MICROPOS
MEDICAL

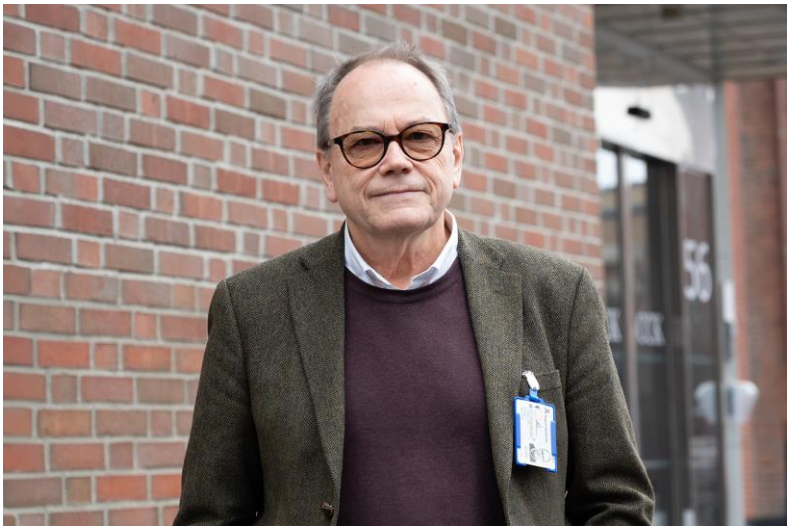
INTERVIEW

The Discovery that Transformed Prostate Cancer Radiotheraphy

Meet Sten Nilsson – One of the Founders of Micropos Medical

In 1991, Professor Sten Nilsson and his PhD student Bo Lennernäs realised that the prostate, contrary to prevailing beliefs, is a mobile organ. A study confirmed their observations, and the new findings were included in Bo Lennernäs's doctoral thesis in 1995. The discovery quickly influenced prostate cancer radiotherapy practices across the world. In the papers of the thesis, they also demonstrated that it was possible to track the prostate's movements in a phantom model by inserting a small magnet that transmitted signals to an external receiver. These two findings led to the founding of Micropos Medical AB.

Sten Nilsson, now a retired senior consultant at Karolinska University Hospital and Professor Emeritus at the Karolinska Institute, has dedicated over 40 years of his career to oncology, with a particular focus on prostate cancer. He has been involved in numerous pioneering research projects and developed new, crucial treatment concepts that are now used globally.



Decades of Development
When Sten Nilsson treated his first prostate cancer patients in the late 1970s, very few were cured. The tools and techniques for diagnosing and assessing whether the cancer was local or had spread were insufficient, as was radiotherapy. The available X-ray technology could visualise the pelvic skeleton but not the prostate, meaning its position had to be estimated based on the anatomy of the pelvic bones. Radiotherapy was cumbersome and time-consuming to administer, with limited impact on the tumours.

"Patients whose cancer was assessed as local received radiotherapy with what we called a 'curative intention'. But in practice, most returned after a while, and the disease remained – eventually spreading," says Sten Nilsson.

In the mid-1980s, surgery for localised prostate cancer began delivering better outcomes than radiotherapy. However, radiotherapy also advanced rapidly. Computed tomography (CT) became available, allowing the prostate and sometimes the tumour area to be visualised, which created entirely new conditions for treatment. Subsequently

radiotherapy equipment, radiobiological research, and various imaging technologies like CT, MRI, ultrasound and others, also underwent enormous development.

The 1990s saw the introduction of high-dose-rate brachytherapy (HDR-BT), a method to which Sten Nilsson made significant contributions. It involves inserting 15–20 hollow needles through the skin into the prostate, through which radiation is delivered. Today, HDR-BT is often combined with external beam radiotherapy in cases of locally advanced prostate cancer.

A Discovery that Overturned Accepted Knowledge
It was during HDR-BT procedures in 1991 that Sten Nilsson and Bo Lennernäs discovered that the prostate changes position under various conditions.

“We used ultrasound to correctly position the needles in the prostate. We then observed that if a patient was anxious, perhaps coughed, raised an arm to scratch their head or simply spoke, the prostate moved. It was a true ‘aha’ moment. The common belief around the world was that the prostate is firmly anchored in the pelvis. We immediately realized that we had to find a way to describe and document the movement of the prostate, how much and in which directions the prostate moved”, Sten Nilsson explains.

Years earlier, he had treated prostate cancer patients by implanting radioactive gold seeds into the prostate to deliver a strong local radiation dose. The method was abandoned when seed production ceased, but the treated patients retained the seeds (they were not surgically removed) – creating an opportunity to document the discovery of prostate movement.

“The gold seeds, and thus the prostate’s position, are visible on X-rays. We called in a number of the former patients and took images under various conditions. For example, while straining versus relaxing, with full versus emptied bladder, and so forth. We found that the prostate frequently moved by several millimeters, in some cases as much as one and a half centimeters, and in one case two centimeters. It was astonishing. And entirely unknown at the time.”

From Research to Innovation – The Start of Micropos Medical
Bo Lennernäs, Sten Nilsson, hospital physicist Ulf Isaksson, and several other colleagues continued developing a technical solution for monitoring prostate movement.

“We were working in the Radiotherapy Department at the Oncology Clinic at Uppsala University Hospital. There, in the evenings, we built prototypes using phantom models simulating patients. We tested real-time monitoring of prostate motion by placing a small magnet in the prostate, which could be tracked by an external receiver. It worked excellently.”

This discovery was also described in Bo Lennernäs’s doctoral thesis.

Early on a collaboration was initiated with two experienced and laeding clinicians in oncology and radiotherapy: Bengt Rosengren, Professor Emeritus of Radiotherapy in Bergen, Norway, and Seymour Levitt, Professor Emeritus of Radiotherapy in Minneapolis, USA, who later became a guest professor working with Sten Nilsson at Karolinska Institutet.

The next step was getting in touch with Chalmers Innovation, where people quickly showed interest in developing the technology further, now using electromagnetic transmitters.

“The collaboration with Chalmers Innovation was highly successful. To take things further, we needed a proper business structure, so in 2003, we four clinicians founded Micropos Medical. Another co-founder was Tomas Gustafsson, who also became the company’s first CEO. A highly skilled and innovative research department was created in a short time, which came to form the basis of the success story.”

The Tumour Gets the Intended Dose
From the very beginning, the four researchers understood the significance of being able to track prostate movement: increased precision in radiotherapy. And also, security for the clinical staff administering the treatment.

“The advantage of being able to monitor the position of the prostate in real time with millimetre accuracy during radiotherapy is that margins to surrounding healthy tissue can be significantly reduced. This means side effects to, for example, the rectum, bladder and the nerves and blood vessels important for erectile function can be minimised. But

the most important benefit is that you ensure the tumour receives the full intended dose, reducing the risk of underdosing and recurrence," says Sten Nilsson.

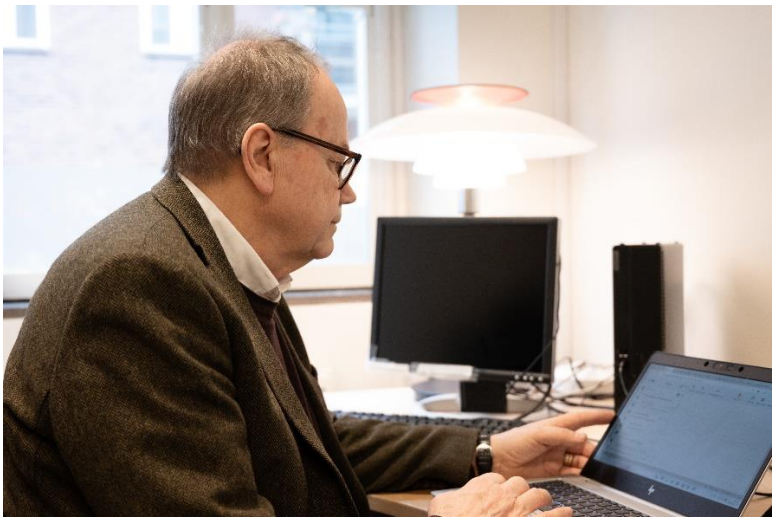
Monitoring prostate motion has long been standard practice in radiotherapy worldwide. Most often, this is done by implanting gold markers whose position is tracked using X-rays during treatment. However, Micropos continued developing its real-time monitoring of prostate movement via signals from a transmitter inside the prostate, what is now known as the Raypilot System. While the original technique worked well, it was seen as impractical since it required the transmitter to be surgically inserted. That changed when the company developed its current solution – placing the transmitter inside a catheter in the urethra. This technology is CE-certified and has been used since 2020.

A Growing Need for Precision Monitoring
Sten Nilsson expects the Raypilot System to become increasingly adopted, especially considering the recent shift in prostate cancer radiotherapy; treatment on a few occasions and with a much higher radiation dose instead of on 20-40 occasions as has been the practice for decades. It is in these contexts that Sten Nilsson sees that Raypilot System has its place.

"There is now evidence-based research showing that, for many patients, just five treatment sessions with higher radiation doses work well. I believe this will become the new standard for external radiotherapy of prostate cancer worldwide. However, with higher radiation doses, precise real-time monitoring of prostate movement becomes even more critical. Fewer sessions also mean each treatment lasts longer, increasing the risk that the prostate shifts position during the session. So, the requirement to really have control over the movement of the prostate all the time, that demand increases. Raypilot System monitors the prostate's position with millimetre precision in real-time and signals immediately if it changes position during radiation therapy."

Another factor supporting the Micropos solution is ALARA (as low as reasonably achievable): An overarching principle adopted by radiation safety authorities worldwide. It stipulates that among available methods, one should always choose the one that exposes the patient to the least radiation.

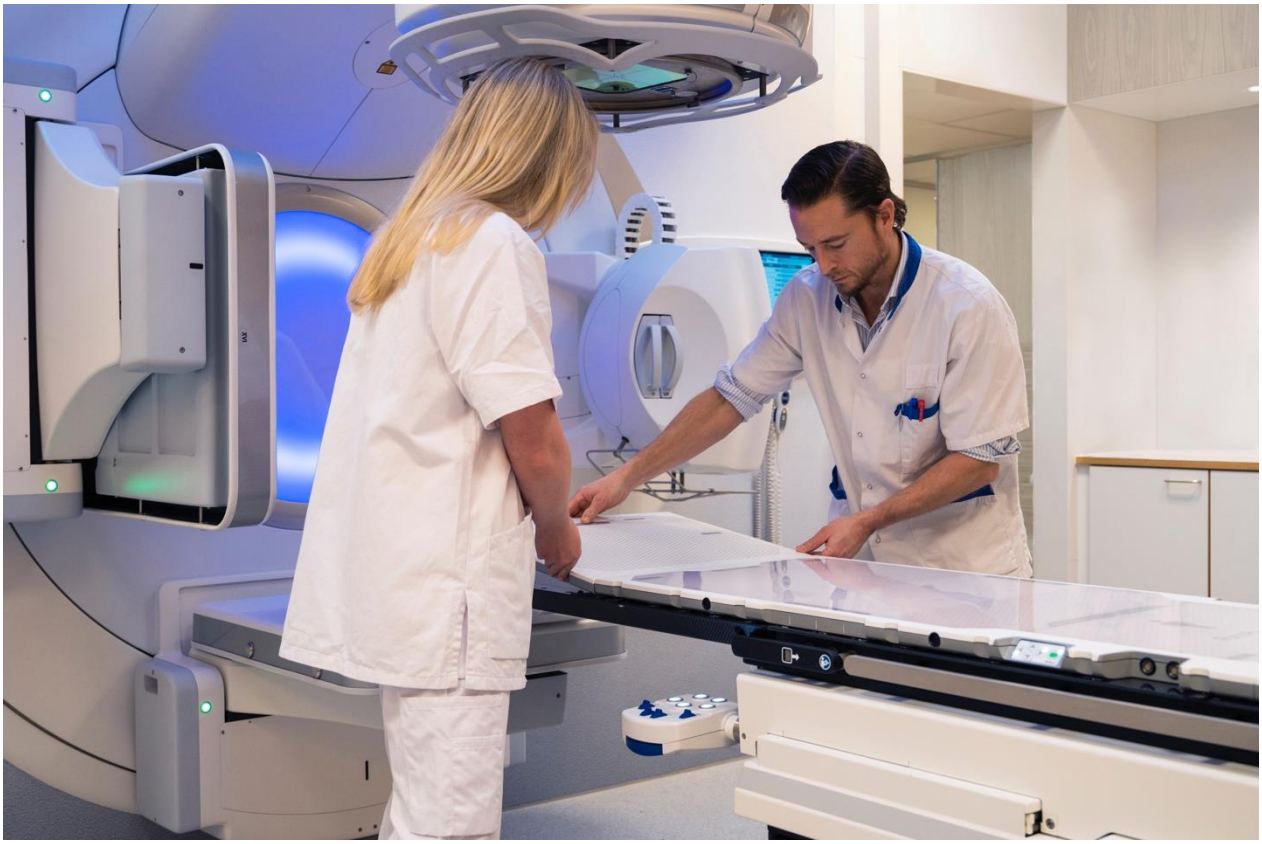
"Using X-rays to monitor prostate movement and thereby exposing patients to a large number of doses of added radiation to the bowel, bladder and other healthy tissue is of course not reasonable. And then you deviate from the accepted ALARA principle."



Believes in Growing Interest
Sten Nilsson is clear that there are other concepts based on his and Bo Lennernäs' discovery and technology. But probably nothing quite as good and at the same time so easy for both patients and clinicians.

"The more clinics that use the Raypilot System and share their experiences, the more others will be interested in trying it. The work at the clinics naturally benefits from the staff being completely confident in the technology's high precision and that the system signals immediately if the prostate is moving more than the predetermined radiation margins."

Sten Nilsson is the only one of the four founding professors of oncology behind Micropos who is still alive. His and Bo Lennernäs's discovery of prostate mobility, and Micropos's development of the Raypilot System, continue to contribute significantly to better cure and quality of life for many prostate cancer patients.



Preparing for radiotherapy treatment in the Linear Accelerator Treatment Room: The Raypilot Receiver is securely positioned.

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Micropos Medical AB is a Swedish medical device company that develops, manufactures, and sells technology enabling enhanced radiotherapy cancer treatment. The Raypilot® System, the product from the company, generates high precision as well as high efficiency through real time tumour tracking in radiation treatment of prostate cancer. Using The Raypilot System, clinics can treat their patients with accuracy and reduced risk of damaging healthy tissue surrounding the tumour. The company is listed on the Spotlight Stock Market. www.micropos.se