if you're cognisant of how to incorporate this into workflows, organisational structures, or roles that are not quite optimised for it yet.

Implementing AI in pharma commercial operations

Once we understand some of the nuances of AI, it's important to understand that to be successful with intelligent technology, it must be married with a business problem.

The business problem in commercial pharma is easy to state: how do we optimally and continuously coordinate all marketing and sales activity? By expanding on the various elements of this objective and adding a few observations about the subject matter, the complexity and magnitude of the challenge become apparent.

First, we recognise that the problem involves making decisions in a coordinated way about many channels – digital and non-digital. All channels involve communications with healthcare providers (HCPs), some involve the actions of sales representatives, and all indirectly affect patients. In comparison with common marketing systems, in pharma there are two or three customers, not a single 'target' customer.

Additionally, the communications involved are complex in terms of their content: they are about drug characteristics, treatment options, and challenges. This is especially difficult for a firm with many and often unrelated brands, treatments, and indications. Finally, the notion of optimality calls for understanding subtle economic impacts of contacts and other actions vis-à-vis customers in multiple channels over time. To optimally coordinate such communications streams requires understanding the dynamic interactions between all the events taking place in the course of the commercial operations.

Of course a large base of data is needed to support such optimisation, including historical marketing and sales interaction data, data about HCPs, and data about patients.

Large data sets can answer very precise, complicated questions. In fact, with AI, machine learning, and data science, the more difficult your question, the more helpful the systems potentially are. But to bring the most value, we must ask the questions that are most important for a business. To ask the right questions, we must first identify a clear business problem to solve **that is well-suited to what AI does well**. This often means understanding your own business problems in more detail than you have had to consider before.

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Using well-rounded AI to optimise implementation

To solve any business problem, it is best to have AI applications that function as a well-rounded set of technologies working together to achieve your goals. While AI has shown remarkable results at simple tasks like recognising human faces or translating languages, those are very narrow problems. Business problems tend to be much more complex.

For example, when it comes to commercial pharma, Intelligent technology can help sift through data to bring to surface only the most relevant information through next best action for a sales rep. Machine learning then uses the feedback data from the rep to deliver guidance to brand teams on how to best optimise commercial strategy moving forward.

Managing this communication path across multiple channels is a much more nuanced problem than identifying a face or translating something from Chinese to English.

To be truly 'well-rounded', an AI platform must include several different kinds of technology that work well together to cover different aspects of the problem.

These can include:

- Machine learning models – A mathematical representation of a real-world process fuelled by data for the machine to learn. For example, Aktana's platform uses machine learning components to predict the results or impact of recommendations and takes into account location so that it doesn't recommend visits too far from where the rep is going to be. These decision systems should be based on clear rules

- Expert models – Emulating the decision-making ability of a human expert

- Expert-based feature engineering – Using expert knowledge to create features that make machine learning algorithms work

- Constrained optimisation – Optimising an objective function to find a best assignment that satisfies hard constraints. For example, the decision support optimisation engine can determine what suggestions should go to where or what action should be taken in what channel

- Feedback loop – AI constantly learns from the data it is gathering and analysing

- Natural language processing (NLP) – Allows AI to easily explain itself in human-relative terms, which is particularly important in sectors like commercial pharma that still involve a lot of human interactions. This is often referred to as 'explainable AI'. When Aktana's programme makes a recommendation to a sales rep, for example, it needs to be able to tell them why it thinks it's a good idea.

To make well-rounded AI practical, it must be built for efficiency and scalability. This includes the automation of machine learning model retraining and rescoring, and configurable processes that can run on a large scale. In other words, to go beyond simply being a prototype, an AI programme needs to be able to be industrialised and commercialised, and able to solve more than just one problem.

Well-rounded AI systems do not necessarily need to have every single one of these elements, but a system with several of these technologies working together will be much more useful for commercial teams – and several other areas of the life sciences industry – than simpler programmes.

Harnessing the potential of AI

Finally, to be successful when using AI in commercial pharma buy-in is needed from key stakeholders and leadership team members. Helping with organisational change is where a partner like Aktana can come into play to provide teams with the tools and best practices they need to begin change management. However, companies should also ensure that leadership understands the technology to encourage and endorse this change.

Educating your leadership team about AI technology, how it all works, and how to define the problem correctly is a crucial step in forging a successful path forward. Ensuring key stakeholders understand how the organisation needs to adapt to handle a new, intelligent technology will empower others to drive the adoption from start to finish.

This process will become easier as AI continues to develop. The industry is heading more towards explainable AI than deep learning tech, where the machine understands more than its users. Once explainable AI becomes more common, we will be able to break down many organisational barriers that currently exist. At that point, it will become intuitively obvious how to use AI, even for people who have little experience with it.

For now, it's important for companies to get started by understanding the basics, recognising the value this technology can bring, and where to best implement it to enable sustainable success. By ensuring your leadership and key stakeholders are both educated and bought in to the value this technology can bring, organisations will have the top-down support to successfully harness the potential of AI in pharma commercial operations.

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About the Authors

Matthew Van Wingerden, VP analytical services, Aktana

Matthew Van Wingerden is VP of analytical services for Aktana, which offers products that use AI and machine learning to help life sciences commercial teams make data-driven decisions for more personalised customer engagement. In his role, Matthew works with customers to develop, test and deploy new machine learning features, in addition to providing oversight of the company's machine learning and data science vision.

Before joining Aktana in October 2017, Matthew spent five years at global management consulting firm McKinsey & Company, where he worked on commercial analytics and strategy development for pharmaceutical marketing and sales teams. Matthew holds a PhD in Organic Chemistry and lives in San Francisco.

Pini Ben-Or, chief science officer, Aktana

Pini is an experienced technology leader who oversees artificial intelligence (AI) and analytic innovation at Aktana. He has spent much of his career focused on improving business decisions using advanced analytics, optimisation, business intelligence, and machine learning. In addition to being a data science expert, Pini enjoys and excels at building highly capable teams and nurturing a culture of innovation.

Prior to Aktana, Pini served as global head of analytics at Actimize where he helped transform the company from reliance on rule systems and expert models to deploying fully agile machine-learning-based models for financial crime detection. Throughout his career Pini has introduced analytics innovations in the applications of machine learning, data management, operations optimisation, marketing channel optimisation, and business intelligence. He has multiple patents and patents pending, most recently in the area of machine-learning on network graph data.

Pini has a BSc in Physics, Mathematics, and Philosophy from The Hebrew University in Jerusalem, and a MA and MPhil in Philosophy from Columbia University in New York, where his research areas were Decision Theory, AI, and Philosophy of Physics.

About Aktana

Aktana is a pioneer in intelligent engagement for the global life sciences industry. Its proprietary platform harnesses machine learning algorithms to enable commercial teams to seamlessly coordinate and optimise multichannel engagement with healthcare providers. Committed to customer success and innovation, Aktana supports 150+ brands worldwide to capitalise on data investments, drive productivity, and continually enhance campaign performance. More than half of the top 20 global pharmaceutical companies are Aktana customers. Headquartered in San Francisco, Aktana also has offices in Philadelphia, London, Barcelona, Tokyo, Osaka, Shanghai, Beijing, Sydney, and Sao Paulo.

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Bringing performance marketing into pharma

Matt Lowe from performance.io says that performance marketing disciplines including SEO should underpin every element of a pharma marketing strategy, but are almost non-existent in the industry currently. He told pharmaphorum how companies can fix this.

Where does nearly every single one of your audiences go when they need information? They Google it.

As Matt Lowe, CEO of performance.io, the industry's first specialist online performance agency, notes, "this is a universal behaviour for all of your audiences – healthcare professionals, pharmacists, carers, nurses, patients, and payers".

But Lowe says that for most organisations, their performance and search engine optimisation (SEO) marketing strategy is a "barren desert".

"Before we launched performance.io, I hadn't come across one company in any market that had a congruent, well thought-out, SEO strategy," he says.

"For an industry that spends billions on digital, soft skills and in call quality to routinely ignore the first step in every single customer's user journey is nothing short of bizarre. There's a real risk that as an industry we spend millions on creating campaigns with great creative that nobody ever sees."

Lowe began his career working across a range of commercial sectors in pharma, for companies such as Sanofi and Grünenthal, and winning awards for his integration of data-led marketing and digital solutions applied to the marketing mix for drug launches.

It was this success that led to him being approached to head up digital operations globally for a mid-sized network agency, and the transition to agency life enabled him to get more exposure to the solutions being offered from creative, communications, med ed and digital agencies.

"In pharma I got a bit disenfranchised by decision-by-committee" he says. "Often digital is just a box-ticking exercise – companies get a website, a Facebook page, an app, tick these off and move on. I noticed that this wasn't just in pharma, but agencies often become an echo chamber for clients, adding more things to the shopping list, without these recommendations being determined or measured by data".

Seeing this shortfall inspired him to launch the industry's first specialist SEO agency, Search Unlimited in 2015. Two years later, once the group had been sold, Lowe set up performance.io – whose goal, he says, is to "redefine performance in healthcare".

"People talk a lot about new technologies and their impact on healthcare. Machine learning, artificial intelligence, IoT – all developments that are helping the industry address the way we provision solutions. But for me it's the everyday skills and disciplines that are missing from the core competency framework in pharma."

Lowe feels that as marketing and communications converge through technology, it is understanding the mechanisms of the web, the opportunities and data it yields that will provide the area of competitive advantage pharma companies seek.

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That said, Lowe draws a distinction between "SEO" and the kind of end-to-end 'online performance marketing' that performance.io specialises in.

"We hear and see a number of scenarios where communications or creative agencies have done a 'social listening exercise', followed a quirky acronym process or done 'some SEO'. For us that's not performance."

SEO is one of a multitude of disciplines in performance marketing that in turn is affected by a plethora of factors (such as content, frequency, links, metadata and mark-up data) and is predicated by the foundations on which it sits.

Performance marketing strategies

When working on performance marketing strategies, performance.io cleans and analyses vast data sets including information on search behaviours, semantic search queries, video, imaging, news, social media, attribution modelling and click streams, to get a forensic understanding of audience needs before anything is built.

"Step one is to gain a firm understanding of audience needs (user intent), the competitive landscape, where to play and perhaps more importantly where to avoid. I often give the example that if you are launching a running shoe in the UK and you target the word 'running shoe', after one year you wouldn't have made a chip on the bonnet of the Nikes or the Reeboks of this world. Understanding the keywords to avoid is important, so you don't blow your budget trying to win with the words 'cancer' or 'diabetes', which no pharma companies are going to do any time soon in any market outside the US (where they still don't index)."

Understanding the landscape enables performance.io to map out the optimal foundations for a brand to thrive online. This is done by optimising and structuring the website information architecture to ensure Google's crawling software indexes the whole site.

"We then develop data-driven site maps, with an optimal domain strategy, URL hierarchy, taxonomy, which in essence becomes an empirical content plan. The success of all subsequent PR, social media and online content is ultimately predicated by these foundations and a quick look at nearly all sites in pharma today shows this isn't considered."

Step two is to work with development partners to ensure online performance aspects are considered through build and shortcuts aren't taken that compromise performance.

"No assumptions should be made that development teams specialise in these disciplines," says Lowe, "and through our work with a broad spectrum of superb development teams this has been our experience. You need to work in harmony with UX and Dev teams to balance online performance elements, load times, plugins and content and all with the end user in mind!"

Step three is working with clients on an ongoing basis to iterate as part of a 'permanent beta' approach and develop content based on a constant loop of data and feedback of how users have arrived at your site and how they have used it.
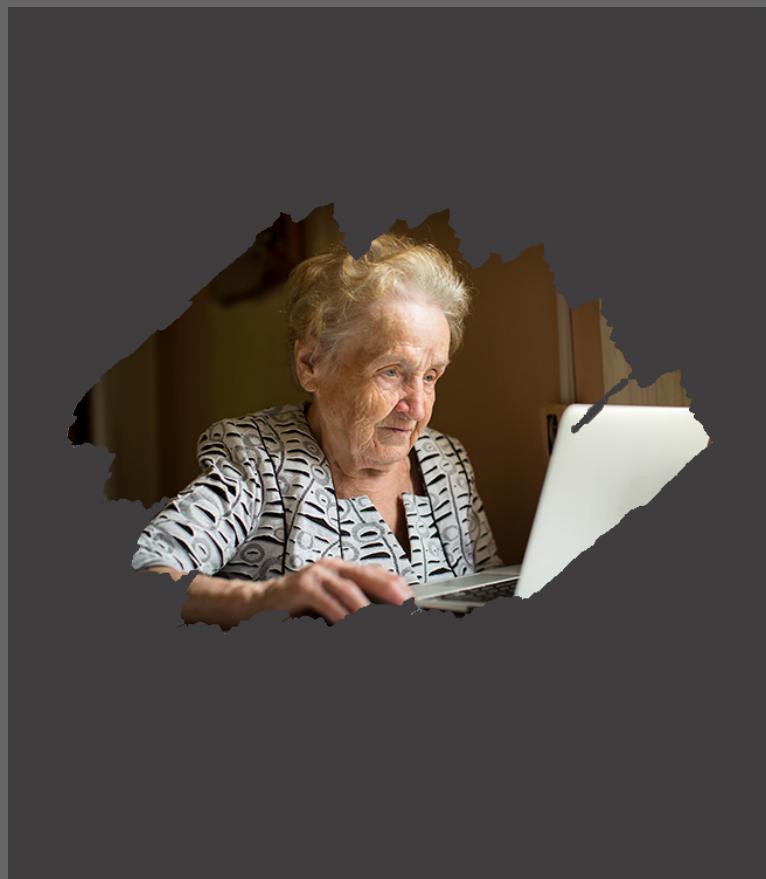
Measuring success and ongoing performance

Performance marketing is an incredibly active process in a landscape that is constantly evolving. Just last month Google rolled out significant changes to how videos are indexed and presented in search results, launching its 'in this video' key moments, and in 2018 Google made over 3,000 changes to its system.

"It's ultimately about understanding all of the moving parts that impact performance, from SEO and highly targeted paid media campaigns (for non-HCP sites), to email optimisation, social media optimisation, events and congress sign-ups, which are so often overlooked in pharma," says Lowe.

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"When working with clients, they often say 'our media agency or creative agency have done some SEO for us' and we find they have done a bit of paid media, or used a simple plug-in. That is not performance marketing. Conversions are non-existent and it doesn't align with any plan. This isn't helping healthcare to be more patient centric!"

What can help is getting clients into the top organic positions for non-branded keywords (dynamic opportunities) on Google.

"No one clicks on paid ads at the top of a search results page anymore (on average less than 5% of clicks are on paid ads on Google)," Lowe says. "I'm not that interested in paid media. We do it for a number of clients because it has a role in acquisition and indexing for non-branded keywords, but mostly people only care about organic results. Our job is to get our clients into those top positions. If we do that, then they are clearly an authority (Google's engine is far more powerful at determining relevance than any agency index!) and a valued resource."

Another goal is to get the company's information to appear on the first page of the search results as a 'featured snippet' – search results that appear at the top of a results page giving additional information from a website, often in the form of bullet points and an image.

"They are tremendously valuable for clients and their audiences. There's around a 114% increase in click-through rate for keywords that appear in featured snippets. For the clients and campaigns we've worked on this year, we've delivered over 100 of these, seeing a huge impact for clients' campaigns and sales where relevant. If you get a featured snippet, it gets indexed twice on Google – once as a featured snippet and then once in the search engine result below.

"I feel this is an incredibly exciting time for pharma and healthcare. We've seen the bar raised in the past few years in pharma with creative more akin to the consumer space, and I feel we're now driving this with online performance."

Patient Impact

Lowe says that having a good performance marketing strategy can have a profound impact on sales and understanding audience needs; moreover it's about saving lives through earlier diagnosis, alleviating anxiety for patients, and helping healthcare professionals by using the vast data sets that pharma sits on to provide a source of useful information at the time it's needed most.

"I have always thought it a privilege to work in pharma and healthcare, but I can't help feel there is a tremendous waste of money on campaigns no one sees and limited use of the functionality that CRM and CLM offer consumer brands. We should be aiming to save and help as many lives as possible by providing balanced information in people's hands at the time they need it most".

Looking to the future, Lowe says he would like to see the broader industry embrace performance marketing and raise the bar in this space, and is proud that performance. io is leading from the front as an industry first.

"I would like us to be recognised as the gold standard in performance marketing in pharma and healthcare. We'd like to continue to work with progressive partners/leaders across the marcoms mix, to ensure their campaigns reach and help as many people as possible. This involves going on a journey together and not always doing what has been done before."

Despite the fact that pharma is still finding its way with online performance marketing and SEO, Lowe says that companies have come a long way since he started in this space.

"In 2015 we were the very first to launch a specialist SEO solution, and when I was taking it into clients there was definitely some technical hand holding required and odd looks at 'the strange digital guy'! The odd looks haven't entirely disappeared in some circles, but 2 years later when we launched performance.io (2017), there was more awareness that online performance isn't just a slide at the end of the pitch where we talk about measurement. Online performance is the thread that runs from the very beginning when you're defining the ecosystem, the audience's behaviours, through to build, through to conversions, and then back into content. People understand that now, they know it's important."

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Nevertheless, Lowe says he often still needs to convince people that this needs to be prioritised as part of the spending within the product-related costs.

"I know companies often still see this as innovative, but the first search engines were launched in 1996 and there were no real performance or SEO strategies in pharma even as late as 2015. This is starting to change.

"It's good to see. I think that's a product of diminishing access to healthcare professionals. Most people now know that even doctors will look on Google, either within a consultation or in between."

SEO and online performance marketing are finally here to stay and can't be something you do a 'bit of' or 'some'. We are seeing more and more integrated agencies trying to craft solutions in this space, but Lowe's advice is "do it properly with a focused performance agency or don't do it at all, and if you need more info than that, Google it…"

About the Interviewee

Matt is founder and chief executive at performance-io.com, focused on bringing healthcare solutions to as broad an audience as possible through new technologies. He spent over a decade in pharma working across a range of commercial sectors, before leaving to head up digital operations at a mid-sized network agency globally. In 2015, he launched the industry's first specialist SEO agency, Search Unlimited, before founding performance.io, the industry's first specialist end-to-end online performance marketing agency in pharma in 2017.

Passionate about mental wellness, he is a board member at the PeaceLove Foundation, who help children and adults in prisons and schools throughout America, with neurodiversity challenges to express themselves through creativity. Matt also assumes the role of co-founder at Artmatr, a company originating out of the Media Lab at MIT, who are developing technologies that sit at the nexus of art, engineering and robotics and extrapolating their tech to help people with physical disabilities to engage with the arts. He has also recently been appointed as trustee of Shafi Ahmed Foundation, whose goal is to use technology to train and teach medical skills to improve global access to safe surgery.

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Creating solutions, not products, in diabetes

Roche Diabetes Care's Michael Goetzl explains how the company is spearheading a combined digital-pharmaceutical approach to diabetes and how pharma firms can best embrace holistic strategies.

Despite tremendous advances in medicine over the last few decades, the healthcare and pharma industries have not yet really managed to get diabetes under control.

"We are managing the disease as best as possible, but there could be much more progress in helping patients," says Michael Goetzl, managing director UK & Ireland at Roche Diabetes Care.

Goetzl believes that combining pharmaceutical products with digital solutions can make this goal much more achievable.

Part of Goetzl's role is ensuring that the company fits with Roche's new global strategy, Agenda 2025.

"With Agenda 2025 our key objective is to become the leader in providing integrated diabetes management solutions," he says. "This means we want to take a much more holistic approach to diabetes."

To do this, he says that Roche, and the pharma industry in general, needs to move from a 'product-oriented' approach to diabetes, focused solely on drugs, to a 'solutions-oriented' approach – which involves bringing together software, hardware and digital services and creating solutions that are easy to access for the patient while delivering real benefits.

"It requires products on the market that can be easily connected with digital applications, and easily connected with our software. This must work quite smoothly, and it must be easy to understand – if it is too complicated for the user, the patient or the healthcare professional, it will not succeed. We are not quite there yet, but we are getting closer.

"Once we are able to offer solutions like that in the market at a high standard, we can get closer to this dream becoming true."

He says these kinds of approaches are needed in diabetes because of the huge shift in the market towards people using more innovative technology to manage their disease.

"People will use whatever technology they can – from apps to online services and smart devices – to gain more control over their disease. If you only have one kind of product, you are not fitting into that market.

One example he uses is Roche's acquisition of software company mySugr, which has developed an app that can be linked to some of Roche's diabetes products to gather the information patients are creating when measuring their blood glucose. It allows a more visual approach to glucose monitoring, for example by using graphs.

"It puts everything into context, so it enables the patient to better understand what is happening and what things affect their glucose levels."

But as the term 'solution-oriented' implies, these kinds of approaches can be about more than just digital apps.

Goetzl uses health coaches as an example of another service that can help patients with their diabetes management. Software designed for healthcare professionals that enables them to collect a wide range of data, and therefore come to better conclusions faster, could also help.

Working with healthcare systems

Of course, for combined digital/physical solutions to be truly successful they need to be integrated with healthcare systems.

Goetzl says that the UK's NHS is further along in this journey towards integration than many other systems around the world.

"They are aware that the traditional approach will not get diabetes under control, considering that the number of patients that suffer from diabetes is increasing every year," he says.

"They have already started a lot of projects, but it's a process on both sides. It requires a lot of discussion with the industry and stakeholders to make it fit together, to know what is really possible to achieve.

"It really needs to be developed on the ground, so that we know where we want to go or what is missing in healthcare today, and how to make that possible. What kind of products do we need to combine? How do we implement that into the system? This is exactly where we are at the moment and this is where we want to start playing our part."

Nevertheless, Goetzl notes that there are still many barriers to implementation that need to be overcome.

For example, despite the NHS seeing the need for these kinds of solutions, Goetzl says that there isn't really a corresponding budget.

"You're often targeting four or five different siloed departments at the same time," he says. "You need to go to a certain level where you find people that do understand the overall concept and help you to decide, from a technical point of view, how this could work in terms of reimbursement.

"While this remains an unresolved question, it can be hard to move forward. The funding and the willingness can be there, but you can still find difficulties within the system."

There are also some challenges from the patient perspective.

"We need to make sure that patients really get engaged and are motivated to follow you. If the patients do not stick to the recommended guidelines, if they just follow your solution for six months and then step away, you will not succeed.

"That's an issue the entire industry is facing, and it highlights the need for solutions that are easy to understand and easy to use."

Meanwhile, he says that most internal barriers that stop companies fully embracing solutions-oriented approaches revolve around "mindset shifts".

"If you have been successful as a provider in the market for many years by selling traditional products, it can be difficult when, within quite a short time, you realise something is happening in the market and you need to follow that.

"You need to upskill the organisation and find people with the right skillset. There are positions Roche now needs that we were never looking for 10 years ago.

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> "It's necessary to have people that really understand how the technology works. You need to be able to explain to your people why this is important, what your vision is and which direction you want to move in."

He says that partnerships can be key to helping companies move into areas they previously have had little experience in.

"We know that it's simply not possible to work in every sector, so we are looking for partners that want to join us and bring in complimentary business."

For a partnership like this to be successful, Goetzl says companies need to have a very similar vision of the objectives they want to achieve.

"For example, we recently partnered with Accenture because we realised that building all these tools together requires expertise in software, but that isn't our core focus at Roche. Meanwhile, Accenture also want to play a more important role in the healthcare sector."

Few in the industry would deny that digital solutions working together with pharmaceutical products is the future, but as Goetzl demonstrates, there are many factors companies need to think about when preparing for this change. Nevertheless, as pharma pushes forward with these new solutions there is hope that one day soon diabetes will be a much more manageable disease.

About the Interviewee

Michael Goetzl became managing director of Roche Diabetes Care, UK & Ireland, in January 2019 having previously led the business in northern Latin America. Prior to Diabetes Care, Michael has a background in tissue diagnostics, joining Roche following the acquisition of Ventana Diagnostics where he had started his career in sales.

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