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Transformative Life Sciences Trends for 2024

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The intersection of tech and healthcare holds immense potential for the life sciences industry. From generative artificial intelligence (GenAI), augmented reality (AR), and virtual reality (VR) to decentralised clinical trials and 3D printing, we delve into the latest tech trends such Cellular Multi-Omics, Gene Editing CRISPR Technologies, Decentralised Clinical Trial (DCTs), digital health, digital twins, smart manufacturing, and wearables poised to lead the life sciences landscape in 2024.

As we enter 2024, we predict the technology trends that will influence the life sciences industry in the upcoming year. The evolution of GenAI is poised to revolutionise healthcare, with 49.6 per cent of healthcare providers planning to invest in GenAI use cases, as per a recent IDC report. Augmented Reality (AR) and Virtual Reality (VR) applications are gaining traction for enhancing medical training and surgeries. Trends such as 3D printing, Cellular Multi-Omics, Gene Editing CRISPR Technologies, Decentralised Clinical Trial (DCTs), digital health, digital twins, smart manufacturing, and wearables are expected to redefine the landscape in the new year. Let's delve into these trends in detail.

Gene Editing CRISPR Technologies propel cell and gene therapies

On December 8, 2023, the US FDA (United States Food and Drug Administration) approved the first-ever CRISPR-based treatment, CASGEVY, for sickle cell disease by Vertex and CRISPR Therapeutics. This marks a pivotal moment in gene editing, offering hope for genetic disorders and fueling the CRISPR therapeutics sector, one of pharma's buzziest areas.

“In the dynamic realm of gene editing and CRISPR technologies, the pace of advancement is nothing short of remarkable. Developers in the cell and gene therapy arena are fervently working to create improved therapies characterised by greater efficacy, improved safety profiles, and streamlined manufacturing processes. At the heart of this pursuit lie innovations in payload and delivery mechanisms. Within the gene editing landscape, developers are narrowing in on novel nucleases with specificity to, and optimal activity, at the targeted site. This endeavour seeks to navigate regions that may elude the original

Cas9 nuclease. Simultaneously, developers are honing deaminases with high editing efficiency, coupled with a meticulous avoidance of bystander or off-target editing. The quest for precision extends to the realm of guide RNA design algorithms, ensuring the accurate navigation of nucleases to their intended target sites," said **Michelle Fraser, Head of Cell & Gene Therapy, Revvity, USA.** Revvity is a science-based solutions company that leverages innovation across life sciences and diagnostics to help improve lives.

In Asia, Korean firms like ToolGen and GenKOre are utilising CRISPR for gene-editing therapies. ToolGen focuses on wet macular degeneration and Charcot-Marie-Tooth (CMT) disease, while GenKOre is developing treatments for muscular, brain, and eye disorders. In January 2023, GenKOre partnered with a US-based pharma company for the development of in vivo gene editing therapies.

"Anticipating the trajectory in 2024, the horizon is set for substantial strides in gene modulation technologies. Expect to see a surge in the adoption of more intricate gene editing approaches, signalling a year marked by significant advancements in the refinement and application of these transformative technologies," said Michelle.

Cellular Multi-Omics advances shaping life sciences and diagnostics

The coming year promises to be a transformative one for the life sciences, with cellular multi-omics taking a leading role in helping to advance our understanding of cellular composition and function, and potentially revolutionising clinical diagnostics.

"In the rapidly evolving field of cellular multi omics, we can anticipate significant breakthroughs that will shape the future of life sciences. Cellular profiling assays are transitioning from traditional reliance on a limited set of markers within a singular molecular class to newer high-plex, high-cell number multi-omics assays. These assays target a combination of RNA, proteins, DNA, and various other marker types, and they are deepening our understanding of cellular composition and function. We can expect this very active applications development area to deliver significant advances in assays including expanded marker numbers and diversity; increased numbers of cell interrogation; streamlined workflows; enhanced resolution in spatial analysis; and reductions in the cost per cell or marker analysed. These improvements will make multi-omics technologies more accessible and drive their adoption. Additionally, AI/ML-driven informatics will simplify the interpretation of complex multi-omic datasets, making it easier to extract meaningful insights from vast amounts of data. While researchers in the highly competitive life sciences arena are rapidly making progress, we can also expect to see CROs and life science tool providers working diligently to standardise specific assays. This standardisation is a crucial step toward incorporating these technologies into clinical trials and eventually deploying multi-omic signature-based and companion diagnostics," said **Dr Craig Monell, Senior Vice President, Business Operations, BioLegend,** part of Revvity. BioLegend is a global developer and manufacturer of antibodies and reagents used in biomedical research.

3D printing will surge

In life sciences, 3D printing, once associated with organs, is now gaining momentum in printing drugs. As the pharmaceutical industry shifts to personalised models, 3D-printed drugs have the potential to revolutionise production.

"Biopharma and biotech companies in 2024 should keep an eye on the 3D printing of pharmaceuticals since the technology is at an emerging stage as the next high-potential segment of the pharmaceutical industry. This innovative technology enables complex drug delivery and programmed drug release that is impossible using conventional technologies. These digital and diverse solutions to drug delivery challenges are accelerating the development of new drug molecules and extending the life cycle of branded products," said **Dr Senping Cheng, founder and CEO of Triastek, China.** Triastek is a global leader in 3D printing pharmaceuticals, pioneering the next generation of digital pharmaceutical processes.

Echoing the similar views, **Alexander Ruckdaeschel, Chief Strategy Officer of Laxxon Medical, USA**, said, "In the pharma industry, key players are eager to discover new, sustainable approaches to smarter medicine that can keep up with the demands of customers, providers and patients while also earning their loyalty. Noteworthy technologies will not only enhance treatment effectiveness and improve patient adherence but also streamline manufacturing processes and unlock disruptive commercial opportunities. Smart drug delivery systems with tailored pharmacokinetics, multi-drug tablets, optimised release profiles and anti-counterfeit primary labelling are just the beginning of what is already underway for companies like ours." Laxxon Medical is pioneering a novel additive manufacturing technology platform, SPID-Technology.

The APAC region is witnessing a surge in 3D printing innovations. Singapore General Hospital partnered with Nanyang Technological University for a Joint R&D Lab, aiming to deliver personalised medical solutions through additive

manufacturing. Korea followed suit as Ulsan National Institute of Science and Technology collaborated with Pusan National University Yangsan Hospital to advance 3D printing for medical devices. Australia contributes to the frontier with a team from the University of Sydney and Children's Medical Research Institute (CMRI) utilising 3D photolithographic printing to replicate organ architecture for tissue creation. In the pharmaceutical sector, China-based Triastek and Eli Lilly explore 3D printing for oral drug delivery.

Digital demands shaping biopharma manufacturing

As pharma shifts from generic drugs to personalised medicines, it has become apparent that conventional systems need more capabilities to keep up with complex manufacturing processes. An increasing number of companies, including major biopharma firms, and contract development and manufacturing organisations (CDMOs), are digitising their processes. Sanofi inaugurated its first digitally enabled continuous manufacturing facility back in 2019. By June 2023, the company declared a comprehensive commitment to AI and data science across all operations. In manufacturing and supply, Sanofi is digitising quality assessment, transitioning from paper to electronic batch records, and harnessing digital capabilities for enhanced asset utilisation and increased productivity under manufacturing 4.0. With an in-house AI-enabled yield optimisation solution, Sanofi achieves consistently higher yields, optimising raw material use and supporting environmental goals.

After the successful completion of a proof-of-concept project with Siemens and Atos that focused on the production of particles of a vaccine adjuvant, GSK has gradually begun implementing digital twins into its development activities. Pfizer has also been utilising digital twins in its manufacturing process.

The University of Melbourne launched the ARC Digital Bioprocess Development Hub, an $18 million, five-year research programme funded with $5 million from the Australian Research Council (ARC). This initiative aims to enhance the Australian pharmaceutical sector's global competitiveness by integrating digitisation and AI into pharmaceutical manufacturing. The hub, led by an interdisciplinary team, focuses on developing advanced manufacturing processes that leverage big data for industry-wide adoption.

2024 will see increased adoption of industry 4.0 capabilities in the biomanufacturing process.

Pharma’s digital health ambitions will solidify

Big pharma and digital health, once on opposite ends of the spectrum, are now coming together. The pharmaceutical industry increasingly relies on digital solutions to make further inroads into healthcare delivery, with broad-spectrum implications. Pharmaceutical giants have forged partnerships with digital health players; for example, South Korea-based startup Kakao Healthcare signed a business agreement with Denmark-headquartered Novo Nordisk Pharmaceuticals, a leading global diabetes treatment company, to provide smart healthcare services for chronic diseases. Japanese digital health firm Ubie also inked multiple partnerships with prominent pharmaceutical giants. In April 2023, Ubie partnered with Takeda to address Hereditary Angioedema (HAE), and in March 2023, Ubie collaborated with Pfizer to facilitate over 17,000 provider visits for OAB (overactive bladder) patients in Japan through integrated digital health solutions.

Some companies have launched separate entities for their digital health businesses. In May 2023, Bayer launched a business unit focused on developing new precision health products. In November 2023, AstraZeneca launched Evinova, poised to become a leading provider of digital health solutions catering to the needs of healthcare professionals, regulators, and patients.

In September 2023, leaders from Gilead, Merck, Novartis, Bayer, and Sanofi united to launch the Digital Pharma Circle (DPC). The Digital Pharma Circle brings together decision-makers within the digital health sector of the pharmaceutical industry, fostering meaningful discussions to drive the advancement of digital technology within the industry. DPC aims to drive practical implementation, ensuring members possess the expertise to catalyse transformative changes in the industry.

In 2024, anticipate a surge in collaborations, with pharmaceutical giants solidifying their digital health ambitions.

Decentralised clinical trial (DCTs) will reach new peak

Regulatory bodies are actively supporting DCTs. In May 2023, the USFDA issued draft guidance to facilitate their implementation, emphasising elements such as local laboratory tests and telemedicine-driven clinical follow-ups.

China, recognising the value of DCTs, issued guidelines in July 2023 supporting their implementation through telemedicine. Beijing encourages local pharmaceutical players to initiate DCT pilot projects, potentially paving the way for broader APAC interest in 2024, particularly in cost-constrained environments.

Another development in cross-border DCTs involves a Memorandum of Cooperation between Thailand's Department of Medical Services and Japan's National Cancer Center. This marks the first time patients from Thailand can participate online in a Japanese DCT, enabled by the granting of temporary medical licence in Thailand. This initiative promotes international collaboration, facilitating convenient patient participation and early enrollment.

GenAI takes centre stage

GenAI took the world by storm last year, and this is expected to catalyse progress in 2024. The healthcare industry also tested the waters with this latest tech, with almost all companies announcing projects with the potential to revolutionise the field.

Last year witnessed various initiatives and investments in the Asia-Pacific region. Singapore's Integrated Health Information Systems (IHiS) has formalised collaboration with Microsoft through a Memorandum of Understanding (MOU), marking a significant leap in generative AI and cloud innovation. This partnership introduces secure GPT for Healthcare Professionals, powered by Azure OpenAI Service, empowering healthcare workers with insights and task automation for heightened efficiency. In Japan, a cutting-edge generative AI tool has been introduced to aid doctors in summarising extensive patient interviews. Ubie's new GenAI feature achieves a remarkable 90 per cent user satisfaction rate, effortlessly condensing patient findings and streamlining medical record documentation. Australia reinforces its commitment to addressing health and medical challenges through strategic investments in GenAI.

The tech is expected to make greater strides in 2024. According to Deloitte, over 90 per cent of biopharma and medtech leaders foresee the impact of generative AI. Sixty-six per cent of life sciences companies are experimenting with generative AI, focusing on automating functions, transforming supply chains, and enhancing compliance. While 25 per cent of biopharma has established governance for generative AI, 50 per cent aim to do so within a year. For medtech, 20 per cent have governance in place, with 57 per cent expecting it by 2024. About 70 per cent of biopharma prioritises using generative AI for research, while half of medtech companies prioritise it. Some executives (25 per cent medtech, 18 per cent biopharma) await more evidence before investing in generative AI. In Medtech Digital Innovation, over 80 per cent allocate their largest digital investments to AI.

Wearables wave to continue

Weatbales- once seen as trendy accessories have now become an important healthcare device. GlobalData's IoT Thematic Research indicates a pivotal role for wearables in healthcare, driven by ageing populations, the rise of remote patient care etc.

Several APAC firms secured regulatory clearance for their wearable devices. Indian Startoon obtained a US FDA clearance for its wearable recovery tracking device. Singapore approved Aevice Health's wearable stethoscope for respiratory monitoring, and Respiree, another Singaporean startup, received US FDA 510(k) clearance for its respiration monitor.

Researchers and companies are actively developing new, small, and sophisticated wearable devices. South Korea-based Sky Labs, known for its ring-type BP monitor, secured $15 million in Series C funding. Researchers at Monash University also developed a new ultra-thin skin patch with nanotechnology capable of monitoring 11 human health signals.

In an article in the British Journal of Sports Medicine, scientists emphasise the urgent need for improved integration of wearables in clinical trials and cohort studies. They propose regulators approve specific devices as add-ons to standard care, advocating for increased collaboration between industry and academia to unlock wearables' full potential in chronic disease diagnosis, prevention, and treatment.

AR/VR will soar to new heights

AR and VR in healthcare are revolutionising patient care, medical training, and treatment methodologies. With advancements in software and hardware, these technologies promise improved diagnostics, patient engagement, and overall healthcare outcomes. In 2024, it will become even more integrated into medical practices.

The most obvious and widespread application of VR has been in the space of medical education. Medical institutes and hospitals have been incorporating this technology in education. Thailand-based Mahidol University adopted virtual reality for medical education. While Hong Kong pioneered nursing education with first-of-its-kind VR learning. Japan-based startup Jolly Good in collaboration with Brigham and Women's Hospital, a hospital affiliated with Harvard University, developed emergency careVR content. Jolly is also developing a virtual reality-based cognitive behavioural therapy (CBT) programme for the spatial computer Apple Vision Pro.

The technology is also enhancing remote care and diagnosis. Australian researchers have developed smart glasses to improve diagnosis and treatment of foot wounds. Enosis Therapeutics, an Australian medical technology and research company, is exploring the integration of VR into existing psychedelic protocols. Singapore-based Mediwave unveiled the world's first mixed reality and AI-powered connected ambulance, with successful launches already implemented in Malaysia and Sri Lanka.

“In 2024, biopharma and biotech companies should pay close attention to non-traditional, industry-disrupting technologies and clever business models which catalyse innovation, minimise cost and time, and integrate digital tools amidst the rapid growth of virtual health and artificial intelligence,” said Alexander.

Genomics growth

In recent years, the fields of genomics and healthcare have experienced significant growth, with experts predicting a continued upward trajectory. Genomics is the backbone of personalised medicines. More than two decades after the completion of the first Human Genome Project, numerous countries are engaged in initiatives to collect and sequence health data. These efforts aim to enhance healthcare delivery for both large patient populations and personalised care.

The Asia-Pacific region has seen notable initiatives and investments. Australia introduced a genomic profiling initiative, bringing hope to 23,000 cancer patients. In Singapore, Agilent Technologies signed an agreement with the National Cancer Centre to accelerate translational cancer research on the genomic landscape of prevalent Asian cancers. Additionally, LifeStrands Genomics and Ambry Genetics are poised to offer laboratory testing for clinical implementation pilots in Phase II of Singapore's National Precision Medicine Programme. Indonesia has also taken substantial strides in developing its genomics ecosystem.

The life sciences industry is experiencing a digital revolution, with technology permeating almost all aspects of drug development and healthcare. In 2024, we expect further advancements and continued integration of technology to enhance clinical development, manufacturing and healthcare delivery.

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