How video games inspired a fight against mitochondrial diseases

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Electrical and Computer Engineering doctoral student Arya Mugdha. Credit: Colorado State University

What do video games and medical imaging tools have in common?

Both are driven by the synergy between software, electronics, and physics—the magic sauce behind many modern innovations.

Arya Mugdha, a Colorado State University doctoral student, knows firsthand. Video games are what led him to biomedical research.

Growing up in Bangladesh, Mugdha wanted to understand the science behind video games and the computer hardware that made them possible. "It's what inspired me to pursue electrical engineering," said Mugdha.

Now, his curiosity is feeding research that could one day save lives and improve health outcomes for people suffering from devastating health conditions.

Diagnosing and monitoring mitochondrial diseases without a biopsy

Mughda is working with Electrical and Computer Engineering Professor Jesse Wilson who uses advanced microscopy techniques and laser light to study mitochondria. They are developing the inner workings of a noninvasive imaging tool that could shed more light on mitochondrial diseases, and advance the understanding of how cells use energy.

Mitochondria are the power plants of our cells: They turn nutrients into energy. But when they malfunction, they starve the cells of energy, leading to a host of complications from vision loss to premature death.

Mugdha, Wilson, and their collaborators are leading a new study that leverages the power of transient absorption imaging to enable an unparalleled view of mitochondria functioning in their natural environment inside living cells.

Their technique could lead to noninvasive imaging and treatment of mitochondrial diseases, meaning without the need for a biopsy.

"Potentially, you could put a patient's arm under a laser to diagnose or measure their progress without having to cut out tissue," said Wilson, recipient of the Lisa and Desi Rhoden University Professorship.

Mughda and his fellow researchers are building on findings from Wilson's recent publication that analyzed mitochondria in excised muscle fibers to measure the accumulation of electrons in the mitochondrial respiratory chain. Their study also draws on Wilson's recently published discovery that proved transient absorption spectroscopy is sensitive to effects of Barth Syndrome, a type of mitochondrial disease, on electron transport chain supercomplexes.

"It's fascinating to help build technologies capable of producing these incredibly detailed images of cells," said Mugdha. "The physics in the microscope allow us to see so much more."

After Mugdha earns his Ph.D., he wants to use his knowledge and love for technology to make a difference. "I think there are many opportunities in industry that will allow me to make a big impact," he said.

Provided by Colorado State University