Photonics research in cancer therapy and industrial spin-off

Interstitial Photodynamic therapy

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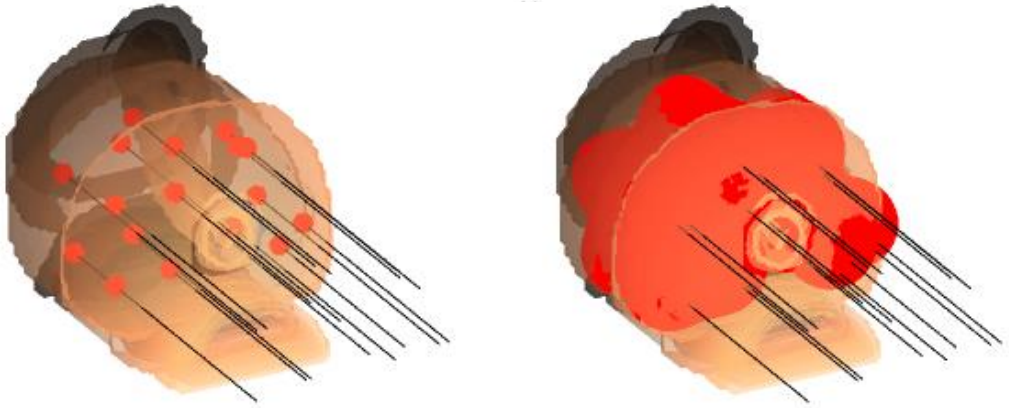


Laserlab-Europe Symposium "Lasers Fighting Cancer"

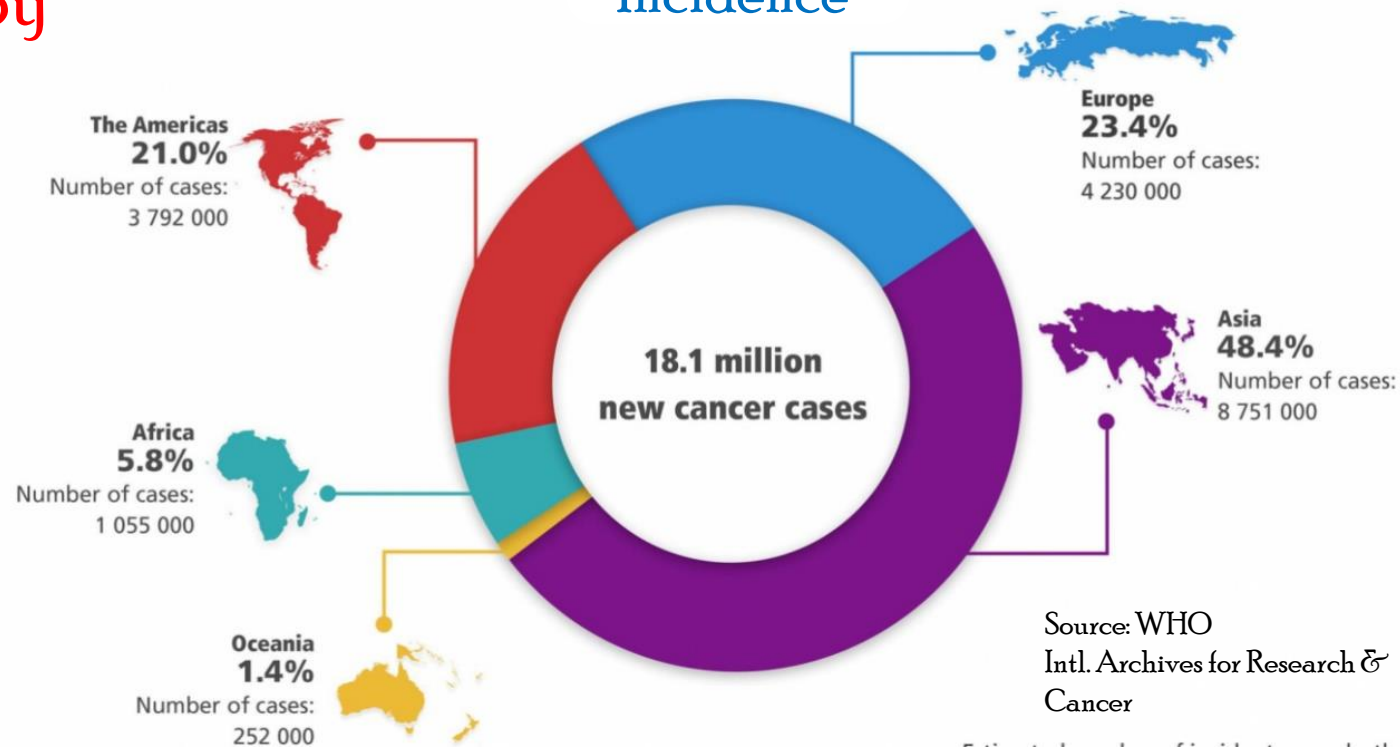
Medical and industrial application of lasers in the diagnosis and treatment of cancers

World-wide health threats

Increasing incidence of cancer – early detection, minimal invasive therapy

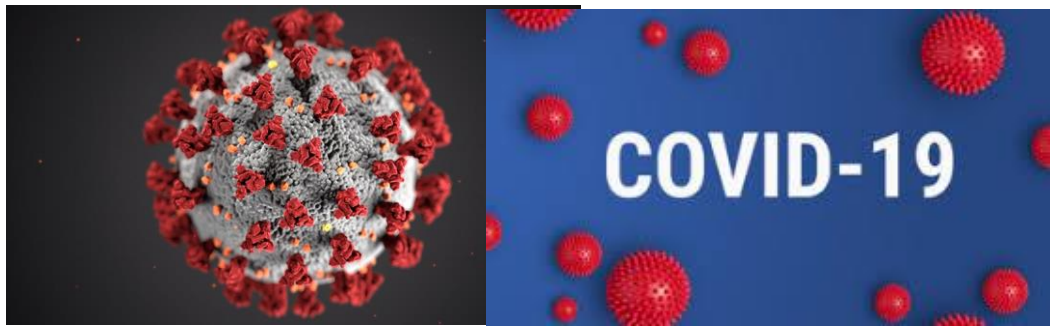
There will be a doubling of cancer cases until 2040

2020
Global Cancer Incidence



Source: WHO
Intl. Archives for Research & Cancer

Infectious diseases & antibiotic resistance



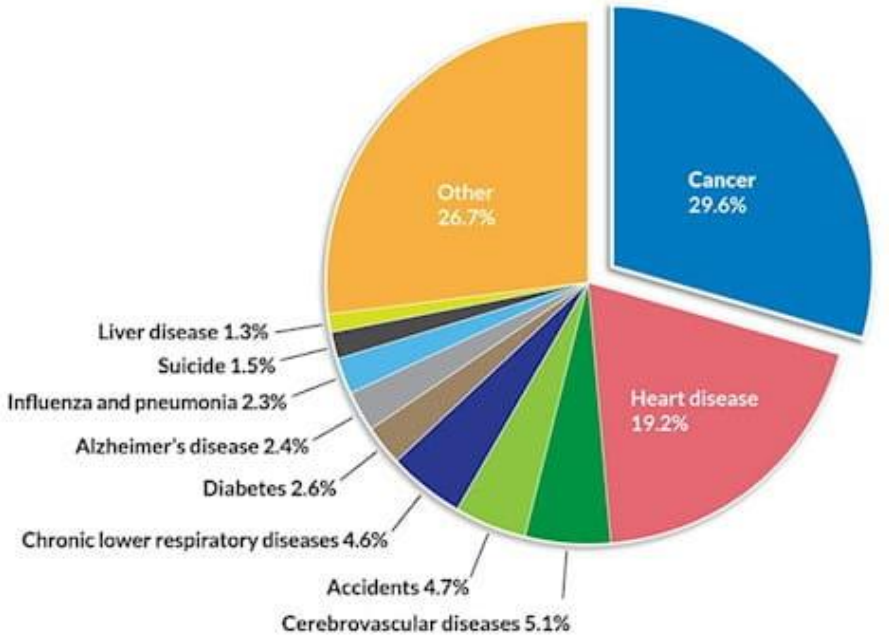
The Corona virus which threatens a whole world

Cancer is a man killer in Europe & Worldwide

4-5 new diagnosed cancers/1000 persons each year –
1 person every 15 minutes in Sweden (9 milj)

The cancer incidence varies from region to region -
Highest incidence in the urban areas
The highest incidence of breast- and prostate cancer in large cities

Proportion of Deaths Due to Cancer & Other Causes, 2016



Source: WHO
Intl. Archives for Research & Cancer

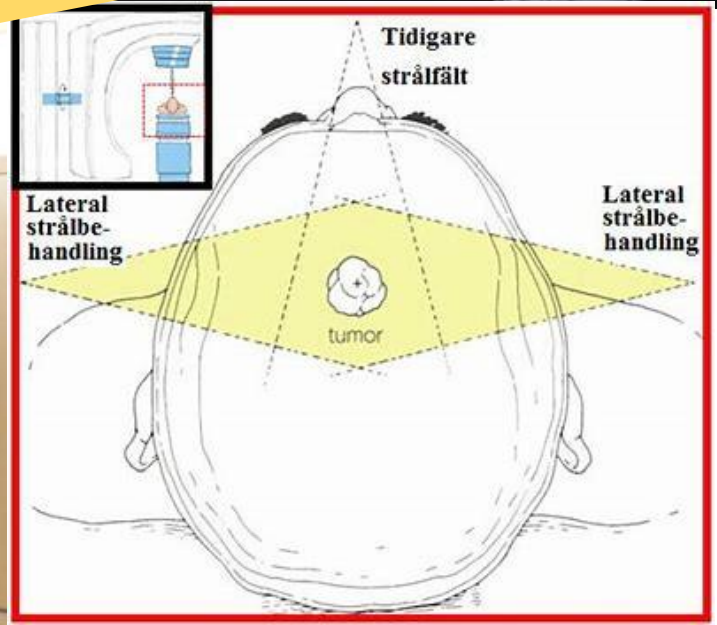
Approximately 30 % of all deaths in the Western World are caused by cancer.
Equal numbers for cardiovascular disease.

Surgery and/or Chemotherapy

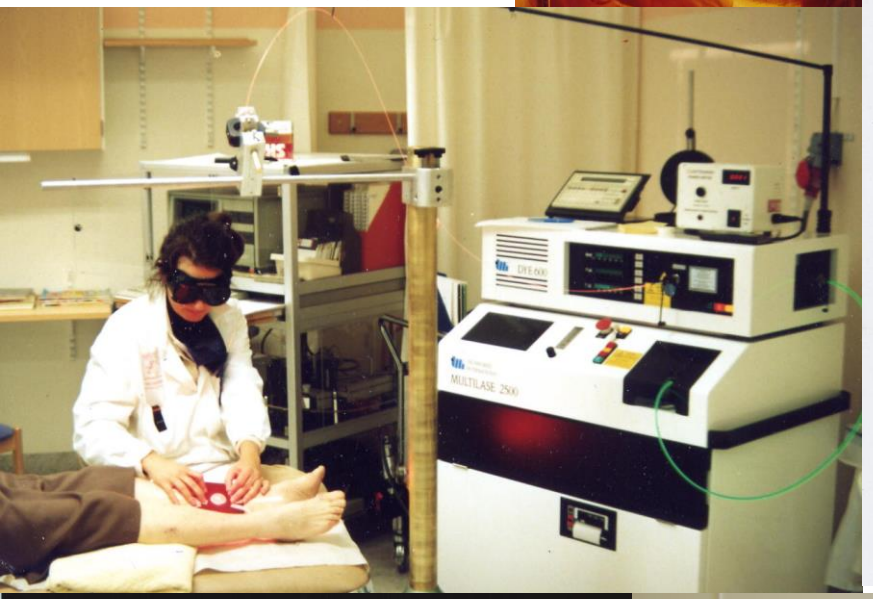
External ionizing radiation therapy

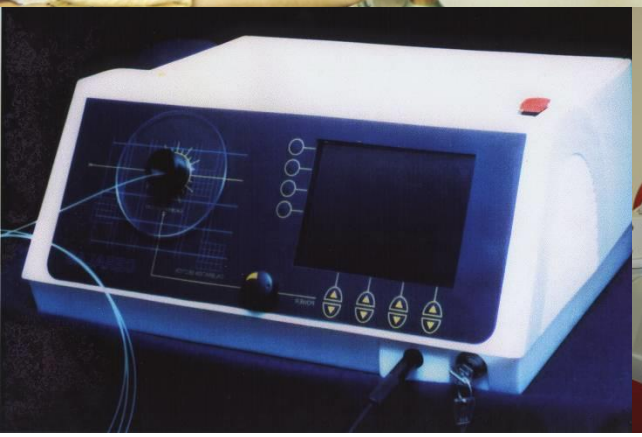
Linear accelerator, also called Linac

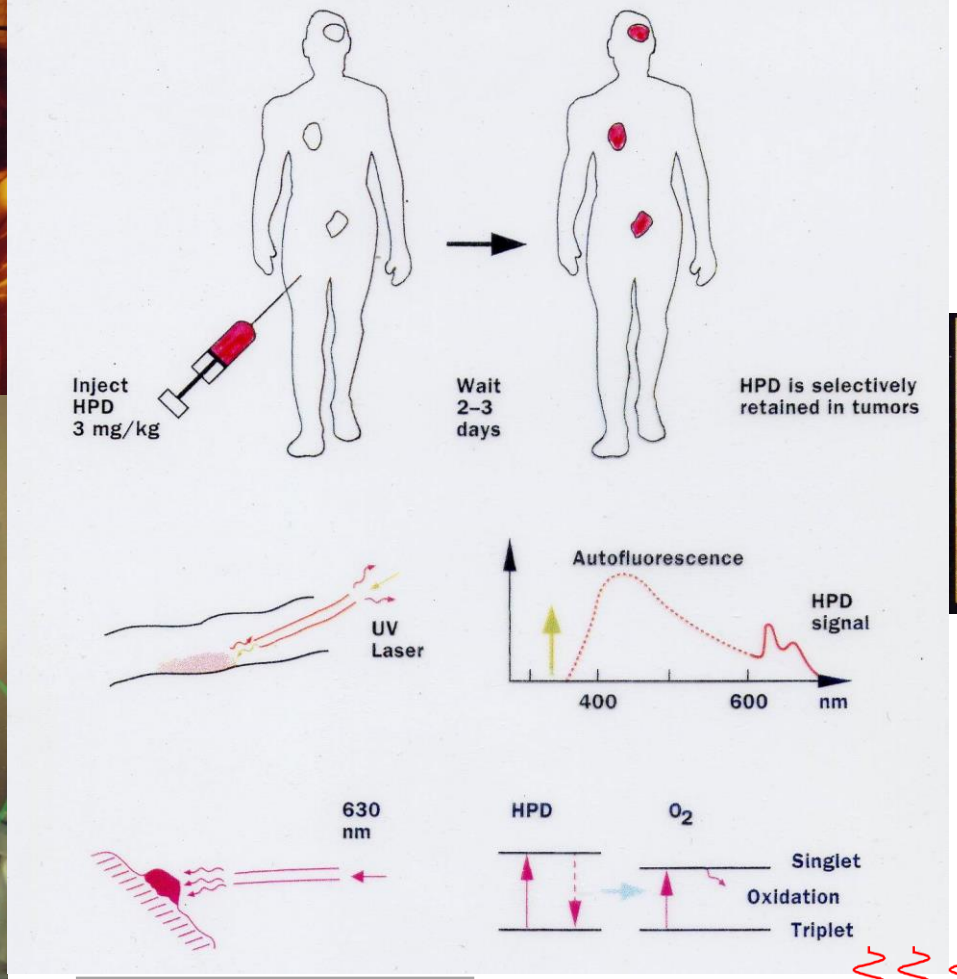
There is a need for minimal-invasive individualized treatment modalities



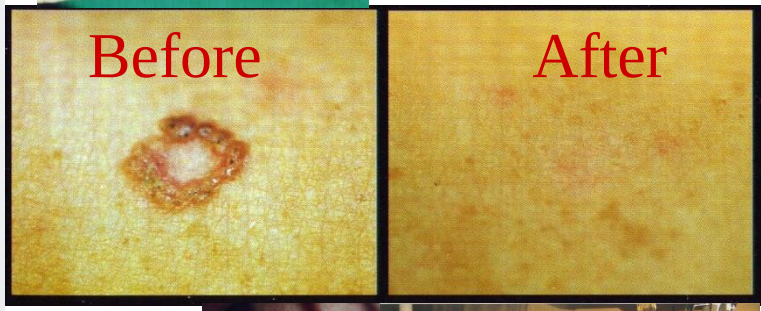
Photodynamic therapy for individualized therapy







PDT of basal cell carcinoma and squamous cell carcinoma

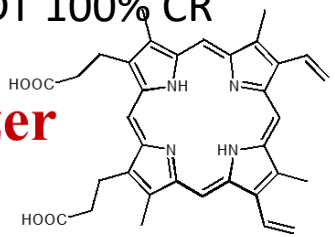


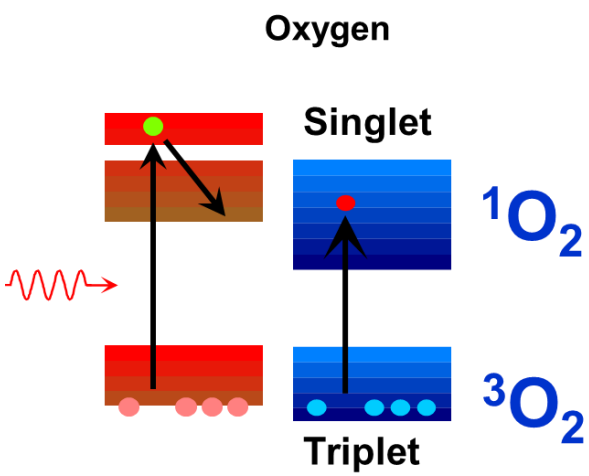
The principle of PDT

Red light

Post PDT 100% CR

Photosensitizer

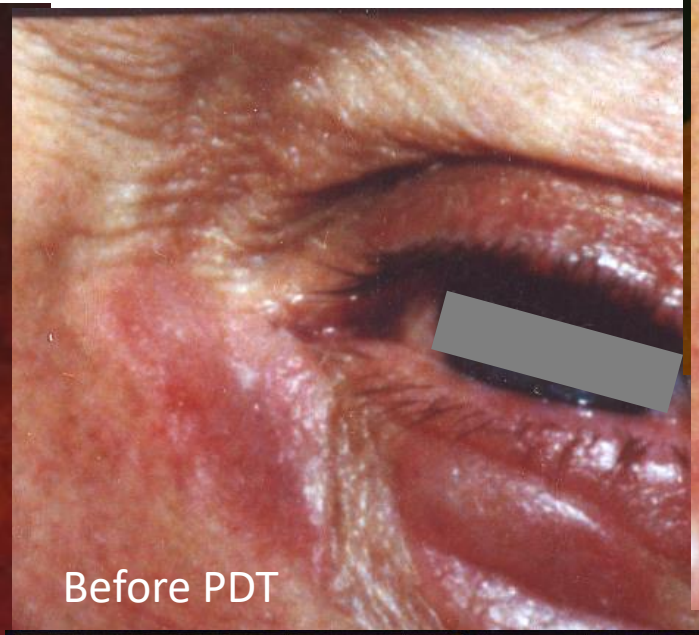


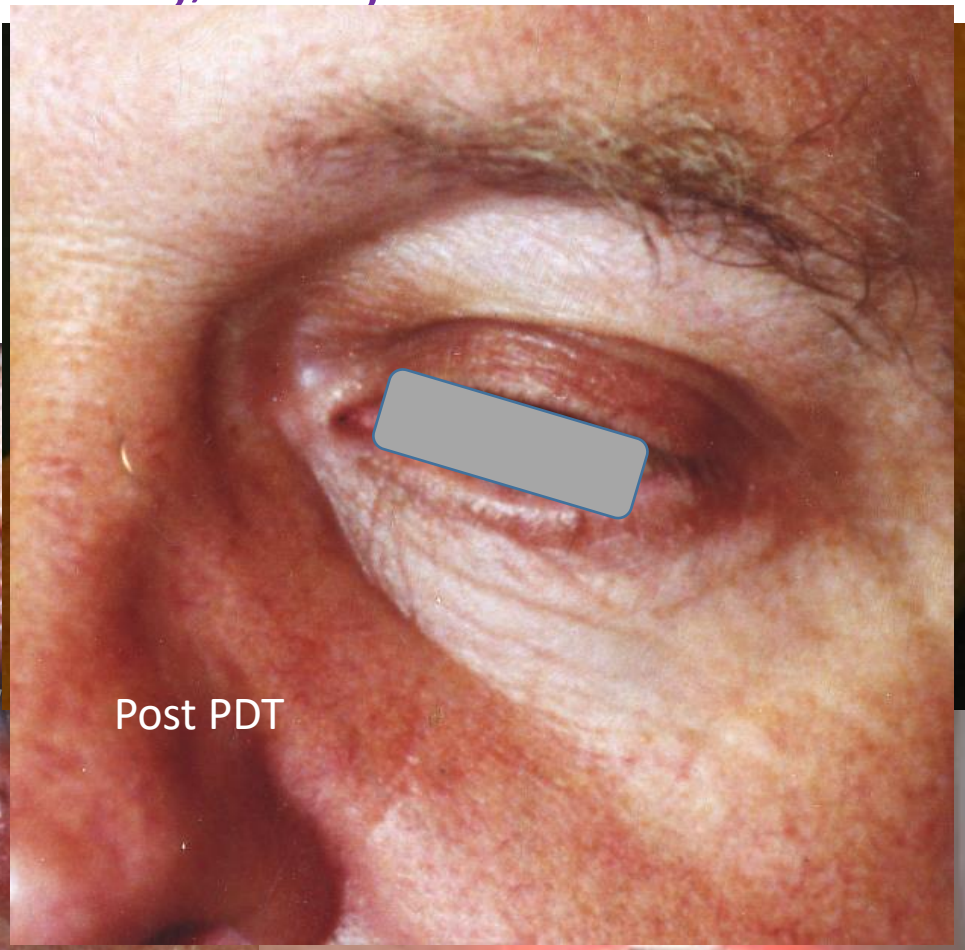


PDT is one such a promising treatment modality

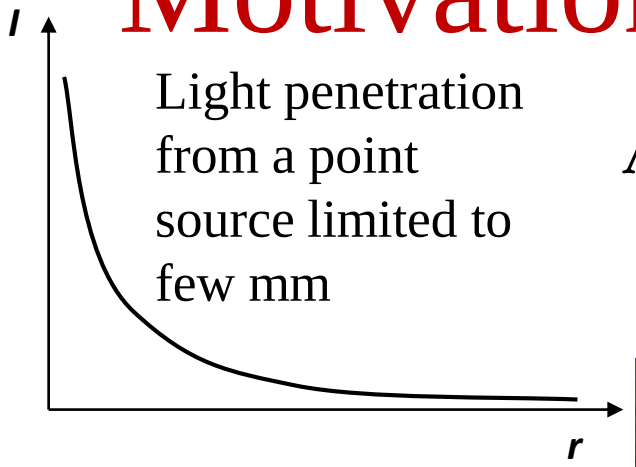
Photodynamic therapy at Lund University/Hospital

Approximately 3000 non-melanoma skin cancers
Implemented a Phase III study for clinical approval (90% CR)
Developed fluorescence diagnostics in oncology
Developed & Patented Interstitial Photodynamic Therapy





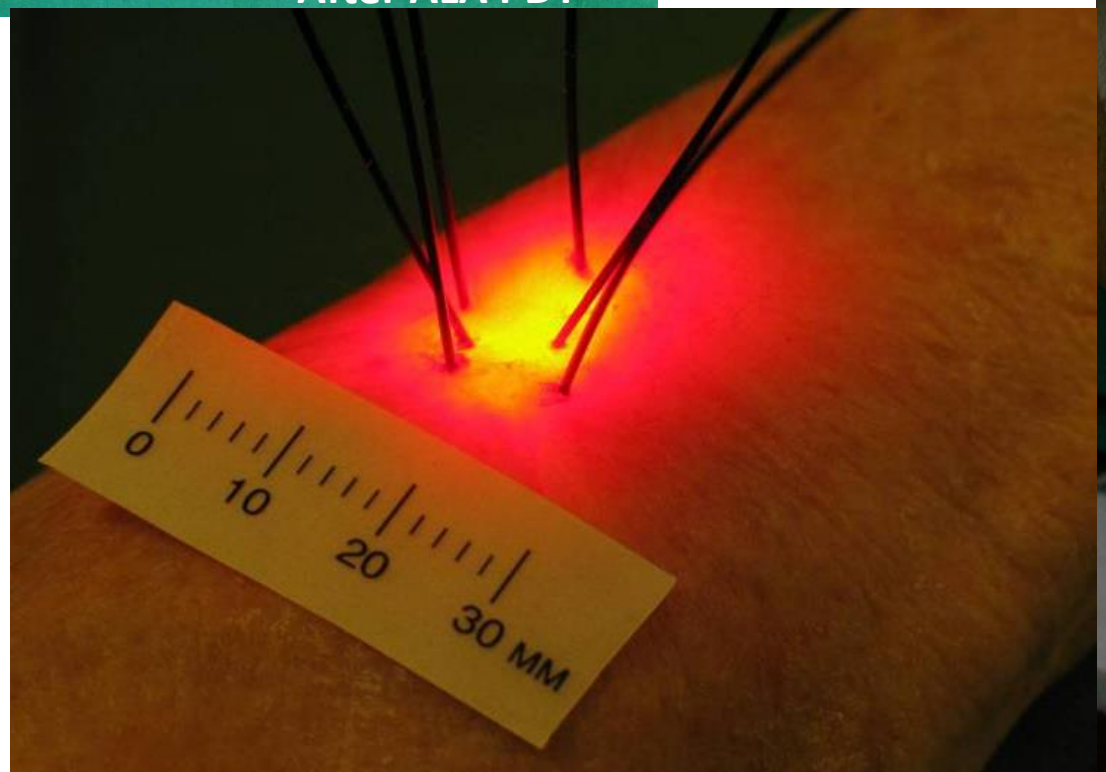
Motivation for Interstitial PDT

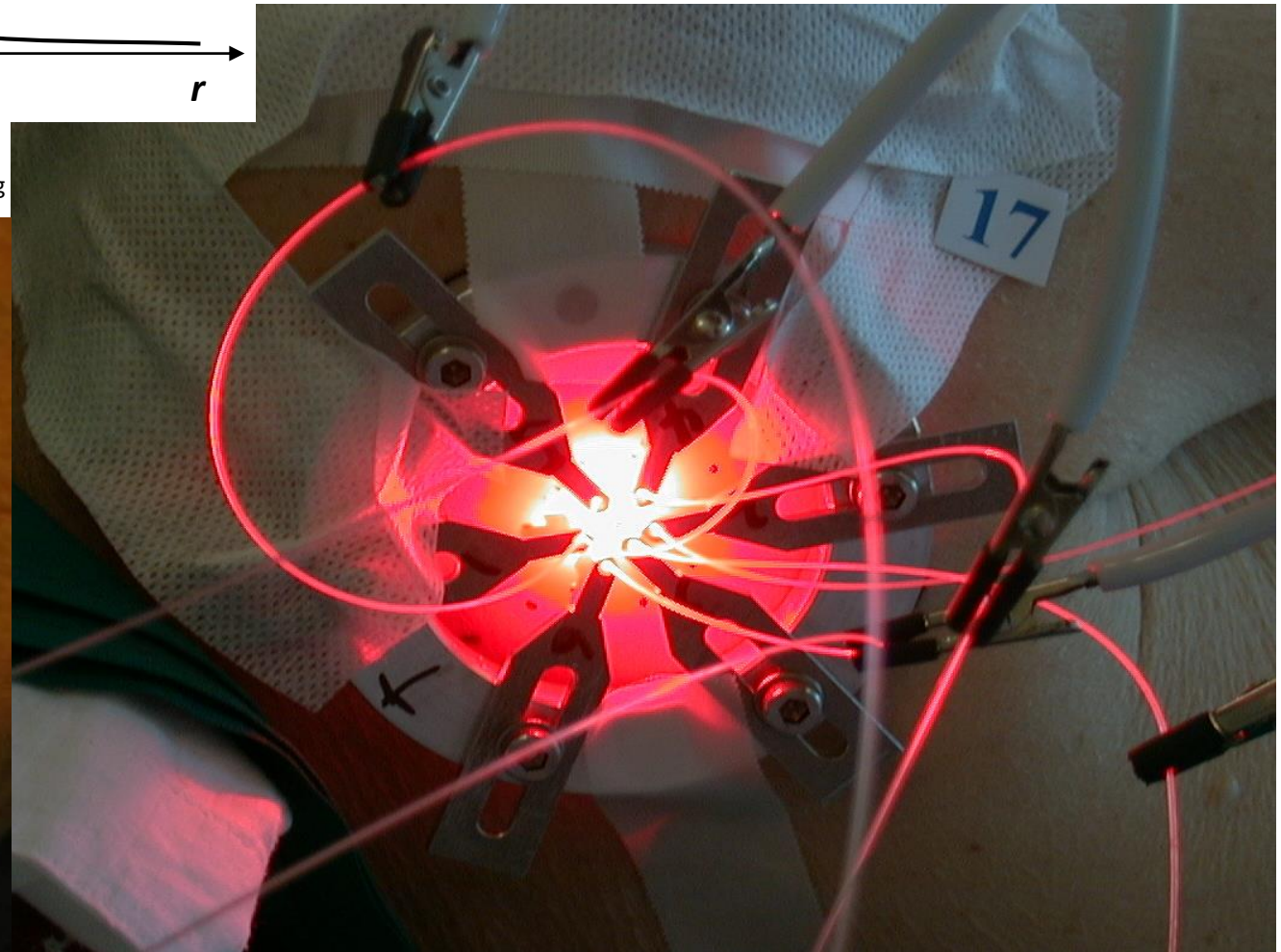


Light penetration from a point source limited to few mm

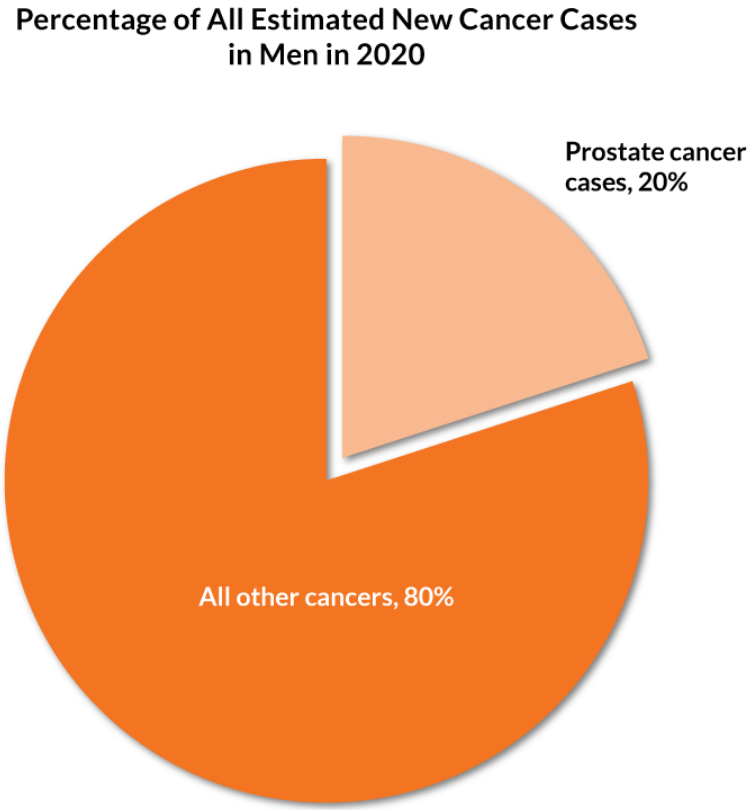
Application: deep lying imbedded tumor

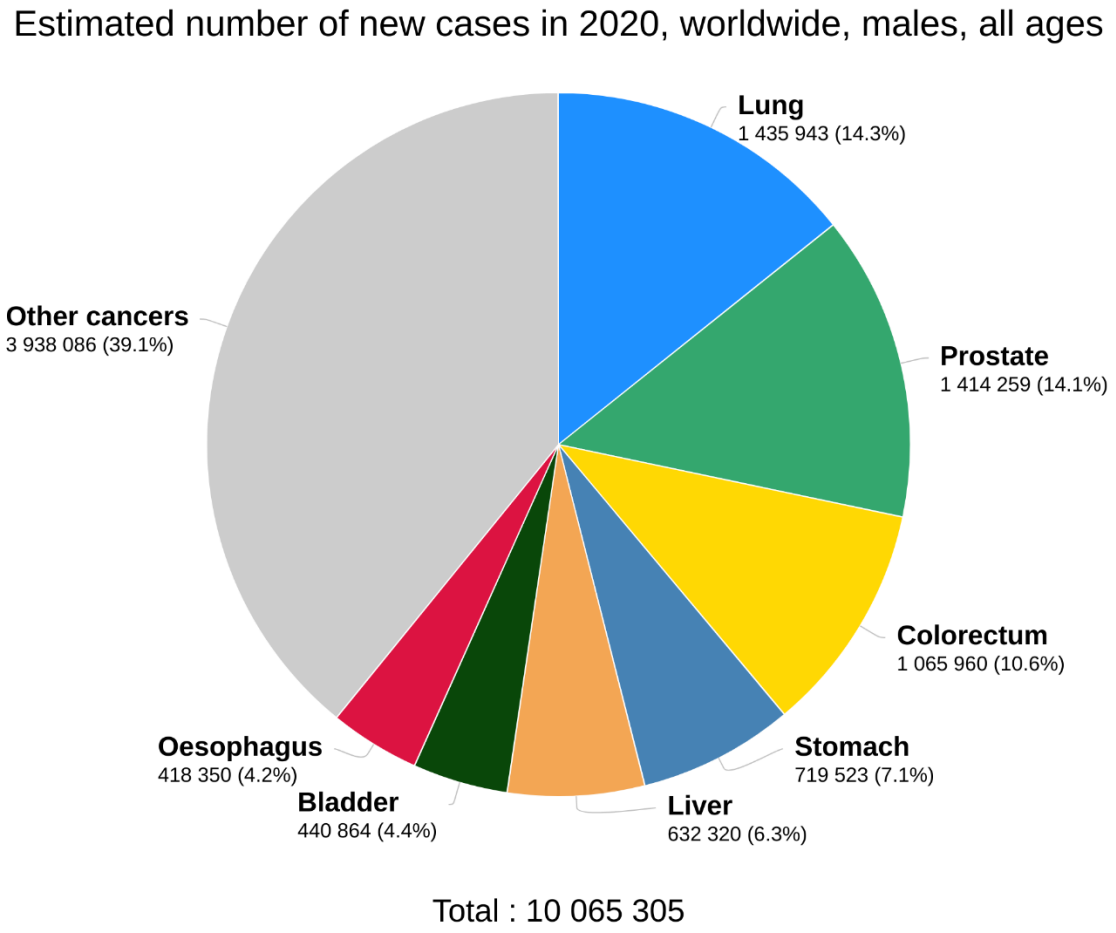
Johansson et al. JBO (2006)
Wang et al. Br. J. Dermatol. (2001)
Andersson-Engels, Svanberg, Svanberg





Prostate Cancer – a perfect target for IPDT

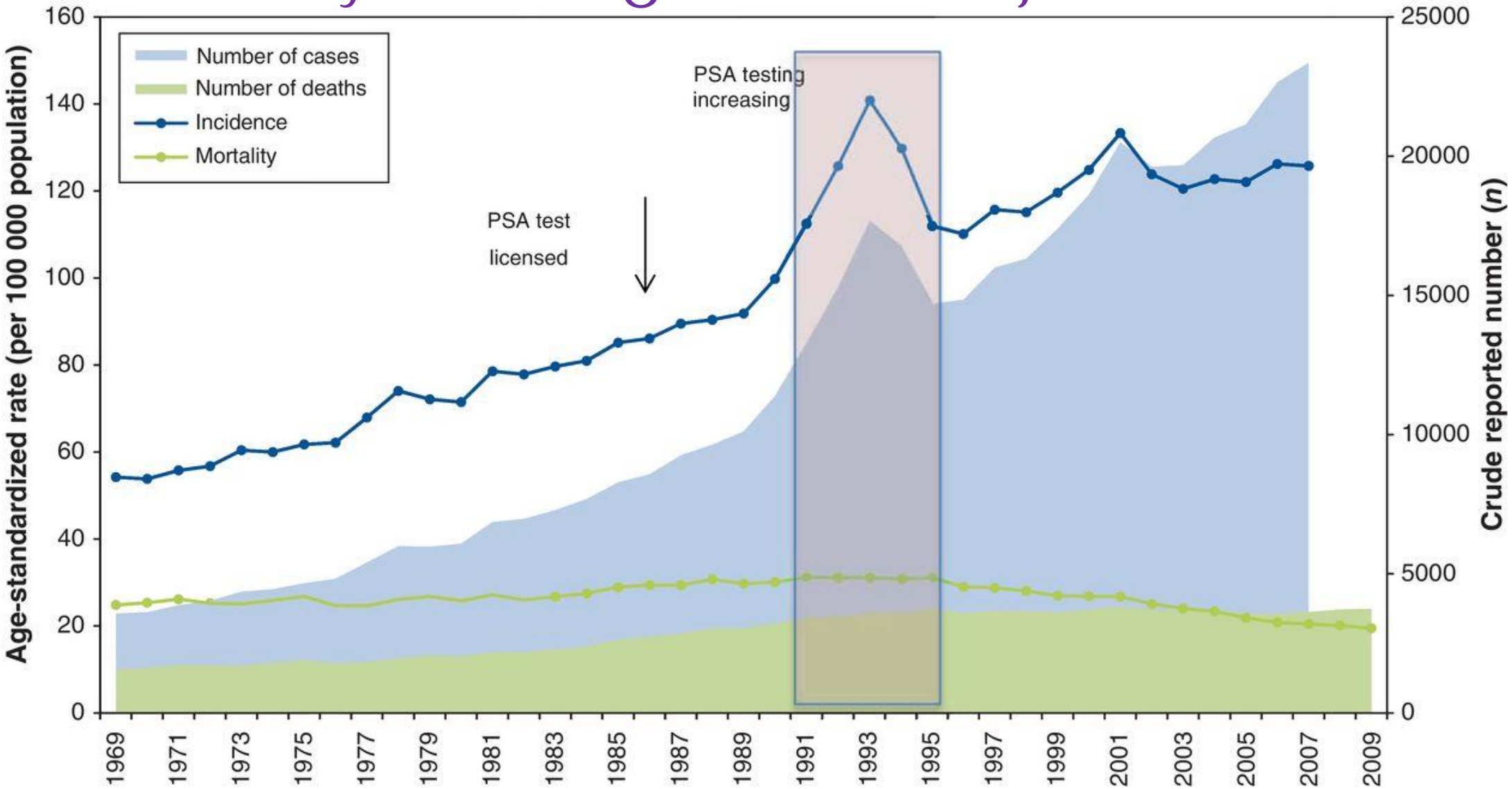




Prostate cancer is the second most commonly diagnosed **cancer** and the sixth leading cause of **cancer** death among men **worldwide**, with an estimated 1 276 000 new **cancer** cases and 359 000 deaths in 2018

Source: WHO
Intl. Archives for Research & Cancer

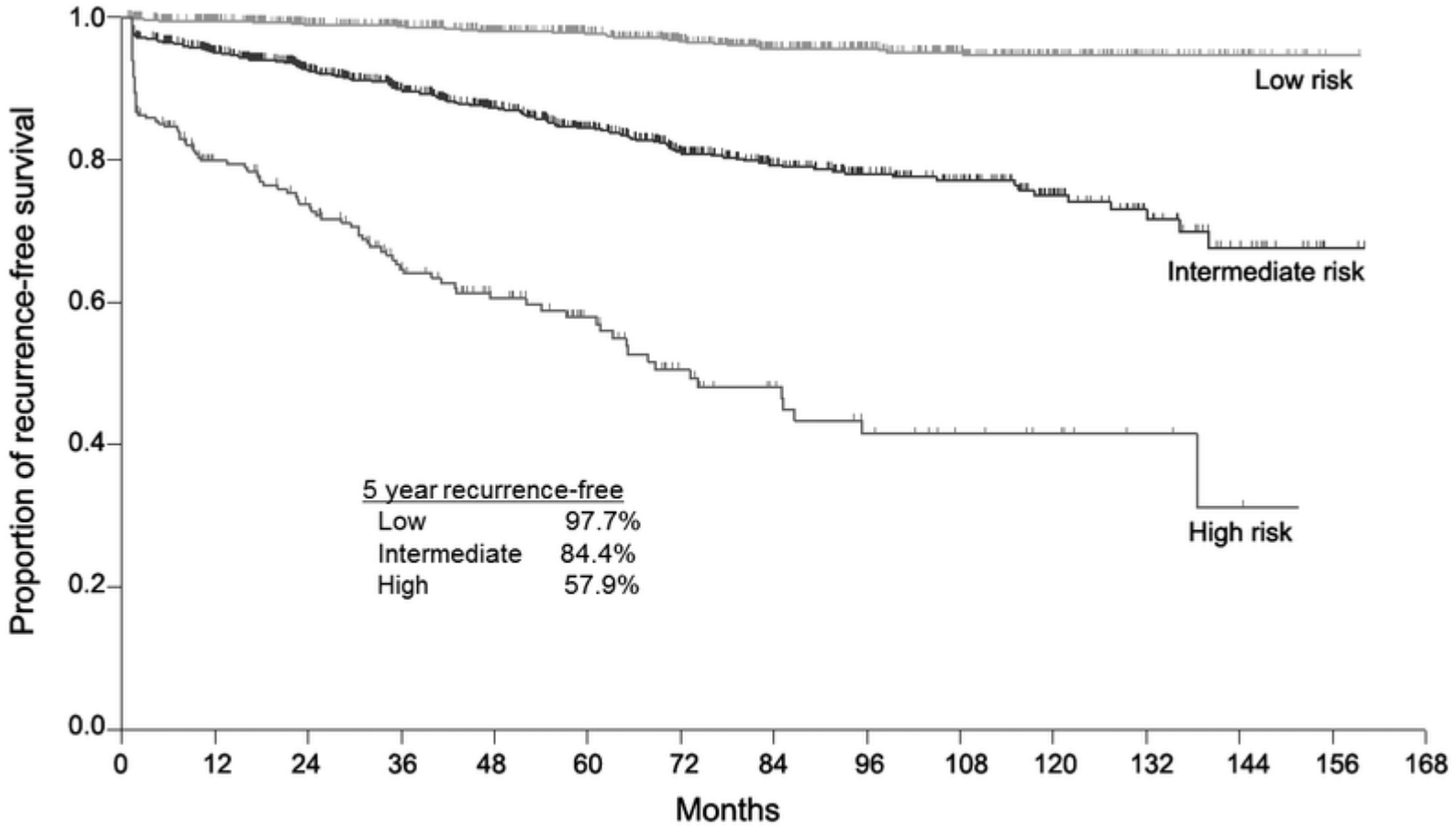
Constantly increasing incidence of prostate cancer



Age tandardized trends in prostate cancer incidence and mortality in Canada during the era of prostate-specific antigen (PSA) screening

Ref., cmajo March 1, 2016 vol. 4 no. 1 E73-E79

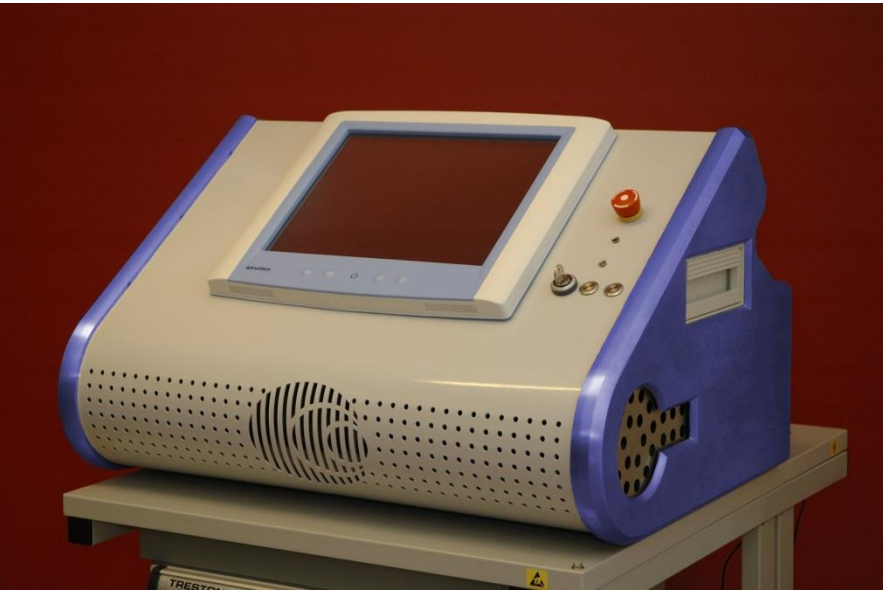
Recurrence rate after ionizing radiation therapy ranges in the order of 15-25%

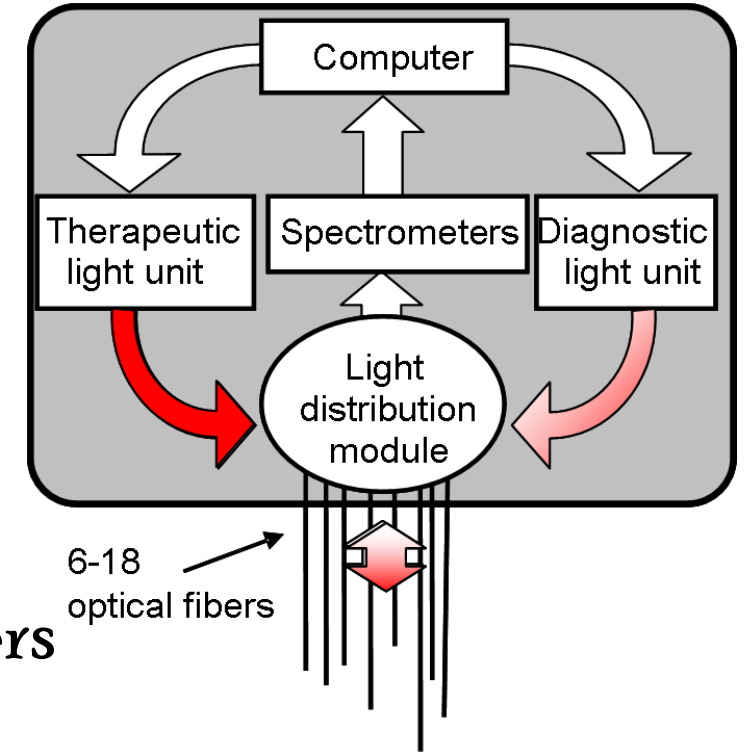


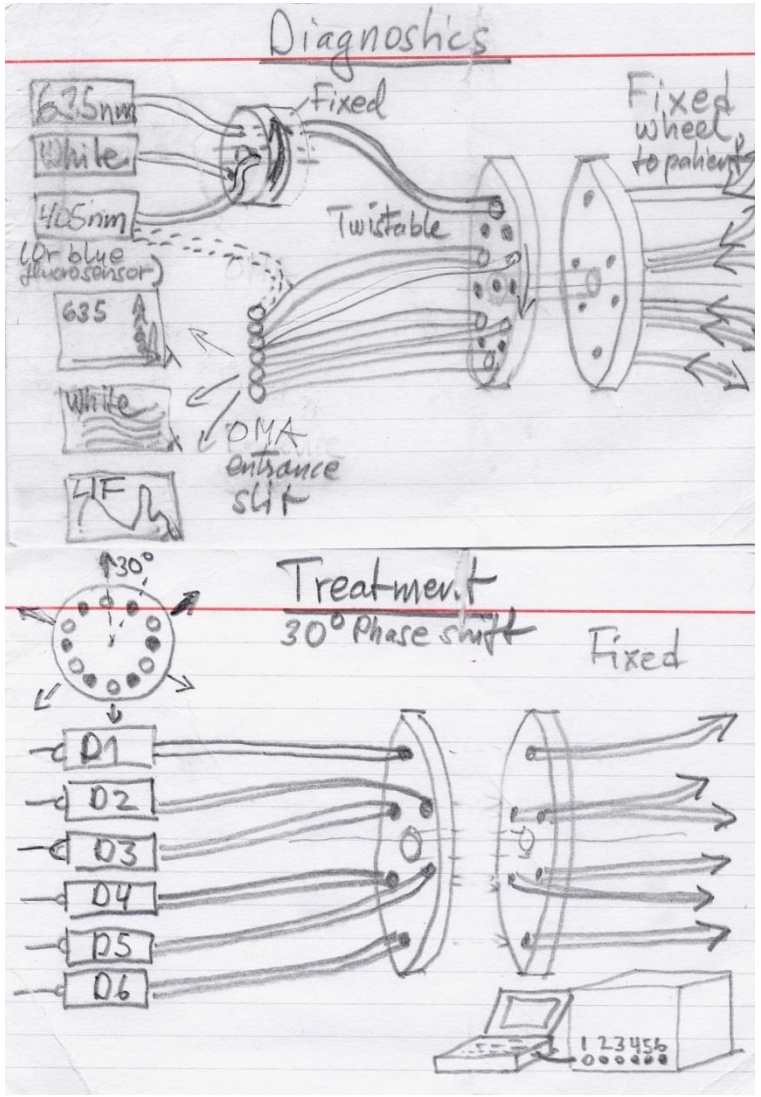
Number at risk

Low	1251	1123	995	901	792	674	547	430	335	251	164	87	38	3
Intermediate	1298	1081	892	751	614	483	364	275	200	143	90	51	24	2
High	263	167	138	102	77	58	41	32	23	17	11	6	3	

Interactive IPDT Instrumentation – world wide patent







6 -18 **treatment/diagnostic** fibers

realtime monitoring of:

- light transmission
- sensitizer fluorescence
- tissue oxygenation

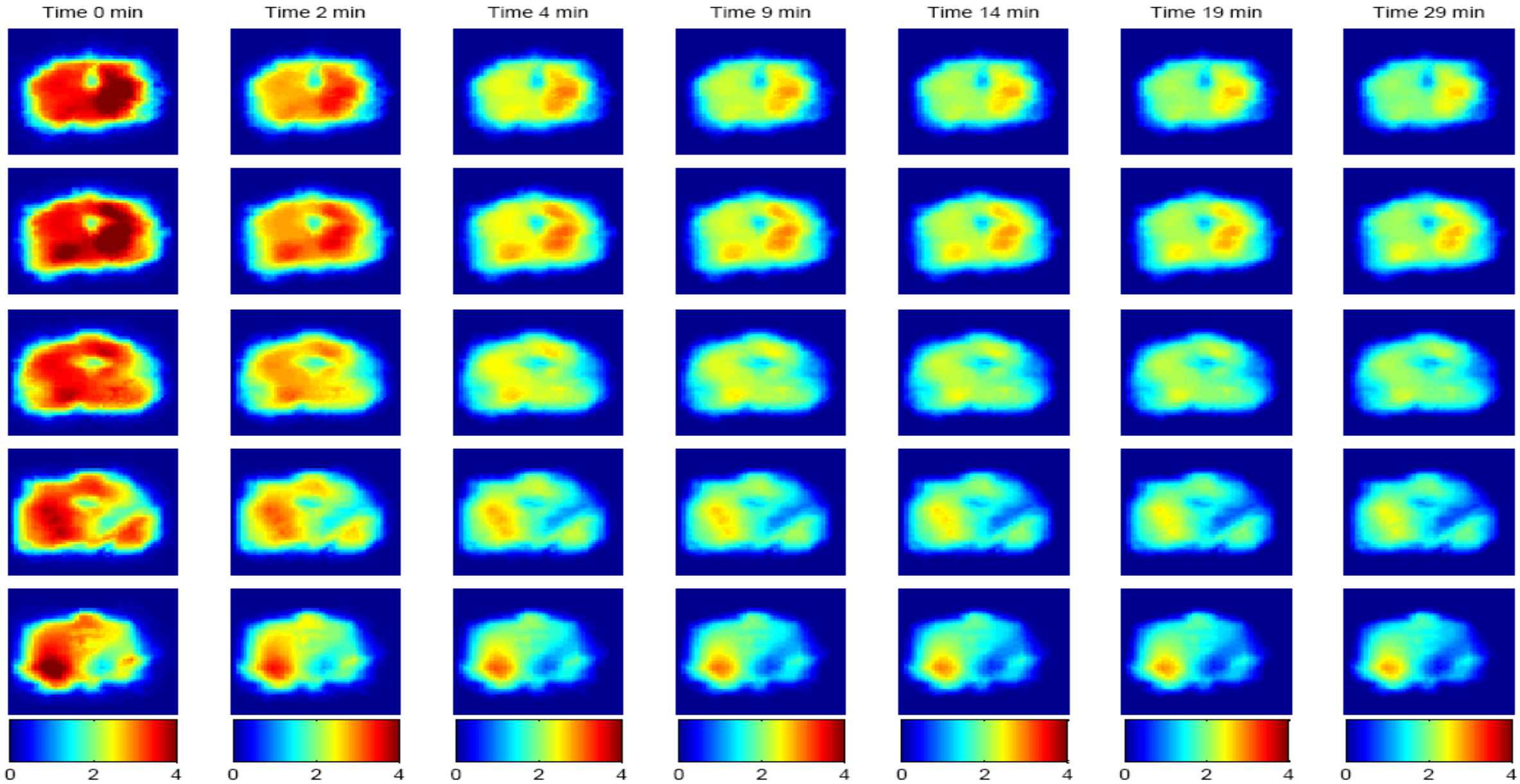
online feedback based on light transmission for **interactive dosimetry**

The patent first sketch of the patent behind the development is the work by Sune Svanberg

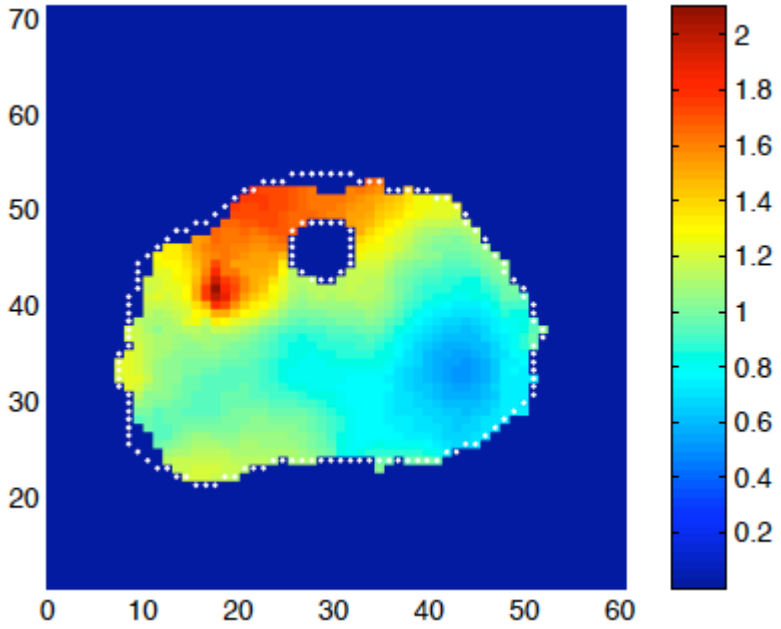
SPECTRACURE

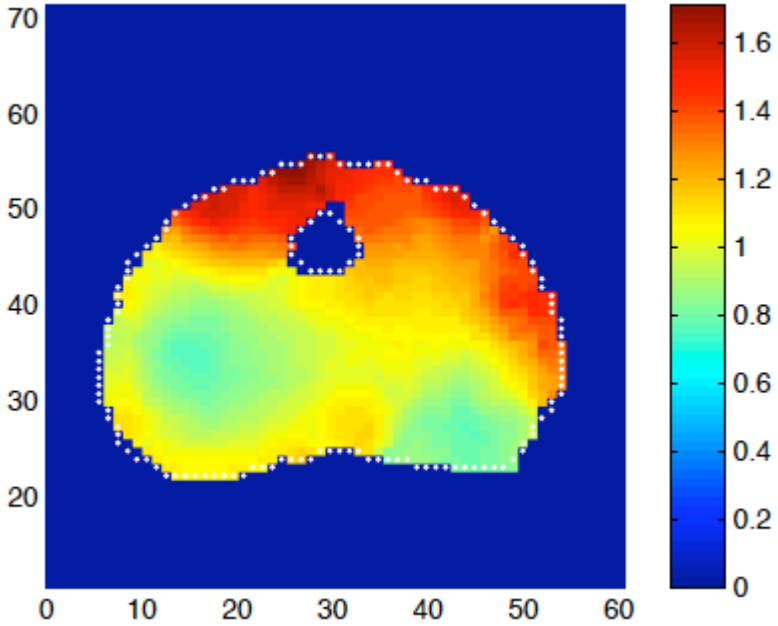
3D mapping of the fluorescence of the sensitiser Foscan in the treated prostate gland

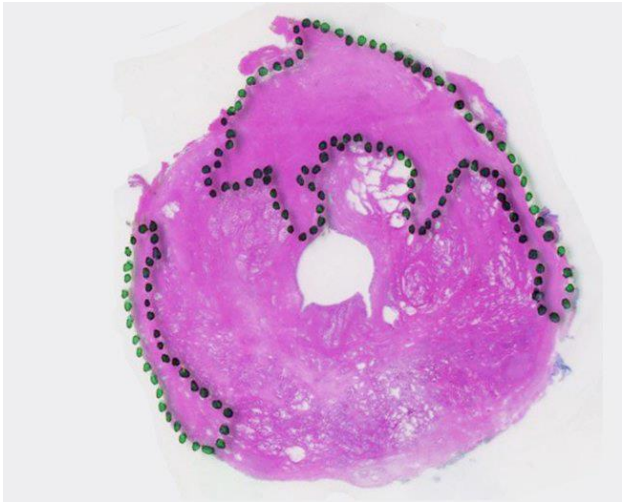
Johan Axelsson *et al.*

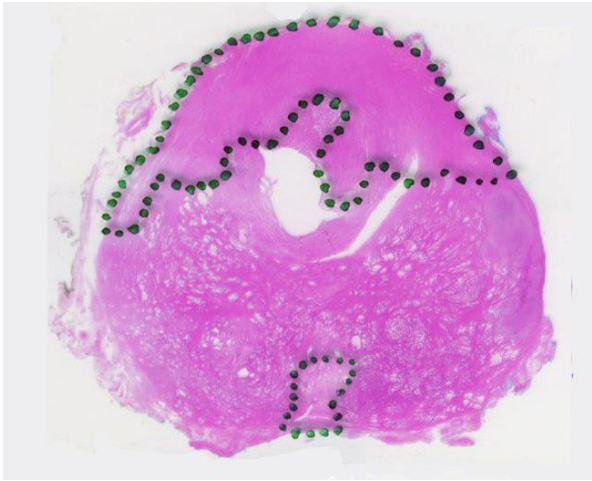


Correlation between the sensitizer concentration and cell death (necrosis formation)

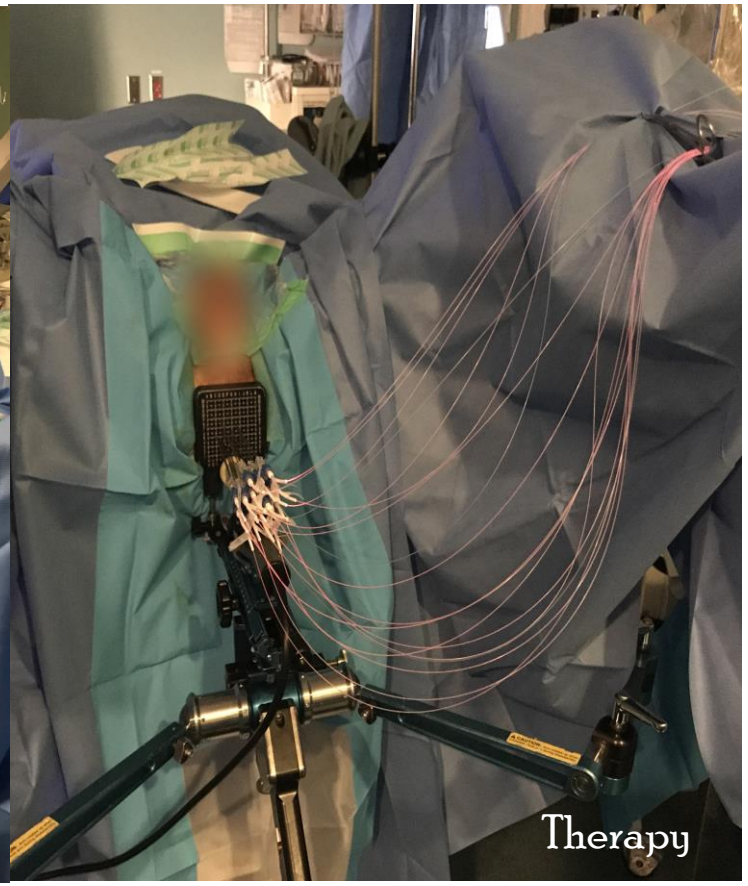








Interstital PDT Clinical Trial of recurrent prostate cancer started 2017 after FDA-approval



Study Sites:
Princess Margaret Hospital Toronto, Canada (ongoing)
London Medical College (ongoing)
University of Pennsylvania, Philadelphia (agreement signed)
Memorial Sloan Kettering (agreement signed)

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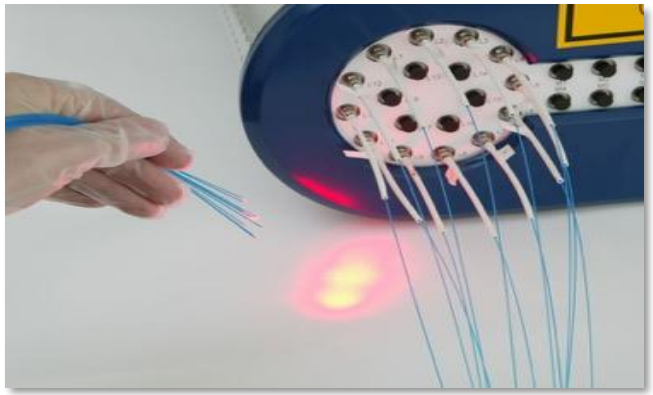
www.spectracure.com

Treatment overview using the IDOSE® interactive light dosimetry
Based on the optical parameters for each patient

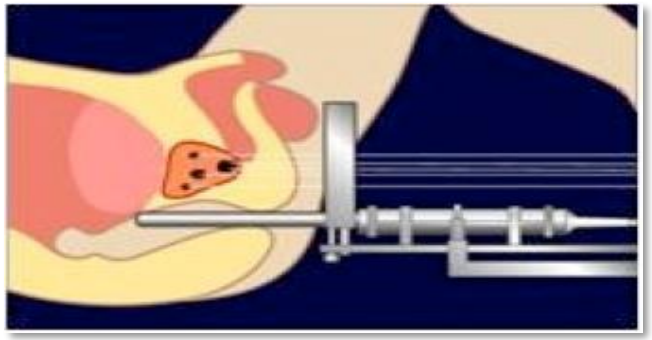


Treatment planning

Administration of photosensitiser

Insert optical fibres into prostate

Laser light-dose delivery



Individualized therapy

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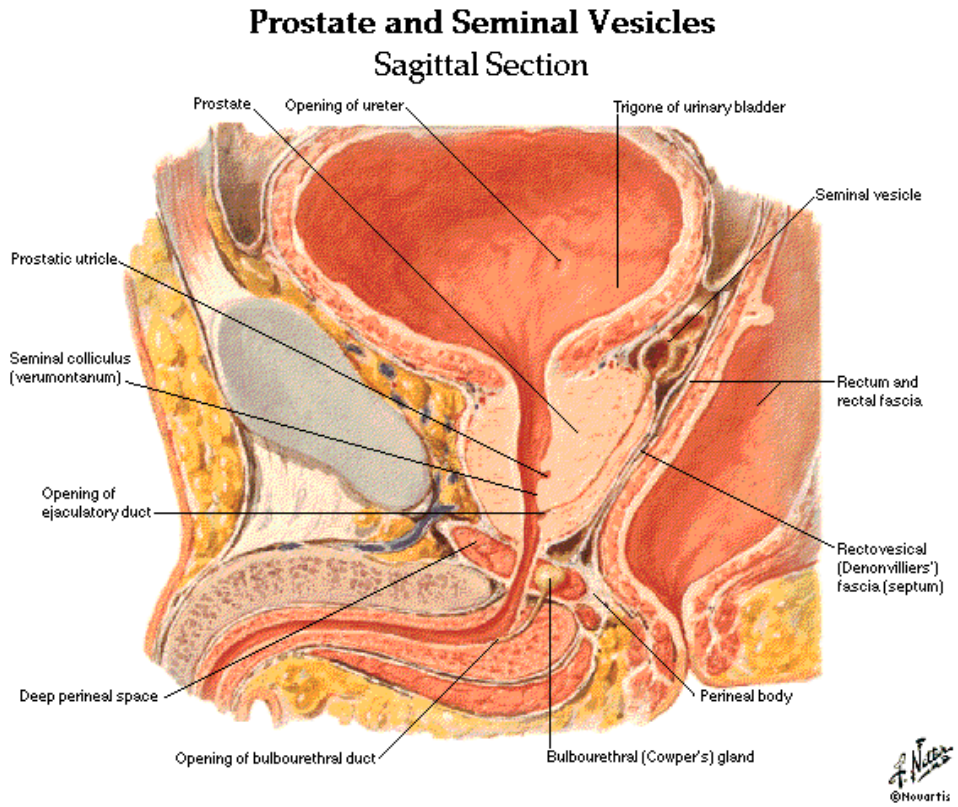
TOE

The uniqueness of the interstitial therapy equipment:

1. The same fibers are used for therapy and diagnostic monitoring of the
- therapy light
- sensitizer
- oxygen in the tissue
2. Resulting in an interactive dosimetry
3. Full treatment of the target (recurrent prostate cancer)
4. Sparing risk organs

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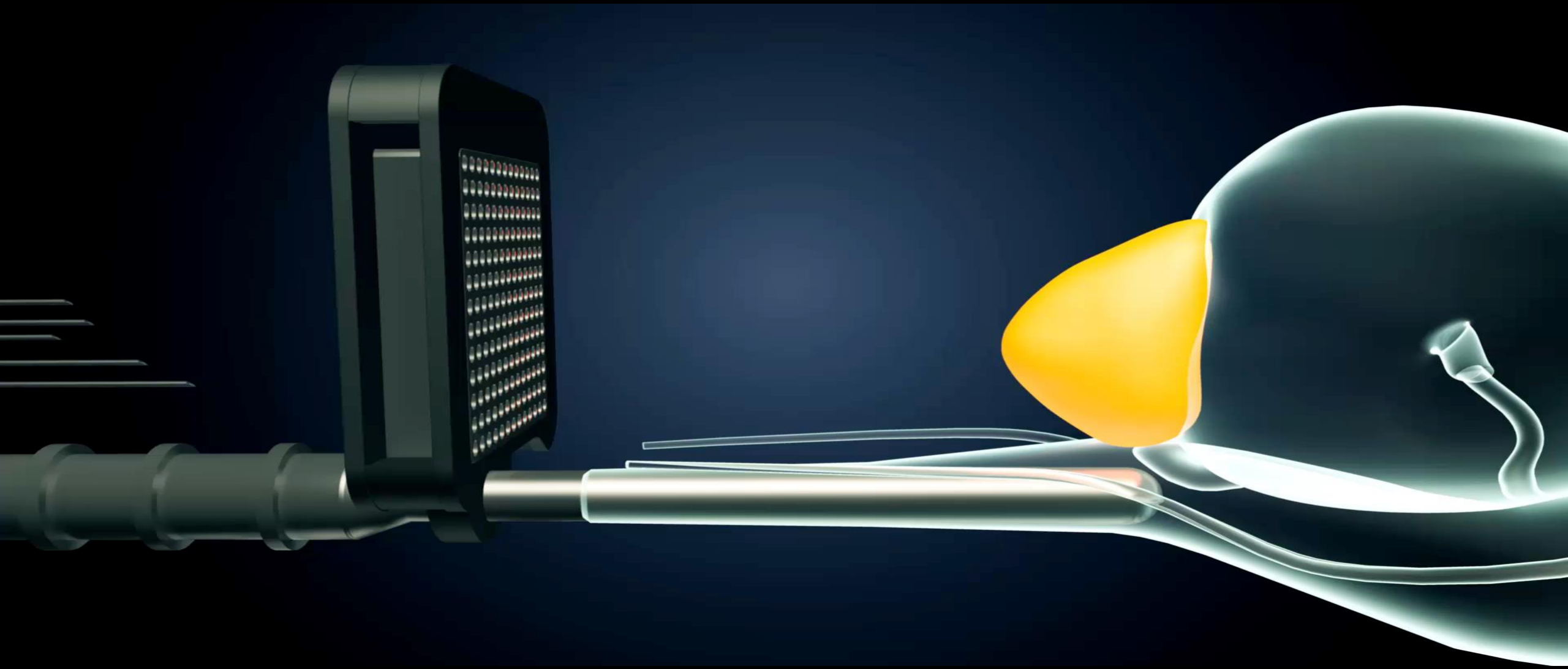
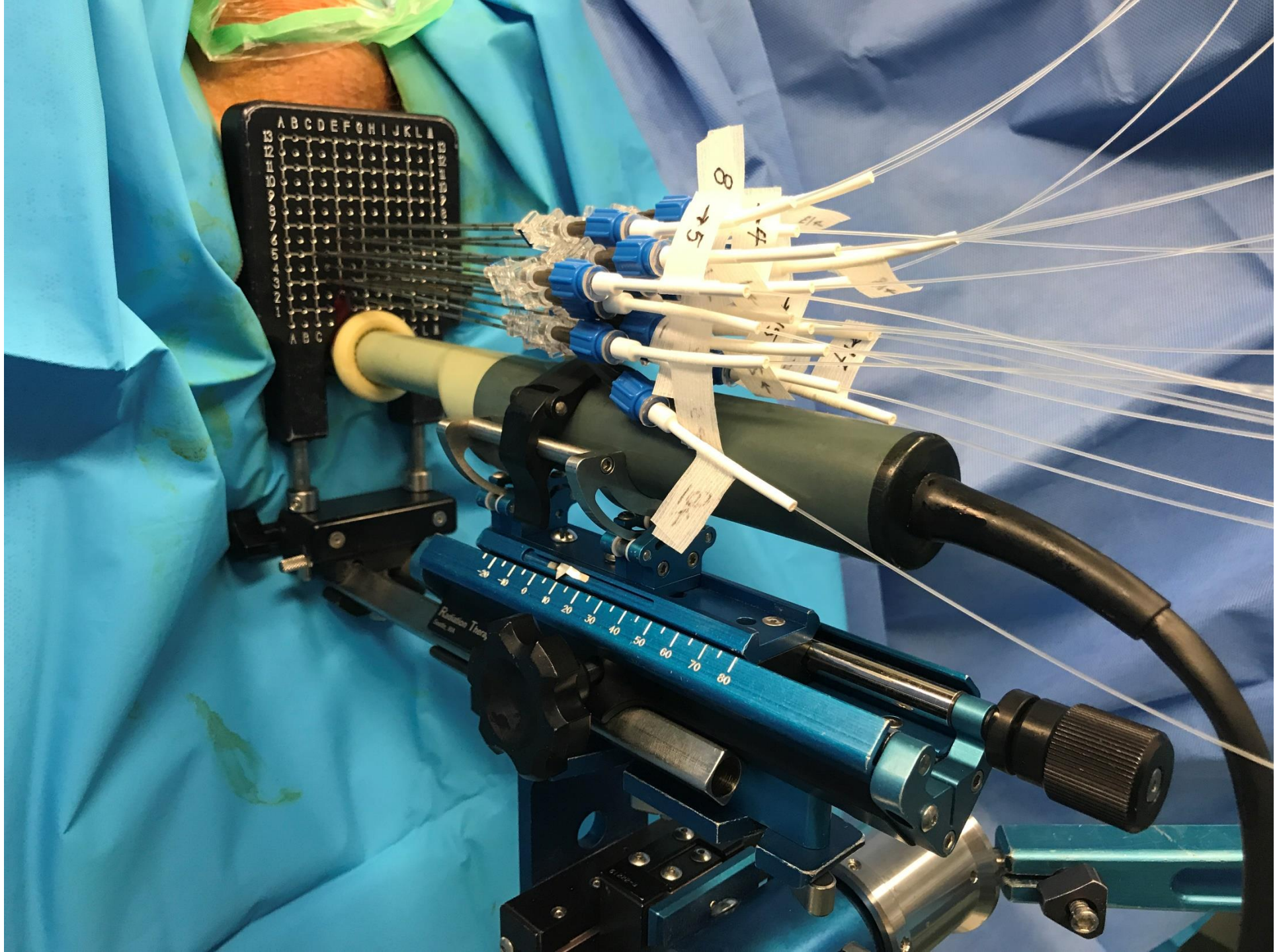
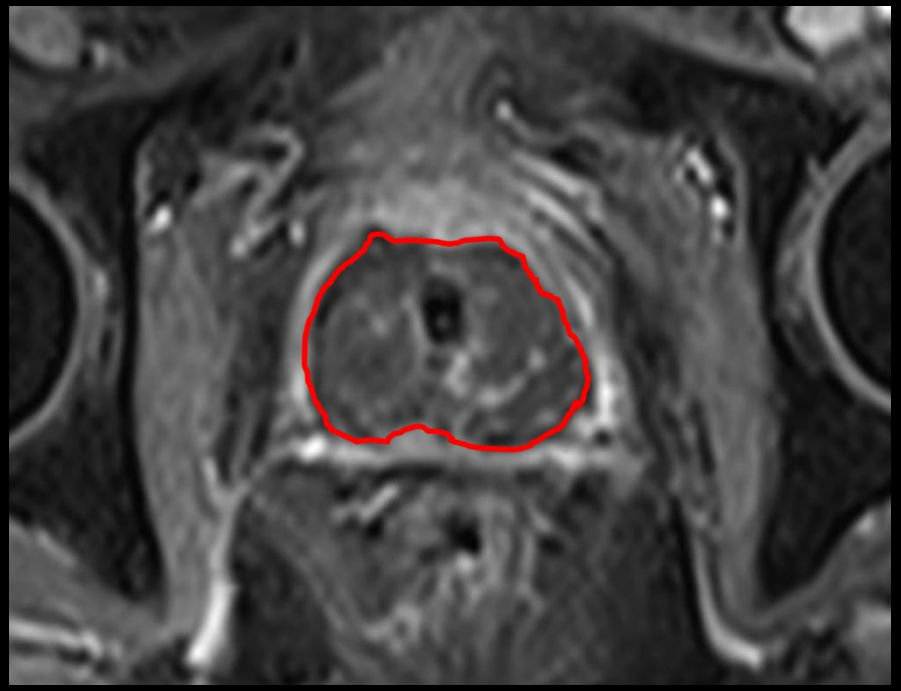


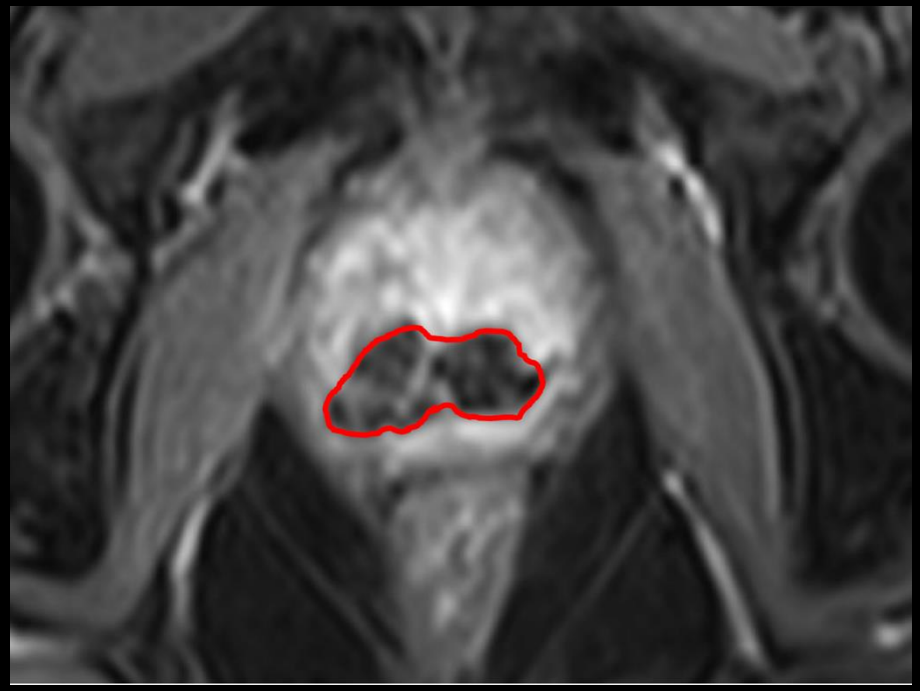
SpectraCure


A B C D E F G H I J K L M
13 12 11 10 9 8 7 6 5 4 3 2 1
A B C
-20 -10 0 10 20 30 40 50 60 70 80

Different therapy strategies



Whole gland



Focal tumour

Collaborators

LUNDS UNIVERSITET

LUNDS UNIVERSITET

S. Andersson-Engels S. Svanberg N. Bendsoe

W. Alian, P. Andersen, J. Ankerst, J. Axelsson, E. Alexandratou, L. Baert, B. Bauer, R. Berg, M. Brydegaard, E. Cardoso, L. P. Clemente, S. Colleen A. Derjabo, M. Diop, L. Eker, A. Enejder, S. Gräfe, A. Gustafsson, Z.G. Guan, M.A. d´Hallewin, K. Herrlin, H. Heyerdahl, K. Jakobsson, D, Jocham, A. Johansson, J. Johansson, D. Yova, J. Kapostins, I. Karu, D. Killander, C. af Klinteberg, E. Krite-Svanberg, D. Kopyar, M. Kyriazi, M. Lewander Xu, H. Liu, S. Lindberg, P. Lundin, J. Oyama, Q. Peng, J. Moan, S. Montan, H. Nilsson, B. Olsson, L. Persson, A. Pifferi, S. Pålsson, G. Somesfalean, M. Soto-Thomsen, J. Spigulis, S. Steen, U. Stenram, J. Bood, C. Sturesson, J. Swartling, P. Svenmarker, T. Svensson, J. Popp, A. Vaitkuviene, A. Wague, I. Wang, H. Xie, R. Ziobakiene, A. L. Sahlberg, M. Brydegaard

Lund Laser Centre

Blue – medical collaborators
Red – technical/physics collaborators

LUND INSTITUTE OF TECHNOLOGY
Lund University

Lund University
Medical Laser Centre

The core Research team

Physics

Johannes Swartling (SpC)
Marcelo Soto Thompson (SpC)
Stefan Andersson-Engels
Sune Svanberg

Medicine

Niels Bendsöe
Katarina Svanberg

Company

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Physics – Medicine

At the crossroads that´s where things happen !!