Imagine no drugs
I wonder if you can
No need for surgeries or intervention
A brotherhood of electroceuticals
Imagine all the devices
Sharing all the world...
Subsequently, in diseased states, individual electrical impulses and patterns will need to be identified to elicit the most effective therapeutic response. Finally, electroceutical devices in the form of a cuff, bristling with electrodes, will need to be developed which can be attached to nerve bundles to alter the electrical signals sent to brain on one hand or bodily organs on the other (Fig. 1). These devices might use microchip-controlled electrode arrays and may be powered by electromagnetic energy (heat, light, magnetic), mechanical or even chemical energy harvested from body’s resources. First generation of these devices were available in size of a pill or a pen, but with current technology they have reached the size of a pin-head. However, the future will be micro- or even nanoscale devices.

Simply put, the concept is to first map the nervous system and understand which nerves control which functions and then develop an implantable device to control this function. In diseased states it is a matter of rewiring the body if signals go awry, a kind of volume control (like a radio) on a nerve; by changing the volume of the signals (using the device) it may be possible to control the organ. Any endocrine organ may be controlled this way; islets of Langerhans stimulated to produce more insulin at the time of meal ingestion or dilatation of airways during episodes of asthmatic attacks, just far more precise than the conventional drugs, with a real potential to optimize and personalize the therapy but at the same time with far less side-effects.

4. How are electroceuticals different from conventional drugs?

Therapeutically, electroceuticals score over conventional drugs in a number of ways. Number one, they target neural electrical circuits which are composed of discrete elements; a system of – interconnected cells, nerve fibre network and nerve bundles, thus allowing for precise application of therapeutic effort. The final common pathway of this whole circuit is generation of action potential which itself can be modified allowing for additional control. Thus overall, efficacy increases but side effects decrease because of extreme specificity of response.

5. Electroceuticals in cardiology

Electroceuticals have long been used in the area of cardiology. The first implantable pacemaker was placed into a 43-year-old man suffering from cardiac arrhythmia syndrome in 1958, and the patient went on to outlive his surgeon, Dr Ake Senning from the Karolinska Institute in Stockholm.3 Later cardiac defibrillators were developed and then cardiac resynchronization devices. However, recently vagus nerve has become a focus of interest. Vagus nerve stimulation or vagal nerve stimulation (VNS) is a medical treatment that involves delivering electrical impulses to the vagus nerve. Since the vagus nerve is associated with many different functions and brain regions, research is being done to determine its usefulness in treating a host of diseases; various psychiatric disorders and addictions, neurological disorders, multiple sclerosis, etc. However, in the field of cardiology it has been evaluated in heart failure, atrial fibrillation, coronary artery disease and myocarditis.4,5 Likewise, carotid baro-receptor stimulation has been used for resistant hypertension.6 In area of electrophysiology there will be numerous applications; low-energy multistage electrotherapy for atrial and ventricular tachyarrhythmias, medium-voltage electric therapy for pulseless electrical activity, spinal cord stimulation for refractory angina, and contractility enhancement via cardiac contractility modulation devices.7

6. Limitations of electroceuticals

1. The neural network is too complex to be completely mapped and it remains a challenge to durably, reliably, and non-disruptively address a enormous number of individual neurons, and neural information flowing through these circuits.

2. There is a possibility that the impulses targeted to a specific nerve group may also stimulate the surrounding nerves.

Conflicts of interest

The author has none to declare.

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