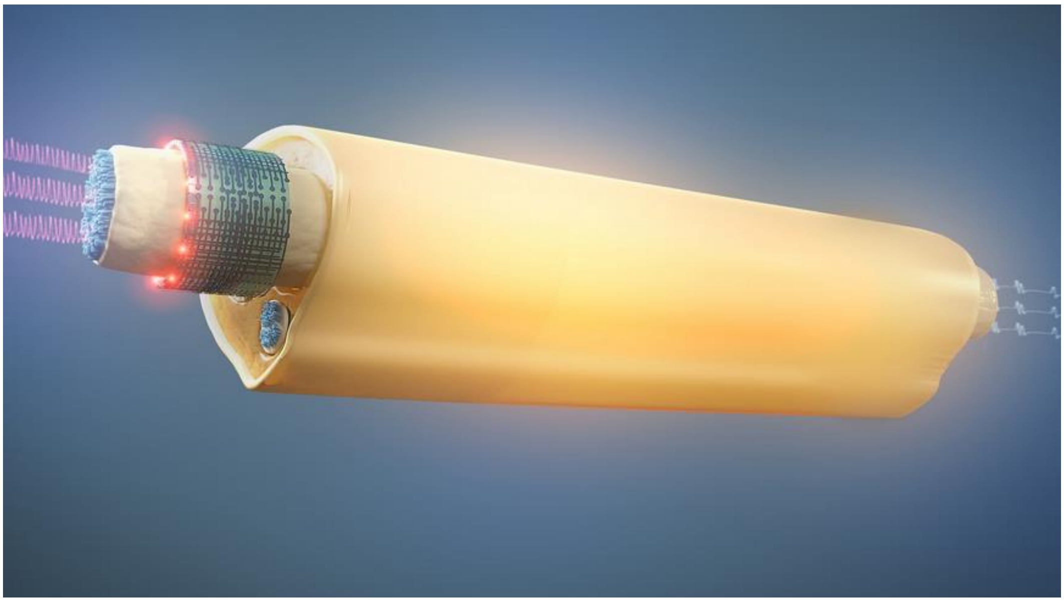
ELECTROCEUTICALS: the 'bonkers' gamble that could pay off for GlaxoSmithKline

In need of fresh ideas, the drugmaker is banking on implantable devices capable of altering electrical impulses in the body



An artist's impression of a bioelectronic implant 'cuff' wrapped around a bundle of nerves.

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Britain's biggest drugmaker, GlaxoSmithKline, under pressure to improve its development pipeline and financial performance, is pinning its hopes on a radical new approach: "electroceuticals".

Also called bioelectronics, the idea is that tiny electronic implants will be able to treat a vast range of chronic diseases, such as diabetes, asthma, chronic obstructive pulmonary disease (COPD), arthritis, hypertension and other heart conditions, and gastrointestinal diseases.

A year after GSK teamed up with Google's parent company, Alphabet, to set up Galvani Bioelectronics, Kris Famm, who runs the venture, is confident that an implantable device capable of altering electrical impulses in the body is within reach.

Several teams of academics are competing for a $1m (£770,000) prize promised by Galvani by racing to develop an implant that can record, stimulate and block neural signals, and are testing prototypes in animals.

“Maybe over the next 12 months we’ll have one [a device],” Famm tells the Guardian in an interview at Galvani’s base in Stevenage, Hertfordshire. It will then be tested in initial human trials involving five to 10 people. The device must be easy to implant in the body via keyhole surgery, as well as being leak- and corrosion-proof and with enough battery power to avoid frequent charging.

Galvani has struck more than 50 partnerships to speed up the development of bioelectronics, but is also working on its own device.

“This is a decade-long endeavour,” Famm says. “From the mid-2020s we should see a wave of therapies that will make this [bioelectronics] much more commonplace.”

Famm believes in a “brave new future” that will mean bioelectronics becomes a mainstay of medical treatment over the next two decades, benefiting up to 2 billion people – a quarter of the global population – who are suffering from chronic diseases. He likens it to the way mobile phones have changed our lives in the past 20 years.

GSK to cut drug development projects to focus on 'winners'

GSK is in need of fresh ideas, having struggled to develop new blockbuster medicines akin to the asthma and COPD drug Advair, once its biggest money-spinner. Its new chief executive, Emma Walmsley, has tightened the company’s research and development focus and scrapped nearly one in seven clinical drug development programmes to focus on the “real winners”.

The company remains committed to pumping £540m into the Galvani venture over seven years alongside its partner Verily, a division of Alphabet. Forty-five people are working for the venture in Stevenage and San Francisco, from data scientists and neuroscientists to neurosurgeons and software engineers.

GSK is the only big pharma company working on the development of bioelectronics, and is competing with a number of smaller firms. Critics argue that bioelectronics is too risky, will take too long and is “a bit bonkers”.

Aside from developing the implantable devices, the other major challenges include mapping the nervous system and understanding which nerves control bodily functions. Famm says some progress has been made but much more work needs to be done.

Bioelectronic devices in the form of a cuff, bristling with electrodes, will be attached to nerve bundles to alter the electrical signals sent between the brain and the other organs in the body. Initially they are likely to be the size of a pill or a pen, but the aim is to make them as small as a grain of rice.

Essentially, it’s a matter of rewiring the body if signals go awry, Famm explains, describing the nervous system as a “switchboard with phone cables going out to different houses”.

"Think of it as a little volume control on a nerve that controls an organ like the liver, pancreas, kidneys or spleen," he says. "By changing the volume, the signals that go into the nerve, up or down, you can control what the organ does: whether it produces less or more of a particular hormone or affects the constriction of the airways."

This will be far more precise than the way conventional drugs work. "There's a real potential for optimisation and personalisation of therapy – controlling just one thing without side effects," Famm says.

But bioelectronics is unlikely to work for cancer, where "typically things have gone extremely awry". Sufferers of brain disorders such as Parkinson's and Alzheimer's and pain conditions will also be disappointed because they affect the whole brain tissue. GSK decided to focus on the peripheral nervous system because the brain is hugely complex, Famm says.

AstraZeneca to make multimillion-pound investment in UK site

Prof John Donoghue, director of the Wyss Center for Bio and Neuroengineering in Geneva, said: "Can you influence nerves? Yes, it can be done." But surrounding nerves with stimulating electrodes to get the right effect is tricky. "I wouldn't call it bonkers but it's a hard thing to do," Donoghue adds. "Making this advance could easily take a decade or more.

"Most people who get into devices don't realise how difficult it is to get to a human trial. There are so many issues you have to worry about. For our first trial we sent 14 boxes of paper off to the FDA [US drug and device regulator] ... And if it works in animals it doesn't mean it works also in humans."

The Wyss Center is working with Brown University and the BrainGate Group in the US on a project to restore movement to paralysed limbs, building on Donoghue's work since 2002. "I'm very optimistic. It's just a matter of time before we have useful devices," he says.