Adding a genetic supertool: Genome Analyzer fuels research dreams and tomorrow's cures

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To identify the hemophilia mutation that affected Queen Victoria and her European relatives, scientific detectives used a cutting-edge "deep sequencing tool." Able to trace rare genetic disease mutations, the tool can turn a single laboratory into a fertile genetic research center.

Now, Tel Aviv University has its own deep sequencer — one of the first in Israel — a Genome Analyzer housed in a new Genome Facility.

The tool will add an important new capability to Tel Aviv University research, including identifying DNA's micro-managers, small micro-RNA that regulate how our genes work. In the world of medicine, it has already uncovered virtually undetectable traces of cancer, and in ecological research, it has been able to sequence the genes of insects to understand how they adapt to different diets in a changing world.

A cure for deafness within earshot

At Tel Aviv University, scientists have ambitious plans for their Genome Analyzer. Prof. Karen Avraham, of the Department of Human Molecular Genetics and Biochemistry, Sackler School of Medicine at Tel Aviv University, is already using it to try to discover the root cause of genetic deafness and make a cure for deafness reachable in the next decade.

"Tel Aviv University will use the Genome Analyzer to rapidly advance genomic research," says Prof. Avraham. "Our focus is on newly identified gene regulators we call microRNAs — the super-stars of gene research in this decade — that act as controllers of gene expression in health and disease. MicroRNAs are believed to control as much as 50 percent of our genes and to regulate many cellular pathways," she says.

"In the work at Tel Aviv University, the deep sequencer provides us with the ability to identify more critical microRNAs — for example, in stem cells, in the inner ear system, and in the RNA that cause susceptibility to viral infection," says Prof. Avraham.

Purchased with a grant to the Tel Aviv University MicroRNA Consortium from the UK-based Wolfson Foundation Charitable Trust, the Sackler School of Medicine and the George S. Wise Faculty of Life Sciences new Genome Analyzer sequencing system and another at the TAU-affiliated Sheba Medical Center hospital give Tel Aviv University the processing power of hundreds of previous version sequencing machines in order to compete with researchers anywhere in the world.

A crystal ball for a cancer cure

This new equipment will affect TAU's work in Life Sciences across the board. "This is a new frontier in science, and it will impact all areas of research that we do -- targeting treatments for cancer and rare and common genetic diseases," says Prof. Avraham, who coordinated obtaining the consortium's efforts.

Prof. Gil Ast of the Department of Human Genetics, Sackler School of Medicine, is another of the pioneering researchers at Tel Aviv University who are using the deep sequencing tool. Among his projects is the exploration of curative possibilities for rare genetic diseases, and unlocking the biology of DNA assembly.

It will be also used by young researchers such as Dr. Noam Shomron, who will also run the facility. Using a deep sequencer tool, Dr. Shomron is working in the rapidly developing area of "personalized medicine", investigating why some patients respond well to chemotherapy while others do not. He is building detailed genetic profiles with the potential to shape specialized treatments for patients and exploring the use of microRNA for "smart drugs" that can target individual and damaged cells.

Provided by Tel Aviv University