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Make light work for medicine

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A project that supports collaboration between researchers, industry and clinicians is helping Europe become a world leader in this exciting new discipline of biophotonics.

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If you were to ask a physicist what they thought was the most important invention of the 20th century, there is a good chance they would mention the laser. The amazing properties of laser light have been used widely in manufacturing, computing, consumer electronics, and telecommunications. You can use a laser to read a CD or weld a supertanker, send data down an optical fibre or survey a farmer's field for urban development.

Some doctors might have the laser as their top invention too. Light, and laser light in particular, has become a new tool for therapy and diagnosis.

Shedding light on medical science

Biophotonics is a relatively new scientific discipline which is developing applications for light and lasers in the life sciences - for pharmaceutical research, clinical diagnostics and therapy, and even semi-automated diagnostic systems for doctors and nurses. Biophotonics also deals with the prevention of diseases; light can be used for precision monitoring of our environment as well as assessing the quality of food.

This is an extremely broad and interdisciplinary field involving physicists, chemists, molecular biologists and other life scientists, physicians and clinicians. However, the healthy diversity comes with a major drawback: fragmentation. Scientists often work in isolation, unaware of important developments and the complementary expertise of their peers in other disciplines. Clinicians, meanwhile, have clear ideas of what technologies they need, but struggle to access R&D expertise.

With a vision to establish Europe as a world leader in biophotonics, the EU-funded 'Network of excellence for biophotonics' (Photonics4Life, or P4L [2]) has spent four years working to unite researchers, industry and clinicians from across Europe.

'Biophotonics has great economic potential for many European industrial sectors and will have an even greater socio-economic benefit from earlier, more accurate diagnoses and more targeted therapies,' states P4L's Support Officer, Dr Thomas Mayerhöfer from the Institute of Photonic Technology, Jena, Germany. 'However, many developments in the field are predominantly technology driven, and there is not yet sufficient dialogue between scientists, technology developers, industry, and biomedical end-users. These stakeholders must interact more to identify unmet medical needs and to match them with the latest scientific discoveries and technological innovations.'

P4L is Europe's biophotonics hub. It provides support and training for people working in this area and facilitates collaborations between research groups, device manufacturers, biopharmaceutical companies and clinical end-users.

The worldwide market value for commercial biophotonics applications and technologies was about EUR 20 billion in 2008. European companies have a strong market presence, accounting for one third of the production volume worldwide in 2005. 'Europe has so much to gain by building up its capacity, expertise and commercial portfolio in this field,' Professor Jürgen Popp, the coordinator of P4L remarks.

Research spotlight

One of P4L's most significant roles has been to foster collaborative research between European partners, bringing together Europe's best expertise in biophotonics. 'The financial contribution to these research projects is small,' explains Dr Mayerhöfer. 'We cover the cost of travel and meetings for research partners to meet up and often explore the possibility of working together on larger, more long-term projects.'

So far P4L has funded over 34 of these year-long feasibility projects which have covered topics such as the use of Raman spectroscopy for non-invasive cancer detection and diagnosis, and the continuous monitoring of brain oxygenation in preterm babies.

'These P4L projects have really focused strongly on end-user involvement,' Professor Popp is keen to point out. 'We insist that clinical end-users are involved in these small projects right from the outset because we believe that R&D in this field must be clinically relevant. There is no point spending time and money on a project that will have no medical benefit at the end or have no real-world application. The only way to make sure new technologies will be adopted and meet demand is to get the end-

users on board from the very outset.'

Illumination

P4L also provided the sector with a significant range of training and exchange programmes, conferences and communication campaigns. These include materials such as the 'Handbook of Biophotonics' which has helped to promote interdisciplinarity within the scientific community.

An annual summer school has helped to raise the profile of biophotonics across Europe and is highly regarded by biomedical and science students. The event is led by a team of complementary clinical and research-focused speakers who together provide an all-round perspective of the latest medical and technological challenges and breakthroughs in the field.

The network has also funded over 20 PhD students and early post-doctoral researchers through its short term exchange program. These students have enjoyed the opportunity to travel to partner laboratories and facilities to use specialist equipment and learn new biophotonics techniques.

Through local meetings, workshops and 'speed dating' events, the core P4L partners have also established several local clusters for biophotonics researchers and companies. Around 500 participants have been involved with P4L at this local level, many forming new alliances and partnerships and seeking advice on EU collaborations.

The Industry User Club has also been highly successful; it has attracted 27 members so far. The purpose of the club is to provide a direct link between industrial companies, especially SMEs, and academic network partners. The services of the club have been presented at six major trade shows.

Lighting the way

Although EU funding for the P4L network has now ended, the core partners are committed to the cause. They will continue to run networking events, the summer school, and support the work of the industrial club. P4L will also make an appearance at the 'World of Photonics Congress' in Munich in 2013 and at the 'European Conference on Biomedical Optics'.

'We are also already planning an event for next year which will bring all our P4L projects together, so researchers can discover the broad scope of biophotonics and meet other researchers,' says Dr Mayerhöfer. 'Going forward, P4L will act a bit like a broker, helping people to work together and facilitating the translation of research into products, new therapies and diagnostics.'

'We will also continue to push the P4L paradigm of demand-driven research. Already we can see this filtering into other domains of EU-funded research such as the "Photonics21 European Technology Platform" [3]. It looks like this approach will also be an emphasis of the Horizon 2020 research programme. In many ways the promotion of bottom-up R&D is the greatest success of Photonics4Life.'

Link to project on CORDIS:

- FP7 on CORDIS [4]
- Photonics4Life factsheet on CORDIS [5]

Link to project's website:

- 'Network of excellence for biophotonics' project website [2]

Links to related news (CORDIS RCN) and or articles:

- Photonics21 European Technology Platform website [3]

Other links:

- European Commission's Digital Agenda website [6]

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Links
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[2] http://www.photonics4life.eu/
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[4] http://cordis.europa.eu/fp7/home_en.html
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