Biosensors and Biochips Sense Central and Peripheral Disease
Patricia A Broderick*

Department of Physiology and Pharmacology, City University of New York Medical School, USA

Market growth for biosensors and biochips is virtually exploding. There are markets for biosensing technologies in the Asia-Pacific region which show Compound Annual Growth Rates of 11% (2008-2018) [1]. Growth Rates of 10.7% occur in the highly developed market of the United States (US). In fact, this market is projected to reach 8.5 billion, speaking in terms of US currency, within five years, in about 2018. This global analysis accounts for both the established markets, in addition to the "new kids on the block" within United States, Canada, Japan, France, Germany, United Kingdom, Italy, Asia-Pacific and Latin America. It is noteworthy that the global market includes research laboratories that focus on diagnostic and treatment strategies for brain diseases and or diseases of the periphery, directed and managed by central mechanisms.

Why, the exploding market in nanobiotechnology? It is a "no-brainer"! The scientist continues to delve into and unabashedly attempts to unveil the elusive mysteries of the brain and its exquisite management of peripheral organs. The field of nanobiotechnology is the new nexus of this fascinating world between nanotechnology and medicine. Indeed, the word, neurotransmitter, is the latest household jargon. Depression is spoken of in the vernacular as serotonin deficiency and psychoses is spoken of in terms of "too much dopamine"; these well-known monoamine neurotransmitters are actually sensed via nanobiotechnologies. Biochips, on the other hand, are usually computer-based sensing mechanisms. The field of biochips is part and parcel of nanobiotechnology which interestingly began from the invention of sensor technologies per se and one of the first of these beginning sensor technologies was the Oxygen Sensing Electrode by Leland Clark in 1956 [2].

Biochips encompass a wide range of a variety of research efforts and together with the advent of excellent semi-conductors such as graphene [3], previously huge bundles of computer-based chips can now squeeze into smaller spaces, enabling sensor function to be more diverse. Biochips are made up of two dimensional microarray boxes, consisting of computer microchips, antenna coil capacitors and glass capsules [4]. Sensor biochips, developed at the Technische Universität München[5] can be used to establish whether or not a particular cancer drug is likely to work in an individual patient's body. This sensor biochip is a ceramic version of a biochip, which is 7.5 mm across and packed with sensors that monitor the vitality of living cells. Since it is very difficult to predict whether or not a cancer drug will help an individual patient, these microchips can establish in a laboratory setting, whether or not a patient's tumor cells will react to a given drug, in the future, they may play a role in individualized medicine.

Nanobiotechnology also relates to diagnoses and treatment of brain disease. Enter the fascinating world of carbon. Fullerenes are spherical assemblies of sixty carbon atoms arranged in the same pattern as a soccer ball. A subset of fullerenes includes carbon nanotubes which are hexagonal arrays of carbon that are similar in structure to graphite.

Fullerenes were shown to be neuroprotective in the pathogenesis of Parkinson's disease by alleviating the symptoms of Parkinson's disease. Fullene treatment protected mesencephalic dopaminergic neuron cultures that had been treated with either the neurotoxin, 6-hydroxydopamine (6-OHDA) or the neurotoxin, 1-methyl-4-phenylpyridinium (MPP+), a metabolite of 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine [6].

Moreover, multi-walled carbon nanotubes when filled with Nerve Growth Factor (NGF) promote neurite outgrowth in both dorsal root ganglion neurons and PC12 cells in vitro [7]. Finally, Broderick PROBE and its related biotechnologies present a carbon-based nanobiotechnology that links brain/behavior connections on line, in real time and in vivo. The BRODERICK PROBE is the first clinical nanobiosensor to study brain disease intraoperatively in the epilepsy patient [8-14].

Thus, the exciting field of nanobiotechnology weds engineers and electrochemists with neuroscientists, biologists and pharmacologists and matches experts in electromagnetism with experts in biochemistry and biophysics. The results are producing remarkable interdisciplinary teams of workers fighting to make life more productive and worthwhile by providing diagnostics and therapeutics for the ever besetting frailties of humanity.

References
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