



OPPORTUNITY

11

SCOPE TRANSITIONAL

UNCERTAINTIES

Technology, Values

MEGATRENDS

Materials Revolution

TRENDS

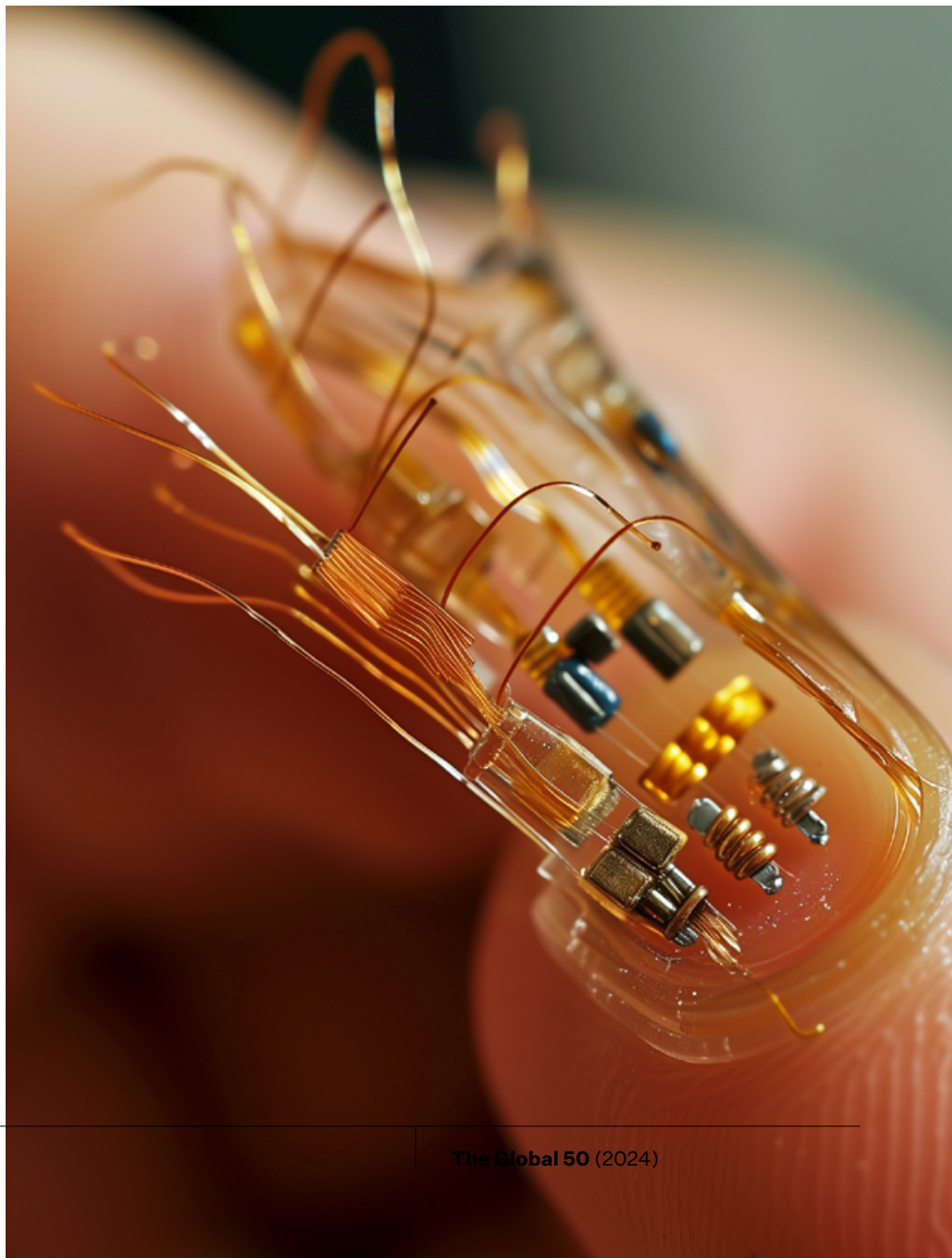
- Biomaterials
- Brain-Computer Interfaces (BCI)
- Immersive Technologies & Wearables
- Longevity & Vitality
- Neuroscience

SECTORS IMPACTED

- Communication Technologies & Systems
- Consumer Goods, Services & Retail
- Data Science, AI & Machine Learning
- Digital Goods & Services
- Education
- Government Services
- Health & Healthcare
- Immersive Technologies
- Infrastructure & Construction
- Manufacturing
- Materials & Biotechnology
- Art, Media & Entertainment
- Travel & Tourism

What if we restored a lost sense of touch?

# AT YOUR FINGERTIPS





## WHY IT MATTERS TODAY

Tactile receptors in the skin have a crucial role in sensing<sup>368</sup> and motor control.<sup>369</sup> Paralysis, diabetes,<sup>370</sup> and multiple sclerosis (MS), as well as tumours, arthritis, vitamin deficiencies,<sup>371</sup> and certain medications and surgeries, can lead to the partial or total loss of sense of touch<sup>372</sup> or peripheral neuropathy.<sup>373</sup> Peripheral neuropathy, a condition affecting some 2.4% of the global population and up to 7% of those over 45 years of age, impairs the peripheral nerves responsible for translating external information into brain signals.<sup>374</sup>

Getting an up-to-date understanding of global spinal cord injuries is not easy.<sup>375</sup> Nevertheless, there were an estimated 9 million cases of spinal cord injuries worldwide in 2019, a 53% increase compared to that in 1990,<sup>376</sup> with the majority resulting from preventable causes such as road traffic accidents, falls, or violence.<sup>377</sup> In the United States, about 5.4 million individuals live with paralysis, affecting nearly 1 in 50 people,<sup>378</sup> and just under 300,000 live with generalised spinal cord injuries.<sup>379</sup>

In terms of disease prevalence, multiple sclerosis (MS), which affects cognitive, emotional, motor, sensory, and visual functions, is caused by the immune system attacking the brain and spinal cord<sup>380</sup> and affects over 1.8 million people globally, predominantly young adults and women.<sup>381</sup> In 2021, some 529 million people globally had diabetes, 6.1% of the global population.<sup>382</sup> The highest rates were observed in Oceania and the Middle East and North African (MENA) regions, at 12.3% and 9.3% respectively.<sup>383</sup> The illness caused 2 million deaths in just 2019 alone.<sup>384</sup> Type 2 diabetes, which accounts for 96% of cases, is predominantly linked to high Body Mass Index (BMI) and this correlation increased by 24% from 1990 to 2021.<sup>385</sup> Projections suggest over 1.3 billion people will have diabetes by 2050.<sup>386</sup>

**Peripheral  
neuropathy affects  
about 2.4% of the  
global population  
and up to 7% of those  
over 45 years of age**



---

## OPPORTUNITY

Battery-powered or wireless power-transferred<sup>387</sup> implantable tactile sensor systems,<sup>388</sup> together with nanomedicine, regenerate the central nervous system<sup>389</sup> to help individuals restore their sense of touch.

Like implanted cardiac pacemakers, implanted devices for glucose monitoring, cochlear implants, and deep brain stimulators for Parkinson's disease, these implantable tactile sensor systems offer solutions for a better quality of life for those affected. These components can be placed anywhere in the body where the loss of sense of touch has been encased in materials such as titanium, alumina, and fused silica, with output from the sensor encoded via brain microstimulation for tactile feedback.<sup>390</sup>

---

## BENEFITS

People suffering from full or partial sensory loss recover their sense of touch, enhancing independence, quality of life, and productivity.

---

## RISKS

Infections at the implant site, technical malfunctions such as disruptions in wireless power systems, and challenges related to sealing, biocompatibility, and the size of the implantable sensor.



Paralysis, diabetes, and multiple sclerosis (MS), as well as tumours, arthritis, vitamin deficiencies, and certain medications and surgeries can lead to the **partial or total loss of sense of touch or peripheral neuropathy**

