

Advancements in prostate cancer research provide hope for finding a cure and lead to the discovery of new treatments to minimize the impact of a man's prostate cancer and maximize his quality of life. This regular *Hot SHEET* supplement includes some of the latest research from the Prostate Cancer Foundation ([www.pcf.org](http://www.pcf.org)).

The PCF is the world's leading philanthropic organization funding and accelerating prostate cancer research. Founded in 1993, the PCF has raised more than \$745 million and provided funding to more than 2,000 research programs at nearly 200 cancer centers and universities.

### Artificial Intelligence and Prostate Cancer Diagnosis

The field of artificial intelligence (AI) started in the 1950s in the defense industry, and has evolved over the years. In the 2010s, new computer-based "deep-learning" methods were introduced that significantly accelerated the field. Physician-scientists are using this technology in the medical field to improve diagnostic methods. One such researcher is PCF-funded investigator Dr. Beatrice Knudsen, a Professor of Biomedical Sciences and Pathology and Director of Translational Pathology at Cedars-Sinai Medical Center in Los Angeles. She is one of the world's leading research pathologists, and is an expert on the diagnosis of prostate cancer and other diseases from tissue specimens.

In 2014, Dr. Knudsen and team began to apply **advanced AI** tools (machine learning and deep learning) in their studies. The team is aiming to answer key questions, including:

- Can a computer learn to **identify prostate cancer** in pathology slides?
- Can a computer **predict the risk** of existing or future prostate cancer **metastasis**?

When you think of diagnosing cancer, you might think of pink-and-purple slides with regular patterns (in benign tissue) vs. the "angry-looking" irregular patterns of cancerous cells. **Digital pathology is used today as a tool in diagnosis:** The FDA has approved a digital pathology slide scanner and monitor for digital reporting. This means the pathologist no longer needs to peek through a microscope, but can review slides on a computer screen and develop reports based on images displayed on computer monitors.

The same slides that are used to diagnose prostate cancer can also be used to train computer algorithms. Dr. Knudsen and team are using images from prostate needle biopsy slides as a starting point to develop machine learning and AI algorithms for digital diagnosis of prostate cancer. This computer-assisted diagnosis technology will **enable computers to pre-screen slides** for those that have the highest probability of harboring cancer. **Pathologists will be able to examine and confirm** the images that are selected by the computer because they have a high cancer probability. A study published by Memorial Sloan Kettering Cancer Center showed that computer-assisted diagnosis can help pathologists to focus their time on the most critical tissue pieces in the biopsy.

Machine learning is being developed to:

- Increase the efficiency of pathologists
- Shorten the amount of time to develop pathology reports for patients
- Improve the diagnostic accuracy of the algorithms
- Equalize the quality of pathology reports in medical practices throughout the community
- Improve the prediction of cancer severity
- Guide treatment decisions

Much progress has been made recently in digital computational pathology. **The speed of processing a single slide has significantly improved from ~8 hours in 2015 to under 1 minute in 2018.** Recent studies have described a computer-based tool that is able to diagnose prostate cancer with **~99% accuracy**. A PCF-funded Challenge Award team led by Dr. Knudsen and Dr. Isla Garraway of UCLA and the Greater West Los Angeles VA are investigating whether computer algorithms can be trained to recognize prostate cancers that will become lethal based on specific features present in the primary tumor. Results suggest that scores derived from biopsy slides can predict tumor stage at diagnosis.

With all of this technology, what is the role of the pathologist in the future? Despite the recent advances in digital pathology and AI, **Dr. Knudsen does not believe that AI will replace humans for routine diagnosis of human disease.**

**For more information visit [www.pcf.org](http://www.pcf.org), email [info@pcf.org](mailto:info@pcf.org), or call 1-800-757-2873.**