Applying laser technology for cancer care

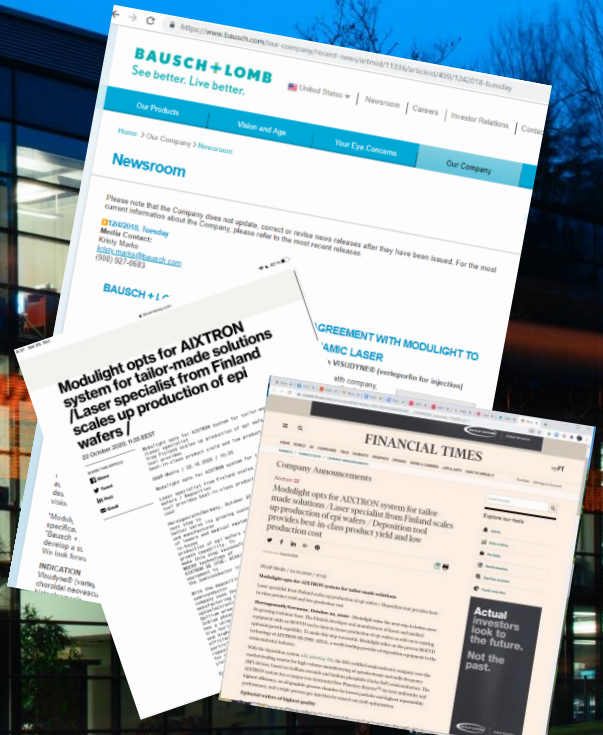
Health Tuesday 2021: Cancer innovations

Seppo Orsila
2nd Feb 2021

Lasers and optics for personalized medicine and better life.

Modulight, Inc.

- ❑ The only vertically integrated medical laser manufacturer in the world
- ❑ Profitable privately held company with > 20 years track record
- ❑ Exclusive supplier to 10+ pharmas & world leading cancer centers in USA & Europe
- ❑ Long track record of making all kinds of semiconductor lasers & pumps (400–2000 nm)
- ❑ Certified ISO13485 QMS in 2011, ISO9001 & 14001 in 2002
- ❑ Co-branded & OEM products currently shipping to all continents except Antarctica
- ❑ 600 000 pcs of 9xx-nm pulsed lasers in 2015 for LIDAR



Photoimmunotherapy (PIT) concept

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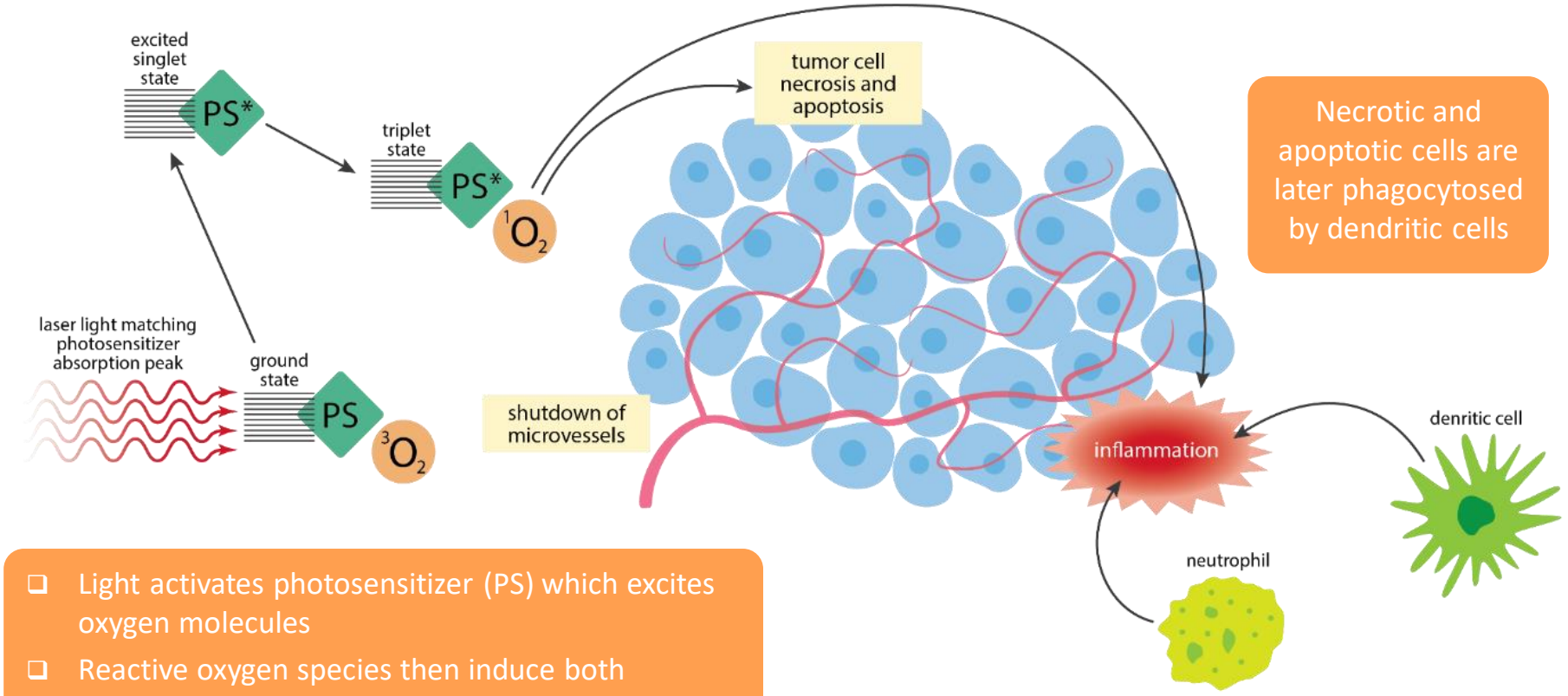
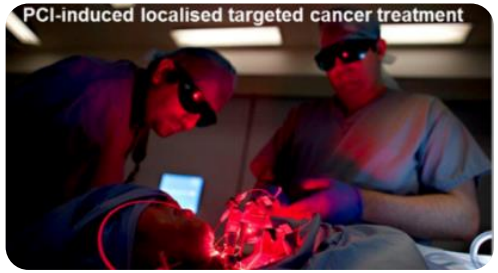


Necrotic and apoptotic cells are later phagocytosed by dendritic cells

- Light activates photosensitizer (PS) which excites oxygen molecules
- Reactive oxygen species then induce both apoptotic and necrotic cell death

PDT: combination treatment in oncology



Photoimmunotherapy

- Less invasive targeted treatment of tumours
- Reducing and inhibiting side effects
- Treatment of tumour margins in surgery
- Initiating or boosting anticancer immuno-response

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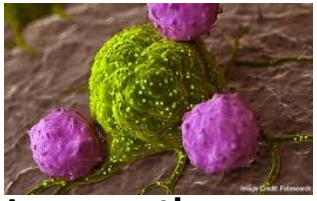
Chemotherapy



Immunotherapy

Surgery

Examples of photoimmunotherapy application areas

- Head & neck cancers
- Esophageal cancers
- Bile duct cancer
- Eye melanoma
- Non-small lung cell carcinoma
- Mesothelioma
- Glioblastoma
- Prostate
- Many others…

Topics today

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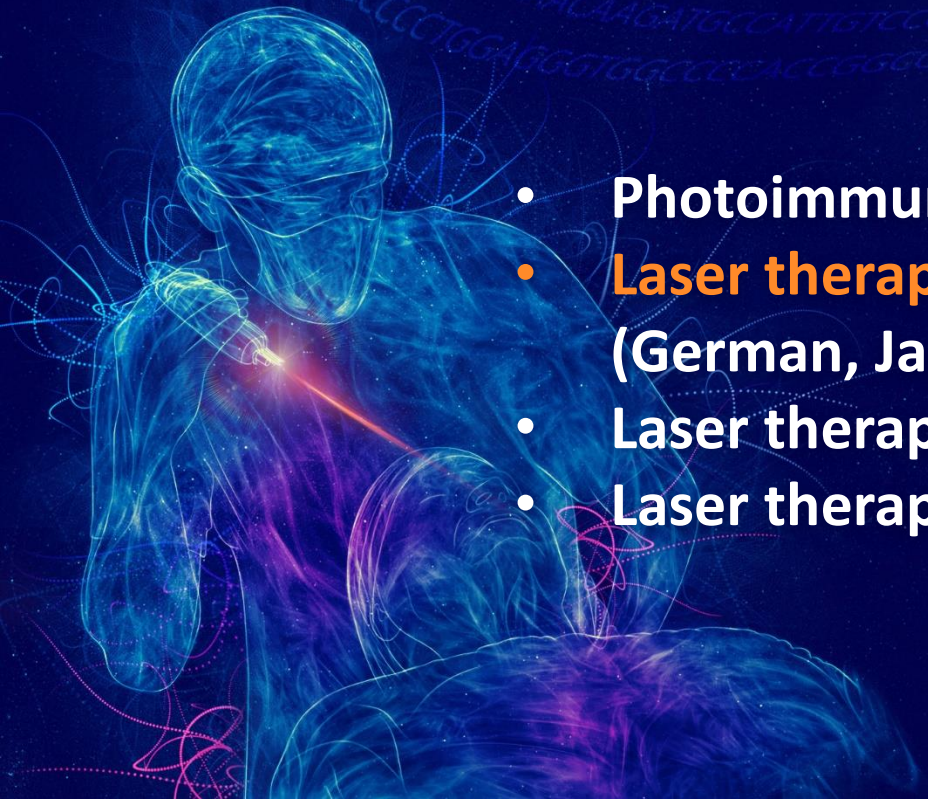
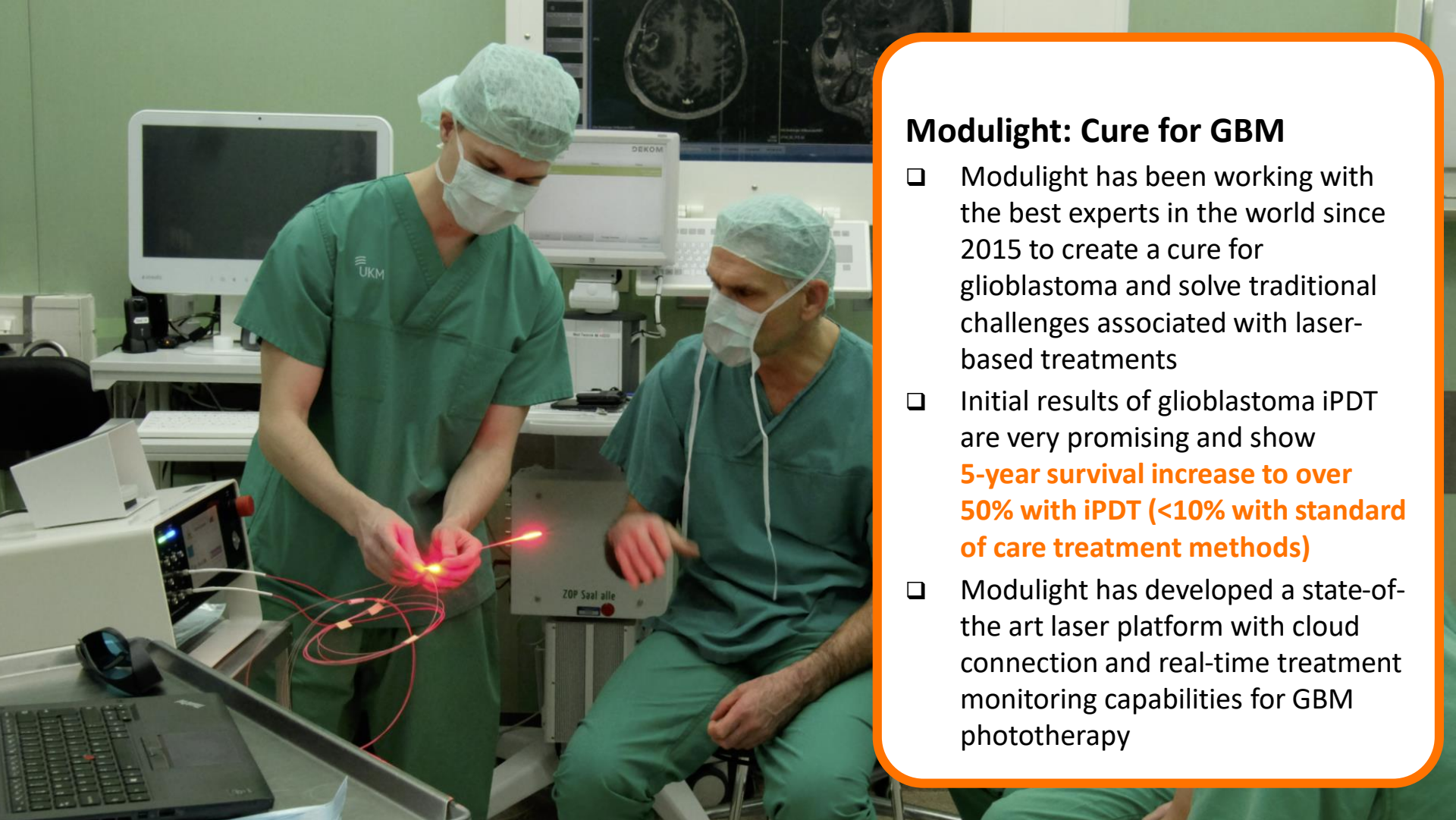


- Photoimmunotherapy in oncology
- Laser therapy for glioblastoma treatment (German, Japan)
- Laser therapy for uveal melanoma (US)
- Laser therapy for lung cancer (Tampere)



Modulight: Cure for GBM

- Modulight has been working with the best experts in the world since 2015 to create a cure for glioblastoma and solve traditional challenges associated with laser-based treatments
- Initial results of glioblastoma iPDT are very promising and show **5-year survival increase to over 50% with iPDT (<10% with standard of care treatment methods)**
- Modulight has developed a state-of-the art laser platform with cloud connection and real-time treatment monitoring capabilities for GBM phototherapy

Photodynamic therapy for glioblastoma

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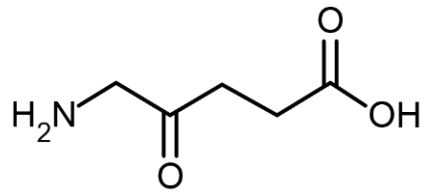
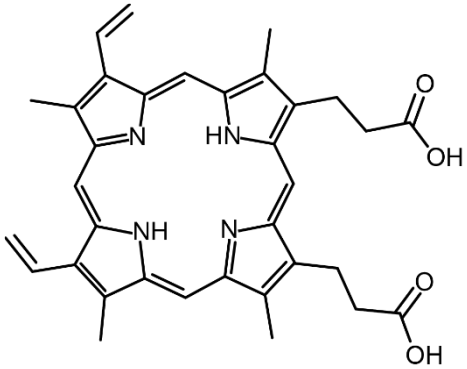
- 5-Aminolevulinic Acid (5-ALA) accumulates in tumor and undergoes a convertion to protoporphyrin IX (PpIX).
- PpIX has an absorption peak at 635 nm, and in the presence of appropriate light source, its fluorescence acts with bimodal function:
  - 5-ALA-PDT

  → series of irreversible photochemical and photobiological events that cause directly damage and killing tumor cells
  - Fluorescence diagnostic marker
  - → assists neurosurgeons to visualize the extent and margins of tumors
  - → Photosensitizer monitoring before, during and after treatment



5-Aminolevulinic Acid (5-ALA)



Protoporphyrin IX (PpIX)

- Up to 8 individually controllable illumination fibers
- **CE certified medical laser**

PDT treatment scenarios for GBM

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FGR surgery

Focal radiotherapy

Chemotherapy

Post-surgical margin treatment

Alternative localized non-invasive treatment

Boosting chemotherapy drugs or priming cancer cells

Photodynamic therapy

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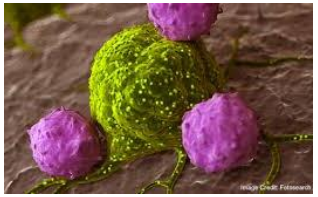
Potential recurrence block via immunoresponse



Photoimmunotherapy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Benefits of novel Modulight laser

- Same laser system and same fibers used for illumination and detection
- Addition of treatment monitoring is made effortless by integrating them to the treatment flow
- Eight channels providing dosimetry data on light distribution over tumor area
- Photosensitizer presence in tissue is confirmed prior to starting the treatment
- Integrated sensors & cloud-based analytics that help in real-time to guide the surgery
- Collected diagnostic data can be viewed from cloud.modulight.com during the treatment and downloaded later

Topics today

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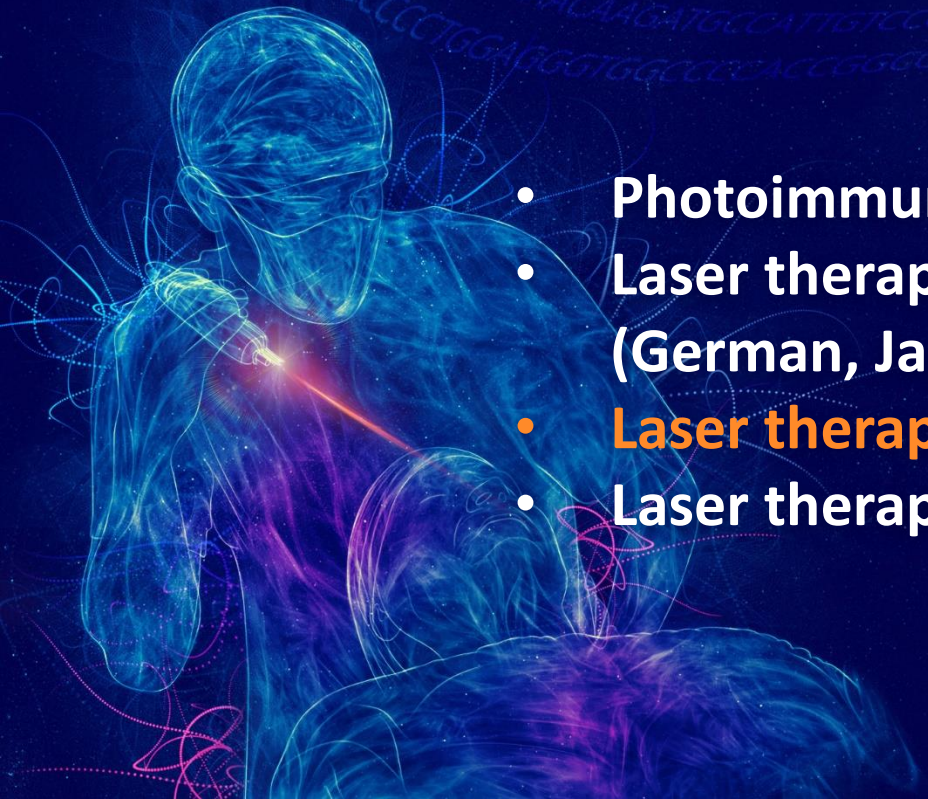

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Uveal melanoma is cancer of the eye

- **Kills aggressively: 5-year survival rate only 15%, half develop metastases, 5 % of all melanomas are uveal**
- **Traditional treatment is heavy: even the removal of the eye**

Modulight **ML7710** laser with slit lamp adapter

- ❑ Mountable to **Zeiss** SL120/SL130/SL115C and **Haag Streit** type slit lamps
- ❑ Set up, calibration and training by Modulight field engineers
- ❑ Direct field and service support from the factory
- ❑ Multispot treatment supported with adjustable spot sizes
- ❑ Easy to use touch screen graphical user interface

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The spot diameter can be adjusted from 0.5 mm to up to 20 mm
with a contact lens. It is a range beyond compare.


WORKUP
Dr. Carol Shields
Wills Eye Hospital
Investigational Drug Trial

Topics today

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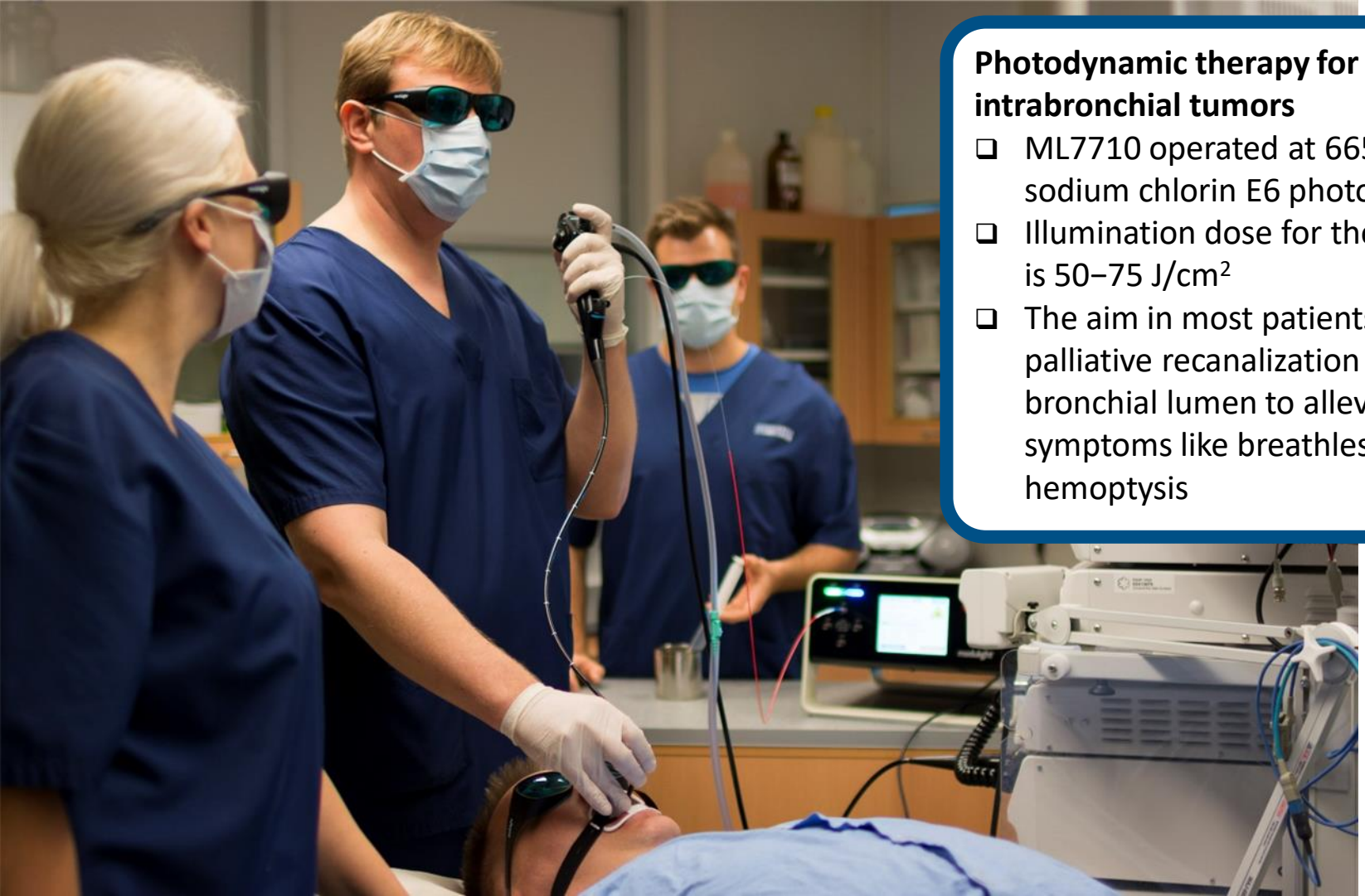

Photodynamic therapy for intrabronchial tumors

- ML7710 operated at 665 nm and sodium chlorin E6 photosensitizer
- Illumination dose for the target area is 50−75 J/cm^2
- The aim in most patients has been a palliative recanalization of the bronchial lumen to alleviate symptoms like breathlessness and hemoptysis

PDT of intrabronchial obstructive tumors

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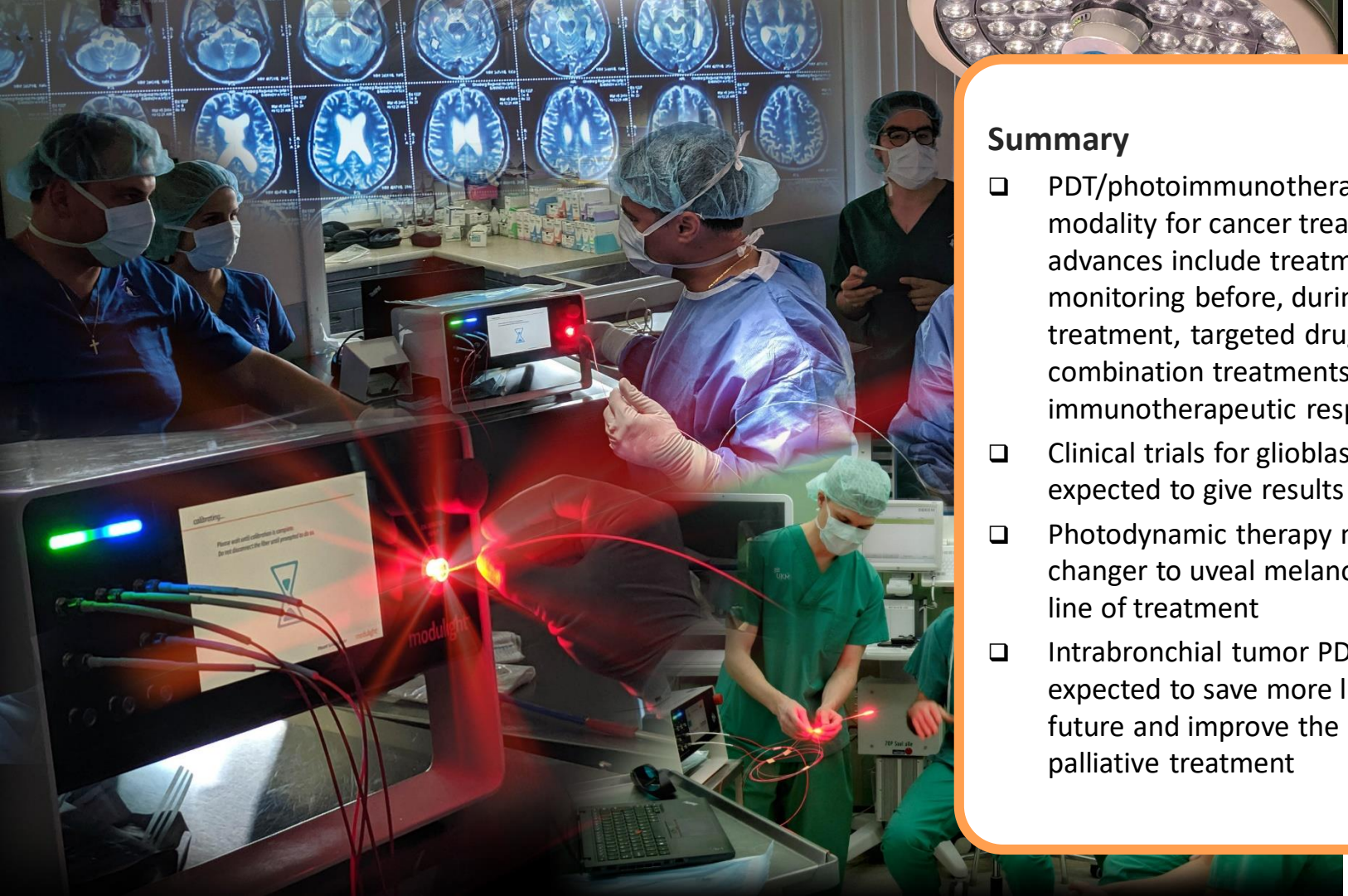
- Before the first PDT treatment the patient's main bronchus was almost completely blocked by the tumor
- Approximately one week after the treatment bronchus is partially open and the collapse of the lung is prevented

- Second PDT treatment was completed a few months after the first one.
- Pictures on the left show PDT treatment area before and a few weeks after the second treatment



Summary

- PDT/photoimmunotherapy is a proven modality for cancer treatment; latest advances include treatment monitoring before, during and after treatment, targeted drugs, combination treatments, and immunotherapeutic response
- Clinical trials for glioblastoma are expected to give results in a few years
- Photodynamic therapy my be game changer to uveal melanoma as a first line of treatment
- Intrabronchial tumor PDT treatment expected to save more lives in the future and improve the level of palliative treatment

Thank you!

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