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Indian scientist develops computer models to map brain disorders

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A computational neuroscientist at the School of Biotechnology of Amrita University in Kerala has developed a computer model to understand the brain disorders.

Besides neurological disorders, the approach based on accelerated computing platform can be extended to understand cancer, its origin and functional misbehaviour and even infections spread through viruses.

Dr. Shyam Diwakar, Lab Director of Computational Neurosciences and Neurophysiology at the School of Biotechnology of Amrita University in Kollam, Kerala said ultimately, this kind of computations could aid in designing tailor-made drugs.

"In neurology, end condition would be something like that - to design drugs to suit each patient. Some drugs can be predicted from the causes, some could be designed from symptoms and some drugs are basically related to well-studied mechanism in some other region of the body," said Dr. Diwakar in an interview with Indian Science Journal in New Delhi.

Dr. Diwakar said, the computer models are generated using GPUs or Graphic Processing Units, which are much faster to conventional CPUs, to study neurological disorders.

"For diseases, I think this is going to change the dimension where you need to do multiple levels of modelling, multi-scale modelling, where you connect all these effects and that is where these technologies are going to aid in," he said. "It helps building right models, taking data from experiments and putting it into these models to see if these models can extrapolate behaviour, which is not seen from behaviour that can be recorded in a lab."

The principle of computation stems from the fact a disease is not caused by a single source. Every few years new symptoms are being found and the computer modelling helps to plug all these sources of disease and create a kind of wrap up all known causes into unknown causes.

Dr. Diwakar admits, clinician's job will remain preeminent, but the computer modelling will connect the physiological function or disfunction with disorders at molecular and cellular levels for faster and accurate diagnosis and treatment, which hitherto was difficult or time-consuming.

"We reduce the time from discovery to diagnostics, bench to the lab. We are cutting down time, which is very crucial," he explained.

Conventional diagnostics are very very crucial. But in order to support advanced medical sciences and promote new studies that are coming up, advanced clinical tests need to be validated at different levels.

"We can even look at the MRIs or FMRI scans, see whether we can reconstruct the activity or whether our mathematically modelled activity is matching with the real subjects," said Dr. Diwakar. "That

gives an idea, how the disease of the dysfunction in the brain actually progresses."

Dr. Diwakar said, a few other labs in India are also working on computation of disease formations through mathematical formulations, but limited to one particular aspect or the other. He said, these mathematical models rely on calculus extolled by ancient Indian mathematicians, allowing modern biology to be represented by logic and dynamics, which until now was explored by European scientists.