HEALTHCARE TECH TRENDS

FROM 2023 TO 2024

POLICY 2050

Healthcare Tech Trends from 2023 to 2024

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The fusion of healthcare and technology has led to more efficient clinical trial infrastructure and sophisticated digital health tools. Yet, the true success of these advancements hinges on the trust levels that innovators are able to cultivate with diverse stakeholders.

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Executive Summary

- Looking back on 2023 and ahead to 2024, the opportunities in healthcare seem endless. The convergence of life sciences and engineering sciences has accelerated, raising ethical concerns and highlighting the importance of trust in healthcare technologies. This can be supported through data-driven approaches that still respect privacy, plus better alignment between innovators, the business side, and patients. Effective communication and well-designed workflows will also promote tech adoption and deliver myriad benefits.

- Significant digital health growth was seen during the pandemic, but users invested in their own “quantified selves” may soon start to expect a wider variety of metrics and a greater depth of meaning.

- Neuroprosthetics is one of the areas showing promising results, with the potential to dramatically improve patients’ quality of life. Neuroprosthetic limbs aim to provide a more optimal, natural function by integrating neural processing.

- Vial, a technology-centric contract research organization (CRO), is aiming to revolutionize the clinical trial space by providing services that are both faster and less expensive. Their platform streamlines patient enrollment and data collection while also tailoring trial designs to meet the specific needs of sponsors in the era of precision medicine. The global CRO market is expected to grow significantly.

- These are just some of the recent advancements. Fundamentally, healthcare technologists should consider and address the ethical, legal, and trust-related concerns that arise from the rapid convergence of domains. Ensuring effective governance, thoughtful stakeholder engagement, and the alignment of different functions or priorities is critical if innovators hope to realize the full landscape of opportunities.

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A HEALTHCARE AND TECHNOLOGY CONVERGENCE

By David Pring-Mill

HEALTHCARE TECH TRENDS FROM 2023 TO 2024

Today, “healthcare technologies” rolls together seamlessly, causing us to forget previous distinctions. And yet, the Council of Europe anticipated the need to explore any human rights and human dignity-related questions that may arise through the convergence of innovations in previously discrete domains, namely the increasing interaction between life sciences and engineering sciences.

A 2014 report produced in collaboration with the Netherlands’ Rathenau Institute identified another convergence that was also emerging: a “techno-human condition.” This hybrid state reflects new habits of digital health, motivated by increasingly quantitative, performative, and mind-related goals. These developments have raised a new class of ethical issues – namely, data privacy – following medical science’s own checkered history of mistreated test subjects and chemical hazards, all striking at yet another blurred relationship: technological progress, and respect for human rights.

Clearly then, the report proposed, “convergence” can be seen as a major driver of innovation, evidenced even in the appropriation of biological concepts, terms, or building blocks for technological purposes, such as *neural* networks, *swarm* intelligence, and *DNA* computers. Furthermore, “there is something qualitatively new about NBIC [Nanotechnology, Biotechnology, Information technology, and Cognitive science] convergence,” as witnessed in AI. The limits of all this newfound participation, data collection, measurement, analysis, and optimization were considered to be ethically and legally unclear; so too was the delegation of inherently social tasks to machines. The Council of Europe disclosed that early drafts of their report sparked “lively debates” during expert discussions and a plenary meeting of its Committee on Bioethics.

The report suggested that “the governance machinery” might be lagging behind, or incompatible with, rapid private sector developments. In this new era, societal learning and deliberation among stakeholders are necessities, since “without new forms of governance, the dynamics of these developments will be left to a variety of techno-scientific drivers and market forces.”

Even before the COVID-19 pandemic forced a wider recognition of the need for biotech, in particular, 80% of healthcare experts at a European conference agreed we were at the dawn of a new age in healthcare. As this *Policy2050.com* whitepaper documents, innovators and investors are now directing their attention to diverse, often interdisciplinary areas such as digital health applications, surgical robots, neuroprosthetics, and optimized clinical trial infrastructure. With so much underway, we identify some of the most important trends and themes.

Trust in Healthcare Technologies

Looking at healthcare tech precedents: 67.8% of practitioners have found that robot-assisted laparoscopic surgery – one of the most active R&D areas in surgical robotics – effectively reduces the length of the procedure. Among patients, in this and other contexts, men tend to be more willing to undergo the technology-centric treatment option. Conceivably, these technological inclinations or fears among patients might also reflect an array of subtle factors that occur during discussions of treatment options and plans. For example, perceptions could be shaped by bedside manner, time pressures, deference to expertise, and institutional biases. False estimations of respective harms and benefits, on the part of both patients and experienced clinicians, also play a role in perceptions. In other words, gender or demographic preferences for treatment options, technological or otherwise, don't exist in a vacuum.

As we slowly but surely transition into a new era of medical robots – potentially reimagined with haptic feedback, augmented reality, and the surgical equivalent of "cruise control" on the operator side – effective communication and well-designed workflows will help to promote tech adoption and deliver benefits. Some of the emerging treatment options will likely be compelling. For example, HistoSonics raised US$226.8M to reinvent medical devices and procedures for patient scenarios where "minimally invasive isn't minimal enough."

A survey of German surgeons indicated that most practitioners expect AI to be first implemented at university hospitals or specialized healthcare facilities. They were most receptive to scenarios where AI is integrated into the medical workflow as a diagnostic tool that aids experienced specialists. Support dropped from 85.09%, for this scenario, to 69.57% for another proposed scenario in which AI has independently analyzed a patient's preoperative data and the specialist is limited to acting on the information. This study also concluded that surgeons are concerned about diminished empathy and efficacy in a tech-led future, obfuscated further by the ethical and legal uncertainties.

Meanwhile, the Canadian public is largely supportive of genomics research. According to an online survey conducted on behalf of Genome Canada, 58% of Canadians think that genomics should be used to help solve the world's most daunting problems; support was especially high for cancer, rare diseases, and COVID-19-related use cases. Only 15% think that the risks outweigh the benefits. While many respondents admitted to being only modestly familiar with genomics, most of them were curious to learn more and believed that public funding levels should be maintained or increased.

Championing a blend of modern-day philosophy and entrepreneurship, founder and CEO Nicole Gibson suggests that success in the digital health space involves moving beyond vanity metrics and measuring the emotional state of the individual. Tech providers should become more transparent and accountable, and users, too, have an opportunity to honestly self-reflect. Gibson's app inTruth is taking on this healthcare challenge directly – screenshots preview how it can help users recognize moments of high tension and "get unstuck."

Gibson elaborated to *Policy2050.com*: "It uses a combination of heart rate variability and a machine learning model which extracts the valence and arousal—key components in detecting emotion. The app shows users what they're feeling in relation to, for example, their activities. By syncing with a calendar, it can map out how one's day affects them emotionally. Over time, it monitors nuanced emotional patterns, correlating them with factors like emotional fluctuation, the challenge of returning to a centered state, and the impact of emotional patterns on decision-making."

Speaking to the eroded trust that users have in Big Tech, particularly around sensitive areas like biometric data, Nicole Gibson noted, "I believe that independents like us have a unique opportunity to make significant inroads in the market. It's rare for smaller independent entities to challenge and capture significant market share from industry giants, but trust could be our competitive advantage. Building a trustworthy brand and showcasing leadership that consumers can rely on extends beyond short-term goals. It's really establishing a new system of health for all of humanity moving forward and I think that's really exciting."

Neuroprosthetics

Prosthetics vary in their methods of control. In recent years, R&D funding for limb prosthetics has largely shifted away from academia to the defense department, along with commercial component manufacturers attempting to fill the void. Innovations, frequent yet beneficial protheses replacements, more precise or versatile options, and the resulting quality of life outcomes are all being constrained by the restrictions and caps on insurance reimbursement that "dominate the selection and utilization of prosthetics used by amputees," according to market analysis out of Worcester Polytechnic Institute's bioengineering center.

This is a deeply important yet challenging area. Fortunately, neuroprosthetic limbs,

which aspire to a more optimal or natural function and sensory experience by integrating neural processing in more sophisticated ways, have nevertheless passed beta testing. In fact, results already achieved have been so groundbreaking that online video demonstrations provoked incredulous accusations of fraud.

As brain-computer interfaces (BCIs) translate thoughts into movements or actions, patients are better able to perceive robotic limbs, or any other controlled technologies, as extensions of their own bodies. To innovators like Synchron CEO Thomas Oxley, this signifies "an oncoming revolution in the treatment of neurological diseases," enabled by surprisingly quick procedures. Synchron, identified as a leader in the same pack as Elon Musk's Neuralink, began 2023 with an announcement of positive results from a peer-reviewed, long-term safety study involving four patients with severe paralysis who received implantations of the first-generation Stentrode™, a neuroprosthesis device. With stable device placement and signal quality, it was possible for this technology to transmit neural signals from inside a blood vessel in the brain.

Optimized Clinical Trial Infrastructure

Clinical trials work in service of both efficacy and trust. However, the hassles of clinical trial participation are actually more of a deterrent to potential enrollees than safety concerns. It's no wonder then that startups like Vial are encouraging the healthcare industry to essentially regroup and reconfigure clinical trial processes inside a streamlined, end-to-end, fixed-fee system, thus bringing "clinical trials out of the paper stone age."

General Catalyst, a lead investor in Vial, noticed that the biotech companies already in their portfolio frequently encountered a "less than ideal" process when outsourcing trials to Contract Research Organizations (CROs), which was echoed in the assessments of pharmaceutical industry partners. Smaller biotech startups felt that their needs received a lower prioritization, which is an existential concern since "small biotechs live and die by their first drug," as a General Catalyst partner noted. The VC firm's investment in Vial was meant to bring the innovation and clinical trial phases closer in sync and on schedule. More details on this will be shared in the subsequent section.

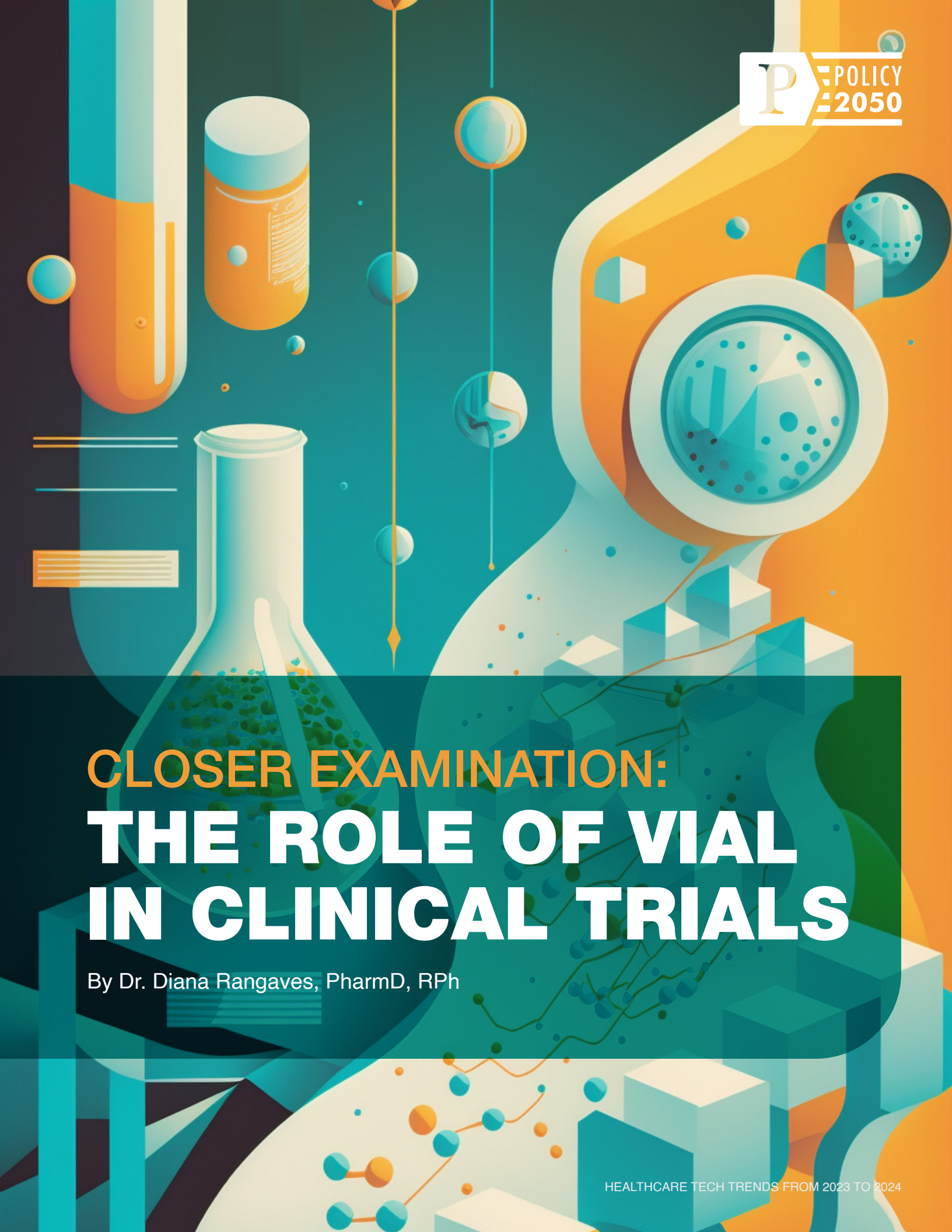
Conclusions

Regardless of whether healthcare technology startups are restoring lost functions through new approaches or connecting volunteers to clinical trials and thus treatments to efficacy, data is the lifeblood of innovation. And it seems that tech will lead the way.

This, again, raises privacy concerns, even among technologists, which is perhaps reflected in an IEEE survey where 42% of LinkedIn respondents identified "healthcare records" as the most impactful non-fungible token (NFT) use case, despite potential implementation problems. The full utilization of electronic healthcare records (EHRs) for clinical trials, even in their existing forms, requires accuracy, rapid updates, and platform interoperability, calling for the engagement of a complex stakeholder group.

Further compounding the concerns regarding "convergence," 18% of healthcare executives perceive a lack of alignment between business and tech priorities, within a "digital health" era that is still ambiguous or undefined, according to 32%. Amid incredible technological potential, the "variety of techno-scientific drivers and market forces" assuming the voids of academia and governance are still somewhat indeterminate.

Layered underneath all these developments, healthcare has a new mandate, as Nicole Gibson proposed: "I believe one of the most underrepresented challenges in the healthcare system is misdiagnosis. It isn't discussed sufficiently, and from a consumer perspective, it often results in a pronounced sense of learned helplessness. This dynamic causes power to be consistently deferred to doctors and practitioners. In order to take control of one's health and behave in a way that is conducive to good health, one of the cornerstones is personal power, a sense of empowerment, and a sense of really feeling like you are in control."



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CLOSER EXAMINATION: THE ROLE OF VIAL IN CLINICAL TRIALS

By Dr. Diana Rangaves, PharmD, RPh

Vial is a technology-enabled contract research organization (CRO) that conducts clinical trials in a manner that is both quick and at least 50% less expensive, according to the company. Contract research organizations, also known as clinical research organizations (CROs), are an indispensable part of the pharmaceutical, biotechnology, and medical technology industries because they support companies in their efforts to test, refine, and market their most current medications and medical devices.

The global CRO market was valued at roughly US$50 billion in 2021, and it is anticipated that it could exceed $88 billion by 2028, indicating a compound growth rate (CAGR) of 8.5%. The surge in expenditures and activities related to research and development and the significant increase in clinical trials in response to the demand for innovation are the primary drivers of this growth.

Clinical Trials

Clinical trials are research investigations that are carried out to test the safety and efficacy of a medicinal, surgical, behavioral intervention, or diagnostic tool. In most cases, the treatment is evaluated compared to the currently accepted therapy method for the ailment that is the subject of the study.

The trials are meticulously planned and must receive approval from the relevant agencies before they can begin. An Institutional Review Board (IRB) is required to consent for most clinical trials involving living human subjects. This is done to ensure that risks are minimized and justified by anticipated benefits, that subjects are selected and treated fairly, and that adequate informed consent is obtained.

The Role of Vial in Clinical Trials

Vial's goal is to redefine clinical testing to deliver significantly faster and more efficient tests to biotech companies. Vial has approached this mission by assembling a team of skilled engineers, product managers, designers, and executives, some of whom brought with them decades of experience in CROs, clinical operations, and clinical strategy. The teams worked together to develop a technological platform to add value throughout each clinical study phase.

The Technology Platform of Vial comprises three offerings: Site Startup, eSource, and Patient Recruiting. With the help of Vial's Site Startup app, processes can be automated and sites can be activated quickly. Paper is obsolete thanks to Vial's eSource, which converts data obtained during research visits into digital form and stores it in an easily navigable interface.

Vial's extensive EMR and CDx integrations are accelerating the enrollment process. The startup characterizes these developments as a next-generation solution that streamlines the processes of onboarding new patients, enrolling them in a clinical trial, communicating, and collecting data, all within a single connected system for increased productivity.

Vial successfully concluded a US$67M Series B round of funding, led by General Catalyst and supported by Byers Capital, BoxGroup, and others. To support biotech clients' global trials, the recent funding will be used to expand the geographic reach of the San Francisco CRO globally into the European Union and the Asia-Pacific region and to further invest in the technological platform.

Vial says that they can help biotechnology clients to control their costs, which they do in part by providing flat-rate pricing and adhering to it for the duration of a project regardless of the amount of time spent on it or costs incurred. If the study design or protocol is amended, however, that could affect pricing.

Currently, Vial provides its CRO services in the medical specialties of oncology, dermatology, ophthalmology, neurology, and cardiology. The contract research organization (CRO) has expressed its desire to expand its operations into all therapeutic fields.

Benefits of Working With Vial

When choosing a contract research organization, clients should consider the organization's level of experience, areas of specialization, geographical reach, and, most crucially, its capacity to fulfill the clinical aims. The following is a list of perks that come along with collaborating with a CRO like Vial:

Experience: Sponsors prefer CROs with experience and a good understanding of the hurdles they will face on the road to gaining regulatory approval. In order to combat the growing complexity of oncology clinical trials, the Vial Oncology CRO has expanded its scientific advisory board to include seasoned research oncologists who know how to

harness the power of precision medicine and clinical data.

Technology: Newly emerging, high-throughput omics technologies enable the retrieval of comprehensive and holistic biological information, while sophisticated data processing capabilities provide the data modeling necessary to support the demanding studies required for precision medicine.

Innovative CROs are in a position to adopt the latest technology, find opportunities for their use, and provide insights on how to use the tech to improve the performance of clinical trials. Several CROs have built their own one-of-a-kind technological products and services. These technologies can reduce the need for sites and investigators, expanding reach and participation.

Trial design: By using electronic health records (EHRs), precision trials are able to be planned to include patients who are most likely to respond to the focused treatment since, through the patients' consent, researchers have access to data about patients' lifestyles, environments, and health. The patient, as well as the sponsor, stand to gain from this.

Conclusions

The newly emerging CRO startups are flexible, quick to adopt new forms of technology, and capable of tailoring their services to the specific requirements of sponsors of any size. Niche players can offer a high degree of specialization in addition to the experience, expertise, and undivided attention necessary to be valued partners in drug development in response to the shift toward precision medicine. Vial has an important role to play in this new paradigm.

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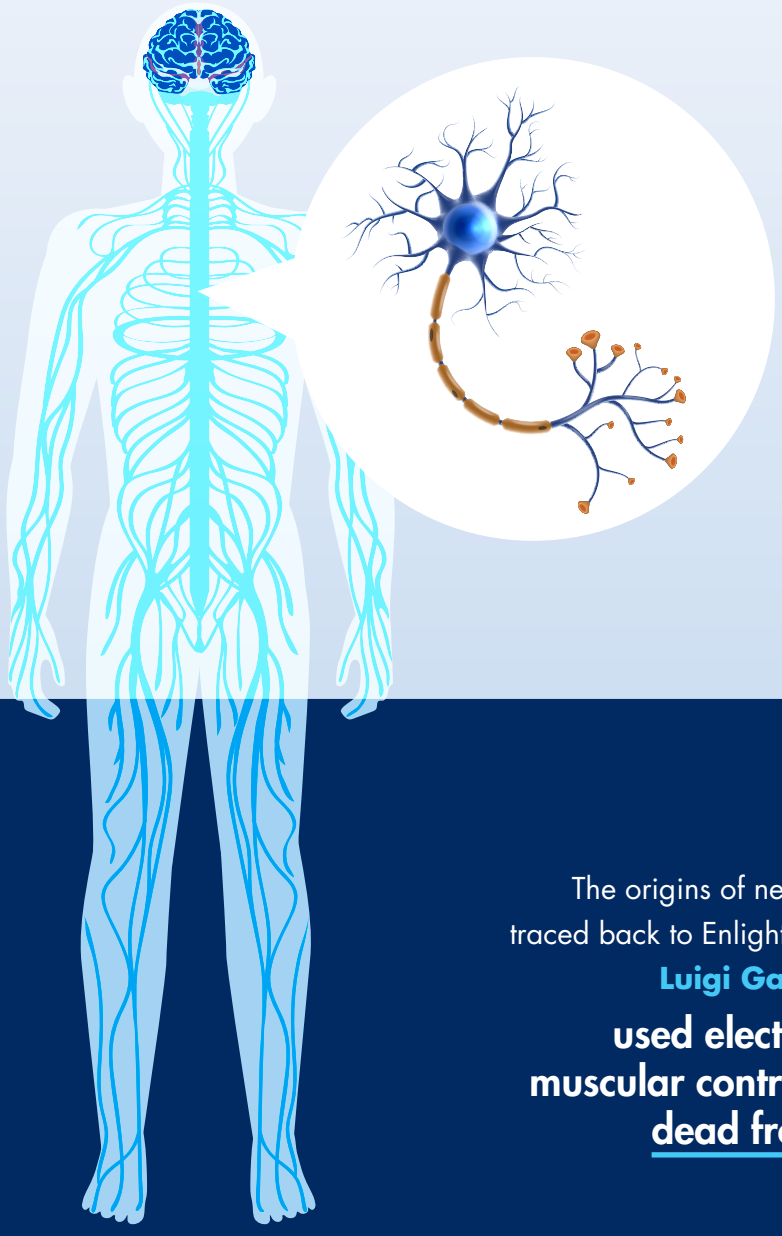


Synchron raised

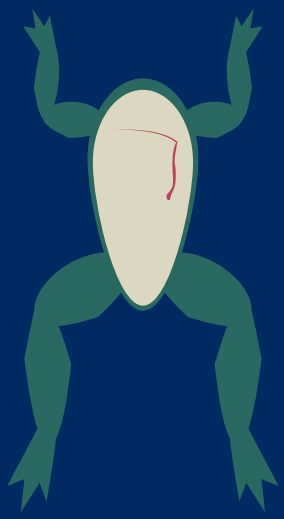
US$145M

in total funding to **"unlock the natural highways of the brain,"** i.e. blood vessels, and pioneer treatment approaches across 3 medical verticals:

- Neuroprosthetics
- Neuromodulation
- Neurodiagnostics

The origins of neuroprosthetics can be traced back to Enlightenment-era physician **Luigi Galvani,** who famously

used electricity to activate muscular contractions, making dead frogs' legs twitch.



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The field's goals of restoring lost functions broadened from there, **especially in the last decade**, but innovators **must also account for business considerations** such as **regulatory approval, reimbursement, marketing, IP protections,** and **risk management.**

The application of an "engineering" mindset to biology is a factor in, and function of, **renewed biotech investment.** However, tech analogies or approaches **have their limitations**. Also, **preventive care**, or even **predictive analytics,** shouldn't be overlooked.

This **biotech growth pressurizes** the operations, patients, data collection, and analytics of clinical trials.

Vial, equipped with

US$101M

in total funding, provides the infrastructure to **redesign the clinical trial experience** from start to finish.

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A survey of geriatric oncology suggested that "tools" represent a barrier to continued research for

4.2%

of medical experts,

while **10.4%** cited **"interventional trials,"**

and **18.8%** were impeded by the time required.

Clinical trials have struggled to meet enrollment targets and timelines, though data-driven approaches can help.

Online recruitment

is proving itself to be the more cost-effective option, with a **median cost per enrollee of US$72** as opposed to **US$199 if conducted offline.**

81%

of clinical trial participants report a positive experience with online portals.

HistoSonics, supplied with

US$226.8M

in total funding, is making noise in the medical world, thanks to its use of focused **ultrasound to reach and destroy diseased tissue at a sub-cellular level,** rendering the target into acellular debris.

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