

## Review

## MAINTAINING EXCELLENCE IN TEACHING OF HUMAN ANATOMY: UNIVERSITY OF NAIROBI EXPERIENCE

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### SUMMARY

Experience in maintaining excellence in teaching of human anatomy is important in informing strategies to mitigate worldwide decline in the level of knowledge of human anatomy among medical students and qualifying doctors. Factors responsible for the decline include reduction in teaching time, inadequate teachers and undermining of cadaver dissection. Measures to address these challenges have resulted in wide disparities in curriculum design teaching methods, number and composition of instructors. In spite of the challenges, the Department of Human Anatomy of the University of Nairobi (UON) maintained excellence of teaching for over 40yrs. This article describes the teaching of anatomy at the UON with a view of elucidating the learning points from which other departments can learn. Analysis reveals that human anatomy is allocated 630hrs per year of which 350hrs are allocated to gross anatomy with 270hrs devoted to dissection. Although dissection has remained the cornerstone of instruction, it is combined with clinically oriented problem based instruction, use of prosections, diagnostic imaging, computer aided and small group learning. Teaching of gross anatomy is integrated with microscopic, developmental and neuroanatomy. The department runs and intercalated Bachelor of Science (B.Sc.) anatomy degree which is a reliable source of members of staff. Over 70% of the staff are surgeons. They are assisted by demonstrators drawn from trainee surgeons and young B.Sc. Anatomy graduates. Excellence in teaching anatomy can be maintained by reclaiming sufficient teaching time, combined dissection with contemporary methods of instruction, integrating gross, microscopic, developmental anatomy, neuroanatomy, involvement of clinicians in teaching, commencing training anatomy early and engagement of demonstrators.

**Key words: Anatomy teaching, University of Nairobi**

### INTRODUCTION

Experience in maintaining excellence in teaching human anatomy is important in mitigating the decline in undergraduate knowledge in the subject. The decline has been attributed to reduction in teaching time allocated in teaching the subject, inadequate teaching staff and diminishing emphasis on dissection (Aziz, 2002; Heylings, 2002; Mc Keown, 2003; Older, 2004; Turney, 2007). This undermines the importance of human anatomy as a pillar in medical education (Vazquez et al., 2005; Waterson and Stewart, 2005) making them unsafe. Consequently medical professional bodies, legal fraternity and patients themselves are reappraising the need for

greater indepth knowledge of anatomy among doctors (Ellis, 2002; Turney 2007). In response, there is resurgence in the value and emphasis of human anatomy (Rizollo and Stewart, 2006). There is however, wide diversity in modes of teaching in human anatomy departments with varying emphasis on each of the methods individually or in combination (Satyapal and Henneberg, 1997; Cahill et al., 2000; Tavares et al., 2002; Boon et al., 2001; Ongeti, 2012). This has resulted in wide variation in curriculum designs, duration, staffing numbers and composition (Heylings, 2002). In Africa, although 90% of the medical schools have retained dissection (Gangata et al., 2010;

Bekele et al., 2011), challenges of reduced time, staff shortages, declining financial allocations and rising student numbers are pushing for change (Ogunranti, 2008). In spite of these challenges, peer evaluation, through external examiners reports, reveal that standards of teaching Human anatomy have remained high at the University of Nairobi (Dean, 2000; Msamati, 2008; Amadi, 2009; Igbigbi, 2012). The objective of this paper is to detail the practices that have sustained excellence in learning human anatomy at the University of Nairobi.

### **METHODS AND APPROACH**

Available records in the department were examined for trends in teaching hours, teaching methods/modalities, staff numbers and composition and student performance since inception in 1967. In cases where data were inconsistent, they were verified from members of staff who have been present longest. The data were analyzed for frequencies and means

and presented in tables, bar charts and macrographs.

### **RESULTS**

Since inception in 1967, the department has grown in terms of teaching infrastructure and student numbers. The performance has remained consistently excellent. These trends have been matched by adjustments in teaching hours; teaching methods and staff numbers.

#### *Teaching hours*

For the first 30yrs, there was minimal variation from the initial 540hrs. The minor adjustment in 1987 was because the course was taught in 2yrs and more time was available. In 1998, there was a drastic increase when the duration of the academic year was increased by 33% to accommodate different entry levels. Currently the course is allocated 630hrs. Out of the total time allocated, 55-60% of it is devoted to teaching gross anatomy, 70% of which is allocated to dissection (Table 2).



Figure 1: Front view of the department of Human Anatomy, University of Nairobi, Showing the administration block, offices and some laboratories.

Table 1: Current Programs

Level	Program	Current enrolment
Undergraduate	Bachelor of medicine and bachelor of surgery	420
	Bachelor of pharmacy	120
	Bachelor of science Nursing	90
	Bachelor of dental surgery	40
	Bachelor of science biomedical laboratory technology	35
	Bachelor of science Nutrition and diatetics	25
	Bachelor of science Food science Technology	30
	*Intercalated Bachelor of science, Anatomy	04
Postgraduate	MMed General surgery	55
	MMed Orthopaedic surgert	05
	MMed ENT surgery	06
	MMed Nerurosurgery	08
	MDS oral and maxillofacial surgery	04
	MDS Paediatric dentistry	02
	Master of science, Human Anatomy	04
	PhD Human Anatomy	05
	MD Anatomy	01
	DSC Anatomy	

\*This is a special one year undergraduate program is offered only to distinguished medical and dental students who have demonstrated high level of interest and enthusiasm in human anatomy. Its main objectives are to inculcate these students, at an early stage; contemporary research methods in biomedical science; leadership, teaching and managerial skills; a deeper understanding of human anatomy. It is offered after 2<sup>nd</sup> year and before 3<sup>rd</sup> year. The students are usually encouraged to return to their medical training.

Table 2: Duration of teaching anatomy over the years

Time period	Duration of teaching	Gross Anatomy	Dissection
1967-1987	540	320	220
1988-1998	560	335	235
1999-2011	720	430	300
Current: 2012	630	350	260

The remaining hours are allocated to microscopic anatomy (25%) and developmental anatomy (15%) neuroanatomy, radiological and clinical anatomy are subsumed within the relevant dissections.



Figure 2: Students going through prosected specimens in the anatomy museum at the department.

### ***Course structure***

The course is divided into three main divisions – gross, microscopic and developmental anatomy. These three are integrated into weekly units in which each of the divisions is taught. This is most evident when the systems are taught for example during the dissection of the thorax, microscopic and developmental anatomy of the respiratory and circulatory systems are taught each as a unit in one week.

#### ***Gross anatomy***

This is taught through dissection, class wide clinical anatomy sessions; tutorials and small group learning. Dissection constitutes the main mode of instruction concordant with the initial requirement of the United Kingdom general medical council that every medical student undertakes regional dissection of the whole body. Each student is required to spend at least 8hrs every week in dissection. The students use a structured dissection manual with clear objectives and tasks to be accomplished.

Students dissect in groups of 6-8 members per body, and required to use atlases and textbooks during the sessions. They are also encouraged to carry computers and use animations as they dissect. The dissection sessions are allocated to demonstrators who are assigned 18-24 students each. A senior member of teaching staff supervises a group of 50-60 students, and takes responsibility of explaining concepts and clinical application during dissection. Students are allowed to revisit regions they have completed using prosected specimens.

#### ***Microscopic anatomy***

This course comprises of cytology, taught mainly through lectures and electron micrographs, histology and organology. The latter two are taught by glass slide examination using light microscopes. The lecturer demonstrates on a television screen the main features of each slide, discusses the salient points, then allows the student time to examine

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Figure 3: Students enjoying an ongoing dissection session in the gross laboratory

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#### *Developmental anatomy*

This is taught in blocks of basic embryology, tissue development and systemic embryology. The mode of instruction is predominantly class wide lectures using 2-D images from textbooks, manuals, models and atlases. Students are encouraged to visit various websites and use computer animations to enhance their understanding.

#### *Radiological anatomy*

This is appropriately incorporated within gross anatomy and is taught using images from real patients to illustrate either normal or abnormal anatomy. The plain radiographs, computed tomography, ultrasound scans and magnetic resonance images are all used to show crosssectional anatomy to enhance understanding of gross anatomy.



Figure 4: An ongoing histology session: students have time to examine glass slides.

### *Clinical anatomy*

This is taught during class wide revisions, tutorials and small group learning. Is it presented in problem based cases which the students are given time to decipher and discuss in relations to the three main divisions of anatomy – topographic, microscopic and developmental. Students are shown pictures of clinical cases/patients to illustrate the relevance of human anatomy.

### **DISCUSSION**

There are wide variations in the manner in which human anatomy is taught in different departments all over the world (Heylings, 2002). These variations are reflected in the course structure, course duration, mode of

instruction, number and composition of teachers.

### *Course structure*

In many parts of US, Canada, UK and Arabia among the traditional medical schools, gross anatomy, histology, embryology and neuroanatomy are taught as stand-alone subjects (Drake et al., 2007; Kaim-khani et al., 2010). In UON at variance with these practices these are integrated including physiology and biochemistry albeit in different departments. This type of integration established at the inception of the medical school in 1967 is now the norm in several newer medical schools in the US, Spain, Saudi Arabia and Britain (Markos et al., 2004; Evans and Watt 2005; Kaimkhani et al., 2010). For neuroanatomy, data from American Association of Medical Colleges

indicate that a majority of medical school courses provide an integrated approach that incorporates many disciplines (AAMC, 2010). At the American university of Beirut (AUB) for example, several disciplines that include gross anatomy, embryology, histology, neuroanatomy, cell biology, organs and systems physiology have been merged to form the department of Anatomy, cell biology and physiology, because like at the university of Nairobi, teaching of anatomy, histology and physiology was the basis of medicine since the inception of the medical department at the Syrian protestant college in 1967; now known as the faculty of medicine at the AUB.

This integration based on the understanding that the experience of dissecting the body and examining the microscope helps students cultivate observational skills and learn the importance of attention to detail (Cotter and Cohan, 2010). Accordingly, it is recommended

that the schools of medicine formulate an integrated program.

#### *Course duration*

There is a worldwide reduction in time allocated to teaching human anatomy (Yates, 1999; Leong, 2000; Aziz, 2002; Gillingwater, 2008), to accommodate other emerging subjects such as cell and molecular biology (Table 3). At the UON, however, since inception, the duration has remained over 500hrs, way above that in most parts of the world where time allocated to anatomy has reduced by 80% (Craig et al., 2010).

A notable feature at the UON is that 75% (270hrs) of the time for gross anatomy is allocated for dissection, which is the cornerstone of teaching human anatomy (Ongeti, 2012).

Table 3: Duration of human anatomy course

Reference	Country	Gross anatomy contact hours
Heylings et al., 2002	UK	125
Leung et al., 2006	US	167
Kaimkhani et al., 2010	Saudi Arabia	287
Craig et al., 2010	Australia	52.5
Current study	Kenya	350



Figure 5: A small group leaning session at the UON

#### *Mode of instruction*

Over 250hrs, translating to 8-10hrs per week is allocated to dissection. This is much more than the total time allocated for the whole anatomy course (Table 3) in most schools including some in Africa where only 2.5hrs per week is allocated (Boon et al., 2001). This high number of hours for dissection is believed to be the reason for consistently excellent performance. Pertinent to this suggestion are the observations of numerous student studies which reveal that cadaver dissection based learning provides students with a definite authoritative source of knowledge that enables them to develop active learning skills that facilitate mastery of structural knowledge (Johnson, 2002; Aziz et al., 2002; Older, 2004; Vazquez et al., 2005; Prakash, 2007; Arora and

Sharma, 2011). Consequently it results in better examination performance (Patel and Moxham, 2006; Anyanwu and Ugochukwu, 2010). Indeed many students consider dissection important and indispensable in the study of human anatomy (Lempp 2005; Onakpoya et al., 2009; Izunya et al., 2010; Ongeti, 2012). Dissection also develops habits of mind, spatial reasoning skills, fosters self-reflection and integration of effective skills for medical practice and essential attributes for clinical professionalism (Rizzolo and Stewart, 2006). For these reasons, it continues to be the cornerstone of human anatomy instruction (Evans and Watt, 2005) and even the medical schools that initially dropped it have been compelled to reinstate it (Rizzolo and Stewart, 2006). Accordingly, it is important that medical schools provide

adequate infrastructure and time for cadaver dissection.



Figure 6: A computer laboratory with accessible to students at the department of human anatomy UON

A notable adjustment of this traditional standpoint occurred in the last 15-20 years when the other contemporary modes of instruction were entrenched in the modes of instruction. This is concordant with the views advanced by the so called modernists who advocate for alternative methods of teaching (Granger, 2004; Mc Lachlan, 2004; Drake, 2007; Drake et al., 2007). These methods involve introduction of clinical reasoning, physical examination skills, clinical imaging, problem based learning, use of prosected specimens, models, radiographic images and computer simulations (Topp, 2004; Leung et al., 2006; Habbal, 2009). The UON model combines all these modes of teaching. To

support these activities, there is a computer laboratory and an open access website – [www.oganatomy.org](http://www.oganatomy.org) on which a lot of learning material is readily available. This integration was necessitated by the rising numbers in a manner similar to what happened in UK (Evans and Watt, 2005). Indeed integration of clinically relevant content into the teaching of anatomy facilitates and encourages understanding of the subject thus aiding in development of clinical thinking (Boon et al., 2001). Accordingly it is recommended that the various modalities of instruction be integrated (Mc Lachlan, 2004; Evans and Watt, 2005; Turney, 2007; Ogeng'o, 2009). This integration requires a clinically trained staff.



Figure 7: Students revising on their own using prosected specimens.

#### *Staff composition*

In order to implement the integrated curriculum delivery modes, the composition of staff must be taken into account. A remarkable aspect of staff composition at the UON is a commendable number of surgeons, many of them with primary training in Human Anatomy, and PhD anatomists with clinical training (Table 4). This staff composition is a major outcome of intercalated B.Sc. Anatomy program. Basic scientists have limitations in teaching of applied anatomy. Accordingly, a potential source of teachers in practicing clinicians (Ellis, 1994; Haase, 2000). According to Skandalakis (2002) Anatomy, instructors should preferably be trained physicians so that clinical orientation can be given to the subject. Indeed at UON, all members of staff are trained physicians,

concordant with the practice in many schools in the US, Canada and UK (Ellis, 1994). Indeed teaching of gross anatomy preclinical students by surgeons and other medical doctors in the USA and UK provides clinical adjuncts and offers assistance to professional anatomists and anatomy course directors (William et al., 1998; Seyfer et al., 2007). Such involvement of clinical specialists gives them a chance to rationalize amount and depth of anatomy content delivered to medical students according to good clinical practice and advancing techniques (Rizzolo and Stewart, 2006; Inuwa et al., 2012). It also helps physicians maintain their own level of knowledge, making them safer practitioners, helps alleviate the problem of staff shortage in anatomy teaching and address in advance the criticisms of specialists

about their juniors' lack of anatomical knowledge – producing safer more competent

practitioners less likely to make mistakes and incur litigation (Turney, 2007).

Table 4: Academic staff members

Cadre	No	Highest qualifications	Nationality
Full professor	1	PhD	Egyptian
Associate professor	3	DDS PhD MMed (Surg)	Tanzanian Kenyan Kenyan
Senior lecturer	2	PhD MMed (Surg)	Kenyan Kenyan
Lecturer	7	MMed (Surg) – 4 MMed (ENT Surg) – 1 MMed (OMFS) – 1 MSc Anatomy - 1	Kenyan Kenyan Kenyan Kenyan
Tutorial fellow	4	MSc Anatomy -1 MBChB -3	Kenyan Kenyan
Teaching assistants	12	BSc Anatomy (Hons) - 12	Kenyan

Another important development in teaching human anatomy at the UON has been involvement of human anatomy graduates, medical students and surgical trainees since 1995 as a measure to mitigate staff shortages in the dissection room (Ongeti, 2012). This practice is concordant with the practice in many renowned medical schools in North America, Europe, Australia and New Zealand (Heylings, 2002; Craig et al., 2010). Accordingly, it is recommended that that teaching of medical

students be done by a blend of trained clinicians and professional anatomists.

In conclusion, excellence in teaching anatomy can be maintained by reclaiming sufficient teaching time, combined dissection with contemporary methods of instruction, integrating gross, microscopic, developmental anatomy, neuroanatomy, and involvement of clinicians in teaching, commencing training anatomy early and engagement of demonstrators.

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