Photonics21 Press Release

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New imaging system to detect bowel cancer at the earliest stages using photonics

Early intervention could prevent many of the 160,000 deaths from colon cancer in Europe each year. Colonoscopies, the gold standard for spotting bowel cancer early, can still miss up to 20% of precancerous cells. But now, thanks to a pan-European health consortium, a new concept that uses photonics to help doctors spot bowel cancer could soon prevent up to half of these deaths and save €9 billion in reduced healthcare costs.

No tools exist that can look inside the colon at the cellular level in real-time to give an immediate diagnosis. But now, this European research team based across Denmark, Germany, the UK, Ireland and Austria is creating a new optical imaging platform that uses harmless light beams to spot the tell-tale signs of colon cancer at an incredibly early stage.

Instead of having a traditional camera inserted into the intestine then surgery to cut away a growth for inspection and analysis, this new optical imaging technique can assist clinicians to avoid unnecessary invasive biopsy by instead peering into the tissue in much greater detail than ever before.

Fitted to an endoscope, the new optical imaging system can give clinicians the power to zoom in on areas of the intestine they identified for inspection. Building up rich 3D images, the new device uses light to make a more detailed examination at incredible speeds.

Screening with Light

First, using conventional white light in a camera, then using more advanced photonics and optical imaging, a doctor can look at the microscopic and molecular levels – switching across the different modalities to look deeper and analyse the tissue further.

To increase the spatial resolution, penetration depth, and molecular sensitivity, the team behind the optical imaging concept, are taking the novel approach of combining several methods, namely optical coherence tomography (OCT), multi-photon microscopy, and Raman spectroscopy. Scientists are already applying these modalities as stand-alone methods in several different applications; for example, OCT is routinely used in ophthalmology for scanning and diagnosing retinal diseases.

The number two cause of cancer deaths in Europe, colorectal cancer (CRC), kills a staggering 160,000 people every year across the continent, but lack of specific, early diagnostic tools and education means just over one-tenth of the population receive adequate screening.

Diagnosing bowel cancer can be a tricky procedure for clinicians: when examining polyps – clusters of cells that form along the ridges of the colon that could go on to develop cancer – doctors can sometimes miss a precancerous growth. When polyps are smaller than 10mm in diameter, multiple in number, or flat in appearance, they are often associated with a higher miss rate. According to a 2017 study, nearly 1 in 5 (17.2%) colorectal polyps were missed during colonoscopies.

Project coordinator Peter Andersen said: "It is tough to discriminate serrated lesions from hyperplastic polyps."

'Google Earth' of Colonoscopies

"A good analogy for our imaging concept is like the Google Earth of colonoscopies: we start with a map of the country and then zoom into a town, then a street, then a building. Similarly, our imaging procedure starts with conventional white light to identify a suspicious area a clinician would like to inspect further. Next, we can zoom into the depth of the lesion using first OCT, then multi-photon microscopy for metabolic information, and finally Raman spectroscopy for molecular information (almost a molecular fingerprint of cancerous cells) to assess the suspected lesion."

"Cancerous cells have a higher metabolism than the adjacent, non-cancerous cells, implying higher blood flow and vessel growth surrounding suspected lesions. Once zoomed in on a lesion at the cellular length scale, we can measure blood flow, metabolism and molecular-specific information to identify cancerous lesions at cellular resolution. Our technology is, for the first time in colon inspections, an all-in-one device and, most importantly, label-free, meaning we do not have to inject a patient with dyes or biomarkers to flag up something suspicious."

"Advancing the combat against cancer by earlier detection of lesions is important. Success in this aspect relies on ongoing and reinforced continued research in lasers and photonics across Europe; results that translate into further improvement of diagnostic capabilities."

Calling themselves PROSCOPE, the consortium has ambitious targets to save up to half of the 160,000 lives lost annually in Europe to CRC.

"Currently, only 14% of the EU population participates in screening programmes due to inconvenient tools and insufficient education or awareness. With early intervention, we could do so much more, save more lives and reduce healthcare costs; PROSCOPE is a crucial step in this journey to tackling this disease," said Andersen.

Concluding in 2024, the PROSCOPE project will conduct future trials at clinics at the Medical University of Vienna. The four-year PROSCOPE project received a grant of €5,999,383.75 from Horizon 2020 under the Research and Innovation action funding scheme. It is coordinated out of the Danmarks Tekniske Universitet in Denmark and includes a mix of technical partners from: Austria - Medizinische Universitaet Wien; United Kingdom - The University Court Of The University Of St Andrews, M-Squared Lasers Limited; Germany - Albert-Ludwigs-Universitaet Freiburg, Grintech Gmbh, Ovesco Endoscopy Ag, Universitaetsklinikum Freiburg, Din Deutsches Institut Fuer Normung E.V.; Ireland - Q4 PR LIMITED

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About Photonics21

Photonics21 is the European Technology Platform (ETP) for photonics, a technology encompassing all products and processes around the emission, manipulation and detection of light. Photonics technologies are integral to many industries, including the medical, healthcare, transport, manufacturing, and telecommunications sectors.

"Photonics21" was set up in December 2005 to bring the community of photonics researchers and industries together. The European Commission defined photonics as one of five European Key Enabling Technologies (KET's) in September 2009. Shortly after, the European Research & Innovation Program "Horizon 2020" invited Photonics21 to become a "Public-Private Partnership" (PPP). The "Photonics 21 Association", a legal entity under Belgium law, became the private contract partner in November 2013 in a Public-Private Partnership (PPP) in conjunction with the EU Commission and will become a Photonics partnership during the current framework programme Horizon Europe.

Today Photonics21 represents more than 3,000 personal members from across Europe and abroad. Our members and stakeholders are experts in the photonics industry, research and innovation organisations, universities, and value chain partners who actively engage with us to develop a joint photonics strategy for future research and innovation in Europe.

With the global photonics market growing from €499 in 2015 to €654 in 2019, light technologies represent an industry with long-term growth potential. Valued at €103 billion in 2019, the European photonics industry has been growing at a solid CAGR of 7 % since 2015 and currently employs around 390,000 people directly.

With optimistic growth forecasts, current industry trends like digitalisation, resource efficiency, individual and zero failure production will further drive the photonics industry.

Photonics plays a significant role in Europe's Digitisation and Technological Sovereignty. It has the enormous potential for solving Europe's societal challenges, such as the instant diagnosis of major diseases, quality food from farm to fork, accident and congestion-free transport, and a truly circular economy.

As a breakthrough key enabling technology that is increasing the competitiveness of European industry, photonics can make a significant contribution to the over-arching European Union objectives, such as the digital transformation of European industry, achieving the European Green deal and a sustainable EU future, and the establishment of a future sovereign and resilient European digital infrastructure.

Contact

W: http://www.photonics21.org

E: secretariat@photonics21.org

T: https://twitter.com/Photonics21

L: www.linkedin.com/company/photonics21