

for assessment. Finally, at the end of the year, they return to Singapore for the final examination. The overall diploma is awarded by continuous assessment over the entire one-year course.

Development has continued regularly. The seven videotapes have now been converted into two compact discs contained in a jewel case. The curriculum has been in great demand. The initial 100 sets produced were quickly exhausted. Therefore, another 250 sets were produced in April 2000. The multimedia curriculum package has been further redesigned to have all the seven module booklets conveniently housed in one specially printed box container, which contains the seven modules, two compact discs, an audiocassette and a new updated textbook as a companion volume to the multimedia curriculum. This new compact design makes the distribution of the curriculum more convenient. The updated volume *Radiation and Tissue Banking* (2000) was written by experts contracted by IAEA and printed with funds from the Singapore Government. It is an appropriate companion volume to the IAEA multimedia curriculum. It was released in July 2000 and provided free of charge to tissue banks in the member states throughout the world.

2. The Present Development

The basic sciences component of the syllabus for the Diploma Course, which is presented in the training course, includes subjects such as Anatomy, Matrix Biology and Physiology of Tissues, Microbiology, Sterile Techniques, Radiation Sciences, Biology of Healing of Allografts, Biomechanics of Allografts and Immunology. It was quickly realised that students found difficulty in obtaining basic text for this part of the Diploma Course curriculum. Available specialist textbooks on the diverse subjects addressed, such as Anatomy, Microbiology, Immunology etc., were too detailed to meet the needs of the Diploma students. It was therefore decided to produce a specifically-designed specialist textbook incorporating the various topics and to be directed at the appropriate level so as to address the specific needs of the Diploma Course students and generally that of the tissue banker, tissue procurer, tissue processor

and tissue transplanter. This textbook is written with this objective in mind. Authors were selected to write the various chapters, with specific instructions to address the needs of tissue-bank operators.

Section I: Anatomy

Tissue bankers need to have a basic knowledge of anatomy of the various regions ranging from the upper limb, lower limb, spine, pelvis to the maxillo-facial region. Several tissue-bank operators without a medical background will find this section especially useful when carrying out their daily work. Personnel with a medical background will also find this section a joy to read, rather than having to access detailed texts from anatomy textbooks since no textbook of anatomy for tissue-bank operators exists. Technologists too can now understand better the anatomy of the tissues they have been procuring or processing, and also the types of tissues that could be used for different anatomical regions.

Section II: Matrix Biology & Physiology of Tissues

The microscopic structure of tissues are detailed in this section, starting with the extracellular matrix, bone, cartilage, skin and amnion. Again, the major attractive feature is its descriptive nature with excellent illustrations. Worthy of mention is a special chapter on electron microscopy of the amnion, a tissue widely used in the Asia Pacific region.

Section III: Microbiology

Microbiology is a very important subject for tissue bankers and tissue transplant surgeons alike. The basic concepts in medical microbiology are carefully explained. Bioburden estimation itself merits one whole chapter. Equally important is the knowledge of the various transmissible diseases. Tissue bankers seek to maintain a high quality control standard to ensure safe tissue transplantation practice. No

efforts must be spared to prevent possible disease transmission during tissue transplantation. It is therefore important that tissue-bank operators have a good knowledge of the seriousness of these diseases, including AIDS, Hepatitis B and C, and syphilis.

Section IV: Sterile Techniques

To achieve high quality control standards, tissue procurement should be performed as far as possible under sterile conditions. One whole chapter is devoted to the principles of aseptic technique from scrubbing techniques, monitoring of sterility in the operating room to methods of sterilisation of equipment and materials. Another chapter is devoted to procuring tissues under sterile conditions and a third chapter to ensuring that the tissues transplanted are prepared in the correct aseptic manner so as to avoid the much dreaded complication of infection. Again, excellent illustrations have been used to make the text more readable and easier to understand.

Section V: Radiation Sciences

This section contains chapters written by three radiation scientists. The basic principles of radiation sciences are presented in the first chapter with good illustrations, so that technologists with medical background and no training in the radiation sciences can better appreciate the principles of ionising radiations. The second chapter deals with the effect of radiation on microorganisms and the third the effect of radiation on viruses, proteins and prions.

Section VI: Biology of Healing of Allografts

The biology of the healing of tissues is described, starting from the scientific basis of wound healing to the healing of the skin and amnion, and the healing of bones and ligaments. The role of various growth factors, including bone morphogenetic proteins and platelet-derived growth factor to promote bone healing, is also described and discussed in greater detail.

This section is important to surgeons who use allografts and who need to understand how the transplanted tissues heal so that they can choose more wisely the right type of graft for the various clinical conditions they encounter. In this way, better results can be obtained and complications minimised. Similarly, tissue bankers who prepare the tissue grafts will also better understand the functions of the various types of tissues they process.

Section VII: Biomechanics of Allografts

The first chapter is written by a mechanical engineer to introduce the basic concepts of biomechanics, and which could be readily understood by the tissue-bank technologists. Ample illustrations have been used to make this section user-friendly. In another chapter, the structural requirements of bone allografts for the various reconstructions performed are described by an orthopaedic surgeon, covering deep-frozen cortical bone allografts for massive allograft reconstruction of lower limbs requiring weight-bearing functions, the adequacy of lyophilised cortical allografts for massive spine reconstruction and the adequacy of lyophilised morsellised bone allografts for packing cavities in bones.

Section VIII: Immunology

This last section, written by an immunologist, outlines the basic principles of the immunology of tissue transplantation. This is vital both for the end-users (surgeons), using the bone allografts to avoid the dreaded complication of immune rejection and resulting infection and for the tissue-bank operators who need to process the tissue grafts to eliminate as much as possible any immunogenic properties of the tissue graft products.

3. References

NATHER, A. (1999a). Tissue banking in Asia Pacific region — The Asia Pacific Association of Surgical Tissue Banking. In: *Advances*

- in Tissue Banking*, Vol. 3, G.O. Phillips, R. von Versen, M. Strong and A. Nather, eds., World Scientific, Singapore, pp. 419–425.
- NATHER, A. (1999b). Tissue Banking in the Asia Pacific region: current status and future developments, *J. Orthop. Surg.* 7(2), 89–93.
- NATHER, A. (2000a). Diploma training for technologists in tissue banking, *Cell And Tissue Banking* 1(1), 41–44.
- NATHER, A. (2000b). Tissue banking in Asia Pacific region — Ethical, legal, religious, cultural and other regulatory aspects, *J. ASEAN Orthop. Assoc.* 13(1), 60–63.
- PHILLIPS, G.O. (2000). The future role of the International Atomic Energy Agency (IAEA), *Cell and Tissue Banking* 1, 27–40.
- PHILLIPS G.O. and STRONG D.M. (1999). The contribution of the International Atomic Energy Agency (IAEA) to tissue banking. In: *Advances in Tissue Banking*, Vol. 3, G.O. Phillips, R. von Versen, M. Strong and A. Nather, eds., World Scientific, Singapore, pp. 403–417.