

Researchers design smaller, more cost-efficient electron cryo-microscope

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The new 100 keV electron microscope, which is much smaller than existing high-end models. Credit: MRC Laboratory of Molecular Biology

Researchers have designed a new electron cryo-microscope that is a fraction of the size and cost of current alternatives and used it to

determine 11 atomic structures. The breakthrough aims to slash the cost of running electron cryo-microscopy (cryoEM) to make it more accessible to scientists all over the world.

Increasing access to cryoEM technology will enable the structures of many more proteins to be determined that are important for understanding biology and developing new therapeutics and better health care.

The research, [published](#) in the *Proceedings of the National Academy of Sciences*, was carried out at the Medical Research Council (MRC) Laboratory of Molecular Biology (LMB).

Small, efficient and reasonably priced

Dr. Christopher Russo from the MRC LMB, said, "Current electron cryo-microscopes are like Ferraris—expensive, complex and designed for [high performance](#). What we have come up with is essentially a family hatchback that is small, efficient and reasonably priced. The next step is to get the technology fully commercialized so that it can be used by biologists all over the world. When this project is fully commercialized it will help create [new jobs](#) and have a real impact on the economy."

The first prototypes are expected to be in laboratories by 2024.

The paper describes several key advances, including:

- a new 100 kilo-electronvolt (keV) field emission gun
- a low aberration objective lens with cryobox
- a new high speed, high-efficiency electron detector

These are all designed for efficient structure determination by single-particle cryoEM.

Together these developments mean that an electron cryo-microscope can now be constructed that is far cheaper than current models. It will also reduce the time and effort required for structure determination, even when compared to more powerful state-of-the-art 300 keV microscopes.

Future development

The new lower cost microscope will help set the path for the future development of experimental structural biology and help grow the number of structures being determined.

Dr. Russo says, "This microscope will allow us to see things we could not see before. It will both lower the cost of research and improve results, and have significant long term, lasting impacts."

In their paper, the researchers demonstrate conclusively that it's possible to do as much with modest hardware as you can with much more expensive equipment, and potentially even more. An additional advantage of the new microscope is that it will give scientists more time to study their samples.

Current cryoEM microscopes emit enough radiation to damage samples, meaning researchers must work against the clock to get results. But the new cryoEM [microscope](#) uses far less power meaning scientists will have longer to review their samples before they are damaged.

More information: Greg McMullan et al, Structure determination by cryoEM at 100 keV, *Proceedings of the National Academy of Sciences* (2023). [DOI: 10.1073/pnas.2312905120](https://doi.org/10.1073/pnas.2312905120)

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