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President of the Ulster Medical Society

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YOUR LIFE IN YOUR HANDS. A SURGEON'S VIEW OF HAND FUNCTION—ART EXPRESSION AND FORM

Just as the eye is the window of the Heart, the hand is
the Mirror of the Man.

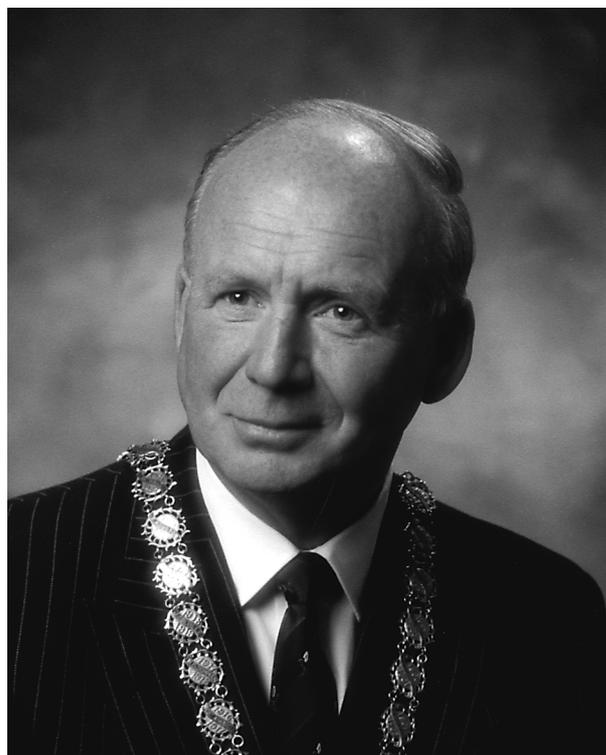
“Behold the Window of my Heart, Mine Eye”
Shakespeare—*Love’s Labour’s Lost*

My interest in Hand Surgery was initially encouraged
by Professor R. I. Wilson, a man who had an immense
influence on orthopaedics and a father figure to many
of the orthopaedic surgeons. It was further stimulated
when I rotated through the plastic surgery unit in the
Ulster Hospital, Dundonald, and I worked with Mr.
John Colville and learned very much from his wisdom
and skills.

In 1974 I took my family to Paris and commenced
work with Professor Tubiana at l’Institut de la Main. I
met many of the great personalities in hand surgery
who tended to visit Paris as an attractive stop on their
visits to Europe. I later visited Harold Kleinert in
Louisville, Kentucky, for a short period.

This paper will emphasise the importance and
significance of the hand in all aspects of our lives and
the great influence of its function in our lives. Consider-
ing the relative importance of hand function in
everyday life, I think that Michelangelo put it in
perspective in its central role in “Creation”. More
recently a less attractive art work portrays Penfield’s
Homunculus, and brings back for many of us
memories of preclinical days. It shows the large area
of representation of the hand in the brain, both motor
and sensory, in relation to other body parts and in so
doing indicates the relative importance of the hand in
our lives.

Returning to beginnings, the hand has been
represented among the earliest known forms of art.
The prehistoric picture of the hand as illustrated is
found in a grotto in Peche Merle in the Dordogne. The
representation of the hand in art has played a very
important role in communicating the image and
personality of the subjects, just as our own image and
personality are enhanced and emphasised by the
expressive use of our hands each day.



Occasionally disease or deformity may be portrayed,
which gives an insight into the condition of the
subject but more often the hand is presented as an
image of beauty as in a sculpture by Canova, or an
image of strength as in Michelangelo’s David.

Through the centuries the hand has been
portrayed in art to a greater or lesser extent. In Greek
and Roman art it was found particularly in sculpture,
but it was largely absent from Islamic art. It again
gained prominence in the Middle Ages and in the
Renaissance. Since then and up to modern times,
frequent attention has been given to the form, beauty
and particularly the expression of the hand as found
for example in The Bronzes of Rodin.

The hand is involved in a major part of our lives—
hence its prominence in Penfield’s Homunculus.
When we consider the miracle of skill which lies
within the hand we can only be amazed at our own
indifference to its everyday function. Voltaire said of
Sir Isaac Newton that “in spite of all his knowledge, he
did not know how his own hand functioned”.

Broadly speaking, function of the hand may be
classified as motor and sensory but this provides no
depth of knowledge or understanding of the capacity
and extent of function of the hand. As surgeons we

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are most often involved in improving and restoring motor function of the hand by reconstruction as in rheumatoid arthritis although following injury we may indeed have to repair various nerves.

It is surprising to consider that most of man's physical activity takes place with use of the arms and hands carrying out the actions conceived and desired by the brain. The legs mainly provide locomotion and even then although locomotion may be indeed the conceived and desired action, the arms are often used to supplement the leg action.

The primary function of the upper limb is that of exploration. The hand can sweep round on a radius formed by the arm and this circle overlaps that of the other hand which can also move in a similar fashion. The areas accessible to the hand therefore overlap in the same way as the visual fields overlap. The hand and the brain function together in such a unified fashion that I would question the validity of the term 'manual worker' and suggest that there is no such person. One of the particular assets of the mobility of the arm is that it allows the hand to move outside the fields of vision and explore the environment.

On proceeding to consider the primary motor function of the hand it is recognised that all motor functions require some sensory input. Basic functions of the hand may be considered as follows:

1. Eating. The ability to reach out, take food and place it in the mouth is necessary for survival. Such is the recognition of this as a basic function that we describe the minimum possible lifestyle as a "hand to mouth existence".

The ability of the upper limb to move and enable the hand to explore space is therefore a very great asset in allowing man to contact food as in reaching and grasping and indeed helping himself.

2. Hygiene. The hand can reach virtually any part of the body, including the perineal region. Personal hygiene is a very significant function and may be a problem when mobility of the upper limbs is limited and the hand cannot be delivered in space by the restricted mobility of the arm due to disease or injury. Care of the hair, face and body may cause difficulty. The upper limb surgeon must be aware of this when there is the prospect of arthrodesis of both wrists. Arthrodesis of one wrist is done with slight extension of the wrist in order to allow maximum power grip but if bilateral arthrodesis is required, one wrist must be placed in slight flexion so that it is possible to place the hand in confined spaces, a function not

possible if an immobile wrist is in a position of extension.

3. Work Activity and Recreation. A study of the anatomy of the hand shows the numerous interdependent structures. This very complex anatomy is capable of the most delicate and intricate activities while it is also capable of carrying out heavy work where power and force are essential. It may act as a tool—gripping, turning, twisting, lifting and carrying or even digging. The hand of man, however, is unique in that, in addition to its role as a tool, it can itself manufacture a suitable tool to assist or take over a particular task. The hand may also act in a primitive manner as a weapon of attack or defence. The fist may be clenched and the wrist locked to effectively produce a weapon. This most delicate and sophisticated structure may thus be used simply to inflict force as an assailant attacks or it can be used as a mobile and protective instrument in absorbing the effects of an assault and protecting more vital areas, such as the head including the face and brain, or other more vulnerable parts. The diversity of action of which the hand is capable is truly remarkable. Not only do some individuals, to the admiration of all, excel in particular manual skills but even the average person is capable of an immense range of skills. For example, it is conceivable that a concert pianist may have an interest in gardening or the dress designer may enjoy rowing.

On a personal level, fracture care frequently involves intramedullary nailing of femur or tibia which demands considerable manual force while on the same operating list I may release a carpal tunnel or repair a digital nerve—not a claim of any exceptional skills on my own behalf but rather an example of the extraordinary range of action of which the hand is capable. Do we know of any machine or mechanism which has such a diversity of function?

It is interesting to realise that the limit of precision in surgery is not manual skill which seems almost unlimited, but rather visualisation. The microscope or loops enable the surgeon to see the structure and 'if you can see it you can suture it!'

The limits of function may be extended by training, for example, grip strength may be increased by a programme of training, but skills may also be increased whether in sport or other activities. Much of training establishes a pattern—do any of the golfers know exactly where the club head is at a particular point during their swing? Much skilled action occurs

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involuntarily. The concept is followed by the action and the involuntary movements occur precisely and sequentially as the well practiced action takes place. The concert pianist practises for long hours so that much of his playing occurs subconsciously, even driving a car involves much subconscious manual activity.

I have already referred to the role of the upper limb in all activity. All games involve the upper limb—even soccer for example, requires the balancing effect of the arms in executing the football skills. Again various games demand different degrees of power and precision. Racquet and bat games require strength and skill with hand/eye co-ordination while in snooker or darts, precision is the main requirement. Some sports however require a wide range of power and touch. Perhaps this explains the fascination of golf for so many of the medical profession.

4. Communication. Sensory function plays a significant part in communication. Movement, touch and expression are forms of communication and it is perhaps this function which is least obvious to us. While expression of the hands is recognisable to all, it is often carried out subconsciously.

In daily communication with one another, only the face and hands are exposed—with the obvious exception of the female legs. Second only to the face, the hands indicate mood and personality. The background of a person, the work activity and much other information may be indicated by the hands. The hands may be well cared for or may demonstrate a lack of care. They may be deformed or a thing of beauty. Age is reflected in the hands, as it is in the face although I am not certain whether or not plastic surgery on the hand can be considered as an adjunctive procedure to a face lift. We communicate with our hands to express nuances and enhance the meaning of our words or emphasise our thoughts. We may express emotions such as despair, tension, happiness, grief or tenderness. We may indicate apprehension or triumph.

The absence of hands produces a curiously deficient image.

People in the public eye are conscious of the effect of the hands. In recent history, orators and leaders, good and bad, made great use of expression of the hands to underline and emphasise their viewpoints.

In addition to expression of mood or emotion, a touch of the hand may indicate friendship or give

reassurance. Love is expressed by the hands and may result in an embrace. But the hand is also a potent vehicle of sexual advance and may produce erotic arousal. This function is a good example of the law of physics which states that to every action there is an equal and opposite reaction. Not only may the hand act as a vehicle of sexual arousal but it, by its own sensory response, acts to arouse the initiator of the advance.

Moberg, who was a Swedish Hand Surgeon, brought to our awareness the sexual problems associated with loss of hand function. As an instrument of touch and caress, flexibility of the hand is all important. Where disease or injury has affected the hand, he found that in some instances the patient preferred the retention of flexibility even though an arthrodesis might have increased the power pinch and grip.

By the use of sign language and Braille, the hand does of course achieve its greatest place in communication. Those who cannot hear can communicate, through Braille those who cannot see can communicate. The use of the hand in communication therefore opens a whole further dimension for those with these disabilities. This skill can surpass the recognition of the written word as the deaf and blind can even enjoy music.

Primary Sensory Function of the Hand

In some respects the hand acts as a third eye—indeed it has the added ability to see around corners which is not possible with the eye, so that by feel alone an object may be clearly recognised and an exact image may be visualised even though it is out of sight. As a sensory organ, the hand has the great advantage of mobility. It can reach towards the object of interest, explore and feel it to acquire more information with regard to surface texture, temperature, compliance, density and weight. The proprioceptive aspect of sensation is very important as actions are initiated or carried out without having to localise the position of the hands. In any case, as I have commented earlier the hands are not always within the fields of vision. It seems remarkable that without consciously thinking, we always know the position of our hands. It would be difficult for us to achieve the Biblical exhortation 'Let not thy left hand know what thy right hand doeth'—Matthew ch. 6 v. 3.

The sensory function of the hand therefore is essential in the recognition of our environment.

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Initially we recognise by sight but the appearance only becomes reality as a result of touch and feel.

Within medicine the sensory function of the hand perhaps reaches its greatest when diagnosis by examination is carried out. The visual information of inspection is followed by palpation, percussion and auscultation, all of which are manual but mainly sensory skills. Much of diagnosis is therefore made by manual skills. The hand is not only inexorably involved in diagnosis, but the patient's hand may itself be a fertile source of information. Various abnormalities may be readily seen in the hand and may give an indication of local or generalised disease, for example, Dupuytren's contracture may be obvious, while finger clubbing may possibly indicate respiratory disease.

I recently became aware that in addition to clawing of the ring and fifth fingers and associated sensory deficiencies in ulnar nerve lesions, the more subtle deficiencies of ulnar nerve function in partial lesions may be detected by demonstrating what I describe as the "Flick Test". The normal ability to flick the index or middle fingers against the opposite palm and produce an audible click is lost due to weakness of the interosseous muscles so that a sound cannot be produced. One hand may be compared with the other. For the same reason the middle finger may not be able to cross over the index finger—the Sign of Hope.

Having considered the motor and sensory function of the hand, it is obvious that disease, deformity and injury may cause very serious disability with loss of sensation and loss of mobility. Injury in particular may affect all aspects of hand function, both motor and sensory. Even a relatively small loss of movement may cause a significant reduction in normal dexterity of the hand. In Dupuytren's contracture, the affected finger may prevent effective grasp and often the patient may find that he or she may catch the finger when washing the face or have difficulty placing the hand in the pocket. A person with a hand deformity is of course at risk when working with machinery because of the loss of normal dexterity. The lack of the involuntary response of the hand which is normally the outcome of an intended action can be dangerous as it exposes a digit or digits to danger. Loss of joint mobility may prevent the hand from carrying out skilled activities and in some cases a stiff finger may be an impediment to hand function so that occasionally removal of a digit may improve function.

On considering amputation, I personally am very conservative and often my first reaction when faced with the possibility of this procedure is to stop and think again. Perhaps the influence of Mrs. X has a part to play in this reaction.

I met her at the Royal Victoria Hospital after she had presented with a crush injury to the ring fingertip. She had an extremely sensitive fingertip having lost a centimetre of length. She prevailed on me to explore and excise the neuroma. This lady had such sensitivity of the finger that she shuddered and tensed even when I sat down opposite to her. The vibrations of my entry were enough to make her withdraw the hand indicating a remarkable degree of sensitivity. With more good intention than hope, the neuroma was excised but the sensitivity persisted. After many reviews she persuaded me to amputate the terminal phalanx. This again was a complete failure. Months passed and I became very familiar with her at review. I even went as far as dividing both digital nerves at the base of the finger which in fact resulted in a numb finger but without relief of the sensitivity. Her family contacted me and I spoke to her daughter with some foreboding but in fact the interview was very pleasant and she simply requested me to refer her mother privately to a London surgeon for a second opinion. I referred her to Mr Rolfe Birch in Harley Street who is now the acknowledged authority on peripheral nerve injuries. She duly attended him and he referred her on to Mr Wynn Parrv whose reputation in rehabilitation was established in the RAF. He admitted the patient to the Royal National Orthopaedic Hospital under the National Health Service and she was kept there for 3 weeks. During this time she had a series of treatments, including intravenous blocks, a desensitisation programme, various analgesics. All this, however, was to no avail and she returned unchanged. At that point she told me that she was intent of pursuing her case for injury at the factory where she had worked. She told me she had two daughters and she had decided to make her claim and when it was settled she would pass on the proceeds to her daughters and then commit suicide. My relationship with her was very good and I did believe her. I of course protested and asked her to see a psychiatrist. She readily agreed and told me that it would make no difference.

This lady, a most gentle person, saw the consultant psychiatrist, who told me that she had no mental illness and that in all probability she would

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eventually commit suicide but that he had no means of preventing this action. Sadly I have to say that the last I heard of her was that she was admitted as a suicide attempt but was resuscitated on that occasion. I have since lost contact with her.

This case has naturally left me with a lasting reluctance to carry out amputation of the finger.

I will now proceed to describe a second interesting hand case which was referred to me by a rheumatologist colleague some time ago. Mrs. Y had a grossly swollen finger which had not resolved by various medications. I carried out exploration and found a grossly inflamed synovium. I did a synovectomy.

The specimen was duly sent off and the histology came back—tuberculous synovitis. I referred her to Dr J. MacMahon, respiratory physician, who undertook further investigation and treatment. No primary lesion was found. At the follow-up I talked to her and it transpired that she had a large garden and was in the habit of walking around it towards a stream at the back.

She had a problem with badgers which tended to damage the lawn, burrowing into it and she told me that she often repaired the defects patting down the soil with her hand. I immediately concluded that her infection of the finger had been due to the presence of tuberculosis in the badger colony. However, Dr. MacMahon continued to review Mrs Y and he found that she had a fish tank which she tended diligently. One of her more beautiful fish died and was shown to be harbouring mycobacterium marinum.

Medicine, as ever, never ceases to fascinate and challenge us and for that we are grateful. We are a very privileged people to work in a profession which provides such an absorbing interest.

Finally, let me return to the hand and its intimate connection with the brain. The photograph shows Renoir but indicates clearly the hand deformity typical of rheumatoid arthritis. Renoir developed the disease at approximately fifty years of age and as it progressed it gradually led to poor hand function, particularly in his later years. During this time, he continued to produce very many paintings. He became confined to a wheelchair and wore splints on the hands. Disease in the right shoulder limited the area over which he could paint without moving his whole body. He developed a technique of moving the canvas on spindles so that he could cover its fullest extent and paint large works of art.

The limitation of hand function did not affect his skills in painting as he continued, despite his disabilities, to paint until the end of his life. We must recognise that the hand, deformed and damaged by disease, was still capable of delivering his great talent to produce further masterpieces and we should realise that his immense skill did not really lie within the hand but in the vision of his mind and soul.

We must therefore conclude that the hand is the organ of skill, expression, communication, power and achievement—the most responsive to the brain of all the organs of the body.