



Open the Access to Life  
Science Infrastructures for SMEs

**Project No. 619230**

## Smart Book

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<b>Description</b>	<p>This Smart Book of the OASIS project put together at the end of the project is a gathering of success stories coming from the project, of success stories of SMEs which have been participating in the project and with which we have had long exchanges about their experience, of the best of the project's work packages including all workshops and the descriptions of national biophotonics from the brochures. Finally, it gathers many useful links throughout the document and especially put together at the end.</p> <p>The Smart Book will be jointly publicised by the OASIS consortium as a web-based document after the Final Review Meeting on July 12, 2016. The document presented here has no professional layout and is mostly showing the contents. There is obviously still room for improvements and these will for sure be fixed.</p>

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## OASIS SMART BOOK

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## Foreword

This Smart Book of the European project OASIS is a summary of the main activities and gives a little flavour of the impact the project has had on the European biophotonics. We hope that it will be a source of inspiration for technology providers from the fields of photonics and all other fields required to successfully bring new viable solutions to the two main societal challenges addressed by our project, namely healthcare in an ageing society and safer and healthier food. It will hopefully also inspire the end-users in the 8 application areas identified by OASIS. The medical sector is obviously the most important one and a clear majority of the SMEs that the OASIS partners have been communicating with are from that area. However, as we have experienced in our workshops organized in the 9 locations of the consortium, the needs for technological solutions in other application areas, e.g. in agriculture and food quality assessment and tracing open a vast domain for innovations. An important lesson from the last years of promoting the European photonics is that end users and the public at large do not care much about how the solutions look like, they just want solutions! In that context collaboration with intimately connected technologies like electronics, robotics and micro-systems is a must and this is not less true when it comes to the life sciences. Quite often the photonics part of many products is the key element without which nothing would be possible. So our hope is that even technology providers from those fields will be attracted by what is presented in this little book.

The European photonics is getting stronger and stronger in spite of a large degree of fragmentation. It is estimated that about 5000 companies compose the photonics industry. Another rough estimation is that 20% of these companies are active in the life science sector, which makes 1000 companies. Biophotonics is apparently even more fragmented than the overall photonics but its forecasted growth is clearly above average, with a compound average growth rate lying somewhere between 5 and 10%. The OASIS project and its consortium in 7 countries, in which about 70% of the former EC investments in biophotonics have been made, have dialogued with about 200 SMEs and managed to enrol 120 of them in the project's database in the different workshops, studies and other activities of the project.

The OASIS project thanks to the support of the EC has been clearly strengthening the European biophotonics. We expect that more and more European regions will bring an even bigger momentum to this exciting field and follow the example of some of our partners' regions like e.g. Tuscany, Provence Alpes Côte d'Azur or Berlin Brandenburg. The photonics clusters will be instrumental on this way towards higher degree of integration and joined forces in Europe. The OASIS photonics clusters and all others interested to join will for sure continue the collaboration and most likely build a sustainable collaborative structure to make it powerful.

# The OASIS project ([Video](#))

## OASIS – Open the Access to Life Science Infrastructures for SMEs

The OASIS project aims to improve the links between life science facilities, research projects and product development. The previous large investments in biophotonics are made more accessible to SMEs to allow a competitive advantage in new product development and validation.



Large scale research facilities and technology platforms are usually sets of laboratory equipment that are mainly available to academia and *to a certain extent* to industry. It can be very large-scale equipment, unique to a country or a continent as well as technological halls shared by a wide scientific and technological community, which develops competencies in a specific area.

In the field of the life sciences, the management of open access for researchers and world-class research programmes between these facilities is under consolidation through existing programmes like Instruct, EuroBioimaging, Biophotonics Plus and the network of excellence Photonics4Life.

Large companies have established strong collaborations with these facilities. However, there is still room for improving the economic outputs and the involvement of SMEs in order to create more value and jobs from early scientific results.

By February 2015, the OASIS consortium has inventoried and analysed about 120 companies, unmet needs from 14 hospitals and 14 agrifood companies and more than 80 Life Science facilities. Nine workshops are organised at each partners' premise during the life time of the project to promote exchanges and spread the information and results from the project.

### Application areas addressed



Website: <http://www.fp7-oasis.eu>

Coordination and Support Action (CSA) project from FP7-ICT-2013-11 objective 3.2 Photonics.

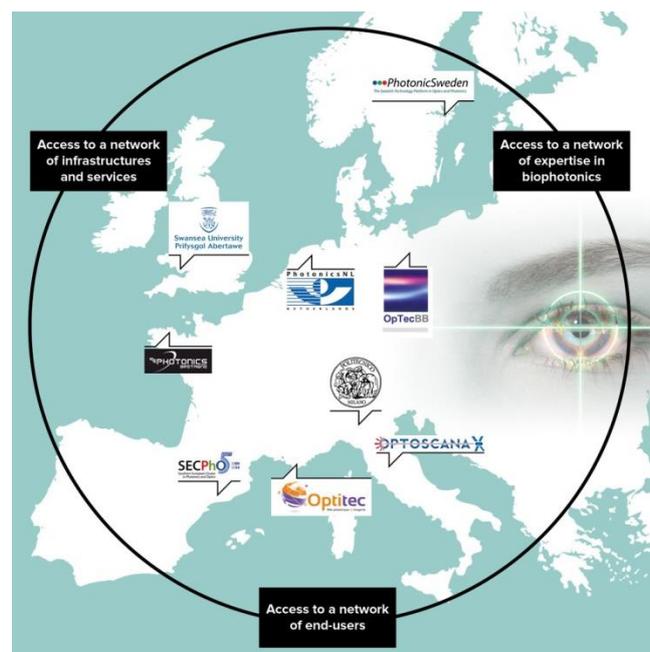
Grant agreement no: 619230

### 9 Photonics clusters involved in the project:

Optitec (Marseille, France); CNR – Optoscana (Florence, Italy); PhotonicSweden; OptecBB (Berlin-Brandenburg, Germany) ; Politecnico di Milano (Italy); SECPHO (Southern European Cluster in Photonics & Optics Association, Barcelona, Spain); Photonics NL (The Netherlands); Photonics Bretagne (Lannion, France) and Swansea University (UK).

Duration : 30 Months (Dec. 2013 to May 2016)

Coordination: OPTITEC, Marseille.



# 1. Activity Report

## 1.1. WP2: Life Science Facilities Opened

Former initiatives, returns of experience and a mapping of facilities interacting with SMEs were identified by each partner of the OASIS consortium.

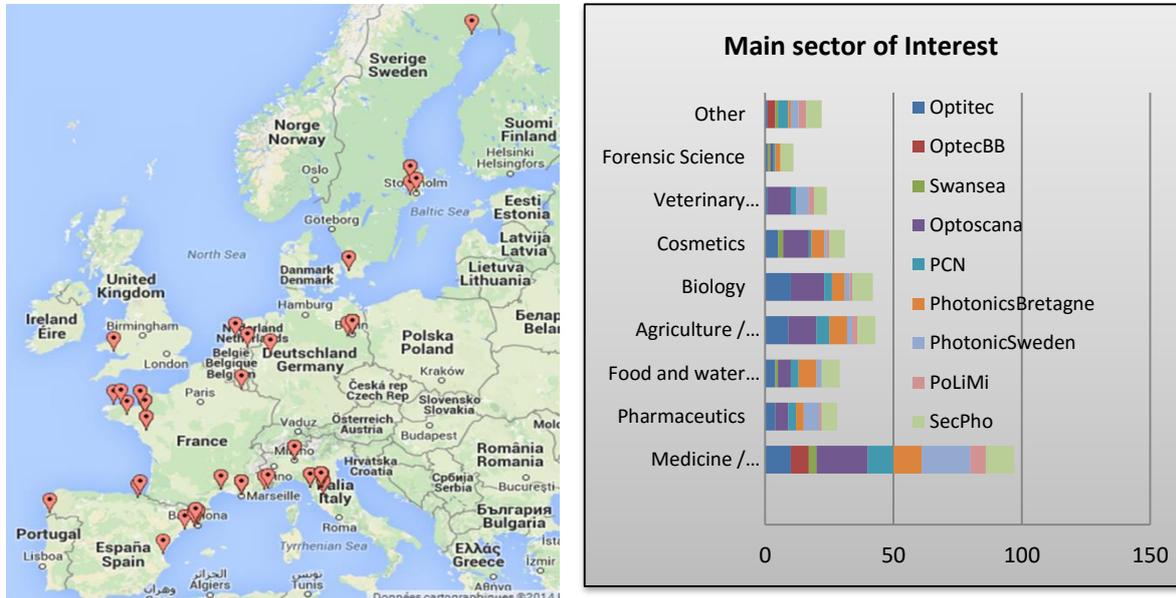


Figure 1: Geographical distribution and specialization of Bio facilities in the OASIS clusters regions.

- Application fields: Mainly related to Medicine and Healthcare. Secondary areas are Biology and Agriculture / Agrifood (see Figure 1).
- Public facilities are part of or very close to Universities. The aim of such type of facilities is to give an access to cutting-edge equipment which are financed thanks to the grants obtained.
- Private facilities (SME, start-up, cooperative, spin-off, etc.) objectives are to generate profits which are used to finance equipment and pay qualified technicians. The main resources come from fees charged for services provided and also include grants for collaborative projects, tax credit for research and venture capital financing.
- Different types of services:
  - Expertise (majority)
  - access to equipment without staff supervision
  - collaborative projects with public or private partners
  - no priority access to the service: customers are treated on a “1<sup>st</sup> come, 1<sup>st</sup> served” basis
- The most critical aspects reported by the facilities collaborating with SMEs:
  1. Confidentiality and Intellectual Property Management
  2. Divergence of objectives
  3. Flexibility

*“We have mostly worked with nonprofit organization, which, by the way, planned their activities just like SMEs, in terms of confidentiality, intellectual property, transfer of knowledge, translational research, subcontract, preclinical/clinical development. We successfully managed to balance our academic ambitions (publications, communications) with their business-focused restriction (confidentiality, protection of IP, etc.)”* **Filipo Minutolo, University of Pisa, Italy.**

- Interactions with other initiatives:



## 1.2. WP3: SME Needs and Mapping

SMEs working in the field of Biophotonics, as well as end users, were contacted by the OASIS partners. They were asked to fill in a questionnaire: this information was used for an analysis showing the characteristics of the European companies in the Biophotonics field and their needs.

The total number of companies and end-users contacted during the WP3 activities are summarized in the following table. The overall number of contacted companies is higher than 250, and the scouting of companies has been continuously performed, as one of the main activity of the OASIS project. During the first year of the project an analysis of the SMEs in Biophotonics was performed, based on 112 participants.

Cluster Name	Count of Cluster Name
OpTecBB	10
OPTITEC	19
Optoscana	21
PCN	10
Photonics Bretagne	11
PhotonicSweden	19
Politecnico di Milano	7
SECPHO	12
SWANSEA UNIVERSITY	3
<b>Total</b>	<b>112</b>

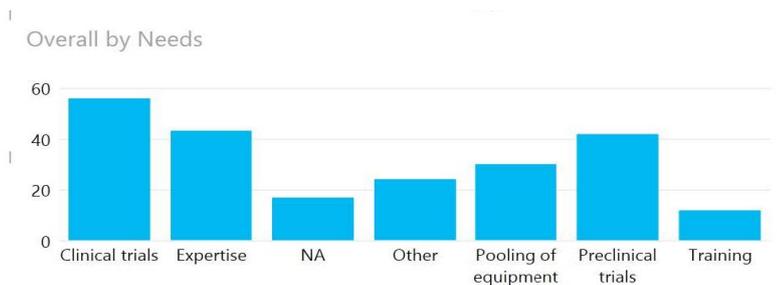
**Table 1: Number of SMEs used for the analysis**

The SMEs that participated to the OASIS activities are homogeneously distributed in the clusters regions, as reported in Figure 2, and only a few SMEs are located outside the clusters regions.



**Figure 2: Geographical distributions of Biophotonics SMEs in the OASIS clusters regions. The radius of the circles is commensurate to the numbers of SMEs in that location.**

The large part of the company are related to Medicine & Healthcare. The first three areas of interest in the OASIS partnership are Biology and Agriculture, after Medicine & Healthcare, and Cosmetics. Veterinary medicine and Food and water safety are present only in six clusters, while Forensic Science is represented only in four clusters. The SMEs were requested to express their needs and the problems they encountered in collaborating with research centers, hospitals and facilities. The requested needs are reported in the following graph ??.

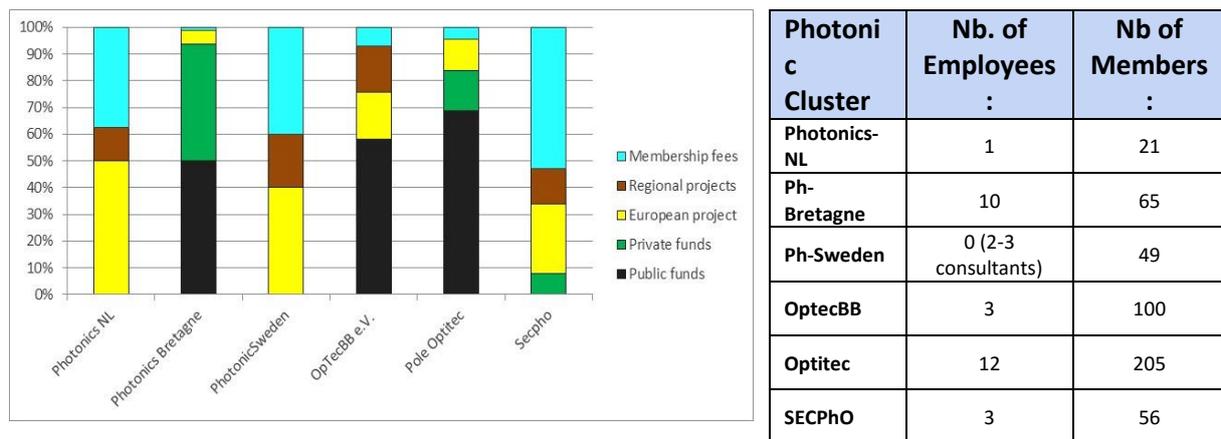


**Graph 1: Repartition of the needs expressed by SMEs**

## 1.3. WP4: Photonics Clusters and their Services

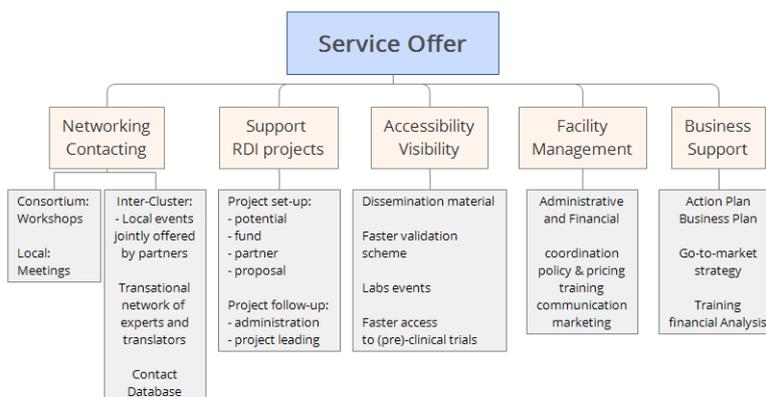
The consortium of OASIS has analyzed the organization and way-of-working of photonic clusters and the services they provide to their members, both in general and more specifically in relation to the biophotonics field.

The photonic clusters which were involved in OASIS are highly diversified in terms of funding structure and volume, type of employees or composition of their members. In fact, two of the OASIS partners, Polimi and Swansea University, were part of an academic organization and not always possible to include in all aspects of the study. One partner was also strongly linked to a research institute (Optoscana). This diversity, which is illustrated for 6 clusters in Figure 3, has been a fruitful source of inspiration.



**Figure 3: (left) share of income (2014). (right) number of employees and members (2014)**

Services from photonic clusters intend to solve, at least partly, the difficulties encountered by photonic organisations in their development and every day business. Many of these organizations are small, often under-critical, and lack appropriate resources in several, usually non-technical, areas. The basic idea is that photonic clusters can provide punctual support that would never make sense to have available in-house in a permanent manner otherwise. In Figure 4 below, the complete range of services is presented together with different possible business models. The collaboration between the photonic clusters is expected to continue in an increasingly integrated manner. This evolution is described in the OASIS exploitation plan.



**Figure 4: Service offer and business models**

### Business Models

- **Membership:**  
Communication/Networking  
Dissemination/visibility material  
Contact Database
- **Facility Management:**  
Access policy, marketing, communication
- **Event Management:**  
End-user workshops, conferences, exhibitions, local events (jointly)
- **Consulting:**  
Project support  
Business support

## 1.4. WP5: Workshops

There were 9 OASIS workshops organised in 7 different countries. The details about each workshop are represented in the table below.

Location	Date	Topic
Barcelona, Spain	October 23 <sup>rd</sup> , 2014	Medicine/Healthcare
Rennes, France	January 20 <sup>th</sup> , 2015	Healthcare/Agrifood
Berlin, Germany	April 21 <sup>st</sup> , 2015	Food and water safety
Florence, Italy	May 21-22 <sup>nd</sup> , 2015	Medicine/Healthcare/Biophotonics
Aix-en-Provence/Marseille, France	November 4 <sup>th</sup> , 2015	Imaging and Biophotonics
Milano, Italy	November 25 <sup>th</sup> , 2015	Ultrafast science and Biomedical Optics
Amsterdam, Netherlands	January 20-21 <sup>st</sup> , 2016	Spectral Imaging for Health, Agriculture & Food, Forensics and Fine Arts
Cardiff, Wales	March 17 <sup>th</sup> , 2016	Laser Sources for Better Healthcare
Uppsala, Sweden	May 19-20 <sup>th</sup> , 2016	Light-Based Solutions for Agriculture, Veterinary and Ecology

Each event had **4 main activities**:

- 1) presentation and visit of the hosting/local Life Science facility (-ies),
- 2) participating SME and facility pitches,
- 3) networking sessions and
- 4) interactive sessions to foster mutual discussions about specific topics and to foster collaboration between participants.

Nevertheless, each workshop was organised in different way and format and included various activities. Below are some of the examples:

- 1) **Exhibition**. Some OASIS workshops had an exhibition area where participating SMEs and facilities could present their products and services: Florence, Marseille, Uppsala;
- 2) Hosting OASIS workshops along other **bigger events**: Marseille (Optitec event), Florence (3rd International Biophotonics Conference), Berlin (week of OptecBB events);
- 3) Workshop **place**. OASIS workshops were held in various facilities: hospitals (Hospital Teknon, University Hospital of Pontchaillou), research facilities (CNR, Polimi, SLU, CERIMED), a museum (Royal Tropical Institute KIT, Amsterdam), science and technology park (Adlershof, Berlin) and innovation hub (Life Sciences Hub Wales);
- 4) Info sessions about EU funding opportunities for photonics in Life Sciences: Interreg programmes, ICT/Photonics/Biophotonics calls in Horizon2020.

Some **statistics** about participation:

- There were **298 participants** and **169 organisations** represented at project events;
- **60%** of attending organisations were **SMEs**;
- Big **End-Users** such as OSRAM, IQE, Philips and El.En.Group participated at the project workshops;
- Besides numerous research facilities and technical universities, there were **7 hospitals, a small organic farm, a museum and 3 regional development agencies** participating at OASIS workshops as well.

All workshop photos can be found on the OASIS Flickr account: <https://www.flickr.com/photos/140982435@N06/albums>

## Barcelona Biophotonics B2B Convention

On 23rd of October, 2014 the first OASIS project workshop "Barcelona Biophotonics B2B Convention" was held at the Hospital Quiron Teknon in Barcelona, Spain. There were 27 participants in total coming from 7 countries.

The workshop was split into two parts:

- an informative session, presenting the 1) OASIS project and its' recent results, 2) hosting organisations (Hospital Quiron Teknon and Institute of Photomedicine) and 3) participating organisations;
- and an interactive, innovation development session, where workshop participants were involved in discussions about innovation topics that workshop hosts prepared. The discussion topics were following:
  1. Methods for tracing gold nanoparticles
  2. Creating a Real femtosecond laser
  3. Building the everyman's multiphoton microscope
  4. Reinventing Sterilisation.



## Rennes Biophotonics Workshop

The 2nd OASIS workshop was held in Rennes, France on 20th of January, 2015. The event was organised in close collaboration with ID2Sante Health cluster from Brittany region. The event took place at the University Hospital of Pontchaillou (Rennes).

There were 35 participants present at the workshop with same ratio of different type of organisations represented (SMEs, research facilities and EU clusters).

The workshop was split into three parts:

- an informative session, presenting the 1) OASIS project and its' recent results and 2) two Smart Specialisation strategies in Brittany and Tuscany with a discussion afterwards;
- later, participating SMEs could present their activity and interest in Biophotonics applications;
- and finally, 6 participating bio-platforms presented their activities and all participants visited 2 of them located in the campus of University of Rennes 1, that were PRISM facilities of functional.



## Food and Water Safety Workshop, Berlin

The event took place on 21st of April, 2015 in Berlin-Adlershof, Germany's leading Science- and Technology Park, one of 15 biggest science parks worldwide. The main topic of this edition of workshop was food and water safety.

There were 45 participants present at the workshop which was split into three parts:

- presentations from german R&D facilities, SMEs and end users that specialize in food & water safety;
- presentation of foreign participating SMEs and research facilities;
- networking session between participants and open discussion.



## Medicine & Healthcare, Florence

The event took place in Florence- Sesto Fiorentino, in the CNR Area of Florence. The workshop took place as a parallel event of the 3<sup>rd</sup> International BioPhotonics Conference 2015.

With the support of *Invest in Tuscany* we offered to the SMEs, members of OASIS clusters, the possibility to participate to the three-day exhibition of the 3rd International Conference on BioPhotonics; the possibility to participate to the exhibitor showcase during the 3rd International Conference on BioPhotonics; a tour of the Tuscany Biophotonics facilities in the Florence area; a tour of the Tuscany Biophotonic SMEs in the Florence area; free access to the 3-day conference.

A total of 157 participants, including 37 invited speakers, registered to attend 3<sup>rd</sup> International BioPhotonics Conference 2015 amongst which there were numerous OASIS SMEs and facilities.



## Imaging & Biophotonics, Marseille – Aix-en-Provence

The event took place in Aix-en-Provence and Marseille cities in France and was co-organized along the international Optitec Event ([www.optitec-event.com](http://www.optitec-event.com)). In total, there were 36 participants registered only for the OASIS workshop in addition to 109 attendees of the Optitec event.

During the morning session, examples of end user needs and successful experiences at EU projects were presented at the premises of the CERIMED research center. Afterwards, a tour to Cerimed labs took place. In the afternoon session, the workshop continued at the Optitec event premises with an info session about biophotonics calls in Horizon2020, participating SME pitches for new collaborations and networking activities that led workshop participants to discuss possible new projects.



## Industry meets Research, Milano

The event was organized by POLIMI at the Chemistry and Applied Physics Departments of Politecnico di Milano on 25<sup>th</sup> of November, 2015. There were 29 participants (SMEs, research facilities, EU clusters and some students during the morning session).

The workshop was split into five parts:

- an informative session;
- SME presentations;
- facilities and research centers activities presentation;
- visit of the CUSBO laboratories;
- and an interactive session, where workshop attendees were involved in discussions about innovation, technology transfer and collaborative strategy to develop between academia and industry to access funding opportunities and new and future market.



## Spectral Imaging. Beyond Vision, Amsterdam

The 7th OASIS project workshop took place on 20<sup>th</sup> – 21<sup>st</sup> of January, 2016 in Amsterdam, Netherlands at the Royal Tropical Institute KIT. Topic of the event: Spectral Imaging for Health, Agriculture & Food, Forensics and Fine Arts.

The event attracted 46 high level invited attendees representing the whole "value chain". This workshop attracted the record number of participants which was achieved through the early and active preparation of the agenda and dissemination activities, the selection of a specific photonics technology as a topic of the workshop as well as 3 specific client industries. Finally, the two-day event format allowed to offer the participating organisations a variety of activities: from key note talks from industry and R&D leaders, to more specific technological presentations, SME pitches, networking and visits of research institute (AMOLF) and Rijksmuseum.



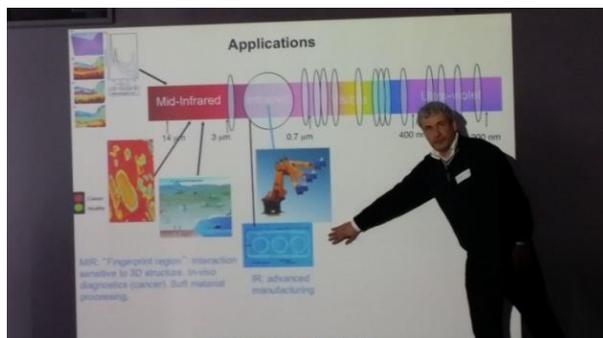
## OASIS workshop Cardiff

The event was organized by Swansea University and co-organised with the Knowledge Transfer Network (KTN) and took place at the *Life Sciences Hub Wales* facilities.

The event was split into 5 parts:

- *Presentations: Light sources and Applications;*
- *Networks and funding opportunities;*
- *Pitch Talks: Companies, End Users, OASIS Clusters, Facilities;*
- *Networking & wrap up;*
- *Social dinner at Cardiff bay.*

*The workshop was able to collect all the Wales facilities that are more focussed on biomedical applications as well as all the main UK and Welsh player: KTN and BIC innovation (with link to the European Enterprise Network).*



## Light Based Solutions for Agriculture, Veterinary and Ecology, Uppsala

The event took place at the premises of the Swedish Agricultural University and was co-organised together with Photonics21 association within the InnoPho21 project. The topics analysed during the workshop were same as the title: photonics applications in Agriculture, Veterinary and Ecology.

This workshop attracted the highest number of participants during the whole project - 60. This was achieved through already previously verified tactics:

- an early and active preparation of the contents of the event and dissemination activities (first dissemination at the beginning of January, 2016);
- the selection of specific workshop topics where photonics is applied;
- the two-day event format held at the end of the week;
- different types of activities: from key note talks from industry and R&D leaders, to more specific technological presentations, SME pitches, matchmaking roundtables, networking breaks and town/facility visits;
- logistically-comfortable location: the Stockholm airport is 18 mins away by train from Uppsala.

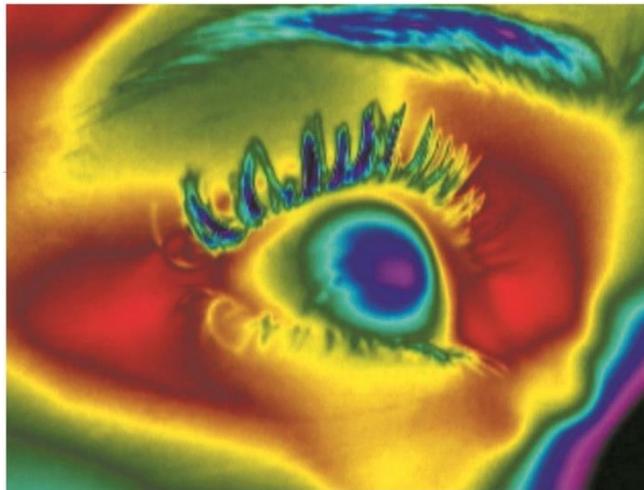


## 2. Impact of the OASIS project

Impact is one of the three main criteria used to evaluate EU project proposals, but the most important. In fact, this criterion has been having a larger and larger importance during the last years for the evaluation and is usually determinant to rank two proposals with the same total score. It is obvious that in many cases the results and their effects have a bigger importance than the people who produced them or the methodology followed to achieve them. In the assessment of the impact of an EU project, there are two main parts:

- A general part looking at: a) The potential impact through the development, dissemination and use of project results. b) The appropriateness of measures for spreading excellence, exploiting results and disseminating knowledge through engagement with stakeholders and the public at large.
- A specific part that is described as *Expected Impacts* in the Calls. The OASIS proposal and project addressed the following two expected impacts:
  - Improve innovation effectiveness of photonics clusters in particular towards SMEs.
  - Broader and faster take-up of photonics in innovative products, in particular by SMEs.

The impact on the photonics clusters involved in the project and other ones in Europe or elsewhere is mostly described in the following documents produced by the project: *Exploitation Plan, New Cluster Services to be Developed for SMEs and Facilities and Business Models of New Cluster Services*.



Photonics, eye-opener (IR-imaging of an eye, Courtesy Acreo Swedish ICT)

Five aspects of the impact of the OASIS project, mostly on SMEs are presented in the next pages:

- 1.1. Networking and New Collaborations.
- 1.2. Partnering for Collaborative Projects.
- 1.3. Contacts with End-Users.
- 1.4. Internationalisation.
- 1.5. Product development.

## 2.1. Networking and New Collaborations

Direct contacts between SMEs, facilities, academics, institutes and clusters during the OASIS workshops and other networking activities performed by the project partners have resulted in many new collaborations.

All OASIS workshops were successful in bringing companies into direct contact. The workshop in Florence was the occasion for many SMEs to present themselves and meet other companies. In that particular case, the success most probably was due to the fact that the workshop took place in parallel with the event of the 3<sup>rd</sup> International BioPhotonics Conference 2015 with a large audience and a company exhibition. The situation was similar in Aix-en-Provence where the workshop was co-organized with the Optitec event and also had a large exhibition. The workshops in Amsterdam and Uppsala were stand-alone events organized during two days and had the largest audiences of all OASIS workshops with 46 and 60 participants respectively, among which about a third of representatives from SMEs. The three first workshops in Barcelona, Rennes and Berlin attracted quite a few SMEs but mostly local ones.

The contacts between SMEs have sometimes resulted in collaborations to develop new products. As an example, a close collaboration between a French and an Italian company has been finalized after the first exchange was engaged during the workshop in Florence in May 2015 after the signature of a non-disclosure agreement. The French company can provide speciality fibres to the Italian company which in its turn can provide well-established optical characterisation techniques for a medical application. There are many other examples of contacts between SMEs facilitated by the OASIS project and leading to the start of collaborations. Following the workshop in Uppsala, a system integrator and the institute Acreo Swedish ICT were discussing a close collaboration to provide solutions to end-users in agriculture. In that particular case, the two parts will probably try to find project financing to make the collaboration possible. The institute provides advanced technologies and the integrator of course its large experience of the end-user needs and boundary conditions.



Meeting between companies and researchers during the Florence workshop exhibition. <http://biophotonics2015.ifac.cnr.it/>



Visiting the Institute of Photomedicine (Instituto de Fotomedicina) at Quiron-Teknon hospital in Barcelona, Spain ([www.teknon.es](http://www.teknon.es)).

## 2.2. Partnering for Collaborative Projects

The OASIS workshops have also been a perfect occasion to build up collaborative projects and to discover and look for appropriate partners. In some cases, the connection between project partners has occurred through the action of the partners of OASIS. For example, one partner sent a sketch of a project idea to the other partners with specific profiling of the missing partners. The search of possible candidates was performed by using the OASIS Database and all other possible connections.

Let us first describe with some details an example where OASIS partners and OASIS workshops have been decisive to set up two new project proposals which have been submitted to the ICT-29-2016: Photonics KET 2016 Call for the topic a) i) Biophotonics. Both proposals have been initiated by researchers from the CNR-IFAC. One proposal was about an eye imaging device, the other one was about photoacoustics detection of skin cancer. The local cluster, Optoscana, was instrumental to find some key partners, thanks to the OASIS clusters contacts. The workshops that were held in Aix-en-Provence and in Amsterdam played an important role: the first direct contacts between possible partners were set up in the framework of these two OASIS events, and finalized afterwards. The partners that were directly involved in the partner search were: Optoscana, Optitec, PNL, Photonics Bretagne and SECPHO.

Since most of these collaborations are in most cases still being built up and only at the stage of an application or at a too early stage to be described in many details, we will here only give a flavour of the contribution from our project in this matter:

- Two Public bodies from Tuscany and Bretagne were gathered in the workshop in Rennes leading to the involvement of the Brittany region in ERANET programme “Photonic Sensing”.
- 3D X-ray imaging of cells under microscope in a collaboration between a university and a company following the workshop in Berlin.
- Project idea from an end-user in agriculture about new methods for traceability in food quality analysis: inspired by workshop in Uppsala.
- Proposal involving an integrator and an institute on lighting technology in agriculture following workshop in Uppsala.
- Two consortia for the Call SFS-05-2017 on “Robotics Advances for Precision Farming” are being built after the workshop in Uppsala.



Participants of the Amsterdam workshop

## 2.3. Contact with End-Users

Contacts of the OASIS project with end-users in the medical and health sector, researchers and even practitioners, has been obvious from the start. This sector is just one among eight application fields in biophotonics according to our definition, but clearly the largest and dominant one in terms of market size. In fact, a large majority of the SMEs in the 9 regions/countries covered by OASIS were addressing that market. As an example, looking at the accumulated turnover of the Swedish biophotonics companies<sup>1</sup>, nearly two thirds is dedicated to the health sector, and the main remaining parts to biology (also indirectly related to health) and food and water safety. The level of activity in fields like veterinary, agriculture, pharmaceuticals and forensics is significantly lower. One possible interpretation is that the potential growth in these fields for biophotonics technologies in Sweden is in fact high, in particular in agriculture (and ecology) and in pharmaceuticals, a traditionally strong sector in Sweden.

Following the inventory of the life science infrastructures relevant for biophotonics and following the dissemination activities (especially the creation of the brochure on the Swedish biophotonics), PhotonicSweden was invited by Karin Artursson, the research coordinator of the National Veterinary Institute (SVA in Swedish) in May 2015, to discuss their needs of new technologies. The meeting was also attended by the chair of PhotonicSweden's work group 3 on Life Science and Health, Ingemar Petermann. As a follow-up of this exciting discussion and visit, PhotonicSweden was also invited to SVA's Research Day on November 17 the same year in Uppsala, and additional fruitful interactions occurred and more needs expressed.

It became clear that the last OASIS workshop, to be held in Sweden, had to be organized in Uppsala in close vicinity of SVA and its large neighbour, the Swedish University of Agricultural Sciences (SLU). The event, which was held on May 19 and 20, 2016, was an excellent occasion to discuss new ideas with photonic solution providers, end-users, researchers and innovators in the fields of agriculture (e.g. the so-called precision farming), veterinary, and even in ecology (environment surveillance). This last event of OASIS has had a large number of leads and follow-ups as can be seen in other parts of this document.



Meeting involving end users, SMEs, facilities and clusters during the Uppsala Workshop

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<sup>1</sup> Note that in Sweden, the companies active in the field of cosmetics have not been included. The turnover of these companies is far from being negligible.

## 2.4. Internationalisation

Internationalisation is of course one of the most important aims of European projects. One idea is that by combining the most suitable actors and resources from different parts of Europe you can realise things that no actors from a single European country or region will be able to do by themselves. Another one is that such projects allow for an efficient exchange of best practices and allow to avoid for “reinventing the wheel” at all corners of the EU. OASIS is a so-called Support and Coordination Action (CSA) project and as such particularly instrumental to an internationalisation of the actors from companies, facilities and academies.

Here are some examples of internationalisation as a result of the OASIS project:

- Links with other biophotonics initiatives: The co-organisation of the OASIS workshop and of the 3<sup>rd</sup> International Conference in Biophotonics in Florence on May 20-22, 2015, was decisive to reinforce the links with the Network of Excellence Photonics4Life lead by Prof. Jürgen Popp and the Micro Photonics Congress, to be held on October 11-13, 2016, in Berlin.
- Links between and with regions and with EU policies: Representatives from the regions of Tuscany and Brittany met during the 2<sup>nd</sup> OASIS workshop in Rennes in January 2015. A result was the involvement of Brittany region in the ERA-NET Cofund Network entitled PhotonicSensing. OASIS has also been an opportunity for a closer collaboration with regions. PhotonicSweden was e.g. invited by the Swedish region Skåne to present OASIS in an ERRIN workshop in April 2016. Regions have also been contacted and enrolled for the ÉPRISE application.
- Exchange programmes between universities: Following the workshops in Amsterdam and Uppsala, the Swedish University of Agricultural Sciences and the Wageningen University in the Netherlands will most probably start an exchange programme for students.
- Involvement of countries/partners from outside the OASIS consortium: Photonics Finland and actors in Finland have been interacting strongly with the OASIS project. Companies and facilities are encouraged to be part of the OASIS Database.
- Spreading of the photonics clusters collaboration: The learnings from OASIS and the exploitation of the OASIS results will be spread to all interested photonics clusters in Europe.



Internationalising OASIS team in December 2013 in Marseille: 7 countries, 9 partners, 10 nationalities.

## 2.5. Product Development

As mentioned earlier, it is not an easy task to report about the development of new products following the actions of the OASIS project. First, the companies involved are for obvious reasons reluctant to disclose any information before the products are successfully brought to the market. Second, bringing new products to the life science markets, not the least in the health sector, takes a lot of time. Much longer time of course than the 3-year lifetime of the OASIS project.

For these reasons, we will below only give one example of product development related to the action of one of OASIS partners, the University of Swansea and the support it provided to the company [Cymtec Ltd](#). It concerns the design of a new tool/instrument as an innovation transfer activity.

The company involved in this story is Cymtec Ltd (Tredomen Business & Technology Centre, Tredomen Business Park, Hengoed, Caerphilly CF82 7FN, UK), that has been contacted during the OASIS activities related to WP3 (questionnaire filling in).

Cymtec NeoLite is a compact LED Multiplexer, which requires minimal alignment for smaller, lower cost light engines. The LED Multiplexer is designed to collimate, colour mix and homogenise high brightness LEDs in étendue restrictive systems. This means that it is possible to create a colour changeable light source with a small emission area and uniform spread of light. This technology is tailored for specific applications ensuring optimal performance. There are many possible applications including Medicine, Biology and Military.

Swansea University is contributing to the characterization of the performance of the LEDs multiplexer and measuring the light beam quality. A seed funding to the national funder EPSR has been recently applied for.



### LED Multiplexer

CYMTEC'S WORLD BEATING TECHNOLOGY

PRODUCT OVERVIEW

What is an LED Multiplexer?

Cymtec NeoLite is a compact LED Multiplexer, which requires minimal alignment for smaller, lower cost light engines.

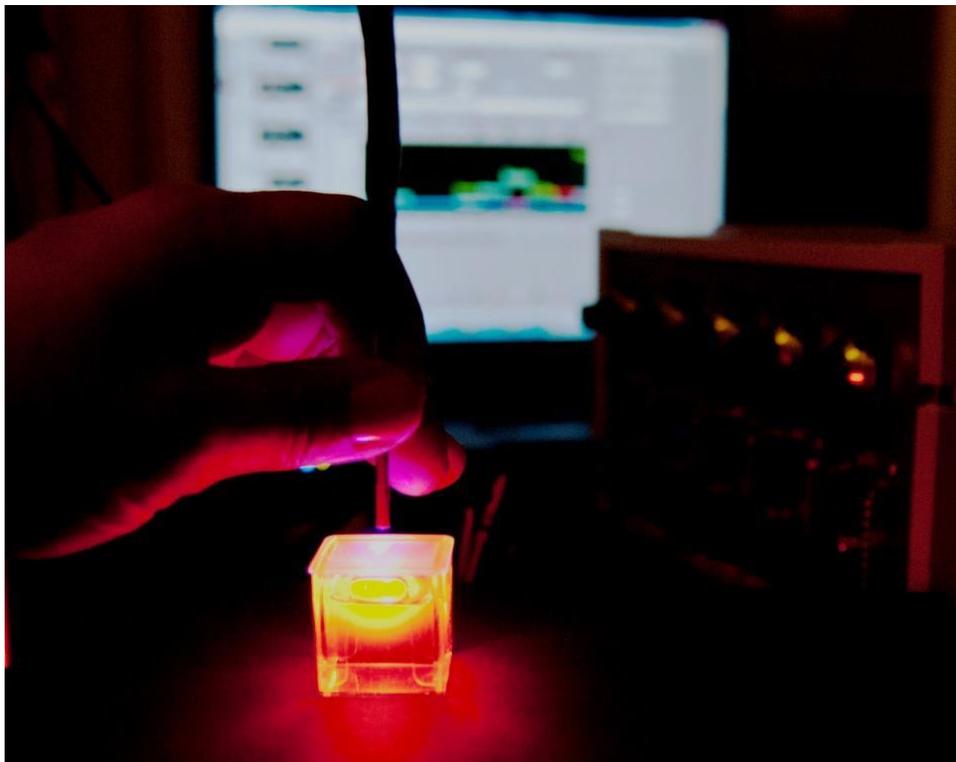
The LED Multiplexer is designed to collimate, colour mix and homogenise high brightness LEDs in étendue restrictive systems. This means is that it is possible to create a colour changeable light source with a small emission area and uniform spread of light. This technology is tailored for specific applications ensuring optimal performance.

<http://www.cymtec.co.uk>

### 3. How Biophotonics SMEs Have Successfully Brought New Products to the Market.

This section is presenting six examples of successful development and introduction to the market realized by small and medium-size biophotonics companies. All these examples describe how the tight collaboration with academic groups, either from the university or institutes, has been playing a determinant role for the successful development of new products. This is of course not typical of the field of biophotonics and similar tight SME-academy links could be described in other fields. What is probably particularly important in the field of biophotonics is that academic cooperation is required both for the development of the technology and for its use in the life science sector (like university hospitals). These examples are also showing in most cases that a successful introduction of new biophotonics technologies takes a lot of time. This is the reason why the OASIS project is not able to present successful introduction of new products fully originating from a collaboration started during the lifetime of our project.

We believe that these examples can be a source of inspiration for new-comers in the biophotonics field. For us, understanding the evolution and the needs of the SMEs is a very important part of our everyday work in photonics clusters.



### 3.1. Claranor S.A.: Pulsed Light Packaging Sterilization – Successful Long-Term Collaboration with Fraunhofer IVV

[Claranor](#) delivers compact in-line solutions for packaging material sterilization, using the technology of pulsed light. Its customers are end-users from the dairy and beverage sectors, and complete line suppliers willing to integrate the technology in their new lines.

The assessment of the technology efficiency is a key to Claranor's success. The validation of the microbiological decontamination obtained with the Claranor equipment has to be done by an independent structure to ensure customers trust.

Claranor has developed throughout the years a relationship with the German [Fraunhofer Institute IVV](#), dedicated to Process Engineering and Packaging. The institute is a recognized expert in the field of microbiology and assessment of surface treatments. It has then naturally become a regular but independent partner for Claranor, working on presales trials as well as inline qualification of the pulsed light treatment. A static pulsed light equipment is now permanently installed at the Fraunhofer Institute.

In this partnership, Claranor gains its customers' trust thanks to the international renown of the Fraunhofer, and has found a reliable and skilled partner, enable to give precious technical advices.

The Fraunhofer Institute, on its side, extends its expertise on surface decontamination treatments with pulsed light and has the possibility to join research projects on the topic thanks to the availability of the static equipment.



<http://www.ivv.fraunhofer.de/en.html>



Pulsed Light Sterilization

[www.claranor.com](http://www.claranor.com)

Video:

<https://www.youtube.com/watch?v=9AwLKzvTLf8>

## 3.2.HemoPhotonics S.L.: Care Solutions of Cerebrovascular Diseases - New commercial venture of ICFO



[HemoPhotonics](#) S.L. spun out of [ICFO, the institute of photonic sciences](#) in Barcelona, in April 2013 after two years of incubation in the so-called [Knowledge and Technology Transfer](#) Launchpad. HemoPhotonics is the fifth spin-off venture of ICFO. This new high tech company introduces a diagnostic tool based on near IR optical monitoring which will allow doctors to better provide care for many cerebrovascular diseases by non-invasively monitoring blood flow in the brain. The technology finds important applications in diseases like stroke which ranks among the leading causes of death and disability world-wide. Improving doctors' diagnostic tools can contribute to better stroke prevention and can significantly enhance future quality of life for patients and their relatives. In addition to clinical applications, this technology promises to be a valuable tool for researchers seeking to gain a better understanding of the brain, all while contributing to the network of new high-tech industries needed to create employment and generate wealth in society.

HemoPhotonics is a result of ICFO's expertise in medical optics and optical monitoring. With the generous support of [Fundacio Cellex](#), the [Medical Optics group at ICFO](#) led by Prof. Turgut Durduran has demonstrated the key role of biophotonics in real-time monitoring and has developed and tested a prototype for monitoring blood flow and oxygen levels in adult patients using photonic technologies.

Hemophotonics won the first runner-up prize in the "Best Innovation by a Multilateral Project, Organization or Company" at the [SPIE Photonics Europe 2014 conference](#). Udo Weigel represented both, the Medical Optics group led by Prof. Turgut Durduran at ICFO-The Institute of Photonic Sciences, and HemoPhotonics for their project, "A portable diffuse optical Neuro-Monitor."

[www.hemophotonics.com](http://www.hemophotonics.com)



Video:

<https://vimeo.com/83866363>

### 3.3. Diafir - Cooperation with Academics works!

DIAFIR develops a versatile and easy to use fibre optic diagnostic tool for healthcare. It offers to the practitioner the power of a rapid, label free diagnosis, without significant training or knowledge in optics required, and to the patient a minimally invasive procedure.

Bringing a highly innovative technology to a practical solution for healthcare requires a close collaboration between multidisciplinary research teams, the laboratory developing the technology and a healthcare application platform.



Figure legend: Diafir sensor within the system

DIAFIR was created in June 2011, more than 12 years after the early work initiated by the Verres & Céramiques research team on the analysis of organic compounds by infrared probe using chalcogenide glass optical fibres. It soon became clear that this highly innovative sensing technology could find relevant applications in the field of healthcare. This work was carried on in close collaboration with the INSERM U991 laboratory, a medical research team specialized on liver pathologies and hosted within the University Medical Center of Rennes. This helped to highlight the relevance of fibre infrared spectroscopy for the analysis of tumor, cirrhotic tissues and gave a green flag for the creation of DIAFIR. It allowed to demonstrate the capacity of the technology on actual medical samples, bacteria and human serum. The development of a robust sensor, with the help of “Verres & Céramiques” industrial partners, opened the path toward a first patent and a commercial product.



Figure legend: Disposable fiber sensor receiving a sample drop

Today, the DIAFIR patented solution provides additional comfort to the patient by avoiding injury or unnecessary hospitalizations. It also helps practitioners to deliver a rapid and robust diagnosis following an easy-to-use medical practice for a growing range of pathologies: Fast diagnosis of arthritis, diagnosis of nonalcoholic steatohepatitis (NASH), analysis of tumoral tissues and bacterial identification.

A key point to create the start-up was the building up of a team gathering a comprehensive set of competences, the initial scientific knowledge and a solid industrial experience.

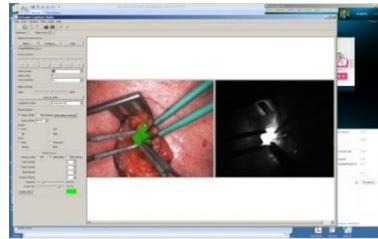
Video (only in French):

[https://www.youtube.com/watch?v=0\\_rF6mQAakE](https://www.youtube.com/watch?v=0_rF6mQAakE)

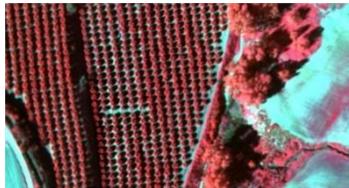
### 3.4. Quest Medical Imaging B.V. - Cooperation with Academics works!



**Multi Hyperspectral Camera for medical applications**



**Sentinel Lymph node detection and removal in the neck at MSKCC, New York**



**Agriculture: UAV-image of an orchard**

[Quest-Innovations](#) develops and manufactures high quality multi- and hyperspectral cameras and dedicated software for advanced imaging applications. The main markets are in science & life science, medical industry, agriculture, industry, defense & security and Unmanned Aerial vehicle (UAV) optimized solutions. Quest manages the medical market with a division called [Quest Medical Imaging](#).

For the translation of technology to solution the cooperation with University or knowledge institute is essential. In 2008 the possibility of attaching a fluorescent particle to tumours and thus showing the edges of the tumour allowing to get it out as a whole without taking out more tissue than necessary, was demonstrated. These particles were only visible with a special camera. With a grant Quest Medical Imaging and Leiden University Medical Center (UMC) started developing both particle and camera. The Camera system is now ready, validated and operational. Quest MI now also works together with particle developers who are getting their probes in trials to get them approved. They need the Quest camera system in the process.

Quest also developed systems combining 2D imaging with hyperspectral imaging used e.g. for showing where one type of tissue changes into another type. But it is also the perfect technique for cameras mounted on an UAV, a technique that will revolutionize precision agriculture. Here as well collaboration with a scientific partner is very helpful, and in this case the WUR (Wageningen University Research center).

To develop medical systems, it is essential to have a relation with a university medical centre able to test and validate the system before commercialisation. After this, clinical validation and feedback on practical use are needed. Small trials to get an indication of applications are also needed and are good to realize in combination with a UMC since they have a need to do their research for publications. The next step, proving that the compelling evidence is significant, is more difficult.

Videos:

<https://www.youtube.com/watch?v=Q-7DdjVVxQk>

[https://www.youtube.com/watch?v=YT5FnvnLC\\_s](https://www.youtube.com/watch?v=YT5FnvnLC_s)

<http://www.mskcc.org/videos/artemis-imaging-technology-new-standard-care-operating-room>

### 3.5. Perimed AB- From an academic success to clinical applications



Perimed develops and manufactures instruments for diagnosis of microcirculation. The Perimed product portfolio contains instruments that measure blood flow in one single point using a laser Doppler technique or over a tissue surface with laser speckle contrast analysis (LASCA) or scanning laser Doppler. Imaging with laser Doppler is realized by scanning the laser beam over the surface, whereas it is realized through direct imaging with LASCA. Perimed instruments usually also contain instruments that measure oxygen and carbon dioxide through the skin (transcutaneous). Perimed instruments can among other things be used for assessing the wound healing potential or for diagnosing peripheral arterial disease.

Since its start in 1981, Perimed has built up a very large and impressive knowledge base on microcirculation by collaborating with many research groups throughout the World. More than 1500 publications and 100 doctoral theses have been generated all using Perimed instruments. These collaborations have also supported the economic development of the company and allowed its gradual move towards the clinical area. Today, more than 50% of the turnover comes from the clinical part. Perimed is a model of organic growth from academic to clinical applications.

The key success factors are certainly the strong collaboration with academic groups in particular in Sweden with the Dept. of biomedical engineering of the Linköping University. The collaborations have brought a validation of the technology, a feedback on what to improve and a spreading among researchers and clinicians.



<http://www.perimed-instruments.com/>

Video: <https://www.youtube.com/watch?v=RUIecMrl05o>

### 3.6. Light4Tech - First Prize for a multilateral project: when research centers and SMEs work together



The collaboration of a team from a Tuscan SME ([L4T srl](#)) and research centers ([CNR IFAC](#), [LENS](#), [INO](#)) resulted in designing a new photocoagulator based on LED technology. The device is used to stop bleeding in superficial wounds (e.g. skin abrasions, oral mucosa bleeding, etc.). The working principle of the photohaemostatic device, [EmoLED](#), is a light-induced coagulative process, that enables an immediate stop of the bleeding by a selective and localized photothermal effect. The light source is a LED emitting in the 400 – 450 nm range: the light is mainly absorbed by the haemoglobin (i.e. the blood) and the effect is a localized temperature enhancement. By optimizing irradiation settings, it is possible to reach the temperature threshold to denature the blood proteins and thus to induce in few seconds a localized coagulation effect. The photocoagulation process is achieved with a process completely different from the natural coagulation processes, and can be applied to anyone, including those suffering from coagulation problems, as hemophilia, von Willebrandt, etc. The EmoLED device has been developed in two different versions: a) the self-medication version, that can be used directly by the patient as a first aid medical tool (treatment of abrasions, replacing plasters or bandages or improving their effect by providing a shorter healing time of the wound); b) a fibre-coupled version, where the direct end users are clinical personnel operating in day surgery, microsurgery, dentistry etc., that could be interested in having a cheap, easy to use, and selective photo-haemostatic device in their clinical settings as an alternative tool to currently used local haemostatic products or to standard laser-based devices.



The portable device was presented at the SPIE Innovation Village 2012, held in Brussels during SPIE Photonic Europe 2012, on April 18th. Light4Tech won the first prize in the multilateral category with the project "Low-cost and easy to use photohaemostatic device based on LED technology".

<http://www.light4tech.com/who.html>

Video: <https://www.youtube.com/watch?v=NMfhjW9OIBw>

## 4. Overview of Regional and National Biophotonics

This chapter provides an overview of the Biophotonics in the different countries and regions covered by the OASIS project. It is basically an extract from the brochures produced for the dissemination activities. The links of all biophotonics companies part of the database can be found in the next chapter.

### 4.1. UK Biophotonics

United Kingdom has a long tradition in Photonics, Healthcare and the Pharmaceutical sectors, with a large number of employees and high-tech companies involved. About one quarter of the over one thousand UK Photonics companies are involved in the supply chain to Healthcare and Life science and several regional and national government (as Scotland and Wales) recognized Photonics as one among other Smart Specialization priorities. On the other side strong investments have been done to support the Pharmaceutical Industry and nation like Wales promoted independent program to develop the Life science sector, with strong financial support to attract investment and companies from abroad. Biophotonics companies and Research centres directly involved in Biophotonics as well as involved in the supply chain are present in all the four British Nations making this field of extreme importance for the British occupational policies.

However since often Photonics and Life science sectors are governed by separated bodies and very often rely on different funding schemes, the interplay between the two sectors has often been not properly supported. In this Brochure, through the support of the OASIS project, we present a brief overview of the type of companies, facilities and associations involved in this field in UK. We focussed on small-medium (but sometime even micro) companies to shows how vibrant the British Biophotonics sector is and how different can be the needs of Biophotonics SMEs. Needs vary from necessity of R&D support from an R&D Centre, to the simple requirements of accessing a specific instrument to the necessity of finding end-users or a specific supplier. Strangely across the full spectrum of interviewed companies, independently from size or product type, there were no need for training. A final remark is on how Biophotonics start-ups are quite appropriate for regions in the phase of economy development (for example convergence areas). This is due to the low cost of photonics components while market may offer added value. A good example of it are small companies successfully operating in the cosmetic area. A few of major larger companies are also listed, particularly when offering logistic support and/or access to equipment to SMEs. A few relevant databases are also listed to demonstrate the spread of Biophotonic activities all across UK.

#### LINKS

short video on nanomedicine

<https://youtu.be/2VcNpl8-PRI>

Vidoe on visible lasers from Quantel (Brittany) for LIFT projects (Swansea included).

The video is about a laser for ophtalmology.

[https://www.youtube.com/watch?v=1\\_f7rpKouco](https://www.youtube.com/watch?v=1_f7rpKouco)

## 4.2. French Biophotonics

Our society is facing various societal challenges such as population aging and growth, environment pollution and food quality and security, among others. The way we address these challenges will become even more critical in the upcoming years. In the last 10 years biophotonics has provided many answers and possible solutions and has been recognized as a field of science and innovation that will play an ever increasingly important role in the future.

With 700 French industrial companies, over 200 system integrators and a turnover of 10,8€ billion, French photonics sector is one of the leaders of the European photonics industry. National research institution such as CEA, INSERM, INRA, INRIA, ONERA, CNRS and engineering schools, recognized at the highest level, play an essential role in the field of research and education.

At a national level biophotonics represents 12 % (1, 3€ billion) of turnover generated in the photonics sector, which is under the European average with 20%. However, it is important to underline that French biophotonics sector is constantly growing thanks to a leading edge research, high level technical skills and a large number of possible niche applications. As a result, a lot of start-ups developing advanced imaging or sensing technologies are being set-up (LLTECH, ImXPAD, Fluoptics, Prestodiag, First Light Imaging, Envolution...).

We present here an overview of the French biophotonics stakeholders, located in some of the French regions: Provence Alpes Côte d'Azur (PACA), Rhône-Alpes, Limousin, Bretagne and Ile-de-France. Most of French biophotonics companies, are micro and small companies with less than 100 employees 10 years of existence and a turnover between 0,5 to 2 € million. However, larger companies and groups are also actively present in the sector: Biomérieux, Horiba Jobin-Yvon, Horiba Medical, Quantel, Eurofins and Super Sonic Imaging.

10 networks & organisations conclude the portfolio of French photonics, with 8 national platforms and 3 regional networks, dedicated to life science, health, biomedical imaging, microscopy, laser and environment.

### **Main assets of French biophotonics**

Photonics technologies are related to two fields:

- Detection techniques, monitoring diseases and minimally or non-invasive treatments.
- Innovations in instrumentation and ophthalmology.

The most advanced research in France includes:

- Instrumentation for medical imaging: endoscopy, nonlinear microscopy, Optical Coherence Tomography (OCT), Raman spectroscopy, linear and nonlinear spectroscopy, adaptive optics applied to the vision and in-vivo microscopy, vision support tools (spectacle lenses and contact lenses).
- No conventional & multimodal imaging: advanced medical imaging system (fluorescence imaging, X imaging, confocal imaging...), Coherence Tomography (CT), Positron Emission Tomography (PET), opto-acoustic, TeraHertz, nuclear imaging,
- Lasers: therapeutic lasers, femtosecond lasers for X-ray imaging, fibered lasers, laser systems Surgical, lasers treatment for eye surgery
- Biosensors, point of care (POC): in situ diagnostics (biosensor, POC), biosensors for diagnosis in vivo-in vitro

### Main disruptive technologies

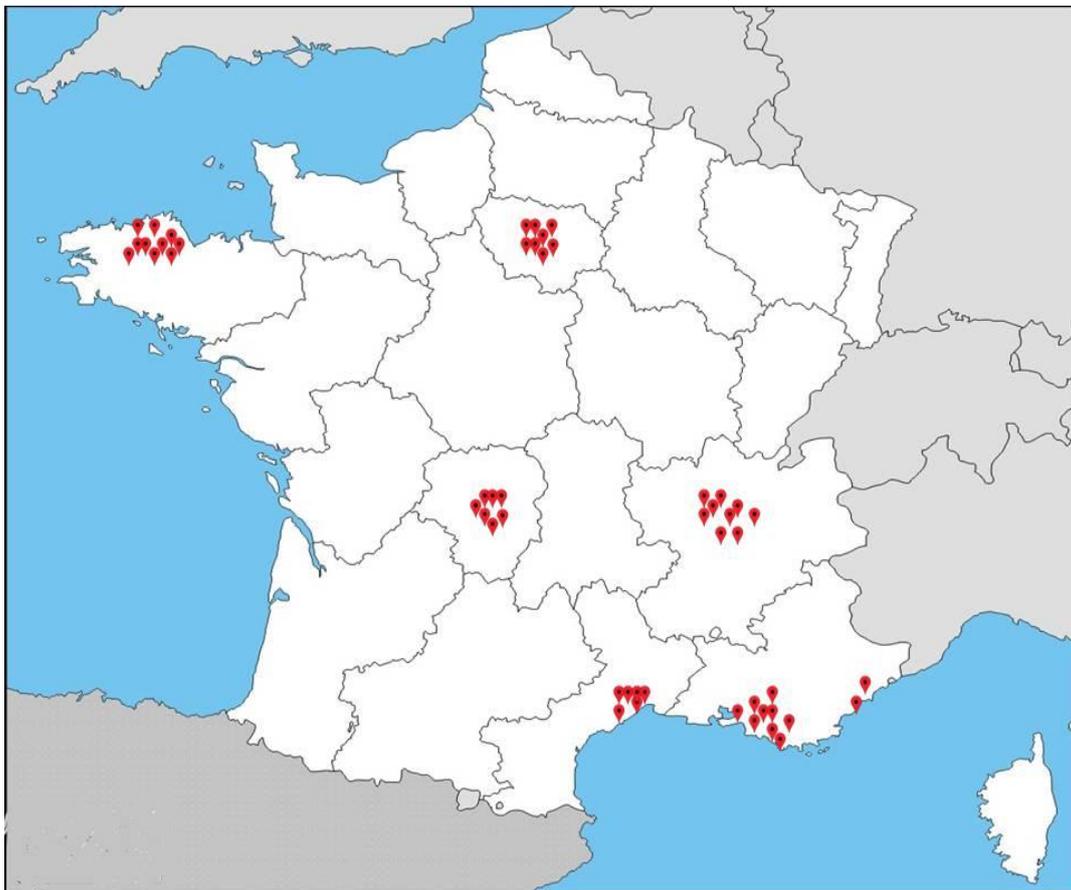
The technologies developed by the French companies in the field of biophotonics, which were interviewed in the framework of OASIS project, are mostly focused on 4 topics:

- Laser and systems, non-laser light (LED/OLED);
- Detector, sensors,
- Camera, data processing and imaging systems;
- Optical fabrication equipment and fibers optics.

The technology large parts of life science infrastructure are related to:

- Medicine and Healthcare,
- Biology
- Agrifood & Agriculture.

French biophotonics public research involves the national research institution (CNRS, CEA, INSERM, INRA, INRIA, and ONERA) as well as the regional and national platform (Cérimed, PEMOA, BNIF, Institut de la vision, Perfos, APEX, PRISM, Microscopy Rennes Imaging Center...).



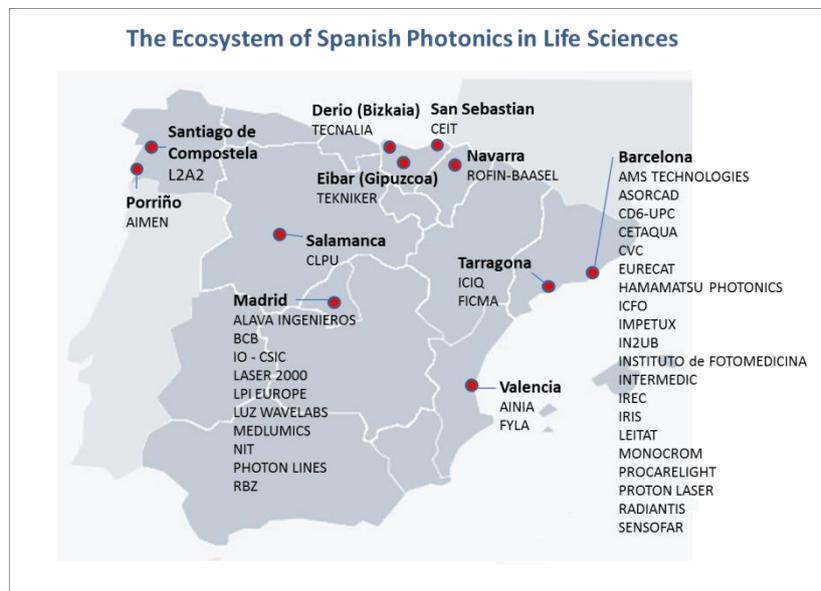
## 4.3. Spanish Photonics in Life Science

### Introduction

This report is based on the analysis of SECPHO cluster members which represent the major part of the Spanish industrial photonics sector with 62 members along the value chain. There are 41 organisations in Spain that identified Medicine, Photonics in Life Sciences, Agriculture or Food and Water sectors to be their major market of interest where their products and services are (or can be) applied. This corresponds to 66% of the whole SECPHO network.

### The current ecosystem in Spain

The main poles of activity are distributed around different areas of Spain. Catalonia, Madrid, Basque Country, Valencia and Galicia represent the most active areas where majority of the actors are concentrated (also seen in the map below).



### Value Chain of Spanish Photonics in Life Sciences

The photonics industry in Spain is represented through the whole value chain in Life Science applications.

#### Value Chain of Spanish Photonics in Life Sciences



### Main areas of application:

- **Dermatology** – specialty with both medical and surgical aspects dealing with the skin, nails, hair and its diseases;
- **Ophthalmology** – the branch of medicine concerned with the study and treatment of disorders and diseases of the eye;
- **Gynecology** – from photonics use in aesthetics applications to surgical tools used in this field;
- **Endoscopy** – a nonsurgical procedure used to examine person's digestive tract;
- **Medical imaging** – the technique and process of creating visual representations of the interior of a body for clinical analysis and medical intervention;
- **Cancer treatment** – covers surgery and radiotherapy where photonic sources are used for cutting, irradiation or illumination;
- **Surgical tools** – usually photonics sources used to cut tissues or in medical imaging and lighting;
- **Sensors for telemedicine/ wearables** – photonics provides key components for telemedicine and wearable solutions;
- **Microfabrication of stents** – cutting stents out of metal sheets using ultrafast laser systems;
- **Sensor systems for planting and irrigation** – analysis of the concentration of different chemicals in the soil;
- **Cattle control** – using imaging techniques (i.e. cameras on drones) to visualize the distribution of cattle in the field;
- **Analysis of various parameters of fruits and vegetables** – various photonic sensor systems enable continuous surveillance of flow of products in production lines;
- **Safety during food processing** – same photonic systems can be configured so that it would detect various parameters indicating if products are safe for consumption or not;
- **Biosensors in food packaging** – development of specific dyes that react with various gasses and other compounds indicating the state of the product inside the packaging;
- **Water quality measurement** – use of photonic sensors and radiation sources for the analysis of water quality;
- **Aquaculture** – illumination used in farming of aquatic organisms such as fish, crustaceans and aquatic plants;
- **Forensic analysis** – use of advanced illumination and chemical characterization systems;
- **Monitoring colonized species, pests and diseases of crops** – various control techniques using photonics for controlling the crops;
- **Improvement of phytosanitary product dosing** – photonic components allow more detailed and accurate dosage in agrofood industry;
- **Surgical equipment sterilization** – UV light source use for sterilization;
- **Detection and correction of visual diseases** – optical components and photonic detection systems allow more accurate and specified detection of various visual problems.

Spanish photonics sector is estimated to reach 4 000 million euros of turnover representing 0.3% of country's GDP and employing over 15 000 people directly. It's importance is recognised nationally and supported in various levels: from providing funding for research and innovation directly to the industry players and universities to supporting national and regional associations and platforms related to photonics such as awarding the SECPhO cluster with the label AEI (Business Innovation Association) or the national technology platform of photonics – Fotonica21. The stable growth is assured by high level technologies developed by Spanish photonics companies and world-wide known research facilities that attract the most promising talent from various countries.

## 4.4. Biophotonics in the Netherlands

### **Remarkable contributions throughout history**

The Netherlands has a rich history in photonics. This long rich tradition started in 1690 with Christian Huygens and his *Traite de La Lumiere*. Huygens was one of the greatest Dutch physicists, a telescope (device) builder and also the founder of the theory of the propagation of light. The first optical device builder was Antonie van Leeuwenhoek, who constructed the first microscopes. The Dutch physicist Frits Zernike received the Nobel Prize for theory of the propagation of light and its application in the phase-contrast microscope. In recent years world class electron microscopes, wafer steppers and space instruments have been developed and built in the Netherlands.

### **Topsector Policy in The Netherlands**

The Dutch government has defined nine topsectors. Through our top sectors, we are stepping up our efforts in areas that show major growth potential and in which we are already achieving solid results. The most important topsectors where Biophotonics plays an enabling role are High Tech Systems & Materials, Health & Life Sciences, Horticulture and Agro & Food.

### **Biophotonics in Life Sciences & Health, Horticulture and Agro & Food**

Today, the Netherlands remains a major player in the global Life Sciences and Health industry, with a strong technological position in Biophotonics in the complete value chain. The Dutch sector owes this position to collaboration, cooperation and coalition building between businesses, research institutes and universities, supported by government, linking research to product and business creation.

The Netherlands counts 10 universities with a medical center where Biophotonics play an important role in the research programs for Life Sciences & Health. The research at these universities is more application driven in developing new instruments for medical diagnosis and therapy. Just some examples of “State of the Art” research areas that already have led to new innovative products are hyper spectral camera’s for early and non-invasive diagnostics, forensic research at the crime scene and fiber optic sensors for non-invasive blood analyses.

Besides these universities we have the Delft University of Technology (TUD), the Eindhoven University of Technology (TU/e) and Twente University (UT). The research at these universities is more technology driven in finding and manufacturing new photonic components in a broad sense. A ‘State of the Art’ example is the development of advanced Photonic IC’s (PIC’s) for sensing (UT region) and ICT applications (TU/e region). Imagine, a complete spectrometer on a chip!

Besides the universities there are several other research institutes where Biophotonics is an important research topic and especially on the nanoscale (e.g. Physics of Biomolecular systems and Nanophotonics). The most important institutes will be described in this brochure. In the topsector Horticulture and Agro & Food the Wageningen University & Research Center (WUR) takes a unique position. WUR is a world-renowned center that combines fundamental and applied research with innovative education in the areas of food, agrotechnology, production systems, nature and the environment.

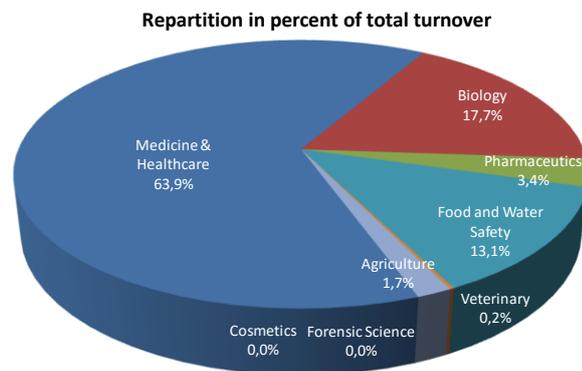
The Netherlands has more than 120 photonic companies. About 30 companies are directly related to Biophotonics. In this Oasis-brochure 16 companies will be described.

## 4.5. Swedish Biophotonics

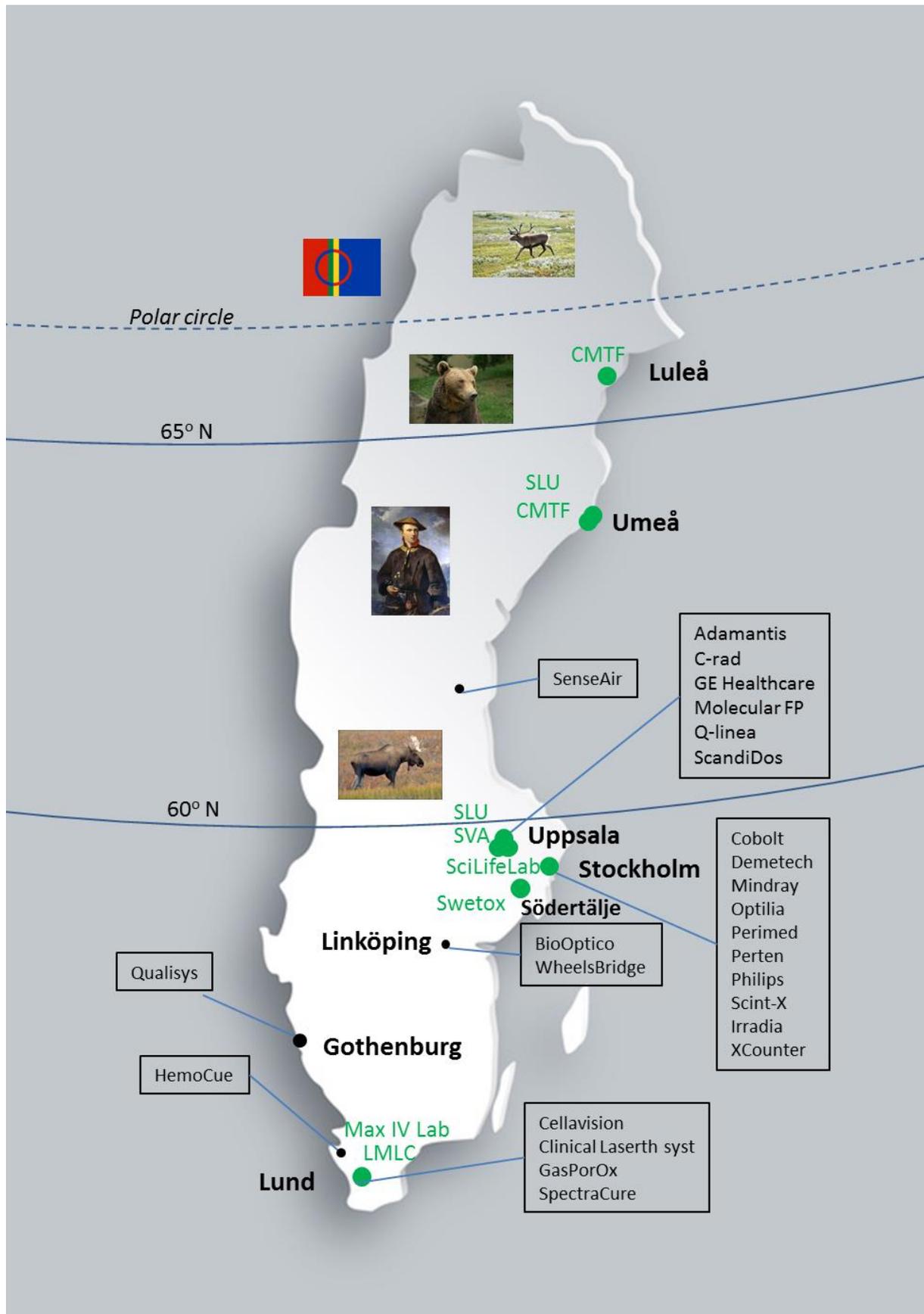
**Life Science:** Sweden is the home of Carl von Linné and his cataloguing of the world's flora. It is also the country of several very important innovations in the life sciences such as e.g. the pacemaker, the gel filtration chromatography, the hemodialysis, Losec® and the lidocaine. The dynamic environment found in Sweden is also part of the very important human proteome project and a famous researcher from the Royal Institute of Technology (also affiliated to SciLifeLab), Prof. Mattias Uhlén, is responsible for the Human Protein Atlas program with the ultimate goal to characterize the expression, localization, modification of all the human proteins. Several leading global Life Science companies have established themselves in Sweden. The organisation SwedenBio estimates that about 30,000 people work in around 800 companies in the Swedish Life Science which stands for around 20% of net exports. It is probably worth mentioning that the Karolinska institute (KI), which is also part of the SciLifeLab, is by far the highest ranked academic environment in Sweden. In the Time Higher Education world university ranking 2014-2015, KI is ranked 44 as a whole and ranked 8 (first in Europe) by QS World university rankings by faculty (Life Science and Medicine). Life Science is a very important field for the largest regions of Sweden, before all the region of Stockholm-Uppsala region, but also Scania (Skåne) and the region of Gothenburg. Life Science is part of their regional strategies and in some cases integrated in the Smart Specialisation Strategy effort at the European level.

**Biophotonics:** The work group 3 of PhotonicSweden on the life sciences and health has been inventorying the Swedish actors for the Photonics research and innovation agenda published in December 2013. There are nearly 40 biophotonics companies and all of them have been approached by OASIS. The Figure beside shows how they address the targeted OASIS applications. In addition to these companies for which biophotonics is at the heart of their product, about 20 more companies have an important but not main part in biophotonics.

Most of the nearly 40 biophotonics companies are, or before acquisition by a large company, small- and medium-size enterprises (SMEs). Nearly all companies, even the large ones have seen their start in Sweden. The four largest companies are GE Healthcare Life Sciences AB, > 1600 employees among which about 200 work with biophotonics (which is based on the acquisition of Biacore AB by GE Healthcare in 2006), Philips Digital Mammography about 100 employees (Sectra Mamea acquired by Philips in 2011), Perten Instruments AB, about 250 employees (acquired by the American company Perkin-Elmer in 2014) and HemoCue AB, over 300 employees (presently owned by the Danish company Radiometer AS). The academic research and the collaboration with universities and institutes are at the origin of most, if not all, of these biophotonics companies. The couple Katarina and Sune Svanberg should have a particular mention here. Katarina and Sune Svanberg are both prominent researchers and professors from the university of Lund, Katarina in medicine and Sune in lasers and spectroscopy. They are, together with Prof. Stefan Andersson-Engels, at the origin of several companies (e.g. SpectraCure and GasPorOx) and of a very strong academic research in biophotonics (see the LMLC, Lund Medical Laser Centre). If a majority of the employees in the Swedish biophotonics companies are active in the application area medicine and healthcare, there is an incredible diversity of products from laser surgery and other kind of treatments to all sorts of diagnostic techniques.



Repartition of the biophotonics companies in the 8 applications addressed by OASIS in terms of turnover



Map of Sweden indicating the Life Science infrastructures (in green) and companies collaborating with OASIS. Only headquarters are indicated for companies.

## 4.6. Berlin and Brandenburg Photonics<sup>2</sup>

### Excellence in Photonics and Microsystems Technologies

There is a long tradition of optical technologies in Berlin Brandenburg. Their roots go back into the early 19th century and still today they are an important economic sector in the region. However, micro-system technology is a relatively young economic sector. It symbolically represents the demands of global competition that innovative products are facing: smaller, more powerful and more cost-efficient. That way, Berlin and Brandenburg and the Photonics Cluster are merging tradition and modernity with its optical technologies and micro-system technology. This builds the foundation for a sustainable development of the regional companies and the creation of new jobs in the sector and its numerous areas of application.

The innovative core of the cluster is represented by 390 technology companies (298 in Berlin and 92 in Brandenburg) as well as 10 universities and 26 non-university research institutions. From that, 11 are located in Brandenburg and 25 in Berlin. 16,600 employees are working in that core – a peak value in international comparison.

What distinguishes the Photonics Cluster in Berlin and Brandenburg from other photonics clusters is its strong scientific basis and the high number of specialized small and medium companies with wide-ranging know-how. This creates ideal conditions for a reciprocal transfer between science and industry and is at the same time a driver for innovation in different sectors. Globally, this highly dynamic development makes the capital region one of the leading photonics locations in Germany, in Europe and even worldwide. Over 4,000 newly created industry jobs in the last 10 years, an annual growth in sales on an average of 8%, an export share of 68% and a share of almost 17% of the total turnover that goes into research and development underlines this fact.

With OpTecBB e.V., Berlin Brandenburg offers an unparalleled industry platform for optical technologies and micro-systems technology. It acts as the central contact and coordinating agency for research experts, manufacturers and users of optical technologies and micro-systems technologies and has set itself the goal of effectively networking between industry and research in Berlin Brandenburg and to lobby for good framework conditions.

### Core areas and competences

Presently OpTecBB has the following technological focus groups that are derived from the competencies present in the region and that specify the profile of Berlin and Brandenburg in the academic and industry landscape of Germany:

- *Biomedical and Ophthalmic Optics,*
- *Laser Technology,*
- *Lighting Technology,*
- *Optics for Communication and Sensors,*
- *Optical Analytics,*
- *Micro Systems Technology.*

In a high tech industry like optical technologies and micro systems technologies education and further education become more and more important. This includes the young academic but also the secure access of companies in the region to qualified work forces. For this reason OpTecBB is engaged in provision of internships, the support of schools in partnerships, guest lectures, days of open doors and company visits. It is the aim to draw the interest of young people to the natural sciences so that it may become the basis for an apprenticeship and a work life in this exciting industry.

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<sup>2</sup> Overview of biophotonics in these regions not available at this date of publication.

## 4.7. Biophotonics in Italy (mostly Tuscany)

Tuscany is traditionally a seat of a product chain in the fields of Photonic and Optoelectronic technologies, with a particular vocation in Biophotonics. This area offers a unique concentration of scientific know-how in the field, represented by Departments (Medicine and Surgery, Physics and Engineer) of the five regional Universities (Florence, Pisa, Siena, Scuola Normale, Scuola Studi Superiori Sant'Anna), Research Institutes of the CNR, such as IFAC (Institute of Applied Physics) and INO (National Institute of Optics) and other like LENS (European Laboratory of Nonlinear Spectroscopy). Besides, the industrial sector of Biophotonics is well developed with about 40 companies, which include important international players. The Regional Government of Tuscany has been in recent years very sensible to the development of research programs and networks on Biophotonics. Within the frame of the FP7 ERANET+ Program called BiophotonicsPlus, Tuscany has supported the participation of regional companies and research centres to six transnational projects in cooperation with other European partners. Moreover, since 2011 the Regional Economic Board has established the Tuscan Pole of Photonics OPTOSCANA to manage the innovation and technology transfer to enterprises, including those of the Biophotonics field. In this regard, in 2013 OPTOSCANA was commissioned by the Region to carry out a Smart Specialisation Strategy survey and a Foresight study, which identified three main technological Biophotonics areas:

1. Photonic devices for minimally invasive surgery and therapy These medical devices are based on lasers, LEDs and high power lamps, developed with the support of robotic technologies, characterized by minimally invasiveness to the patient and therefore potentially capable of reducing hospitalization costs. EI.En. Group based in Florence is a major player in international medical laser with about 200 MEuro of turnover and about 1000 employees. It includes Cynosure (USA), Asclepion (GE), Deka, Quanta and Elesta (IT) and competes with multinational companies such as Lumenis, Spectra Physics, Cutera, etc.. Other players are e.g. General Project (medical lasers) and Light4Tech (LED medical systems and microscopy). Common characteristics of this sector are a large export rate and investment in research of 7-8% of the turnover.
2. Devices for self-medication and point-of-care diagnostics. These are miniaturized and integrated devices for fast and highly sensible analyses, such as lab-on-chips, potentially scalable to low cost production. It is hard to map the main players in the industry, which are represented mainly by start-ups and small HI-TECH enterprises. Nevertheless the market is constantly changing and is facing a considerable potential for growth, since it can be increased by at least one order of magnitude when devices at low cost will be available for mass use.
3. Equipment for diagnostics, imaging and advanced new microscopy for early diagnosis. These are devices for optical and ultrasonic imaging, sensors for biomedical use, and systems based on new pre-commercial microscopic techniques. All these tools can provide early diagnosis of widespread diseases, such as cancer and aging-related ones (eye diseases, cardiovascular, etc.). In the field of ultrasound imaging, ESAOTE from Florence is among the major global players, with competitors such as VisualSonics (Fujifilm Group, CA). In the field of ophthalmic diagnostics, C.S.O. is the largest world manufacturer of slit lamps, which can be equipped with other medical systems like lasers for retinal coagulation and OCT for corneal and retinal imaging, competing with companies like Zeiss. The magnitude of this potential market is globally very large for ultrasound imaging systems (\$6 billion worldwide), while it is more than ten times smaller for optical and optoelectronic diagnostic devices.

## 5. Useful Links

### 5.1. Diverse Links and Videos

- [OASIS website](#)
- [OASIS Video](#)
- [Introduction to Biophotonics \(Video St:Andrews Univ.\)](#)
- 
- OASIS partners website:
  - [Optitec](#)
  - [Optoscana](#)
  - [PhotonicSweden](#)
  - [OptecBB](#)
  - [Photonics NL](#)
  - [SECPhO](#)
  - [Photonics Bretagne](#)
  - [Swansea University](#)
  - [Politecnico di Milano \(Polimi\)](#)
- Network of Excellence: [Photonics4Life](#)
- [European BioImaging Platform](#)
- [In2Lifesciences](#)
- [European Infrastructure for Translational Medicine](#)
- [ACTPHAST - Access Center for Photonics Innovation Solutions and Technology Support](#)
- [Bio Optics World \(Magazine\)](#)
- <http://toolsofscience.se/>
- [ERANET Programme Biophotonicsplus](#)

### 5.2. Companies (and in some cases also end-users)

#### 5.2.1. France (mostly PACA region and Brittany)

##### French companies involved in OASIS:

Company	Website
AIRYLAB	<a href="http://www.airylab.com/">www.airylab.com/</a>
ALPAO	<a href="http://www.alpao.com/index.htm">www.alpao.com/index.htm</a>
ATHEOR	<a href="http://www.atheor.com">www.atheor.com</a>
BERTIN TECHNOLOGIES	<a href="http://www.bertin.fr">www.bertin.fr</a>
DIASYS TECHNOLOGIES VA	<a href="http://www.diasys.fr/compagnie/diasys-international/">www.diasys.fr/compagnie/diasys-international/</a>
ENVOLURE	<a href="http://www.envolure.com/">www.envolure.com/</a>
HORIBA ABX SAS	<a href="http://www.horiba.com/fr/medical/">www.horiba.com/fr/medical/</a>
IMAGINE OPTIC	<a href="http://www.imagine-optic.com/">www.imagine-optic.com/</a>
INDATECH	<a href="http://www.indatech.eu">www.indatech.eu</a>
LIGHT TECHNOLOGIES	<a href="http://www.light-technologies.fr/">www.light-technologies.fr/</a>
RMS SIGNAL	<a href="http://www.rms-signal.com">www.rms-signal.com</a>
SILIOS Technologies	<a href="http://www.silios.com">www.silios.com</a>
SOPRO	<a href="http://www.acteongroup.com">www.acteongroup.com</a>
SUPERSONIC IMAGINE	<a href="http://www.supersonicimagine.com">www.supersonicimagine.com</a>
SYNAPSYS	<a href="http://www.synapsys.fr/">www.synapsys.fr/</a>
XT VISION	<a href="http://www.xt-vision.com">www.xt-vision.com</a>
MEODEX	<a href="http://www.meodex.com/">www.meodex.com/</a>
CLARANOR	<a href="http://www.claranor.com/">www.claranor.com/</a>
FIRST LIGHT IMAGING	<a href="http://www.firstlight.fr/?lang=en">www.firstlight.fr/?lang=en</a>
ARCHIMEJ TECHNOLOGY	<a href="http://www.betabioled.com">www.betabioled.com</a>
KAMAX Innovative System	<a href="http://www.kamax-innovative.com/">www.kamax-innovative.com/</a>
LEUKOS	<a href="http://www.leukos-systems.com">www.leukos-systems.com</a>
AMAROK BIOTECHNOLOGIES	<a href="http://www.amarokbiotech.com">www.amarokbiotech.com</a>

BIZERBA LUCEO	<a href="http://www.luceo-inspection.com">www.luceo-inspection.com</a>
DIAFIR	<a href="http://www.diafir.com">www.diafir.com</a>
E-MAGE-IN-3D	<a href="http://www.emagein-3d.com">www.emagein-3d.com</a>
EVOSENS	<a href="http://www.evosen.fr">www.evosen.fr</a>
IDIL Fibres Optiques	<a href="http://www.idil-fibres-optiques.com">www.idil-fibres-optiques.com</a>
KEOPSYS	<a href="http://www.keopsys.com">www.keopsys.com</a>
LEA PHOTONICS	<a href="http://www.lea-photonics.com">www.lea-photonics.com</a>
LE VERRE FLUORE	<a href="http://www.leverrefluore.com">www.leverrefluore.com</a>
MICROMODULE	<a href="http://www.micromodule.fr">www.micromodule.fr</a>
OXXIUS	<a href="http://www.oxxius.com">www.oxxius.com</a>
QUANTEL	<a href="http://www.quantel-laser.com">www.quantel-laser.com</a>

### Other French companies active in the field of biophotonics:

[LLTech](#), [Horiba Jobin-Yvon](#), [Azur Light Systems](#), [Amplitude Systèmes](#), [Prestodiag](#), [Mauna Kea Technologies](#)

### 5.2.2. Germany (only Berlin Brandenburg)

#### German companies involved in OASIS:

Company	Website
5micron GmbH	<a href="http://www.5micron.de">www.5micron.de</a>
AdlOptica Optical Systems GmbH	<a href="http://www.adloptica.com">www.adloptica.com</a>
Analytica Alimentaria GmbH	<a href="http://www.analytica.international">www.analytica.international</a>
art photonics GmbH	<a href="http://www.artphotonics.com">www.artphotonics.com</a>
Carl Zeiss Meditec AG, Standort Berlin	<a href="http://www.zeiss.com/meditec">www.zeiss.com/meditec</a>
Christian Haubitz-Reinke technische Dienstleistungen	<a href="http://www.berlin-fibre.de">www.berlin-fibre.de</a>
Colibri Photonics	
Dr. Türck Ingenieurbüro für Optikentwicklung und Software	<a href="http://www.tuerck-optik.de">www.tuerck-optik.de</a>
FCC Fibre Cable Connect GmbH	<a href="http://www.fibrecableconnect.de">www.fibrecableconnect.de</a>
FISBA Photonics GmbH	<a href="http://www.fisba-photonics.de">www.fisba-photonics.de</a>
Institut für angewandte Photonik e.V. (IAP)	<a href="http://www.iap-adlershof.de">www.iap-adlershof.de</a>
Laser- und Medizin-Technologie GmbH, Berlin	<a href="http://www.lmtb.de">www.lmtb.de</a>
Novitom - Advanced 3D Micro-Imaging	<a href="http://www.novitom.com">www.novitom.com</a>
O.U.T. e.V.	<a href="http://www.out-ev.de">www.out-ev.de</a>
Raab-Photonik GmbH	<a href="http://www.raab-photonik.com">www.raab-photonik.com</a>

#### Other German companies (Berlin, Brandenburg) active in the field of biophotonics:

Adlershof . WISTA - Management GmbH, Berlin Partner für Wirtschaft und Technologie GmbH, eagleyard Photonics GmbH, EPIGAP Optronik GmbH, FOC GmbH, InBeCon GmbH, LEONI Fiber Optics GmbH, LTB Lasertechnik Berlin GmbH, OECA – Optoelektronische Komponenten und Applikations GmbH, OpTricon GmbH, OSRAM GmbH, PBC Lasers GmbH

### 5.2.3. Italy (mostly Tuscany and Lombardy)

#### Tuscan companies involved in OASIS:

Company	Website
Asa	<a href="http://www.asalaser.it">www.asalaser.it</a>
BIOCHEMICAL SYSTEMS INTERNATIONAL SRL	<a href="http://WWW.BIOSYS.IT">WWW.BIOSYS.IT</a>
Cecchi srl	<a href="http://www.cecchi.com/">http://www.cecchi.com/</a>
Costruzione Strumenti Oftalmici (Ophthal	<a href="http://www.csoitalia.it/en/asp/home.asp">http://www.csoitalia.it/en/asp/home.asp</a>
DEKA M.E.L.A. SRL	<a href="http://www.dekalaser.com/en-GB/Default.aspx">http://www.dekalaser.com/en-GB/Default.aspx</a>
DI.V.A.L. Toscana S.R.L.	<a href="http://www.divalsrl.com">www.divalsrl.com</a>
Ekymed spa	<a href="http://www.ekymed.com">www.ekymed.com</a>
El.En. S.p.A.	<a href="http://www.elengroup.com">www.elengroup.com</a>
Elesta	<a href="http://www.elesta-echolaser.com/">http://www.elesta-echolaser.com/</a>

Esthelogue	<a href="http://www.esthelogue.com/">http://www.esthelogue.com/</a>
Fastenica s.r.l.	<a href="http://www.fastenica.it">www.fastenica.it</a>
Flyby	<a href="http://www.flyby.it">www.flyby.it</a>
General Project	<a href="http://www.generalproject.com">www.generalproject.com</a>
Giotto Biotech Srl	<a href="http://www.giottobiotech.com">www.giottobiotech.com</a>
Hospitex Diagnostics srl	<a href="http://www.hospitex.com">www.hospitex.com</a>
Light4tech Firenze S.r.L.	<a href="http://www.light4tech.com">www.light4tech.com</a>
Molteni Therapeutics srl	<a href="http://www.moltenitherapeutics.it">www.moltenitherapeutics.it</a>
Phronema S.r.l.	<a href="http://www.phronema.it">www.phronema.it</a>
PLASMA DIAGNOSTICS & TECHNOLOGIES srl	<a href="http://www.plasmatech.it">www.plasmatech.it</a>
Quanta system	<a href="http://www.quantasystem.com">www.quantasystem.com</a>
Probiomedica	<a href="http://www.probiomedica.it">www.probiomedica.it</a>
Imaginalis	<a href="http://www.imaginalis.it">www.imaginalis.it</a>
IVTech	<a href="http://www.ivtech.it">www.ivtech.it</a>
Optogenix	

### Tuscan end users (Hospitals and Agrofood):

End users	Website
Bambino Gesù Pediatric Hospital	<a href="http://www.ospedalebambinogesu.it">www.ospedalebambinogesu.it</a>
Ospedale di Cisanello, Neurosurgery Dept	<a href="http://www.ao-pisa.toscana.it">www.ao-pisa.toscana.it</a>
Azienda Ospedaliera Careggi, Ophthalmic Dept.	<a href="http://www.aou-careggi.toscana.it">www.aou-careggi.toscana.it</a>
Azienda Ospedaliera Careggi, Urology Dept.	<a href="http://www.aou-careggi.toscana.it">www.aou-careggi.toscana.it</a>
Azienda Ospedaliera Prato, Ophthalmic Dept.	<a href="http://www.aou-careggi.toscana.it">www.aou-careggi.toscana.it</a>
Progetto Alimenti srl	<a href="http://www.progettoalimenti.it">www.progettoalimenti.it</a>
DNAPhone srl	<a href="http://www.dnaphone.it">www.dnaphone.it</a>
Tecnoalimenti srl	<a href="http://www.tecnoalim.com/eng/">www.tecnoalim.com/eng/</a>
La Valle del Sasso	<a href="http://www.lavalledelsasso.it/">www.lavalledelsasso.it/</a>

### Lombard companies involved in OASIS:

Company	Website
Hyper Photonics	<a href="http://www.hyperphotonics.com">www.hyperphotonics.com</a>
JULIGHT SRL	<a href="http://www.julight.it">www.julight.it</a>
NIROX SRL	<a href="http://WWW.NIROX.IT">WWW.NIROX.IT</a>
Open Technologies Srl	<a href="http://www.scanner3d.it">www.scanner3d.it</a>
OPTEC SpA	<a href="http://www.optec.eu">www.optec.eu</a>
Quanta System SpA	<a href="http://www.quantasystem.com">www.quantasystem.com</a>
Tecnottica Consonni Srl	<a href="http://www.tecnottica.com">www.tecnottica.com</a>
Hyper Photonics	<a href="http://www.hyperphotonics.com">www.hyperphotonics.com</a>
JULIGHT SRL	<a href="http://www.julight.it">www.julight.it</a>
NIROX SRL	<a href="http://WWW.NIROX.IT">WWW.NIROX.IT</a>
Open Technologies Srl	<a href="http://www.scanner3d.it">www.scanner3d.it</a>
OPTEC SpA	<a href="http://www.optec.eu">www.optec.eu</a>
Quanta System SpA	<a href="http://www.quantasystem.com">www.quantasystem.com</a>
Tecnottica Consonni Srl	<a href="http://www.tecnottica.com">www.tecnottica.com</a>
Hyper Photonics	<a href="http://www.hyperphotonics.com">www.hyperphotonics.com</a>
JULIGHT SRL	<a href="http://www.julight.it">www.julight.it</a>
NIROX SRL	<a href="http://WWW.NIROX.IT">WWW.NIROX.IT</a>
Open Technologies Srl	<a href="http://www.scanner3d.it">www.scanner3d.it</a>
OPTEC SpA	<a href="http://www.optec.eu">www.optec.eu</a>
Quanta System SpA	<a href="http://www.quantasystem.com">www.quantasystem.com</a>
Tecnottica Consonni Srl	<a href="http://www.tecnottica.com">www.tecnottica.com</a>

### Lombard end users (Hospitals and Agrofood):

End users	Website
Fondazione Don Gnocchi	<a href="http://www.dongnocchi.it">www.dongnocchi.it</a>
Advanced Light and Electron Microscopy Bio-Imaging Centre	<a href="http://www.hsr.it/research/alembic">www.hsr.it/research/alembic</a>

## 5.2.4. The Netherlands

### Dutch companies involved in OASIS:

Company	Website
Adviesbureau JFH Snel	<a href="http://www.jfhsnel.nl">www.jfhsnel.nl</a>
Avantes	<a href="http://www.avantes.com">www.avantes.com</a>
Cosine	<a href="http://www.cosine.nl">www.cosine.nl</a>
Demcon	<a href="http://www.demcon.nl">www.demcon.nl</a>
Diagnoptics	<a href="http://www.diagnoptics.com">www.diagnoptics.com</a>
Focal	<a href="http://www.focal.nl">www.focal.nl</a>
FTS Forensic Technical Solutions	<a href="http://www.fortechs.com">www.fortechs.com</a>
Hittech Multin	<a href="http://www.hittech.nl">www.hittech.nl</a>
Lambert	<a href="http://www.lambertinstruments.com">www.lambertinstruments.com</a>
LioniX	<a href="http://www.lionixbv.nl">www.lionixbv.nl</a>
MetaSense	<i>Start-up</i>
PR Sys Design	<a href="http://perclass.com">http://perclass.com</a>
Quest Innovations	<a href="http://www.quest-innovations.com">www.quest-innovations.com</a>
RiverD	<a href="http://www.riverd.com">www.riverd.com</a>
Technobis TFT-FOS	<a href="http://www.technobis.com">www.technobis.com</a>
XiO Photonics	<a href="http://www.xiophotonics.com">www.xiophotonics.com</a>

### Other Dutch companies active in the field of biophotonics:

Developing, selling or using biophotonics techniques:

Optics11, 2MEngineering, Innoluce, K-vision, Kipp & Zonen, Konika Minolta Sensing Europe, Promis Electro Optics, Sesor Sense, Unitron Group, VibSpec, Water Insight, WimOptik.

Having a biophotonics activity or division (but not the major part):

DCD, DVC machinevision, IMS, Inventech, Lencon Engineering, Mera Benelux, MILabs, Nedinsco, Notavis Netherlands, NTS Optel, PANalytical, Photonis, Sentix, Sumipro, Teledyne Dalsa, Vision Hardware Partner.

## 5.2.5. Spain

### Spanish companies involved in OASIS:

Company	Website
Alava Ingenieros	<a href="http://www.alavaingenieros.com">www.alavaingenieros.com</a>
AMS Technologies	<a href="http://www.amstechnologies.com">www.amstechnologies.com</a>
Asorcad	<a href="http://www.asorcad.es">www.asorcad.es</a>
BCB Informatica y Control	<a href="http://www.bcb.es">www.bcb.es</a>
Cosingo	<a href="http://www.cosingo.com">www.cosingo.com</a>
FYLA LASER s.l.	<a href="http://www.fyla.com">www.fyla.com</a>
Hamamatsu Photonics	<a href="http://www.hamamatsu.es">www.hamamatsu.es</a>
Impetux	<a href="http://www.impetux.com">www.impetux.com</a>
INTERmedic	<a href="http://www.inter-medic.net">www.inter-medic.net</a>
IRIS	<a href="http://www.iris-eng.com">www.iris-eng.com</a>
Laser2000	<a href="http://www.laser2000.es">www.laser2000.es</a>
Ledmotive	<a href="http://www.ledmotive.com">www.ledmotive.com</a>
Light Precision Innovations	<a href="http://www.lpi-llc.com">www.lpi-llc.com</a>
Luzwavelabs	<a href="http://www.luzwavelabs.com">www.luzwavelabs.com</a>
Medlumics	<a href="http://www.medlumics.com">www.medlumics.com</a>
Monocrom	<a href="http://www.monocrom.com">www.monocrom.com</a>
New Infrared Technologies	<a href="http://www.niteurope.com">www.niteurope.com</a>
Photon Lines	<a href="http://www.photonlines.es">www.photonlines.es</a>
Procarelight	<a href="http://www.procarelight.com">www.procarelight.com</a>
Proton Laser	<a href="http://www.protonlaser.com">www.protonlaser.com</a>
Radiantis	<a href="http://www.radiantis.com">www.radiantis.com</a>
RBZ Embedded Logics	<a href="http://www.rbzrobotdesign.com">www.rbzrobotdesign.com</a>
Rofin	<a href="http://www.rofin.es">www.rofin.es</a>
Sensofar Medical S.L.	<a href="http://www.sensofar.com">www.sensofar.com</a>
VLC Photonics	<a href="http://www.vlcphotonics.com">www.vlcphotonics.com</a>
X-Ray Imatek	<a href="http://www.xray-imatek.com">www.xray-imatek.com</a>

## 5.2.6. Sweden

### Swedish companies involved in OASIS:

Company	Website
Adamantis AB	<a href="http://www.adamantis.com">www.adamantis.com</a>
BioOptico AB	<a href="http://www.biooptico.com">www.biooptico.com</a>
Cellavision AB	<a href="http://www.cellavision.com">www.cellavision.com</a>
Clinical Laserthermia Systems AB	<a href="http://clinicallaser.se">clinicallaser.se</a>
Cobolt AB	<a href="http://www.cobolt.se">www.cobolt.se</a>
C-rad	<a href="http://www.c-rad.info">www.c-rad.info</a>
Demetech AB	<a href="http://www.demetech.com">www.demetech.com</a>
GasPorOx AB	<a href="http://gasporex.se">gasporex.se</a>
GE Healthcare Bio-Sciences AB	<a href="http://www.gelifesciences.com">www.gelifesciences.com</a>
Molecular Fingerprint Sweden AB	<a href="http://www.berzelii.uu.se/english/partners">www.berzelii.uu.se/english/partners</a>
Optilia Instruments AB	<a href="http://www.optilia.eu">www.optilia.eu</a>
Perimed AB	<a href="http://www.perimed-instruments.com">www.perimed-instruments.com</a>
Philips Digital Mammography Sweden AB	<a href="http://www.healthcare.philips.com">www.healthcare.philips.com</a>
Q-linea AB	<a href="http://qlinea.com">qlinea.com</a>
Qualisys AB	<a href="http://www.qualisys.com">www.qualisys.com</a>
ScandiDos AB	<a href="http://www.scandidos.com">www.scandidos.com</a>
scint-x AB	<a href="http://www.scint-x.com">www.scint-x.com</a>
SenseAir AB	<a href="http://senseair.com">senseair.com</a>
SpectraCure AB	<a href="http://spectracure.com">spectracure.com</a>
Spectro Analytic Irradia AB	<a href="http://www.irradia.se">www.irradia.se</a>
WheelsBridge AB	<a href="http://www.wheelsbridge.se">www.wheelsbridge.se</a>

### Other Swedish companies active in the field of biophotonics:

Developing, selling or using biophotonics techniques:

DDD North, Foss Analytical, Gyros, Heliospectra, Hök Instrument, LVI Low Vision International, Masimo Sweden, Phase Holographic Imaging PHI, Redsense Medical, Servotek, UmBio, Xcounter.

Having a biophotonics activity or division (but not the major part):

Aerocrine, Autoliv Electronics, Biotage, Biolin Scientific, Eclipse, Elekta, Elekta Instruments, FLIR Systems, Hamamatsu Photonics Norden, Maquet Critical Care, Maquet Nordic, Obducat, Olink, Optoga, Optronic, RTI ELEcontrics, Serstech, Tobii Technology, ÅF.

## 5.2.7. UK (mostly Wales)

### Companies involved in OASIS:

Company	Website
CoolLED Limited	<a href="http://www.oemillumination.com">www.oemillumination.com</a>
Cymtec Ltd	<a href="http://www.cymtec.co.uk">www.cymtec.co.uk</a>
CyDen Ltd	<a href="http://www.cyden.co.uk">www.cyden.co.uk</a>
CottonMoutonDiagnostics Ltd	<a href="http://www.cmdiagnostics.co.uk">www.cmdiagnostics.co.uk</a>
Invitron Limited	<a href="http://www.invitron.co.uk">www.invitron.co.uk</a>
Gx Group	<a href="http://www.gxgroup.com">www.gxgroup.com</a>
DySISMedical Ltd	<a href="http://www.dysismedical.com">www.dysismedical.com</a>
LUX-TSI Limited	<a href="http://www.lcasb.com">www.lcasb.com</a>
Lightpoint Medical Ltd	<a href="http://www.lightpointmedical.com">www.lightpointmedical.com</a>
Lein Applied Diagnostics	<a href="http://www.lein-ad.com">www.lein-ad.com</a>
Sengenja Ltd	<a href="http://www.sengenja.com">www.sengenja.com</a>
PolyPhotonix Ltd.	<a href="http://www.polyphotonix.com">www.polyphotonix.com</a>
Millennium Lasers	<a href="http://www.millenniumlasers.co.uk">www.millenniumlasers.co.uk</a>
Yu-scan Ltd	<a href="http://yu-scan.co.uk">yu-scan.co.uk</a>
Stratton Technologies Limited	<a href="http://www.strattontechnologies.co.uk">www.strattontechnologies.co.uk</a>

## 5.3. Life Science facilities

### 5.3.1. France (mostly PACA region and Brittany)

#### Life Science facilities involved in OASIS:

Life Science Facility	Website
CERIMED	<a href="http://www.cerimed-web.eu">www.cerimed-web.eu</a>
Institut FRESNEL	<a href="http://www.fresnel.fr">www.fresnel.fr</a>
INMED	<a href="http://www.inmed.fr">http://www.inmed.fr</a>
Institut de Neurosciences de la Timone	<a href="http://www.int.univ-amu.fr">http://www.int.univ-amu.fr</a>
Institut de Biologie du Développement de Marseille	<a href="http://www.ibdm.univ-mrs.fr">www.ibdm.univ-mrs.fr</a>
PEMOA	<a href="http://www.pole-optitec.com">www.pole-optitec.com</a>
Centre de Biochimie Structurale	<a href="http://www.cbs.cnrs.fr/index.php/en">www.cbs.cnrs.fr/index.php/en</a>
Centre d'Immunology de Marseille Luminy	<a href="http://www.ciml.univ-mrs.fr">http://www.ciml.univ-mrs.fr</a>
Plateforme d'Imagerie RMN	<a href="http://www.univ-montp2.fr">www.univ-montp2.fr</a>
Microscopie Imagerie Côte d'Azur	<a href="http://unice.fr/plateformes/mica">http://unice.fr/plateformes/mica</a>
Anatomic Pathology Expertise for Research	<a href="http://www.biogenouest.org/en/contenu/core-facilities/bioimaging/apex">http://www.biogenouest.org/en/contenu/core-facilities/bioimaging/apex</a>
BIBS – INRA	<a href="http://www.biogenouest.org/en/contenu/core-facilities/structural-and-metabolomic-analysis/bibs">http://www.biogenouest.org/en/contenu/core-facilities/structural-and-metabolomic-analysis/bibs</a>
BIOTRIAL	<a href="http://www.biotrial.fr">www.biotrial.fr</a>
C.RIS Pharma	<a href="http://www.c-rispharma.com">www.c-rispharma.com</a>
CytoCell	<a href="http://www.sfrsante.univ-nantes.fr">http://www.sfrsante.univ-nantes.fr</a>
HistoPathology High Precision	<a href="http://www.biogenouest.org/en/contenu/core-facilities/bio-imaging/h2p2">http://www.biogenouest.org/en/contenu/core-facilities/bio-imaging/h2p2</a>
Microscopy Rennes Imaging Center	<a href="http://www.biogenouest.org/en/contenu/core-facilities/bio-imaging/mric">http://www.biogenouest.org/en/contenu/core-facilities/bio-imaging/mric</a>
PRISM	<a href="http://www.biogenouest.org/en/contenu/core-facilities/bio-imaging/prism">http://www.biogenouest.org/en/contenu/core-facilities/bio-imaging/prism</a>
PRODIABIO	<a href="http://www.pft-prodiabio.com">www.pft-prodiabio.com</a>
VEGENOV	<a href="http://www.vegenov.com">www.vegenov.com</a>

#### Other French organisations and networks relevant for the field of biophotonics:

[Aviesan](#), [AllEnvi](#), [Biogenouest](#), [EuroBioMed](#), [France Life Imaging](#), [FranceBioImaging](#), [IBISA](#), [NAIVI](#), [RCCM](#), [RTMFM](#), [SFLM \(Société Francophone des Lasers Médicaux\)](#)

### 5.3.2. Germany (mostly Berlin-Brandenburg)

#### Life Science facilities involved in OASIS:

Life Science Facility	Website
Charité University Medicine, Ophthalmology Dept. (Hospital)	<a href="http://www.charite.de">www.charite.de</a>
Parkklinik Weissensee (Hospital)	<a href="http://www.park-klinik.com">www.park-klinik.com</a>
Leibniz Institute for Agricultural Engineering (ATB)	<a href="http://www.atb-potsdam.de">www.atb-potsdam.de</a>
Kompetenz Wasser Zentrum Berlin	<a href="http://www.kompetenz-wasser.de">www.kompetenz-wasser.de</a>
Fraunhofer Institute for Cell Therapy and Immunology	<a href="http://izi.fraunhofer.de">izi.fraunhofer.de</a>

#### Other German (Berlin, Brandenburg) facilities active in the field of biophotonics:

Beuth Hochschule für Technik Berlin, Fraunhofer-Institut für Angewandte Polymerforschung (IAP), Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Leibniz-Institut für Analytische Wissenschaften – ISAS – e.V., Laserverbund Berlin – Brandenburg, Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (MBI), Physikalisch-Technische Bundesanstalt (PTB), Technische Hochschule Wildau, AG Photonik, Laser- und Plasmatechnologien, Universität Potsdam und innoFSPEC Potsdam, Charité - Uni-Klinik für Dermatologie, Venerologie und Allergologie Bereich Hautphysiologie, Elisabeth Klinik Abteilung für Lasermedizin.

Go to [www.optecbb.de](http://www.optecbb.de) and [www.optecbb.de/lang/de/download.php](http://www.optecbb.de/lang/de/download.php) for more information on Biophotonics in the Berlin-Brandenburg region!

### 5.3.3. Italy (mostly Tuscany and Lombardy)

#### Tuscan Life Science facilities involved in OASIS:

Life Science Facility	Website
Institute of Applied Physics "Carrara"	<a href="#">IFAC</a>
Biophotonics and Nanomedicine Lab	<a href="#">BNLab</a>
BioSens: Fiber optic and microoptic sensor lab	<a href="#">IFAC</a>
Fondazione ICON	<a href="#">ICON</a>
Electron Microscopy Centre "Laura Bonzi"	<a href="#">CeME</a>
European Laboratory for Non-linear Spectroscopy	<a href="#">LENS</a>
Minutolo - Farmacia	<a href="#">Minutolo</a>
Molecular Hormonal and Clinical Biochemistry / dep. Biomedical Experimental and Clinical Sciences/ University of Florence	<a href="#">SBSC</a>
MMMO: Bone and Mineral Metabolism Unit	<a href="#">MMMO</a>
Kinetics and Equilibria in Solution	<a href="#">DCCI</a>
Department of Life Sciences	<a href="#">DSV</a>
BIOMON: Molecular Biology Lab	<a href="#">SBSC</a>
VisMederi srl	<a href="#">VisMederi</a>
BioSens: Laboratorio Biosensori, Dipartimento di Chimica Ugo Schiff	<a href="#">Biosensor</a>
Computer Assisted Surgery	<a href="#">EndoCAS</a>

#### Lombard Life Science facilities involved in OASIS:

Life Science Facility	Website
Centre for Ultrafast Science and Biomedical Optics	<a href="#">CUSBO</a>
Center for Nano Science and Technology	<a href="#">CNST</a>
Femtosecond Laser Micromachining Lab – Institute for Photonics and Nanotechnologies - CNR	<a href="#">FAST-IFN</a>

### 5.3.4. The Netherlands

Life Science Facility	Website
TNO Delft	<a href="http://www.tno.nl/en">www.tno.nl/en</a>
Academic Medical Center University of Amsterdam	<a href="http://www.amc.nl/web/Research.htm">www.amc.nl/web/Research.htm</a>
Vrije Universiteit Amsterdam Medical Center	<a href="http://www.vumc.com">www.vumc.com</a>
Erasmus Medical Center	<a href="http://www.erasmusmc.nl/research">www.erasmusmc.nl/research</a>
Radboud University, Life Science Trace Gas Research Group	<a href="http://www.ru.nl/English">www.ru.nl/English</a>
Institute QuantiVision	<a href="http://www.quantivision.info">www.quantivision.info</a>
Wageningen University & Research Center	<a href="http://www.wageningenur.nl">www.wageningenur.nl</a>
Leiden University Medical Center (LUMC)	<a href="http://www.lumc.nl/research/">www.lumc.nl/research/</a>
Utrecht University Medical Center	<a href="http://www.umcutrecht.nl/en/Research">www.umcutrecht.nl/en/Research</a>
Maastricht University Medical Center	<a href="http://www.maastrichtuniversity.nl">www.maastrichtuniversity.nl</a>
University Medical Center Groningen	<a href="http://www.umcg.nl/EN">www.umcg.nl/EN</a>
Dutch Cancer Institute	<a href="http://www.nki.nl">www.nki.nl</a>

#### Other Dutch organisations and networks relevant for the field of biophotonics:

- Delft University of Technology ([www.tudelft.nl/en](http://www.tudelft.nl/en))
- Eindhoven University of Technology ([www.tue.nl/en](http://www.tue.nl/en))
- University of Twente, Mesa<sup>+</sup>-institute ([www.utwente.nl/mesaplus/nl](http://www.utwente.nl/mesaplus/nl))
- [FOM Institute AMOLF](#)
- [RVO – Netherlands Enterprise Agency](#)
- Relevant Strategic Innovation Programmes:
  - Topsector Health & Life Science ([www.health-holland.com/portal](http://www.health-holland.com/portal))
  - Topsector Agri & Food ([www.tki-agrifood.nl](http://www.tki-agrifood.nl))

- Topsector Horticulture (<http://topsectortu.nl/nl>)
- Topsector High Tech Systems & Materials ([www.hollandhightech.nl/international](http://www.hollandhightech.nl/international))
- Other Relevant Strategic Research and Innovation Agendas:
  - MIT-regeling ([www.rvo.nl/subsidies-regelingen/mkb-innovatiestimulering-regio-en-topsectoren-mit](http://www.rvo.nl/subsidies-regelingen/mkb-innovatiestimulering-regio-en-topsectoren-mit))
  - PIB-regeling, Partner in Business ([www.rvo.nl/subsidies-regelingen/partners-international-business-pib](http://www.rvo.nl/subsidies-regelingen/partners-international-business-pib))

### 5.3.5. Spain

#### Life Science facilities involved in OASIS:

Life Science Facility	Website
AIMEN Technology Center	<a href="http://www.aimen.es">www.aimen.es</a>
AINIA Technology Center	<a href="http://www.ainia.es">www.ainia.es</a>
CD6-UPC - The Centre for Sensor, Instrument and Systems Development	<a href="http://www.cd6.upc.edu">www.cd6.upc.edu</a>
CEIT - Centre of Studies and Technical Research	<a href="http://www.ceit.es">www.ceit.es</a>
CETAQUA Water Technology Center	<a href="http://www.cetaqua.com">www.cetaqua.com</a>
CLPU - The Spanish Pulsed Laser Center	<a href="http://www.clpu.es">www.clpu.es</a>
CVC - Computer Vision Centre	<a href="http://www.cvc.uab.cat">www.cvc.uab.cat</a>
EURECAT Technology Center	<a href="http://www.eurecat.org">www.eurecat.org</a>
FICMA - Physics and Cristallography of Materials	<a href="http://www.urv.cat/dquimfi/ficma">www.urv.cat/dquimfi/ficma</a>
ICFO – The Institute of Photonic Sciences	<a href="http://www.icfo.eu">www.icfo.eu</a>
ICIQ - The Institute of Chemical Research of Catalonia	<a href="http://www.iciq.es">www.iciq.es</a>
IK4-Tekniker	<a href="http://www.tekniker.es">www.tekniker.es</a>
IN2UB - The Institute for Nanoscience and Nanotechnology of the University of Barcelona	<a href="http://www.ub.edu/in2ub">www.ub.edu/in2ub</a>
Instituto de Fotomedicina	<a href="http://www.fotomedicina.com">www.fotomedicina.com</a>
IO-CSIC - Institute of Optics	<a href="http://www.io.csic.es">www.io.csic.es</a>
IREC - The Catalonia Institute for Energy Research	<a href="http://www.irec.cat">www.irec.cat</a>
L2A2 laboratory facility from the University of Santiago de Compostela	<a href="http://www.usc.es">www.usc.es</a>
LEITAT Technology Center	<a href="http://www.leitat.org">www.leitat.org</a>
TECNALIA Technology Center	<a href="http://www.tecnalia.com">www.tecnalia.com</a>

#### Other related Networks and Associations

- Fotónica21 - The Spanish Platform for Innovation in Healthcare Technology ([www.fotonica21.es](http://www.fotonica21.es))
- Fenin – Spanish Federation of Healthcare Technologies ([www.fenin.es](http://www.fenin.es))
- Arahealth – Aragon Healthcare technology ([www.arahealth.com](http://www.arahealth.com))
- CVIDA – The Association for Life Quality Care ([www.cvida.com](http://www.cvida.com))
- Cluster de la Salud de Extremadura ([www.clustersalud.es](http://www.clustersalud.es))
- Health Tech Cluster ([www.healthtechcluster.com](http://www.healthtechcluster.com))
- TicBioMed ([www.ticbiomed.org](http://www.ticbiomed.org))
- BIOCAT ([www.biocat.cat](http://www.biocat.cat))
- BioIB ([www.bioib.org](http://www.bioib.org))
- CataloniaBIO ([www.cataloniabio.org](http://www.cataloniabio.org))
- Andalucía BioRegión ([www.adaluciabioregion.es](http://www.adaluciabioregion.es))
- Madrid Biocluster ([www.madridnetwork.org](http://www.madridnetwork.org))

### 5.3.6. Sweden

#### Involved in OASIS:

Life Science Facility	Website
SciLifeLab General	<a href="http://www.scilifelab.se">www.scilifelab.se</a>
SciLifeLab - Advanced Light Microscopy	<a href="http://www.scilifelab.se">www.scilifelab.se</a>
SciLifeLab - Fluorescence Correlation Spectroscopy	<a href="http://www.scilifelab.se">www.scilifelab.se</a>
SciLifeLab - Biological Visualisation	<a href="http://www.scilifelab.se">www.scilifelab.se</a>
Lund Medical Laser Centre	<a href="http://www.mlc.lu.se">www.mlc.lu.se</a>
Centre for Biomedical Engineering and Physics	<a href="http://www.cmtf.umu.se">www.cmtf.umu.se</a>
National Veterinary Institute	<a href="http://www.sva.se/en">www.sva.se/en</a>
Swedish University of Agricultural Sciences	<a href="http://www.slu.se/en">www.slu.se/en</a>
MAX IV Laboratory	<a href="http://www.maxlab.lu.se/maxiv">www.maxlab.lu.se/maxiv</a>

#### Other Swedish organisations and networks relevant for the field of biophotonics:

- SIK – the Swedish Institute for Food and Biotechnology ([www.sp.se/foodbioscience](http://www.sp.se/foodbioscience))
- Swedish National Laboratory of Forensic Science – SKL ([nfc.polisen.se](http://nfc.polisen.se))
- Open facility for research on technologies for elderly people – SOFTEC ([www.openlivinglabs.eu/livinglab/softec](http://www.openlivinglabs.eu/livinglab/softec))
- SwedenBio ([www.swedenbio.se](http://www.swedenbio.se))
- Swedish Biolmaging ([www.bioimaging.se](http://www.bioimaging.se))
- CTMH – Center for Technology in Medicine and Health ([www.ctmh.se](http://www.ctmh.se))
- Relevant Strategic Innovation Programmes:
  - Electronics Components and Systems (ECS) ([www.smartareelektroniksystem.se](http://www.smartareelektroniksystem.se))
  - SWElife ([swelife.se](http://swelife.se))
  - MedTech 4 Health ([nfmt.se](http://nfmt.se))
- Other Relevant Strategic Research and Innovation Agendas:
  - Swednanotech ([swednanotech.com](http://swednanotech.com))
  - Personalized Medicine.
  - E-hälsa I hemmet.
  - Vattenvisionen – Forsknings- och innovationsagenda för vattensektorn (The Water Vision)
  - Health and social care in the information society (VOIS).
  - Åldrande befolkning (Ageing Society).

### 5.3.7. UK (mostly Wales)

#### UK Life Science facilities involved in OASIS:

Life Science Facility	Website
Centre for NanoHealth - Swansea University	<a href="http://www.swansea.ac.uk/nanohealth">www.swansea.ac.uk/nanohealth</a>
Cardiff Univ. Brain Research Imaging Centre	<a href="http://sites.cardiff.ac.uk/cubric">http://sites.cardiff.ac.uk/cubric</a>
National Physical Laboratory	<a href="http://www.npl.co.uk">www.npl.co.uk</a>
BSI	<a href="http://www.bsigroup.com/en-GB">www.bsigroup.com/en-GB</a>
The Compound Semiconductor Centre	<a href="http://www.compoundsemiconductorcentre.com">www.compoundsemiconductorcentre.com</a>
Central Biotechnology Service	<a href="http://www.cardiff.ac.uk">www.cardiff.ac.uk</a>
CARDIFF MEDICENTER	<a href="http://www.cardiffmedicentre.co.uk">www.cardiffmedicentre.co.uk</a>
Astro Cardiff University	<a href="http://www.astro.cardiff.ac.uk/research/cmp">www.astro.cardiff.ac.uk/research/cmp</a>
Glyndwr Innovations Ltd	<a href="mailto:inovations@glyndwr.ac.uk">inovations@glyndwr.ac.uk</a>
College of Engineering - Swansea University	<a href="http://www.swansea.ac.uk/engineering/">www.swansea.ac.uk/engineering/</a>

#### Other British organisations and networks relevant for the field of biophotonics:

##### Networks

- TechnologyScotland [technologyscotland.scot](http://technologyscotland.scot) [stephen.taylor@technologyscotland.scot](mailto:stephen.taylor@technologyscotland.scot)
- Welsh OptoElectronic Forum [www.wof.org.uk](http://www.wof.org.uk) [susan.sheridan@wof.org.uk](mailto:susan.sheridan@wof.org.uk)
- Enterprise Europe Network <http://een.ec.europa.eu> [L.J.Coombes@swansea.ac.uk](mailto:L.J.Coombes@swansea.ac.uk)
- ESP InnovateUK <https://connect.innovateuk.org/web/espknKTN>
- Innovate UK [connect.innovateuk.org/home](http://connect.innovateuk.org/home)
- Bioscience KTN [connect.innovateuk.org/web/biosciencesktn](http://connect.innovateuk.org/web/biosciencesktn) see website

**LIST of other relevant Companies, Research centers, Database )**

- Andor Technology Ltd [www.andor.com](http://www.andor.com) for contact see website
- GE Healthcare [www3.gehealthcare.co.uk](http://www3.gehealthcare.co.uk) online form
- Michelson Diagnostics [vivosight.com/about-us](http://vivosight.com/about-us) [info@vivosight.com](mailto:info@vivosight.com)
- Nikon UK Limited [www.nikoninstruments.com](http://www.nikoninstruments.com) [discover@nikon.co.uk](mailto:discover@nikon.co.uk)
- UKBiological Imaging Facilities \* [www.york.ac.uk](http://www.york.ac.uk)
- UKPHOTONICS [www.ukphotonics.org](http://www.ukphotonics.org) (includes data on facilities located in: Aberdeen, Bath, Belfast, Birmingham, Brighton, Bristol, Cambridge, Cardiff, Dundee, Durham, Edimburgh, Essex, Glasgow, Leeds, Leicester, Liverpool, London, Manchester, Newcastle, Norwich, Nottingham, Oxford, Pirbright, Reading, Rothamsted, Sheffield, Southampton, Strathclyde, Surrey and York)