International elective training in medicine at the postgraduate level is becoming increasingly sought. Yet this is almost exclusively in the context of “global health” rather than recognizing that international electives can offer excellent technical training in absolute terms. Plastic surgery is a case in point.

Reflections on training in plastic surgery have primarily focused on the structure and process of formal postgraduate or residency training programs. Technical issues, such as the use of simulation and training models, or process issues, such as selection, are readily discussed. However, more fundamental questions of the nature of learning and skills acquisition are also being added to the debate, and this widens the notion of what constitutes effective and safe training.

Given this widening discourse, I describe an established program that has been innovative in placing itself outside the traditional formal training structures as well as having offered excellent technical training with the intention of this being returned to the country of origin of its trainees. In addition, this training model demonstrates effective education and training processes in incorporating some of the best features of appropriate pedagogy for specialty training, which only relatively recently have been discussed in the published literature.

THE MICROSURGERY FELLOWSHIP AT CHANG GUNG MEMORIAL HOSPITAL, TAIWAN

This sentinel program is the Microsurgery Fellowship at Chang Gung Memorial Hospital (CGMH) in Taiwan that was established almost 3 decades ago. During this time, the plastic and reconstructive surgery department at the CGMH has been the main destination for many surgeons seeking highly specialized training in reconstructive microsurgery outside the traditional structures.

CGMH was founded in 1976. From a modest start, it has grown into 6 branches in Taiwan and 1 branch in China, with an overall capacity of more than 9000 beds. The hospital established a new era of medicine in Taiwan by making an affordable high-quality service widely available.

The Microsurgery Division is located in Linkou and is the largest branch with 3800 beds and more than 90 operating rooms. The division comprises 14 full-time staff, with very busy schedules throughout...
the week. According to recent statistics, the department performs more than 1200 free flaps per year, with a success rate of 98%, which represents unparalleled volume and quality.7

One development of the Microsurgery Division was the establishment of a 24-bed Microsurgical Intensive Care Unit that monitors patients who have had reconstructive procedures. Each patient is monitored closely for 3–5 days by dedicated and experienced nursing staff directly connected to a responsible attending doctor. The ICU is one of the major contributing factors to the success of microsurgery in CGMH.

The Department of Plastic and Reconstructive Surgery was a foundation department under the leadership of Professor Samuel Noordhoff, an American surgeon who believed in Taiwan and the potential of its people. Since then, the department has grown rapidly to attain its international reputation. It is now one of the largest departments of plastic surgery in the world and is a pioneer center for its special approach to plastic and reconstructive surgery training based on 4 divisions that aspire for excellence:

- Reconstructive microsurgery
- Craniofacial surgery
- Burns and general plastic surgery
- Trauma plastic surgery

The Fellowship

The Fellowship program started in 1984, with one Fellow assigned to work with Professor Fu-Chan Wei,8 who has pioneered much of the microsurgery in CGMH. As a world authority in the field of microsurgery, he trains 6 microsurgery fellows per year.

The 3 possible programs are as follows:

1. A 1-year Clinical Fellowship
2. A 2-year combined clinical and research Fellowship in reconstructive microsurgery
3. A Master’s degree in the science of reconstructive microsurgery9

Eighty to 90 candidates apply to join the Fellowship each year, making it a highly competitive program. They come from a variety of specialties, including plastic surgery, orthopedics, ENT surgery, maxillofacial surgery, and hand surgery.

Application and Selection

The model that was established by Nordhoff (personal communication, 2013) was intended to select brilliant, committed, and hardworking candidates and has continued as the essence of the department and was the major factor in its development and continuous pursuit of excellence.

Applicants for the Fellowship must have undertaken Plastic Surgery postgraduate training in a recognized center and have a certificate of good standing from a regulatory authority along with the recommendation of the head of the institute.

The comprehensive selection process involves a committee reviewing the applicants and rating them according to their experience, supervisor reports, expectations, and future plans as well as their academic and research interests. The short-listed candidates are contacted for personal interviews, and successful candidates are subsequently notified.

The target candidate qualities and selection processes are in line with recent surveyed opinion about selection into plastic surgery.4

Introduction to the Course

On arrival in Taiwan, each candidate sits with Professor Wei to discuss previous clinical experience, expectations, research interests, and future career plans, so that the rotation can be tailored to individual needs.

Within the Division of Reconstructive Microsurgery, groups of attending surgeons develop their own area of interest, and work heavily on that, which gives them great expertise within their specific field. These areas include head and neck reconstruction, brachial plexus and functioning muscle transfer, breast reconstruction, and lymphedema as well as limb reconstruction.

Each fellow’s progress is monitored closely during the 2-month rotations. Supervisors report regularly to Professor Wei who is the principal of training, and each candidate schedules meetings with him to report on personal progress and skills development. This personal approach is appreciated, as one Fellow said:

I have learnt a tremendous amount of knowledge and operative skills during my Fellowship year. Your generosity and kindness will always be treasured.

The candidates are encouraged to conduct research during their 1-year Fellowship. The research facilities and opportunities are extensive and include composite tissue allotransplantation, peripheral nerve research laboratory, and a tissue engineering laboratory, with funding available for most occasions.

TRAINING MODEL

The training program comprises a number of complementary elements. It recognizes that students at this level require a different approach from students that might be less experienced. The Fellows at CGMH are treated as adult learners as they are mature, self-directed, wishing to contribute, and well-developed individually.6
Apprenticeship

Fellows actively participate in not only the operative management of the patient, but also in the preoperative assessment and postoperative care. A high degree of responsibility is assigned to the Fellows and appropriate latitude and autonomy is routinely given in the clinical care of the patient.10

The Fellows rotate every 2 months to be supervised by one senior surgeon. This time frame has worked well as the fellows are able to complete a sufficient number of cases and spend ample time with the faculty. The learning curve is always more than sufficient.11 Such immersion in practice is recognized as an effective component of social learning organizations.12 One-to-one teaching is the norm, benefiting from the senior surgeon’s schedule of at least 2 days’ operating during which the Fellow operates under the close step-by-step supervision of his senior, developing techniques and attaining skills (Fig. 1). This partnership between faculty and Fellow is a key factor for students at this level, involving each party valuing the other and a flexible interaction that focuses on the needs of the student. Joint reflection is a positive educational intervention.13

The acquisition of a microsurgery skill set requires a number of elements. These include understanding the task, relating knowledge and performance, and developing autonomous and fluid performance. Mastery of the basic skills and concepts, along with the practice in which to apply and develop these, is a requirement for effective learning.14

By the end of each rotation, the Fellow should be able to complete the entire procedure alone. Performing at least 2 free flaps per week is the norm for the Fellowship, in addition to seeing patients on every morning round and helping with the management plan. During 1 or 2 clinics per week, Fellows participate in preoperative assessment and follow-up of postoperative results, which adds invaluable learning in relation to management and outcomes.

A refinement of the skills acquisition model has focused on the role of practice.15 Although immersion in practice is essential, it is not in and of itself sufficient. Deliberate practice is required to develop true mastery. The CGMH approach of attachment to expert groups with careful feedback and supervision provides this.

A positive climate created by the senior surgeons in relation to patients, colleagues, and Fellows makes the environment fertile for learning and expanding personal experience.

As one Fellow said:

Fellows train at the number one microsurgical institute in the world, with many of the world’s foremost microsurgeons; the quality (and quantity) of surgical experience cannot be equaled anywhere!

Didactic and Interactive Sessions

All Fellows are expected to attend and participate in clinical conferences held throughout the week. In addition, Saturday morning conferences are scheduled on a weekly basis, and a morbidity and mortality conference is held once a month. Resident didactic lectures held on Thursday mornings are also strongly encouraged for all Fellows.4

At weekly didactic “grand round” sessions, one senior surgeon presents his personal experience on a specific topic, with follow-up of cases, and reference to other world expertise and current developments in the field.

A weekly lecture is also presented by a trainee at CGMH. A journal club occurs each week, where new articles of great interest or book chapters are discussed with input from both CGMH staff and Fellows.

At the end of each month, there is mortality and morbidity meeting, where each case is discussed, and problems reviewed, with the intention of learning for future practice. Points are noted, and the international literature is searched for similar problems and suggested solutions.

Professor Fu-Chan Wei frequently conducts an ICU round on Saturday mornings, where he goes through cases and discusses their management plans in detail.

Whiteboard Round

Professor Wei typically performs 4 free flap reconstruction cases per week. He invented a “whiteboard round” that occurs before surgery starts and...
takes place in the operating room. An assigned resident and Fellow brief the other Fellows and visiting scholars on each case with a review of the history and physical examination, excisional plan, and reconstruction plan. This is all recorded on a whiteboard. Professor Wei then goes through each point in detail and discusses it and his plans, perhaps with the input of the head and neck surgeon. This is a useful method, which draws on Professor Wei’s experience, approach, “tricks and traps,” and alternative plans should the suggested plans fail in some way.

Learning any medical or surgical specialty is not only a technical challenge but also involves the development of clinical problem solving and management skills. These are also acquired through practice and reflection in clinical settings and require compilation of experience and cases. The intention is to assist the trainees and Fellows to develop their own perception of how to deal with complex cases, anticipate problems, and be always prepared to shift to other plans. It also enhances patient safety as each team member gets assignment during the surgery.

Visiting Professors
The department is a popular destination for world-renowned plastic surgeons, with a constant flow of world authority figures visiting the department, where they are given the opportunity to give lectures on their recent work and discuss this with senior surgeons, Fellows, and residents who also receive feedback on different clinical and research matters.

Research and Academia
The Fellowship offers ample opportunity to conduct high-standard research, with generous support from both the CGMH Foundation and the government in Taiwan. These grants allow researchers at CGMH to establish research laboratories, equipped with state-of-the-art instruments and machines, and animal models for experiments.

There is also a huge database of cases, which gives Fellows the opportunity to conduct clinical research and represents a great opportunity to publish the techniques invented or developed by surgeons at CGMH.

Many of the Fellows have published during and after their work within CGMH, and many have had the opportunity of support to attend and present at different conferences and academic platforms regionally and internationally.

ARE THE ACQUIRED SKILLS TRANSFERABLE?
An online inquiry regarding the experience of past Fellows was conducted to assess their experience following completion of the microsurgery fellowship in CGMH. The purpose was to obtain information about how they developed their perceptions about the Fellowship, how they were affected, and how it influenced the practice of microsurgery in their own institutions.

About 100 Fellows and 1300 visiting scholars have been trained in microsurgery in CGMH. These fellows are distributed all over the world, including North America, Asia, Europe, the Middle East, Africa, Australia, and New Zealand. The 85 completed survey responses were encouraging and informative. In terms of transferability, the survey showed that most Fellows chose the course for professional and career development reasons and have used their microsurgery skills in dealing with cases such as limb reconstruction (60%), head and neck reconstruction (54%) and, less frequently, nerve surgery and breast reconstruction.

These results, and the survey as a whole, will be used for planning Fellows’ rotations in the future. Most respondents (60%) said that they have the necessary equipment and staffing to start applying what they have learnt in CGMH, whereas 30% said that they might need to establish a better infrastructure and staffing at their own institutions. Ninety percent of respondents reported that they developed confidence in their own skills and in their approach to complex reconstructive procedures and that they brought unique expertise to their department or group. For some, the research environment affected their future research interests and they have developed collaborations between their home institutes and CGMH and between Fellows as a global network.

The outcomes and effects of the experience seem to be varied and tailored to circumstance, based on the acquisition of effective skills and knowledge. Although the program only accepts highly dedicated surgeons, 31 of the Fellows are currently professors and 28 of the Fellows are either department heads or program directors.

Others have taken different routes and have transferred their skills further afield:

The Fellowship has had an incredible influence in my life and is the main reason why I decided to leave my practice in USA and move my country to establish a new surgical center.

FUTURE DEVELOPMENTS
The Fellowship will continue to grow, and the plan now is to increase the number of Fellows accepted from 6 to 8 per year. Fellows have suggested the formation of a “Professor Fu-Chan Wei Fellows club,” as a platform for collaboration, not only
between Fellows but also between different experts and authorities in microsurgery all over the world. It is clear that the Fellowship creates a community of practice both in the way that the experience is organized and between the Fellows themselves that is strong enough to persist. This is an essential concept for any profession or trade that passes on its skills and knowledge by having trainees participating in actual practice. A community of practice is the set of relationships and activities centered on participation in a defined world of activity, by means of which knowledge and skills are passed on, safe entry to the world of practice is assured, and lasting groups are formed. The CGMH process effectively creates this community of practice.

Many candidates have shown a special interest in spending extra time acquiring special skills in, for example, nerve surgery (brachial plexus and facial reanimation) and lymphedema. Dedicated Fellowships are being considered for this. A proposal is under development for a Master’s degree combining research and clinical Fellowships.

**CONCLUSIONS**

Fellowship at CGMH has been a life-transforming experience and career turning point for many. The training model is an example of some of the most influential recent thinking in postgraduate training according to which trainees were:

…nurtured by a collegiate group of more experienced doctors using the subtle and probably tacit, but no less educational, means of developing in them important habits, modeling for them good professional conduct, and engaging them in discussions about practice…

The international atmosphere deriving from different surgeons coming together for the sole purpose of training along with the positive and well-managed environment for learning firmly fixes this Fellowship as a leading facility for plastic surgery training. The opportunity to spend time in a different vibrant culture is also welcome to many Fellows. This Fellowship enables dissemination and application of microsurgery skills throughout the world and the establishment of strong and lasting networks of colleagues.

The model of training offered at CGMH demonstrates so many required components of effective education, training and professional induction at this level. Many of these are often missed or just taken for granted. They include the following:

Effective recognition of the qualities of the learners at this level

Allocation of managed and supervised responsibility

Immersion in deliberate practice

Personal supervision, feedback, and planning

Recognition of technical skills development, judgment, and decision making

Attention to the contextual patient-facing skills

Development of a community of practice

Role models who establish effective educational relationships

The effects of this training are considerable: Till now—though 22 years have passed—I woke up, early in the morning, trying to learn something new, meet colleagues and students, and talk to them—a habit developed since my Fellowship days at CGMH. I really miss that place

Mohamed Abdelrahman, MD
Department of Plastic and Reconstructive Surgery
Chang Gung Memorial Hospital
5, Fu-Hsing Street, Kweshian
Taoyuan 333, Taiwan
E-mail: myhrhman@gmail.com

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