# Optimising Workflow and Patient Treatment in the Mohs Clinic with CryoStar NX70 Cryostat

## University Hospital of Wales

Since 1992 the University of Wales, Cardiff has been pioneering Mohs Micrographic surgery in the UK. Led by Dr Richard Motley, MA MD FRCP, the clinic provides the optimum, rapid treatment of skin cancers such as Basal Cell and Squamous Cell Carcinoma. Central to the technique is the rapid preparation of frozen tissue sections of the peripheral margin of the excised tissue. Their choice of cryostat for Cardiff? The CryoStar™ NX70™ cryostat from Epredia.

### Profile

The University Hospital of Wales (UHW) Cardiff is co-located with Cardiff University School of Medicine, and serves a population of around 450,000 people. Built over four years from 1966, the main hospital took its first patients in November 1971 and became one of the first UK hospitals to combine patient treatment with staff teaching. The Clinical Dermatology Service was one of the first services to open in the new hospital and in 1999 relocated to a dedicated building on-site – The Welsh Institute of Dermatology. It is the main dermatology referral centre for Wales, and has a well-deserved international reputation for teaching and research. Featuring six specifically designed operating theatres and a laboratory, the Welsh Institute of Dermatology offers Mohs Micrographic surgery to patients with ill-defined and recurrent skin cancers, predominantly on the head and neck. One-third of patients undergoing this technique have been referred by specialists from other hospitals.

**Dr. Motley examining a patient slide**

Dr. Richard Motley, Senior Dermatologist and leading Mohs Surgeon, oversees a team of consultants and Mohs surgery trainees and three Biomedical Scientists. When he first set up the clinic in 1992, it was one of only three in the UK, and is still the only Mohs clinic in Wales. During a four-hour session they will treat between four and seven patients. In almost all cases the patients are treated on an outpatient basis and will leave hospital the same day. 60% of patients require only one level of excision, 30% require two and 10% require more levels for complete tumour removal.[1,2] In the most-complex cases further surgery may be undertaken over several days.) Most importantly, at the end of the procedure, the doctors and patient can be confident that the skin tumour has been completely removed, with maximal conservation of normal tissue; most wounds are immediately repaired, or in selected cases, left to heal spontaneously.[1] A vast body of literature attests to the extremely low recurrence rates following Mohs micrographic surgery, and the patient can be discharged from further follow-up after review of the healed wound with confidence that the tumour will not recur.[3]

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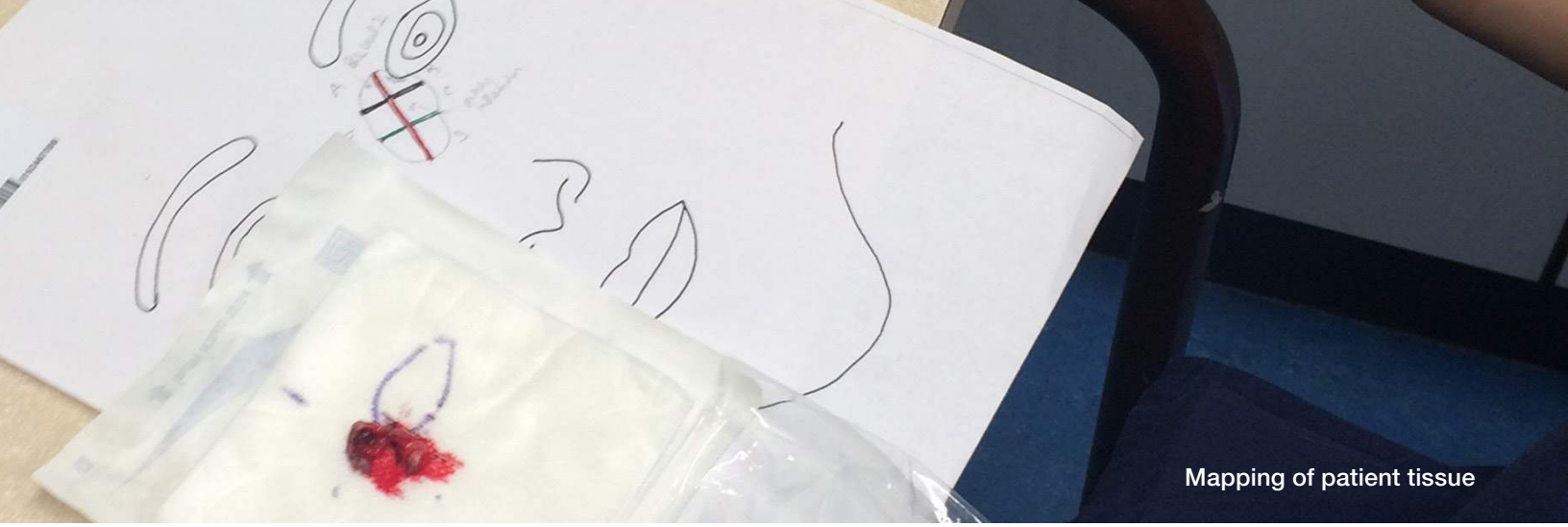


Mapping of patient tissue

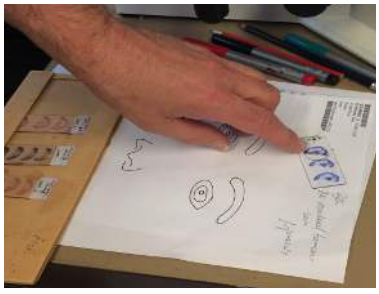
## The History of Mohs Surgery

Pioneered in 1930's in the USA by Dr Frederic Mohs (1910-2002), Mohs micrographic surgery is a highly effective means of treating certain types of primary skin cancer that grow in-continuity, most commonly Basal Cell Carcinoma (BCC) and Squamous Cell Carcinoma (SCC). These cancers most frequently occur on the head and neck and may be ill-defined, with clinically invisible microscopic extensions or situated on critical anatomical structures such as the nose, eyelid, lip or ear. In all cases it is essential to remove all tumour to prevent recurrence, yet also desirable to minimise loss of normal skin tissue to avoid cosmetically unsightly wounds. Basal cell carcinomas account for the majority of skin cancers, but with the ageing population the relative proportion of squamous cell carcinomas, which are more common in old age, is growing.[4]

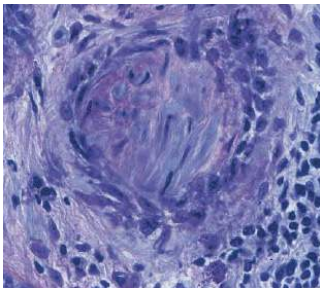
Originally, Mohs' technique involved applying zinc chloride paste to the tumour and surrounding skin overnight, to create an area of devitalised, fixed tissue. A disc of this tissue was then excised and microscopic sections prepared from its undersurface. Today, the procedure uses frozen tissue, enabling results to be obtained from patient to microscope in approximately 15 minutes, while removing a minimal quantity of healthy tissue. The frozen tissue technique was widely adopted, particularly in the USA but also in many countries worldwide. Mohs surgery is a highly successful and cost-effective technique and has a cure rate of up to 99% for basal cell carcinoma.[5] In the UK there are now over 20 centres offering Mohs surgery, many staffed by dermatologists originally trained by Dr. Motley who, to date, has trained over 70 surgeons in the Mohs technique.

## Modern Mohs Technique

After curettage of the main bulk of the tumour, a saucer-like disc of tissue is removed with a small margin of skin from around and underneath the curetted wound. The tissue size and location is recorded on a paper 'map' of the patient's face and the disc divided into suitable size pieces, usually halves or quarters, with the cut borders identified with coloured tissue dye. The tissue is then pressed down with its undersurface against a glass slide, while simultaneously spraying the liquid nitrogen on the undersurface of the slide – freezing the tissue. The frozen tissue is inverted and lowered into cryo-mounting gel on the cryostat chuck using a 'Cryobloc' alignment tool.



**Mapping of patient slide against excision drawing**



**Toluidine Blue staining of BCC**

When the mounting gel has frozen around the tissue, the glass slide is removed, leaving the tissue ready for sectioning.

Frozen skin sectioning requires a great deal of skill and precision to ensure that the full face of the tissue is obtained with minimal 'trimming' into the tissue block. The technician is typically a highly experienced Biomedical Scientist (Band 6 or above). After taking a first section of about 5µm thickness a further five sections are cut and discarded and the next section is collected. This is repeated until a series of six sections with a spacing of 25µm between each section has been collected.

The first three sections are then stained using Toluidine Blue and the next three with Haematoxylin and Eosin (H&E). Dr. Motley comments, “Toluidine blue gives a purple metachromasia around basal cell carcinoma which helps identify the tumour and is superior to H&E for detection of basal cell carcinoma however, if it isn’t a BCC, then Toluidine Blue doesn’t help us. H&E is the conventional primary stain used in most laboratories.” After staining, the slides can then be compared with the map, where the pieces fit – much like the pieces of a jigsaw. The tissue sections are examined under the microscope for the presence of tumour. If tumour is found in the tissue sections then the location is compared with the map, and a further thin layer of tissue excised from the wound and more slides prepared. Over the 25 years of Dr. Motley’s practice the proportion of cases excised in one level has remained at 60%, with a further 30% requiring only two levels. Appropriate reconstruction is then undertaken using one of several well-tried surgical techniques. Dr. Motley and his team are highly experienced and give much consideration to the most suitable wound repair in order to give minimal scarring to the patient.

## UHW Cardiff – Pioneering ‘Mohs first’ Treatment of Skin Cancer in Wales

Dr Motley’s clinic in Cardiff is relatively unusual because, almost without exception, patients in Cardiff with skin cancer are treated within the Welsh Institute of Dermatology and Mohs surgery has been available for all patients who needed this for 25 years. As Dr Motley himself explains, “Often, Mohs surgery is seen as a last resort for tumours that have recurred following previous surgery. In Cardiff, we have been able to offer Mohs surgery as the first treatment for all our patients with ill-defined tumours. As a result of this we rarely see patients from Cardiff with recurrent tumours.”[2,3]

An average clinic will see 40 samples of skin grossed and processed while the patients wait, so the turnaround time of processing the specimens is paramount. Requirements for the Mohs laboratory are the freezing media, a cryostat, stainer and the stains. A critical factor is the reliability and efficiency and ease of use of the Cryostat. When his first Biomedical Scientist retired after twenty years, Dr. Motley decided that it was not only time to find a new BMS but also to look for a new Cryostat. The NX70 cryostat offers the optimum in user comfort. Its integrated, motorised height adjustment suits individual user preferences, while the adjustable LED lighting gives excellent visibility during sectioning. The ergonomic design also makes it far more comfortable for the user, and the motorised cutting serves to reduce user fatigue and avoid repetitive strain injury. An intuitive touch screen is simple for users to operate and train, while the innovative joystick control enables fast adjustment of commonly used sectioning functions. The specimen holder and cryostat blade are separately cooled and their temperatures can be quickly adjusted to the optimal temperature for cutting different tissues. The Cryostat chamber is not as cool as conventional “cooled cabinets” and as a result is more pleasant for the operators’ hands.

Dr. Motley commented, “The NX70 has been a ‘leap forward’ for us in terms of comfort and ease of use and the ability to produce consistent high-quality tissue sections in a variety of tissues”.

Despite the motorised cutting feature of the NX70 cryostat, the sectioning carried out in the Mohs clinic is largely done manually. Dr. Motley comments “If you observe Biomedical Scientists cutting sections manually, they all have a similar approach, there is a slow engagement with the edge of the section, then a steady cut through and release. The automation doesn’t mimic exactly what the technician does and so we find manual cutting more reliable. However, I hope that with future developments it may be possible to cut a perfect Mohs section with the ‘push of a button’”.

## CryoStar NX70 cryostat from Epredia

According to Dr. Motley, the Cryostar NX70 cryostat, first launched in 2011, represents some of the best technology on the market. It features precise temperature control, allowing the technician to rapidly change the temperature of both the blade and specimen head independently. This allows the use of customised settings for different types of tissue. Disposable blades such as the MX35 Ultra™ from Epredia demonstrate greater longevity while delivering high quality sections, while the blade transfer tool and “double-tap” start of motorised cutting both maximise user safety. The secure chuck holder ensures safe handling of specimens without damaging chucks, while coloured chucks allow colour coding of patient cases for greater safety. Simple decontamination between patient cases is done using the proprietary “Cold D” disinfection system, which is dispersed as a vapour throughout the chamber for non-toxic disinfection.

**Cryostar NX70 Cryostat**

Lynne Christian is a Senior Biomedical Scientist in Dr. Motley's clinic, carrying out the majority of the vital cryosectioning and staining. With over nineteen years' experience, Lynne has been carrying out Mohs procedures with Dr. Motley

**Lynne Christian working with the Cryostar NX70 cryostat**

since 2012, in addition to her work in the general histology department. Her sectioning expertise provides Dr. Motley and his team with the necessary specimens for Mohs surgery and she understands the vast benefit that Mohs surgery has for their patients. Lynne comments, "With the rapid temperature control on the NX70 it takes only moments to reduce the specimen temperature". The clinic which begins at 9:00 AM would previously finish at 2:00 PM. Since introducing the NX70 cryostat the same surgery now finishes typically by midday and often with more patients having been treated. Lynne has experienced first-hand the difference that the surgery makes. She again comments, "It's important to me to see the impact of my work – I've had patients come in and thank me! – that's just the nicest feeling".

## The Future of Mohs Surgerys

Mohs surgery is the most effective treatment for ill-defined skin cancers such as Basal Cell Carcinoma, Squamous Cell Carcinoma and Dermatofibrosarcoma Protruberans and rarer skin tumours. Many more dermatologists and surgeons are being trained in the technique but one of the significant barriers to wider availability is the challenge of setting up the Mohs histology laboratory and, in particular, the high level of skill required to cut frozen tissue sections. The technological advances in the Cryostar NX70 cryostat have not only made a significant impact upon the workflow in the long-established Mohs unit in Cardiff, but have also made high quality, reliable tissue sectioning more accessible to those just starting to offer a Mohs service. Dr. Motley comments, "For anyone who is considering setting up a Mohs service I would strongly recommend they look at the Cryostar NX70 cryostat; it will make a real difference".

## Conclusion

Today, Mohs surgery is accepted as the most effective technique for removal of two of the most common skin cancers – Basal Cell Carcinoma (BCC) and Squamous Cell Carcinoma (SCC). It accomplishes the vital task of effectively removing the cancerous cells while also sparing the greatest amount of healthy tissue.[1,3,6] For anyone who is considering setting up a Mohs service, Dr. Motley comments, "The Cryostar NX70 cryostat has brought a 'step-up' in the quality, reliability and speed of cryostat sectioning and has been a welcome advance in our Mohs service".

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