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Carnegie prize winner pursues new discoveries

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By Mark Roth / Pittsburgh Post-Gazette

For Edward Boyden, the discovery that light could be used to manipulate the brain was only the beginning.

Mr. Boyden, a researcher at the Massachusetts Institute of Technology, talked about some of his lab's newest ventures Thursday when he received the third annual Andrew Carnegie Prize in Mind and Brain Sciences on the Carnegie Mellon University campus.

Mr. Boyden, who received his neuroscience doctorate at Stanford University, is a co-founder of the field of optogenetics, in which light-sensitive proteins from plants are inserted into animal brains, and then scientists are able to activate or shut down parts of the brain using light beams.

In his Thursday talk, he mentioned two new initiatives his lab is undertaking.

In one, his group has found a new way to image the brain that relies on the same chemical found in absorbent baby diapers. The technique, known as expansion microscopy, embeds brain tissue in a matrix of polyacrylate, the substance that creates superabsorbent diapers. Scientists can tag parts of the brain they are interested in with fluorescent markers, and then when the brain sample is immersed in water, it expands to 100 times its normal volume.

That allows the lab to examine the brain samples in extremely fine detail using a regular light microscope. "By physically blowing the brain up, now we can use reliable cheap optics potentially to scan these objects, so I think we can use it to try to map the brain," he said.

In another development, his lab has found a protein that responds to red light, which might one day provide a treatment for people who are going blind from retinitis pigmentosa, an inherited disease that destroys the light-sensitive cells in the retina.

Three companies are now trying to use optogenetics to cure the disorder, by inserting light-sensitive proteins in the retina to compensate for the photoreceptors that are being lost. Red-light proteins may be especially helpful in this effort, Mr. Boyden said, because red light does not damage human tissue as much as the blue and green light that has been used in other optogenetics work.

"This is an area where you might have red light sensors in the retina that would help the person

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make sense of the world. We don't know for sure what it would do to color vision, but it potentially could help restore their overall vision."

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