

Elective Report

Plastic Reconstructive and Aesthetic Surgery

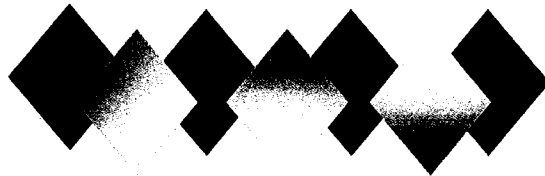
Yale New Haven Hospital

Program of Study: Medicine

Author: Charlotte R. Gould

Chief: Dr J. Persing

Student I.D: 080228437



Elective Report
Department: Plastic Reconstructive and Aesthetic Surgery
Location: Yale New Haven Hospital, Connecticut, U.S.A
Supervisor: Dr. J.A. Persing

Charlotte R Gould
Email: ha08162@qmul.ac.uk
Contact: 07850204800

'It is not sufficient simply to have an experience in order to learn. Without reflecting upon this experience it may quickly be forgotten, or its learning potential lost. It is from the feelings and thoughts emerging from this reflection that generalisations or concepts can be generated. And it is generalisations that allow new situations to be tackled effectively.'
(Gibbs, G, 1988, *Learning by Doing. A Guide to Teaching and Learning Methods*)

Introduction

My main motivation for organising this elective was to attend a world renowned academic institution with a large plastic surgery department in the United States of America. Yale New Haven Hospital has seven university affiliated attending's, each with differing specialist interests, as well as a number of private surgeons. The sub-internship would allow me to experience, observe and assist in a diverse range of operations, (some of which I will later describe) and improve my knowledge of plastic and reconstructive surgical techniques.

In this short elective report I will address the four objectives set prior to my arrival at Yale New Haven Hospital. The objectives incorporate comparisons of health care delivery between the host country, (the United States of America) and my native country (the United Kingdom), and comparisons between the frequencies of surgical procedures of a plastic, reconstructive and aesthetic nature between the two locations. For my knowledge based objective I have chosen to discuss the anatomy of the external ear, how this is distorted in microtia and the surgical techniques for correction. Finally I shall reflect upon the activities and experiences to which I have been exposed during my four week sub-internship and how these may benefit my future practice.

Objectives:

- *Outline how healthcare services are delivered in the USA and compare this to the systems in place in the UK.*
- *Determine the frequencies of surgical operations of plastic reconstructive and aesthetic nature in the USA; how does this compare to the UK?*
- *Describe in detail a surgical procedure and its indications observed during the sub-internship at YNHH.*
- *Reflect upon the activities and learning experiences gained during the sub-internship at YNHH.*

Outline how healthcare services are delivered in the USA and compare this to the systems in place in the UK.

Healthcare systems in the USA and the UK were established following the Great Depression and World War II with the shared objective of delivering improved access to healthcare to their populations; political and social pressures of the time drove each country down a different path of provision¹. The US favoured a 'market-maximised' entrepreneurial model and in contrast the UK favoured a 'market-minimised' socialised model¹.

In the UK, the labour government's health minister, Aneurin Bevan proposed a system embracing three main principles; a service able to meet the need of everyone, free at the point of delivery and based on clinical necessity rather than wealth². This national health care service (NHS) was implemented in 1948; it is funded via general taxation and remains the countries primary service guaranteeing all citizens healthcare access². The NHS is the largest single payer healthcare system in the world, and is regarded by many as one of the country's greatest assets². Currently certain services do require fees to be paid and hence are not free at the point of delivery; these includes drug prescriptions, dental procedures and optical products which often require a small flat rate fee to be paid¹.

Health care in the United States by contrast is not universal nor is it controlled to such a large extent by the government¹. The system is regulated by the private sector, where individuals are required to purchase health insurance. Health insurance is frequently employment based, (explaining why many unemployed individuals are also uninsured)¹. The percentage of individuals who were not insured in America in 2012 was 15.4%, equating to 48 million individuals³. Insurance is typically paid in monthly instalments; when the insured individual requires medical attention for a condition covered under the agreement, the insurer is then responsible for providing or reimbursing the some or the entirety of cost of care¹. However, this is dependent upon the type health insurance purchased (conventional coverage, health maintenance organisations, preferred provider organisations or point of service plans), and the insured individual may be required to pay additional fees out of pocket or in the form of deductibles, co-pays or co-insurance¹. The publically funded segment of healthcare in the US was initiated in the 1960s with Medicare and Medicaid; the former provides coverage to the elderly and disabled population, the latter provides coverage to individuals whose income falls below a state determined cut off level (also includes Veterans Association and State Children's Health Insurance Programme)¹.

At their inception, the systems were at opposite ends of the spectrum, however as the years pass, the US is implementing provisions that enable more individuals to gain insurance, and the UK's market for private medicine is growing. In 2010, President Obama implemented the Patient Protection and Affordability Care Act in order to tackle the large number of uninsured individuals in the US⁴. The federal statute aims to tackle this by driving down costs of insurance by mandates, subsidies and exchanges⁴. In the UK the Health and Social Care Act 2012 has been associated with increasing privatisation⁵. In 2012 the US spent 17.9% GDP on healthcare, compared to 9.4% in the UK⁶. The delivery of services is largely similar in both countries, where primary access is provided by general practitioners who refer patients on to the necessary specialist services. Both systems have their advantages; at present each appears to be considering new approaches to providing comprehensive cover with high quality cost effective health care.

Determine the frequencies of surgical operations of plastic, reconstructive and aesthetic nature in the USA; how does this compare to the UK?

The American Society of Plastic Surgeons (ASPS) produces an annual statistical report documenting the frequencies of cosmetic and reconstructive surgical operations performed in the United States⁷. The British Association of Aesthetic Surgeons (BAAPS) similarly produces an annual statistical report⁸, however I could not locate the counterpart for the British Association of Plastic, Reconstructive and Aesthetic Surgeons (BAPRAS); as such I am able to compare the frequencies of cosmetic procedures for the year 2013, but not those of reconstructive nature.

The desire of aesthetic perfection coupled with the increased public acceptability of cosmetic procedures has led to growth in their delivery; the US consistently carries out a high number of surgeries annually, in 2013 this was 1,668,420 (population of 316,148,990)⁷; 50,122 procedures were performed in the UK (population of 63,700,000)⁸. Whilst in terms of absolute numbers, the UK carries out many fewer cosmetic procedures, the overall trend demonstrates a growth of 17% compared to 2012⁸.

The most common cosmetic procedure in both countries is breast augmentation (USA; 290,224, UK; 11,135)^{7,8}. In the USA this is followed by rhinoplasty (221,053), blepharoplasty (215,641), liposuction (199,817) and rhytidectomy (133,320)⁷. In the UK it is followed by blepharoplasty (7,808), rhytidectomy (6,380) breast reconstruction (5,476) and rhinoplasty (4,878)⁸. As one can see, breast and facial revisions are to be the most popular procedures, however of note, there was a 41% rise in liposuction procedures in the UK between 2012 and 2013⁸. In the US, Caucasian females represent the major cohort undergoing cosmetic procedures (91% female, 70% Caucasian)⁷. Similar data was not available for the UK though it would be interesting to determine whether gender and ethnicity matched that of the US. Is this a representation of the general population in the US, or are certain ethnicities more dissatisfied with their appearance?

The most frequent non-cosmetic procedures carried out in the USA were those for tumour removal (4,426,634) followed by laceration repair (253,660), maxillofacial (198,531), scar revision (177,317), and hand surgery (131,282)⁷. It would be beneficial for a national register of reconstructive surgery to be developed in the UK.

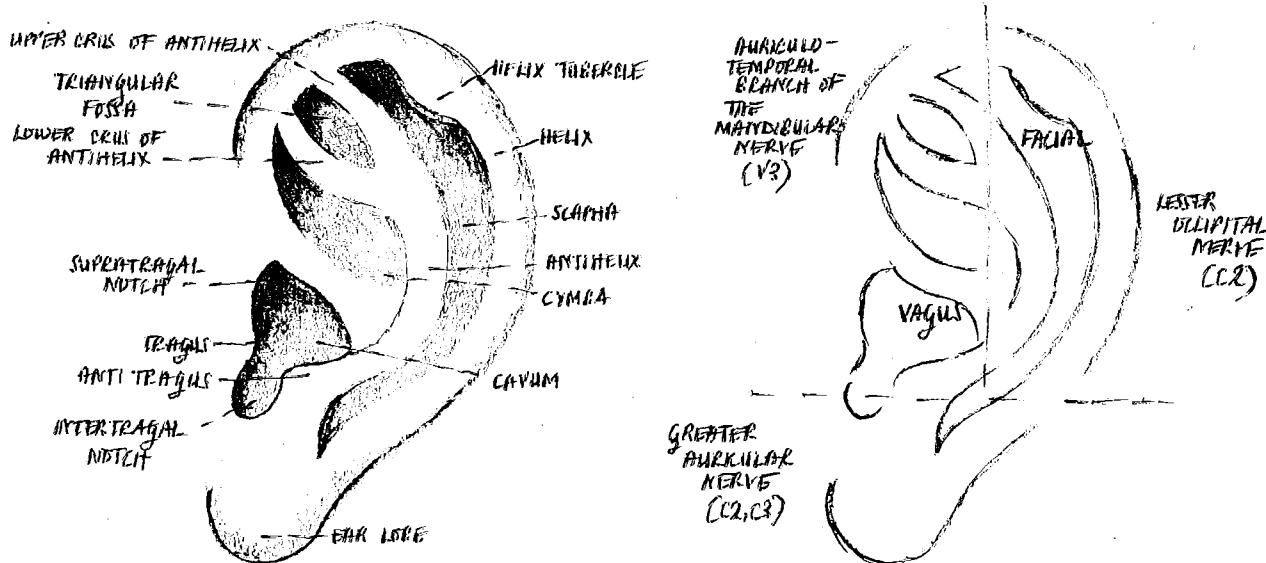
Describe in detail a surgical procedure and its indications observed during the sub-internship at YNHH.

Anatomy of the external ear

The ear is formed of three components; the outer, middle and inner ear. The outer ear comprises the pinna (auricle) the externally visible portion that captures sound and conveys it via the external auditory canal and tympanic membrane. The middle ear comprises the three interconnected ossicles (malleus, incus and stapes, located in the petrous part of the temporal bone), which transmit the vibrations to the internal ear. The internal ear comprises the bony and membranous labyrinths; here mechanical sound waves are converted into electrical impulses via the cochlea. The inner ear is also intimately involved in the control of balance. The section will focus solely on the anatomy of the external ear.

The pinna has a cartilage framework and is covered by skin; various hollows and elevations exist which produce the characteristic shape. The outer rim is termed the helix, the curvature parallel and anterior to this is the antihelix. The external auditory canal arises from a portion of the concha, it runs for approximately 2.5cm until the tympanic membrane is reached. Anterior to the concha is the tragus, opposite this structure is the antitragus. The lobe is the caudal area that is not supported by cartilage. These landmarks are illustrated below.

Intrinsic and extrinsic muscles aid the positioning of the auricle; they are innervated by the facial nerve. Innervation of the outer superficial surfaces of the auricle is illustrated below. Arterial supply to the ear is provided by the posterior auricular artery (branch of the external carotid), anterior auricular artery (branch of the superficial temporal) and branches of the occipital artery. [Anatomy of the ear adapted from Gray's Anatomy for Students, see reference 9].



Ear Reconstruction

The external ear is delicate and exposed thus is prone to damage from a variety of traumatic events such as lacerations, bites, avulsions and burns as well as neoplastic disease. Subsequently the individual may benefit from reconstruction of the ear. Microtia is another indication for ear reconstruction and it is this condition that I will concentrate upon. Microtia refers to the abnormal development of the ear or ears^{10,11}. It is most commonly unilateral and affects the right ear in 60% of individuals^{10,11}. The incidence is approximately 1 in 10,000, and is more frequently seen in males^{10,11}. The spectrum of microtia was initially classified by Marx in 1926 and amended by Rogers in 1977, though a number of different classification systems exist¹⁰. Marx's is perhaps the most simplistic; stage I describes the microtic ear which differs from the normal external ear minimally whereas stage IV describes the complete absence of the ear- anotia¹⁰.

Stage	Description
I	Abnormal auricle with all identifiable landmarks
II	Abnormal auricle without some identifiable landmarks
III	Very small auricular tag or anotia
IV	Absence of total ear- anotia

Table 1: Classification of microtia according to Marx and Rogers¹⁰

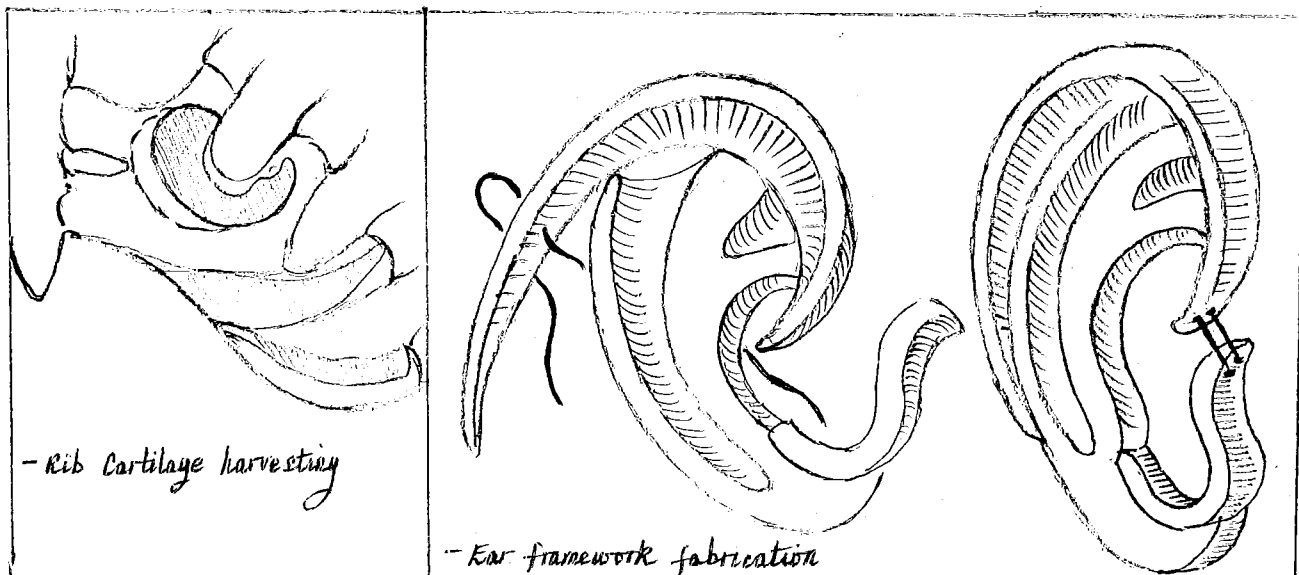
Literature

The goal of all reconstructive procedures are similar; to reestablish the form and function of the component in question. [Regarding microtia, aspects concerning the function of hearing will not be reviewed.] The options available for ear reconstruction include the use of a prosthetic device or the implantation of material beneath the skin to recreate the ears' intricate contours¹². Ear frameworks may be composed of synthetic material (polyethylene or less commonly silicone) or the patient's own rib cartilage¹². Results of the former technique are often poor; graft loss and complications such as infection are not infrequent¹². Trauma to the lateral aspect of the head predisposes to extrusion of the acellular scaffold beneath the delicate auricular skin¹². As in many areas of surgery, there is a growing trend towards the use of biologically equivalent structures where possible, and away from the use of prosthetics; as such, the use of autologous rib cartilage for ear reconstruction has become the standard practice in the US, as reported by Im *et al*¹³.

Ear reconstruction is perhaps one of the most intricate of plastic surgical procedures due to the complexity of the ear and artistic ability required to recreate a structure from the contours of the ribs that matches the normal ear (when one exists) adequately. The pioneer of ear reconstruction using rib cartilage for its framework was Tanzer, whose method was first introduced in the 1960s¹⁴; since this time progressive refinements to the technique have been made by Brent, Nagata and most recently by Firmin^{15,16,17}. Brent advocated a four stage procedure; where the primary surgery would entail the ear framework composition from patients' costal cartilage, the second stage would see creation of the ear lobe, the third stage was designed to give the pinna three dimensional projection, and the fourth stage to construction of the tragus¹⁵. This lengthy approach was condensed to just two stages by Nagata; the initial framework construction would be carried out in concert with tragal construction and lobule transposition, the projection stage following 6 months later¹⁶. Firmin further acknowledges the type of microtia present and recommends tailoring many aspects of reconstruction to this; her reconstructive algorithm is presented in a recent paper¹⁷.

The creation of six segments are necessary for satisfactory ear reconstruction; the base, helix, anti-helix, tragus/anti-tragus, projection cartilage and spare cartilage¹⁵. These portions are harvested from the fifth to ninth ribs on the ipsilateral side via an oblique incision¹⁷. The cartilage (which should be frequently bathed in saline), is carved intra-operatively using a scalpel/chisel and the shape maintained using nylon or wire sutures place on the scaffolds undersurface^{15,17}. Once cartilage modeling is complete the ear pocket in the ideal position is created and scaffold placed in situ^{15,17}. Drains are frequently utilized to deliver continuous suction to the area^{15,17}. A wedged portion of cartilage is banked in the abdomen or posterior to the new pinna for later use¹⁵. At the second phase of the reconstruction, the wedged cartilage can be used as a support in order to obtain ear projection¹⁵. A tissue flap (e.g. temperomandibular/occipital) covering the cartilage is requisite for a skin graft to the posterior aspect of the new pinna to take^{15,17}.

The age at which ear reconstruction is performed is a compromise; the normal ear should be close to its maximum growth potential, and the child must be old enough to have a sufficient amount of rib cartilage, however this is balanced against psychological sequelae which can occur early on. Most surgeons seem to operate between the ages of 7 to 10¹³.



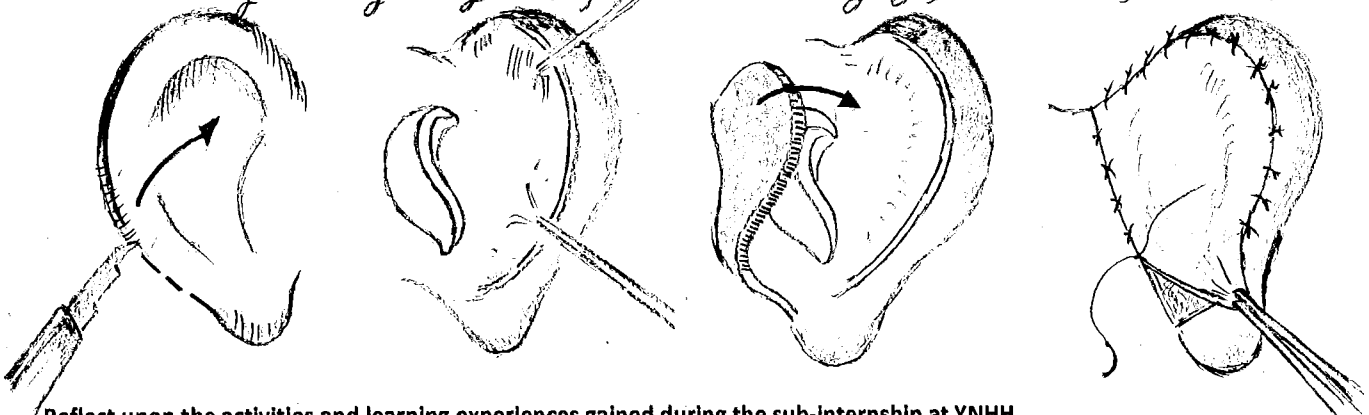
From - Brent - ref 15

Pitfalls

Many surgeons perform ear reconstructions, yet several report performing less than 15 a year¹³. Sabbagh highlights the long learning curve that exists in this sophisticated surgery, which early on in training may be at the expense of the patient¹⁸. Simulation is becoming increasingly prevalent in many surgical areas, indicating the need for adequate practice prior to execution in both routine and more elaborate procedures. Firmin has developed a 'trainer' in which one can rehearse the creation of 3D cartilage scaffolds, as such this step (often believed to be the most difficult aspect of reconstruction) within the operation becomes noticeably more straightforward¹⁷.

Donor site morbidity of rib cartilage grafts has been tackled by Brent, who advocates preserving the rib rim¹⁵. Despite this, chest deformity, pain and clicking (indicative of instability) are still reported. Fattah *et al.* have presented a technique of donor site reconstitution which involves placing morcelised cartilage in a vicryl mesh into the donor defect; this was shown to improve the contour of the chest wall¹⁹. Whilst rib cartilage based ear reconstruction remains the standard for now, a number of drawbacks have been discussed and this begs us to ask 'what is the ideal process for refashioning a microtic ear?' A survey addressing members of ASPS demonstrated 59% to believe the future to lie in tissue engineering¹³. Whilst there is a way to go before cartilage ear constructs can be grown *in vitro* and combined with 3D computer imaging techniques to produce a perfectly matched ear, this is perhaps the ultimate objective for reconstruction.

- Illustration: stage 2: augmenting ear projection with cartilage graft & turnover fascial flap



Reflect upon the activities and learning experiences gained during the sub-internship at YNHH.

From Brent - ref 15.

Typically, the day would begin around 5am by preparing the list of patients for the morning ward round. This involved documenting the patients operation and post-operative status including drain outputs, blood work and medications. The team of students, interns and residents would embark on rounds led by the chief resident, checking patient wounds and redressing if necessary. This was often followed by lectures or anatomy workshops; the majority of the day would then be spent in theatre, where I was welcomed and taught to very high standards. My operative diary is documented (see Appendix); I assisted in each of these cases and when time permitted I was able to excise lesions, tie drains and complete wound closure.

I am particularly pleased to have been exposed to such a wide range of surgical procedures within the department of plastic surgery. These have included paediatric conditions such as ear reconstructions for microtia (as previously described) and cleft lip and palate repair, orthognathic surgery for microsomic and syndromic facies, cancer excisions (skin; melanoma, squamous cell carcinoma) and reconstruction (following mastectomies), traumatic injuries requiring skin grafts and flaps, hand surgery, aesthetic surgery including rhinoplasties, breast augmentation and body contouring following massive weight loss post bariatric procedures. The diversity necessitates a broad base of anatomical knowledge, which I have appreciated reviewing. There have been many beneficial lectures and teaching sessions that I have been able to attend, I particularly valued the dissection classes, where I have had the opportunity to perform a simulated rhytidectomy, blepharoplasty, orbital floor fracture repair and metacarpophalangeal joint replacement.

During my sub-internship, I observed the long working hours of attending's, residents and interns in the USA, who have a maximum 80 hour working week, this is lengthier than I have experienced as a UK undergraduate, where hours are governed by the European working time directive- a 48 hour maximum week (though in both cases these rules may not necessarily be strictly adhered to). The obvious advantages of this include the greater exposure to patients, conditions and operations which one may become involved in and subsequent advancement in competencies. A quote 'if the sun is still up, there is more to still more to do' seems apt-(however this may come at the expense of rest and a work-life balance!).

I have thoroughly enjoyed my elective at Yale New Haven Hospital with the department of plastic, reconstructive and aesthetic surgery. I have assisted in over 50 operations, allowing me to become more confident in anatomical knowledge and my own surgical techniques; I have gained many pearls of advice, including those from Professor Ariyan- 'bleeding always stops!', and how to become more efficient whilst suturing wounds. Overall, this experience has strengthened my desire to pursue this specialty as my future career.

References

1. McClintock Roe, A, M. & Liberman, A. 2007. A Comparative Analysis of the United Kingdom and the United States Health Care Systems. *Health Care Manag.* 26(3): 190-212.
2. The History of the NHS. 2013. The NHS. Online. Accessed 5/11/14. Available at: www.nhs.uk
3. DeNavas-Walt, C, Proctor, B.D. & Smith, J.C. 2013. Income Poverty and Health Insurance Coverage in the United States 2012. Census. Online. Accessed 5/11/14. Available at: <http://www.census.gov/prod/2013pubs/p60-245.pdf>.
4. Affordable Care Act. Online. Accessed: 5/11/14. Available at: <http://www.hhs.gov/healthcare/rights/index.html>
5. Health and Social Care Act 2012. Online. Accessed: 5/11/14. Available at: <http://www.legislation.gov.uk/>
6. Health Expenditure. Online database. Accessed: 5/11/14. Available at: <http://data.worldbank.org/>
7. 2013 Plastic Surgery Statistics Report. Association of Plastic Surgeons of America. Online. Accessed: 5/11/14. Available at: <http://www.plasticsurgery.org/news/plastic-surgery-statistics/2013.html>
8. Annual Audit. British Association of Plastic Surgeons. Online. Accessed: 5/11/14. Available at: <http://baaps.org.uk/about-us/audit/1856-britain-sucks>
9. Drake, R.L., Vogl, W., Mitchell, A.W.M. & Gray, H. 2010. *Grays Anatomy for Students*. 2nd Edition. Churchill Livingstone/Elsevier. Pages
10. Luguetti, D.V., Heike, C.L., Hing, A.V., Cunningham, M.L. & Cox, T.C. 2012. Microtia: Epidemiology and genetics. *Am J Med Genet A.* 158(1): 124-139.
11. Alasti, F. & Van Camp, G. 2009. Genetics of microtia and associated syndromes. *J Med Genet.* 46(6): 361-369.
12. Sivayoham, E. & Woolford, T.J. 2012. Current opinion on auricular reconstruction. *Curr Opin Otolaryngol Head Neck Surg.* 20: 287-290.
13. Im, D.D., Paskhover, B., Staffenberg, D.A. & Jarrahy, R. 2013. Current Management of Microtia: A National Survey. *Aesth Plast Surg.* 37:402-408.
14. Tanzer, R.C. 1971. Total reconstruction of the auricle. The evaluation of a plan of treatment. *Plast Reconstr Surg.* 47: 523-533.
15. Brent, B. 1999. Technical advances in ear reconstruction with autogenous rib cartilage grafts: personal experience with 1200 cases. *Plast Reconstr Surg.* 104(2): 319-334.
16. Nagata, S. 1993. A new method of total reconstruction of the auricle for microtia. *Plast Reconstr Surg.* 92(2): 187-201.
17. Firmin, F. & Marchac, A. 2011. A Novel Algorithm for Autologous Ear Reconstruction. *Semin Plast Surg.* 25(4): 257-264.
18. Sabbagh, W. 2011. Early experience in microtia reconstruction: The first 100 cases. *J PRAS.* 64: 452-458.
19. Fattah, A., Sebire, N.J. & Bulstrode, N.W. 2010. Donor site reconstitution for ear reconstruction. *J PRAS.* 63(9): 1459-1465.

Prof Mike Roberts
Dean for Students
Garrod Building, Turner Street
London E1 2AD
Tel 020 7882 2126
Fax 020 7882 7206
e-mail c.m.roberts@qmul.ac.uk

Dear Colleague,

This letter introduces one of our undergraduate students who has been accepted for a period of elective study with you. May I take this opportunity to thank you for agreeing to take this student and to provide further information about the elective attachment.

Final year students on the MB BS degree course are required to undertake a period of six weeks of elective study. The student may choose to undertake a single speciality or can divide the time in order to work in two different areas.

While we are anxious that our students should obtain the widest possible range of experience it is important that they should not be asked to undertake duties beyond their level of training. Invasive techniques should be carefully supervised by staff that are at an appropriate level of training. Please think about the risks that the student will be exposed to. **A hazard checklist is provided with this letter that should be completed and handed to the student on arrival.**

The students are required to set some specific objectives that they will send you with this letter. At the end of their placement they are required to write a short report addressing these objectives (less than 1200 words) and we hope that you will be willing to assess these on our behalf. This will form a part of their overall elective assessment.

Students are required to provide proof of satisfactory attendance on completion of their elective study. I would therefore be most grateful if you or one of your colleagues would complete the attached assessment form. Please be open and frank in your assessment. We encourage students to read these reports and it is important that they should be informative as possible.

The completed student report will be e-mailed to you within one week of the placement along with an assessment form (Appendix 3 – Elective Assessment) and we ask that you reply by e-mail back to the student, within one week, with a copy to us, providing a simple grade: A = excellent; B = good; C = satisfactory; D = poor; E = unsatisfactory.

In order to assist with this process we are encouraging students to write their report while on placement so that you are able to grade it before they leave. Please let us, or the student know if you are unable to assess the student's report for us (and we will make other arrangements to undertake the assessment.

Should you or the student need to contact us about the student in an **emergency** please email: **elective-emergency@qmul.ac.uk** or telephone **+44 (0)7941 255834** (Dr Martin Carrier, academic lead electives).

Again I am very grateful to you for accepting one of our students and I hope that s/he will be a credit to the Medical School.

Yours faithfully

Prof Mike Roberts MB ChB MA MD FRCP IL THE Dean for students