Summary of a talk delivered at Queen’s University, Belfast, on 16 May 2016 as the invited speaker for an Anatomical Society Departmental Seminar Grants Award granted to

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**Augmented Anatomy: Benefits of a dissection-based anatomy teaching course**

*2016 marks the 300th anniversary of the establishment of the Anatomy School in Cambridge, with dissection-based instruction starting even earlier in the Colleges in the 1560s. This seminar will focus on how this well-tested approach allows medical students, as Tomorrow’s Doctors, to develop in multiple domains: knowledge and intellectual ability, personal transferable skills, clinical understanding and professionalism, as well as motivating them to have inquiring scientific minds.*

The phrase ***Augmented Anatomy*** is intended to convey the idea that using dissection to teach anatomy enables the student not only to acquire anatomical knowledge, but provides them with an *augmented* array of skills which become part of them. In this talk, these additional skills are mapped to the outcomes for doctors that are listed in the latest document published by the GMC in January 2016: *Promoting excellence: standards for medical education and training*, which has superseded the previous document *Tomorrow’s doctors.* A dissection-based anatomy teaching course achieves these outcomes: the doctor as a ***scholar and scientist***; the doctor as a ***practitioner***; and the doctor as a ***professional****.*

The GMC published the *Good Medical Practice* booklet in 2013, describing what is expected of all registered doctors in four domains. A dissection-based anatomy teaching course enables students to develop these skills right from the beginning of their medical course. These domains are: ***knowledge, skills and performance****;* ***safety and quality****;* ***communication, partnership and teamwork****;* and ***maintaining trust****.*

This is a good example of the first step onto the ***spiral curriculum****,* where students are exposed to the same topics throughout their course, with each encounter increasing in complexity and reinforcing previous learning. Students are taught the above basic principles through a dissection-based anatomy course, which are then repeated in subsequent years, leading eventually to the three desired outcomes.

[A summary of where ***anatomy*** fits into both the Cambridge preclinical and clinical courses is given here, including in Part II projects, clinical revision sessions and SSCs undertaken by clinical students.]

The following are eight ways in which an anatomy teaching programme is ***augmented*** by cadaveric dissection. Every ***augmentation* *point*,** which is essentially a **plus point *of added value***, is mapped to the three Outcomes and four Domains listed above. Some will involve more than one Outcome and Domain, but only the principal Outcomes and Domains are listed to avoid confusion.

**1.** ***Enhancing professionalism***

This relates to Outcome 3: the doctor as professional, and Domain 4: maintaining trust. In entrusting our students with donors, they are confronted by issues of ***death and mortality***, which they will need to grapple with throughout their medical career; they learn about the concept of ***informed consent***, in relation to ***body donation*** and regulation by the ***Human Tissue Authority*** – as this will become increasingly important as they interact with live patients; and their attitudes towards ***donors and their relatives*** will lay a good foundation for their becoming more humane doctors, as they realise the generosity of those who had donated their bodies, and the sacrifice given by relatives who face delayed closure after bereavement. At the end of the academic year, students from each Table group are asked to write a ***Tribute*** for their donor. Two students are chosen to represent the whole year group and read out two ***General Tributes*** at the ***Committal Service***, which is only for students and staff. This year, our local paper, the Cambridge News, was especially interested in this, as evidenced by this piece that appeared on 2 May – an eye-catching title and starts off by mentioning the service which will be held on 20 May this year (http://www.cambridge-news.co.uk/cambrudge/story-29200079-detail/story.html)

Writing the Tributes is an education for the students, helping them to reflect on their experiences - something they will be doing a lot of in clinical education – and teaching them to learn to express themselves appropriately, as the Tributes are sent to the relatives. Many of the students are very aware of our programme as one of the very few that still teach using dissection. The idea of the donor as their ***first patient*** and as a ***silent teacher*** is expressed in many of the Tributes. The dissection experience teaches both ***attachment*** and ***detachment****.* The students form an emotional bond with the donor whom they have worked on throughout the year – as they learn their names for the first time and read biographical details that relatives send during the Committal Service, many students are moved and weep, as they read about their donor’s lives. However, in dissecting these physical bodies throughout the year, the students also learn to detach themselves, which is of course crucial to their future medical careers. The new understanding of clinical empathy marries both attachment and detachment, allowing the physician to be emotionally attuned to the patient’s feelings without being overwhelmed by them.

A memorial service is held for family and friends, as they cannot attend the Committal Service in the DR. This took place biennially at King’s College Chapel; from October 2016 it will be held annually at the University Church of Great St Mary’s. This is very well-attended, and greatly appreciated by relatives who especially enjoy talking to students who have benefitted from their loved ones’ generous gift.

**2.** ***Ensuring patient safety***

This relates to Outcome 2: the doctor as practitioner, and Domain 2: safety and quality. Having the privilege of working on one donor and being able to observe all the other 40 donors in the DR means that students subconsciously absorb the idea of diversity – this is what they will experience as they start going on the wards and seeing patients. Patients’ anatomical features do not conform to what is described in textbooks and models, and it is dissection-based teaching that impresses this upon students right from the beginning.

Students learn to appreciate the presence and clinical significance of anatomical variations, and also undertake relevant research as part of their DR sessions. Examples of projects that our students and demonstrators have been involved in this year include the investigation of colonic looping patterns (and their association with those seen on colonoscopy), precise relationship between the femoral artery and vein (with relevance to catheter ablation for the treatment of atrial fibrillation), and the delineation of a safe zone for hip arthroscopic to avoid injury to the lateral femoral cutaneous nerve.

**3.** ***Enabling haptic skills***

This relates to Outcome 2: the doctor as practitioner, and Domain 1: knowledge, skills and performance.

The act of dissection naturally leads to the acquisition of haptic skills, resulting in increased manual dexterity, which is of course beneficial for any doctor in their careers. Dissection is especially helpful for a kinaesthetic learner, as it encourages tactile exploration and enables the student to appreciate structures in 3D.

To further improve dexterity, we run a competitive dissection internship scheme in the summer whereby students create a prosection in a fortnight. Over the past 3 years, the number of applicants has increased from 18 to 32, and we have increased the number of interns from 5 to 10. Additional clinical teaching from our senior demonstrators is also provided for our interns. The quality of these prosections are such that they are good enough for both internal and external teaching courses.

**4.** ***Encouraging teamwork***

This relates to Outcome 3: the doctor as professional, and Domain 3: communication, partnership and teamwork. Doing dissection in a table group of up to eight students undoubtedly encourages teamwork. We encourage students to assign different roles to everyone in the group and students take turns to perform those tasks. For example, one student would read out dissection instructions; two or three students may focus on osteology and gather round the skeleton; another student whose hands are clean will complete the Donor Medical History sheets for the region being dissected (these are explained in more detail below), and the remaining 2-3 students will dissect.

This kind of self-directed learning (there are also three demonstrators per zone, *i.e.* 5 table groups) encourages active discussion and teaches students to work with others. They will also have to deal with conflict among themselves, and we do not allow students to change Tables – after all, they will not have a choice as to whom they will work with in the hospital. Writing the Table Tribute together also encourages communication and collaboration.

**5.** ***Enriching clinical knowledge***

This relates to Outcome 2: the doctor as practitioner, and Domain 1: knowledge, skills and performance.

The students are provided with a folder comprising their donor’s ***medical history***, and the ***cause of death*** provided by a hospital doctor or the GP. Our demonstrators are reminded regularly to encourage students to complete the form for each session and then region. The students discover many pathological conditions as they dissect, *e.g.* emphysema, congestive cardiac failure, cirrhosis, hiatus hernia and malignancies. Students also see interventional procedures that were performed, *e.g.* an SVC stent for bronchial carcinoma, ureteric stents for hydronephrosis, coronary artery bypass grafting and surgical procedures. These facilitate many excellent discussions on the indications of such procedures and potential complications.

The students are timetabled to present their donor’s medical history to one of the demonstrators during a teaching session. Each student at the table takes turns to present their findings to a demonstrator, using a regional approach.

**6.** ***Energising collaborative research***

This relates to Outcome 1: the doctor as scholar and scientist, and Domain 1: knowledge, skills and performance. There are many opportunities within our programme for research: ***Part II projects***, which are undertaken in the third-year by preclinical students, and require students to produce an 8,500-word report based on their findings; ***Student Selected Components***for clinical students, where they can do a research project back in the DR; and ***Medical Electives***, when clinical students can choose to do research in the DR. We collaborate with a number of clinicians both at Addenbrooke’s Hospital in Cambridge and beyond – a form of ***translational research***, where knowledge from the basic sciences is used to enhance clinical practice.

Examples of such projects include ones with historical themes (comparison of methodologies used by Leonardo da Vinci and Andreas Vesalius; pedagogical approaches to anatomy teaching from the 1850s to the present time); and others with direct clinical relevance, *e.g.* analysis of colonic looping patterns in collaboration with a Consultant Gastroenterologist; determination of specific landmarks and measurements on dry skulls for facial reconstruction procedures in collaboration with a Consultant Oral Maxillofacial Surgeon; and detailed characterisation of the neurovascular anatomy of skin flaps in collaboration with a Consultant in Plastic and Reconstructive Surgery, among others.

**7.** ***Educating health professionals***

This relates to Outcome 2: the doctor as practitioner, and Domain 3: communication, partnership and teamwork. Our prosections are used throughout the year when the students are on vacation for running external courses. Some of the health professionals who benefit include ***surgical trainees***, ***anaesthetists, physiotherapists*** and ***paramedics.*** We also run courses for radiology trainees, and a new course is being set up for oncologists planning radiotherapy treatment and therefore requiring more detailed anatomical knowledge.Occasionally we receive requests from companies looking to develop new products, *e.g.* we hosted engineers recently who are designing new intraocular lens implants.

**8.** ***Expanding horizons***

This relates to Outcome 1: the doctor as scholar and scientist, and Domain 1: knowledge, skills and performance. In order to provide students with better access to our historical specimens, currently stored in a safe place, we have been working on the establishment of a virtual museum. We are still in the process of photographing all our artefacts – the finished product will have four “rooms/collections”: historical specimens, normal osteology, pathological specimens and fetal specimens. Initially these will only be accessible by students, but in time some collections will also be open to the general public.

We are also developing 3D teaching videos, where students can put on 3D glasses and watch videos of procedures: this will be extended to anatomy teaching. Our staff are experimenting with soft embalming techniques to enable more courses to take place, *e.g.* arthroscopy, plastic surgeons investigating different skin flaps, *etc.* We also hope to develop our own plastination facilities in order to preserve some of our more delicate specimens, especially brain slices, and head and neck prosections.

In recent years, the number of claims made to insurance companies due to anatomical errors made during surgical and other procedures continues to increase, while surgical consultants bemoan the poor level of anatomical knowledge among their trainees. A dissection-based anatomy course presents multiple added benefits, and helps the doctor to become scholar and scientist, practitioner and professional. Cadaveric dissection remains a USP (unique selling point) which distinguishes the Cambridge course from many other medical schools in the UK.

Cecilia Brassett

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