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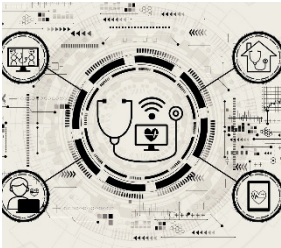
How will the Metaverse Revolutionise Healthcare?

HealthTech Insights

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Healthcare AI

Prevention over cure - How Artificial intelligence could help prevent 80% of Chronic diseases

Leadership in HealthTech

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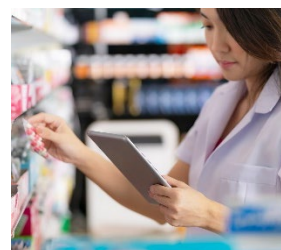
From Apothecaries to Apps - Reflecting on 300 years of Pharmacy Innovation

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- **The Living Heart Project and how Virtual Twin Technology can Improve Healthcare for all**

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HealthTech Insights

How will the Metaverse Revolutionize Healthcare?

Telemedicine and digital twins have already brought a great deal of innovation to the healthcare sector. The ability to leverage new immersive solutions will open the door to a wide range of possibilities, and the healthcare industry has already started tapping into these exciting cutting-edge technologies. For instance, healthcare providers use 3D images of the human body to better facilitate diagnoses and treatments, whilst first responders can conduct exercises in simulated environments to prepare themselves to manage real-time triage and containment challenges. The list of potential use cases is nearly infinite, as is the opportunity ahead.

Innovation today

Telemedicine, particularly through the use of digital twins and improved immersive experiences, can help patients expand the range and number of hospitals and doctors they can consult. This in turn alleviates pressure on local healthcare organizations and empowers individuals to have greater control over their healthcare.

Additionally, digital twins of patients used to visualize and run models in the metaverse can enable doctors to test intervention options, predict recovery trajectory, and identify possible reactions to medication. Using metaverse environments as training vehicles for practitioners enables them to enhance their own anatomical knowledge, as well as deepen their understanding of the human body. Imagine being able to go inside a model of a working human heart – watching exactly how it pumps and visualizing the flow and electrical signals triggering the beat; seeing examples of unhealthy arteries or plaque build-up; watching how the blood passes through the lungs to be oxygenated and through the capillaries to deliver; oxygen and nutrients. This type of visualization holds immense potential for not just the evolution of the medical field, but for medical education as well.

Providing better training ground

The ability to simulate the human body with any condition through the use of visualization technology will greatly improve the training of surgeons, pathologists and osteopaths, among medical professionals. With this, surgeons could practice on virtual patients before committing to the actual surgery. The virtual reality (VR) experience of a metaverse environment can also enable doctors to

have a more detailed look at a patient's pathology or radiology images through high-resolution 3D modeling.

For therapy sessions, metaverse solutions could enable practitioners to create a patient-focused experience, tapping into new tools for treatments such as cognitive behavioral therapy. Physical therapy can be transformed by using haptic sensors to create rehabilitation programmes that help patients cope with symptoms in diseases such as Parkinson's.

An additional possibility is the creation of virtual "war rooms"-- 3D virtual locations where documents and artifacts are readily available and conversations persist to be used to accelerate collaboration among caregivers–whose avatars can meet in real time as needed.

Enhancing patient experience

Another significant benefit of tapping into the potential of metaverses is enhancing the patient experience. Metaverse-based solutions can enable more immersive remote visits to doctors. While video-based doctor visits have become ubiquitous, it is still only a flat-screen experience. As we enhance remote interaction capabilities, patients will have fewer reasons to travel to see an expert in a certain field. In turn, collaborative spaces for doctors will enable consultation among multiple medical professionals with ease, facilitating consensus diagnosis, as patients won't be required to rely on the expertise of a single practitioner.

Patient experience will be further enhanced by the use of IoT-connected devices. Portable healthcare devices such as heart rate and blood pressure monitors and oximeters can sync with the Internet and share that data with doctors inside a metaverse app. Wireless technology could also facilitate biometric and environment data being fed back into a real-time digital model of the patient and represent overlays of medical history and familial history in a single place.

Overcoming obstacles for the future of healthcare

While metaverse-based solutions can revolutionize healthcare, we have to address the risks along the way. Introducing an increasing amount of data from records and connected devices into these virtual spaces can elevate risks that need to be addressed before progress can be made. For example, as free-to-use metaverse platforms rely on algorithms to profile users for

advertising purposes, concerns arise about privacy, security and compliance.

In time, we will understand how transparent metaverse platforms will be when disclosing how much data they collect and how much control users will have over that data. While it is inspiring to see so much interest in the possibilities of the metaverse, healthcare organizations will also need to consider how they can guarantee safety and privacy in their virtual ventures. To fully benefit from the advantages presented by this technology, organizations must be proactive about their strategies for data security, privacy, governance, and compliance.

By Nicole Reineke, Vice President of Innovation, Iron Mountain

Healthcare AI
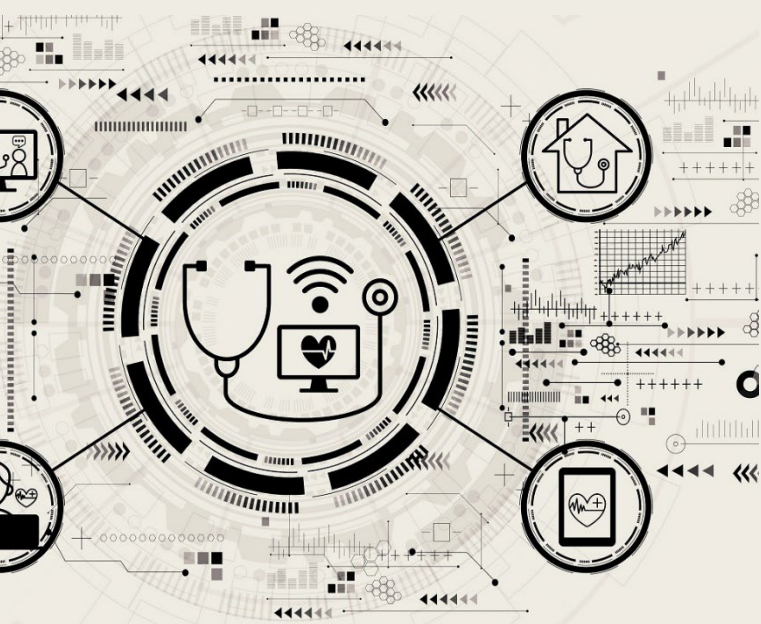
Prevention Over Cure: How Artificial Intelligence could Help Prevent 80% of Chronic Diseases

By Faramarz Farhoodi, CEO of AI Nexus Healthcare

Artificial Intelligence (AI) can be a daunting term and one that has seen immense innovation since the 1960s. It's a term we are all familiar with, yet probably have no idea how many times we encounter it on a daily basis.

The relationship between technology and healthcare is growing rapidly, with an abundance of hardware available that collects masses of biodata and provides consumers with a user-friendly insight into the functions of their body. You may go for a run and monitor the evolutions in heart rate per kilometre, or you may like to monitor your sleep throughout the week.

But what if accessible digital health technology was capable of providing accurate and actionable advice deciphered from something as accessible as your smartphone?

This is where AI has the ability to transform health technology from simply providing remote monitoring, to emulating the diagnostic approach of a clinician and potentially saving lives. With 80% of chronic diseases being preventable, and a global healthcare system that is operating well over capacity, the world is in need of innovative solutions — and AI holds the answer.

Prevention over cure

Almost all diseases develop over a cycle, with each stage providing antecedent signals that often present themselves within vital sign measurements. If the average consumer was able to regularly check their key health signals such as blood oxygen levels, heart rate

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variability and sleep patterns, this would provide a pretty comprehensive outline of their current health. However, to most people, these stats and figures would present themselves with very little meaning — yet they could represent a bigger picture.

This is where, through a combination of complex neural networks and Cognitive AI, data can be monitored and potential causes for concern flagged. It could be disrupted sleep, or low blood oxygen levels — whatever the anomaly in data, this could represent a health issue in the early stages of the disease cycle. AI therefore has the potential to transform healthcare systems from "Sick Care" to "Health Care" by enabling early intervention and the prevention of chronic diseases. This will help eliminate the need for medical intervention further down the line and reduce the strain on healthcare providers who are already struggling to cope with the current demand.

Is it time to evolve our employment of AI?

For too long, AI developers have been centred around machine learning, which essentially teaches computers to learn from experience and does so by applying algorithms to huge collections of data. Tech companies across the world have been trying to code doctors out and replace them with machine learning algorithms, which fails to address the need for reasoning within medical practice. Doctors and clinicians are among the most qualified people in the world and to believe we can replace this with machine learning algorithms does not represent a sustainable or suitable solution for the current healthcare crisis. Instead, this technology is merely imitating human intelligence with a complete absence of cognition and is attempting to view the human body as an algorithm.

This represents a failure to exploit the full potential of AI and created the need for innovation that builds preventative care solutions that cater to every individual — irrespective of their age, medical history, family medical history and lifestyle.

So what's the solution?

The most common point for intervention comes way beyond the baseline risk, earliest molecular detection and earliest clinical detection. Instead, people seek medical help at the latter stages of the disease cycle, which naturally incurs a higher disease burden, higher costs and the reduced prospect of reversibility.

The primary focus should be on prevention and to achieve this it is necessary not only to gather the data but also to make sense of that data and to generate personalised actionable advice for each individual. Centralising this technology in an accessible format is the first key step to making a real difference. If a consumer can obtain health data by simply scanning their face or fingertip using a smartphone, and for this data to be stored and interpreted in real time, would transform people's understanding of their own body. What you are creating is essentially a "check engine" light for the human body — which is supplemented by actionable advice on when to seek medical help.

With this full picture of physical and mental health, individuals will only call upon medical professionals when they really need them and this interaction will likely require far less resources than if it was left until a later date. If this is achieved, consumers will genuinely have "good health in the palm of their hand".

What does the future hold?

Ageing populations are growing exponentially and the demand for healthcare is growing simultaneously. If a true era of 'smart care' is to be achieved, a new form of AI is needed. One that can emulate the cognition of a clinician, and present itself in people's lives in a way that is digestible, affordable and accurate. At AI Nexus Healthcare, we describe this as 'hybrid AI' — combining the revolutionary capabilities of AI with the agency and intelligence of medical professionals. The world has never been more in need of innovative digital solutions and this represents one that could make a genuine difference and redirect the capabilities of AI towards providing a supplementary tool that fulfils the needs of the industry.

Faramarz Farhoodi, founder of AI Nexus Healthcare, has more than three decades of experience in the field of AI, having led more than 1,000 person-years of AI application development across the defence, healthcare, manufacturing and finance industries – with his experience as diverse as helping to build NATO command and control systems to overseeing Amazon.com's largest commercial account.

To Deliver Better Patient Outcomes, Healthcare Providers need to Refine their Approach to Data

By Karen Senior, Strategic Lead, NHS at Oracle

Data will be at the heart of a healthcare revolution. The global healthcare big data market is set to be worth $71.6 billion by 2027, with providers investing as much as 25% of their total budget in technology. Driving innovation in diagnostics, life sciences, and operational efficiency, data helps healthcare professionals to place a greater focus on patient care and wellbeing. Equally, AI and cloud computing will support the creation of more integrated care systems that make use of all available health data to improve treatment plans.

Access to the right data, and the technology to leverage it effectively, will also unlock greater healthcare value. By understanding the unique journey of each patient, from diagnosis to the efficacy of specific treatments, and management of any adverse effects, healthcare professionals can make informed decisions that can ultimately lead to better outcomes.

However, there are barriers to achieving this intelligent, connected approach in healthcare. For starters, data is fragmented, which makes it difficult to deliver efficient, personalised care. Meanwhile, growing compliance and cybersecurity challenges require healthcare organisations to be proactive in the way they approach governance.

Piecing together the data puzzle

The healthcare industry faces unique challenges when it comes to data. Traditionally, healthcare institutions have bought and operated their own systems, with disparate patient records left scattered across different providers and databases. Patient data becomes fragmented, within organisations and the industry at large. As with any silos, this breeds inefficiency and makes it difficult to use data both to serve the needs of the individual patient and society. When this data is

completely anonymised and used in aggregate, it is invaluable for larger community and even worldwide analysis, diagnosis, research, and action.

To unlock the potential of health data, the traditionally well-managed structured data needs to be brought together with unstructured data to create a single view across a range of data sets. Healthcare organisations are just scratching the surface when it comes to collecting data from an ever-increasing range of sources. Data from telematics, wearables, and patient apps are often stored in massive data lakes, which amounts to looking for a needle in a haystack with it comes to finding key insights. Moving to an autonomous database in the cloud enables providers to use their data to its full potential and deliver insights that improve patient care.

Powered by Oracle Analytics Cloud and Autonomous Data Warehouse, Sejong Hospital, the only cardiac speciality hospital in South Korea, has transformed the lives of over 1,600 children suffering from cardiac disease. The collection of data throughout the medical process and seamless delivery of real-time information to medical teams means that lifesaving decisions that used to take hours can now be made in minutes.
For American Hospital Dubai, their major digital transformation also aims to deliver better patient outcomes using data. Partnering with Cerner and Oracle, the hospital implemented a new electronic health record system to help physicians deliver a better patient journey, as well as introducing a resource planning platform to help it reduce costs and enhance productivity. This integrated patient data also drives the hospital's AI and robotics research work, leading to further patient benefits.

Healthcare is not one size fits all

No two patients are the same. They have different healthcare needs, treatment plans, and contact preferences. And yet most patient care remains standardised. The pandemic has driven increased patient expectations, with the rise of virtual appointments and mobile health alerts increasing the range of personal experiences patients receive. Indeed, telemedicine platforms alone have seen a 1,000% growth rate. If healthcare providers double down on personalised patient experiences, online and offline, then everyone gets the right support for them. In addition, outcomes can potentially be improved by ensuring better individual patient adherence to treatment plans.

Implemented effectively, a rigorous approach to data management can deliver greater personalisation and lower costs. Coloplast A/S, a Danish multinational that develops and manufactures medical devices, empowers patients with a personalised support programme. Built on Oracle Eloqua, Coloplast Care supplements the help patients receive from nurses and doctors, providing them with information and support that is personal to them. This kind of support can minimise the risk of preventable conditions, improving patient care and reducing pressure on healthcare services.

Working within the confines of regulations

The majority of consumers worry about the security of their health data, and personal healthcare records are rightly subject to protections. Providers can work with regulations, leveraging data to deliver better patient outcomes in a compliant, secure manner. These systems run in line with regulations such as the GDPR include categorisation and safeguards specific to health data. They also include data localisation requirements, which are especially sensitive for cloud-based healthcare providers. This makes robust governance paramount, not just to protect patients, but also to protect organisations from prosecution.

Dutch health insurer Zorg & Zekerheid ensures its customers get high quality, affordable care using rich data sets, implementing automation to increase data security. Implementing Oracle Autonomous Data Warehouse has automated almost all manual tasks that can cause human error, providing optimum security, cutting costs, and saving time. Data is secured with encryption of unused and active data, protection of regulated data, and rapid auditing and threat detection. This protects the organisation and its data against breaches, malware, persistent threats, and account hijacking.

Data-driven healthcare

We have seen that the healthcare providers which get their data management in order deliver better patient care and gain a competitive advantage. Connected and secure data will not only drive improvements within healthcare institutions — it will feed into broader medical advancements, increasing diversity and efficiency in clinical trials, which can result in getting new treatments to market faster. The responsible use of healthcare data can save lives, and we have only just begun to scratch the surface of what can be achieved.

Pharma Tech

From Apothecaries to Apps - Reflecting on 300 years of Pharmacy Innovation

By Nadeem Sarwar, founder and CEO at Phlo and Phlo Connect

The last 300 years have seen phenomenal evolution in our understanding of, and approach to managing human health and wellbeing. It's fair to say that healthcare in the 2020s is completely unrecognisable from its 1720s predecessor. But it's also fair to say that the pharmacy sector is often slower to embrace new ways of working and the opportunities offered by tech.

As we celebrate the passing of three centuries since the first pharmacies opened their doors, it's an opportune moment to reflect on how - and why - these opportunities should be leveraged. As the cost-of-living crisis ramps up, it is now more important than ever that pharmacies – and the products and services they offer – evolve their operations and offerings to ensure that they are accessible and affordable. Innovation in both

technology and policy can help us do that, by connecting the dots between GPs, healthcare providers, pharmacists and patients.

A brief history of pharmacy

The origins of pharmacy can be traced back to the very earliest civilisations. In Mesopotamia, in 2100 BC, the very first pharmaceutical texts were written on clay tablets and included instructions on pulverising, infusing, boiling, filtering, and spreading herbs, beer, tree bark, and wine. In ancient Greece, pharmacists were known as herbalists – supplying physicians with raw materials, including plants, to make medicines – and in China, the *Shennong Ben Cao Jing (Classic of the Materia Medica)*, which dates back to the first century AD, was said to have contained 365 entries on herbs and the ailments they could treat.

For many thousands of years, the role of physicians and early pharmacists were one and the same. However, in 1240 AD King Frederick the Great delineated the roles and issued professional regulations for both. By the mid-16th century, pharmacists were working in the apothecaries that dotted the streets of European cities, preparing and dispensing herbs and other substances to the public for medicinal use.

Jump forward into the 20th century, when the mass-industrialisation of drug production gathered pace, and pharmacists became even more entrenched as pillars of community life and public health. But despite the centuries of change, the essential services offered by pharmacists today are not dissimilar from their earliest predecessors:

- Dispensing medicines and vaccinations
- Dispensing medical appliances
- Promotion of healthy lifestyles
- Disposal of unneeded medicines
- Signposting patients to appropriate treatments
- Support for self-care

Providing a vital service

Today, pharmacies on high streets, in supermarkets, and often in the heart of deprived communities, perform a vital service – with 1.6 million people accessing their services daily. They support thousands of people who cannot easily access other healthcare services, and provide a space for anyone to secure advice on sensitive health issues outside of the doctors consultation room.

With the NHS under immense pressure – waiting lists for treatment at an all-time high of 6.84 million, and the median waiting time for treatment of 13.3 weeks – this community-based provision is more vital than ever.

However, whilst pharmacy's offering has evolved to include more patient-facing clinical services and better integration with wider healthcare services, transformation in the sector has been slow-moving, with huge regional variations in transformation of – and access to – pharmacy services. As a result, there is significant scope for how pharmacies operate and deliver services.

Digital transformation

Many core pharmacy processes in the UK rely heavily on manual tasks, paper-based administration and in-person interaction. For example, generating and collecting a prescription is much the same as it was 300 years ago: both GPs and pharmacists have to physically sign a prescription – which adds up to hours a day of admin – and a patient has to (usually) physically go to a pharmacy to collect the medication.

This is an inefficient way of working that exacerbates system pressures, but is a clear opportunity for digital transformation. Encouragingly, innovators are rising to the challenge, with recent breakthroughs including:

- **Digital prescriptions:** Using an e-signing solution, clinicians can generate and 'sign' a digital prescription before sending it directly to the dispensing pharmacy. This eliminates the need for 'wet' signatures entirely, saving GPs an average of 2 hours 33 minutes a day and providing patients with accelerated, more convenient access to medication.
- **Digital medication dispensers:** This helps Pharmacists monitor, in real-time, whether a patient is taking their medication, and offers patients a way to communicate concerns remotely and asynchronously with a pharmacist, who can then troubleshoot any required solutions.
- **Virtual therapeutics:** Digital therapy apps (known as digiceuticals) can offer an at-home solution for behaviour change, including treating insomnia or substance abuse. Now, pharmacists can easily prescribe these digital services to patients for a specific duration via an authenticated, time-sensitive, access code.
- **Robotic prescription fulfilment:** Robots are now being used in some pharmacies to automate tasks – such as dispensing pills, searching for medication and managing stock levels – reducing dispensing errors and freeing up time for pharmacists to deliver better patient care.

The future of pharmacy

Reflecting on and celebrating the fascinating history and current state of Pharmacy, it seems only right to look to the decades ahead too. As we move into a model of healthcare delivery that is increasingly preventative, personalised, mediated via digital platforms, and centred around patient empowerment, we'll see the continued proliferation of technologies built to make this model work more effectively. The prevailing tools will be those that promote sustainability and efficiency, streamline workflows, relieve burdens on clinicians, and offer a seamless, transparent and accessible user journey for patients.

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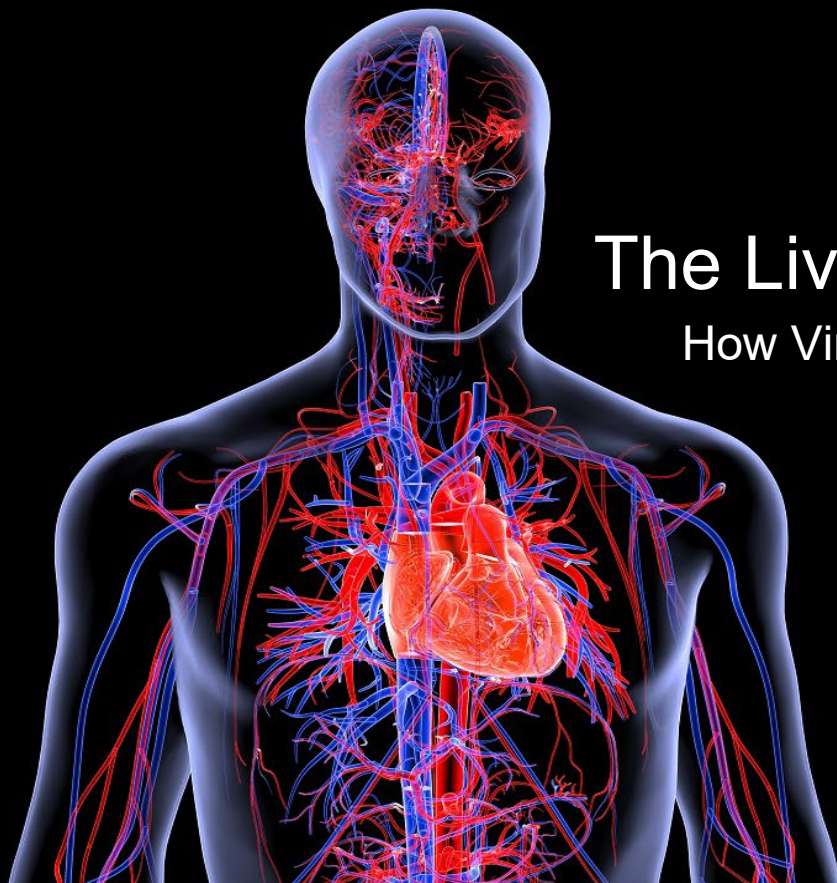
The Living Heart Project
How Virtual Twin Technology can Improve Healthcare for all

By Steve Levine, Sr. Director of Virtual Human Modeling - Dassault Systèmes

What has been standard in other industries for many years is becoming increasingly an issue in healthcare - simulation and modeling in the virtual world. By using so-called virtual twins, valuable insights can be gained to advance medicine, research and patient care.

The use of simulation and 3D modeling for developing and testing new products has already proven its worth in many industries. In the automotive industry, for example, physical crash tests are rarely carried out, as these are nowadays primarily performed in a virtual environment. In medicine, however, it is still common practice to work with 2D images that do not provide a complete picture of the patient's situation. Since the data is now available in digital form, transforming the current standard to 3D will enable what works well in other industries: virtual twins. This approach - the digital mapping of real objects and processes - makes it possible, for example, to virtually analyse body parts, individual organs or the entire human body. Moreover, by training the models with real patient data, results can be simulated under the same conditions as the real counterpart.

One medical discipline that can particularly benefit from virtual twins is cardiology. Figures from The British heart foundation show that Heart and

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circulatory diseases cause a quarter of all deaths in the UK, that's more than 160,000 deaths each year – an average of 460 deaths each day or one every three minutes in the UK. There are also around 7.6 million people living with a heart or circulatory disease in the UK. Modern treatment methods and prevention are essential pillars for improving patient care. To adapt the virtual twin technology to the human body, Dassault Systèmes launched the Living Heart Project in 2014.

The Living Heart Project

The Living Heart Project aims to make the virtual twin of the human heart a reality. To this end, more than 100 institutions from research, industry, medical professions, and regulatory authorities have joined forces. In cooperation with Dassault Systèmes, they developed the first realistic 3D simulation of a complete beating heart using the SIMULIA software solution.

Science and research have been dealing with the complex conditions of the human heart for decades and thus contribute significantly to the success of the Living Heart Project. The interaction with other organs, drugs and treatment methods is of particular interest. In this way, the researchers are making a valuable contribution to being able to map a fully virtual construction of the heart. However, given the complexity of (congenital) heart defects and how they interact with medical devices and replacement tissue, this still requires intensive research.

The clinical environment is also intricately linked to the Living Heart Project. The challenge here is to research innovative treatment methods cost-effectively while meeting high regulatory requirements for safety. Companies from the medical technology sector - such as manufacturers of medical device components, already use the model during the development phase. They can test new applications and devices directly on the Living Heart model through simulations. The findings from the virtual test labs reduce expensive and time-consuming prototype construction, and animal testing can be reduced. Unlike animal models, the virtual heart can incorporate clinical data to represent a human heart more accurately over time as it is used; this enables faster development and approval, contributing to

faster time-to-market for new medical devices. At the same time, company feedback helps further develop the model.

Where are we seeing this practice used today?

Today, personalised heart models are used to support clinical treatments, for example, in operations to correct severe heart defects in new-borns. Here, many virtual surgeries can be performed under the physician's guidance to determine the best approach.

Medical students, hospital staff, and even patients also benefit from the Living Heart - for example, the virtual twin of the heart can be used in education and training in the healthcare sector to train surgical procedures in the virtual world. In addition, development cycles and test series could be accelerated and optimised thanks to simulation. For example, it is possible to better adapt artificial heart valves to the disease conditions of groups or individual patients with the help of the virtual heart - many of the time-consuming and controversial physical tests on animals or specially made laboratory models are thus no longer necessary.

Next Step: The virtual human body

What is still being researched today may already contribute to raising patient care and the development of drugs or medical technology to a new level tomorrow. Dassault Systèmes is, therefore, already working with partners on other organs, such as the Living Lung and the Living Brain. The Living Brain, for example, is currently being used to research neuronal disorders such as epilepsy. Here, brain activities can also be simulated from individual patient data, helping to understand this disease, predict seizures or classify seizure types.

The virtual models of these complex organs are already so advanced that it is possible to think one step further - combining the various individual models and thus simulating the entire human body. Such use of the virtual twin paves the way for further advancing the development of personalised medicine. Every patient, therefore, has the chance to receive treatment tailored to their body, genes, and metabolism.