

Section of Public Affairs	Mi-Yeon Kim Section Chief (+82) 62-715-2020	Nayeong Lee Senior Administrator (+82) 62-715-2024
Contact Person for this Article	Dr. Tae Joong Eom Advanced Photonics Research Institute (+82) 62-715-3344	
Release Date	2018.12.19	

APRI Dr. Tae Joong Eom's joint research team develops core laser technology for optical medical devices for retinal imaging

□ GIST (President Seung Hyeon Moon) and the Advanced Photonics Research Institute (APRI, Director Hyyong Suk) Dr. Hwi Don Lee (first author) and Dr. Tae Joong Eom (corresponding author) with Professor Chang-Seok Kim of Pusan National University have developed a new laser light source technology for OCT * which can display high-resolution 3D structures and blood vessels of the retina more rapidly and in real time.

* OCT (optical coherence tomography): an imaging technique that uses coherent light to capture micrometer-resolution, two- and three-dimensional images from within optical scattering media

□ As the need for 3D vascular images of the wider retina is increasing, there is active research and development for OCT technology using waveguide laser with a center wavelength of 1.0 m. Although related research is being carried out in many organizations, three companies are monopolizing the medical device market by commercializing wavelength-variable lasers for OCT.

- For high-speed OCT imaging, wavelength-variable lasers are used that repeat the output wavelength of the laser at a very high speed. In commercial lasers, there are many ways to use optical elements that change the wavelength while the components actually move inside the device. Laser light sources that require mechanical motion have low output stability and require additional signal processing techniques in the imaging system for each calibration. Therefore, there is a continuing need for high-speed variable laser technology with better stable output characteristics that can be used in OCT medical imaging devices.
- For this research, a technique known as active mode locking was applied to the waveguide laser in the 1.0 micrometer band to overcome the speed limit of mechanical motion, improve the output stability of the laser, and successfully improve the OCT tomographic image of the subjects' retina to the required clinical level.
- To improve the performance of the related technology, the team changed the structure and modulation method of the laser and developed the necessary core fiber grating device in the laser. As a result, they were able to achieve an imaging depth of 7 mm or more, which is the performance of the OCT required in the medical field, and succeeded in developing a laser output to vary around 1.0 micrometer wavelength, which is suitable for retinal photography.
- The developed wavelength-variable laser OCT technology has excellent stability, allowing for the imaging of even the fine flow of blood in the eyes. The combination of laser therapy equipment and high-speed OCT imaging technology, which has only been used as diagnostic imaging device, enables the treatment of retinal diseases that were previously difficult to treat due to the risk of surgery, pioneering a new field of image-based precision treatment.
- Dr. Tae Joong Eom said, "We have demonstrated the effectiveness of this laser technology by overcoming the disadvantages of the conventional variable laser techniques and effectively showed OCT

images of the human retina. This new laser technology not only presents a new technological alternative to the laser light source market for high-speed OCT but also shows a more accurate vascular structure of the retinal structure."

- The research was carried out with the support of the Ministry of Commerce, Industry and Energy's Industrial Core Technology Development Project and was published in *Scientific Reports*, an international journal of the Nature Group, on December 5, 2018.

⌘