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iBrain Could Predict Drug Side Effects by Measuring Brainwaves

November 19, 2009by **Brendon Nafziger**, Writer

Imagine a device the size of a cell phone that by reading brainwaves can predict drug interactions, diagnose Alzheimer's and depression before a doctor could, and even identify how genetically related you are to someone without analyzing your DNA.

NeuroVigil, a La Jolla, Calif.-based startup, claims the iBrain may one day do all this, and apparently even Big Pharma agrees.

The iBrain, which Philip Low, Ph.D., the founder and CEO of NeuroVigil, demonstrated about two weeks ago at this year's TEDMED conference in California, is about the size of a cell phone. As with other electroencephalography (EEG) devices, it uses an electrode to record brainwaves during sleep (Dr. Low says variability in brainwaves is greater at rest than awake, so the data are more useful).

The difference lies in its scope. Although it only runs on a single channel -- most EEG readers need many more electrodes and only score sleep or sleep apnea -- it produces "maps" that draw a complete picture of the activity of a sleeping brain, providing enough information, Dr. Low claims, that they may identify "biomarkers" from it: unique patterns of arousal that correlate with neuropathologies such as Alzheimer's, schizophrenia, Parkinson's and depression. These biomarkers may even indicate when someone had a pathology before it was fully clinical or the person was even aware of it. This could be of interest, perhaps, to a pharmaceutical company, as it can show whether a drug was having any unusual effects that could be otherwise hard to detect in the relatively small number of patients participating in a brief and early clinical trial.

According to NeuroVigil, it can create this map because their algorithms pick up very high frequency brainwaves that are usually overwhelmed by the higher amplitude, low frequency signals that dominate the brainwave spectrum. By comparing these high frequency signals with data collected from other studies, the researchers can pinpoint the location in the brain that the activity is coming from.

"That's how we can link a particular signal to a particular structure, allowing us to unmask hidden data from the signal," Dr Low says.

And according to NeuroVigil, it is this "map" -- different frequencies at different powers coming from different parts of the brain during different phases of sleep -- that may provide clues to disease and drug effects.

Already, Big Pharma has shown interest. Last month, NeuroVigil announced they had reached an agreement with Swiss drug behemoth Roche, though not much is known about the deal. In light of an existing confidentiality agreement, Dr. Low would not comment on it or talk about what his company would do for Roche.

NeuroVigil is also building what Dr. Low calls a "large database" of brain



The iBrain, made by NeuroVigil, could help predict drug side effects by monitoring changes in brainwaves

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The season of giving is year-long for the Milwaukee, Wisc. Company.

records from patients around the world. Dr. Low, currently visiting MIT, says NeuroVigil and MIT are exploring how to work together on this database. "Our goal is to build the biggest library of EEGs to then screen them for these biomarkers," says Dr. Low. "We could then screen incoming data against the large library of biomarkers to tell if someone's doing fine or having a disturbance in the brain they would not otherwise know about."

The preliminary technology behind NeuroVigil got its start when Dr. Low was working as a graduate student at the famed Salk Institute in La Jolla, Calif. It was there he says he jotted down the business plan at his lab bench. "As a result, NeuroVigil won a quarter million dollars in seed funding on a Wednesday and another \$30,000 dollars three days later," he explains. "The venture eventually got backed by Draper Fisher Jurvetson, Howard Morgan and Irwin Jacobs, co-founder of QUALCOMM," he adds. But besides the "applied science," the "pure science" aspects of the enterprise aren't entirely lost; after all, Dr. Low holds academic appointments at MIT, as well as at Salk and Stanford University.

A New Sleep State?

What ultimately might be the most important basic research finding of his work may not help fill the coffers of Big Pharma -- Dr. Low believes he may have found a new human sleep state.

Some caution is in order, according to Dr. Low: While the paper laying out this data is not published yet, which means the scientific community has not had a chance to really evaluate the evidence yet, Dr. Low did recently report a new sleep state in animals, in an a peer-reviewed article published in the Proceedings of the National Academy of Sciences last year and he did report preliminary data on the possible new human sleep state, in an address at the Annual Society for Neuroscience meeting last year in Washington, DC. If this works out, Dr. Low's discovery could be revolutionary, for by analyzing this sleep stage, Dr. Low says they may apparently do what was only thought possible with sophisticated DNA assays: have a measure of genetic similarity.

As Dr. Low explained at TEDMED, twins appear to have a striking similarity when examined in this sleep state. "There's a very strong concordance," he says. "This is very exciting to us. It means now there may be a way to assess genetic similarity, just with brainwaves."

NeuroVigil has many projects in the works to look at the effect of drugs at very low dosages on the brain. Currently, most brain recording studies in animals are invasive, and require drilling into, for instance, a rat's brain to place an electrode directly on the tissue. "By forgoing very invasive procedures," Dr. Low says, "you make it more comfortable for the animals, of course, and it won't require a tech who has to do brain surgeries." In another presentation at last year's Society for Neuroscience meeting, Dr. Low reported on preliminary results on using advanced mathematics to make the need for invasive work unnecessary.

iBrain Apps

With regard to the iBrain, Dr. Low sees many applications, including in the transportation industry, to help monitor truckers during their long hauls and perhaps alert them if they feel like nodding off. But right now, the business is mostly directed toward discovering the brainwaves that might signal neurological abnormalities, which is why the pharmaceutical companies are, Dr. Low says, "a match made in heaven."

Although NeuroVigil expects iBrain to be a consumer product, for ongoing self-administered neurological check-up, Dr. Low insists that the results would probably have to be sent to a chosen health professional to interpret the data and explain to the patient any risks.



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