

Scientific & Social Program

3rd Joint Meeting of the Scientific & Social Programme

3rd Joint Meeting of the

AMERICAN and BRITISH ASSOCIATIONS of CLINICAL ANATOMISTS

19 - 22 JULY 2000

The Joint Meeting of the American and British Associations of Clinical Anatomists will be held at St John's College, Cambridge from Wednesday 19th - Saturday 22nd July 2000 and hosted by Dr. Ian G. Parkin. The programme of the Scientific Meeting is set out below.

Presenters wishing to alter abstracts for publication are requested to give revised versions on abstract forms to the Program Secretary of the AACA or Honorary Secretary of the BACA, as appropriate, by the end of the meeting. Abstracts must conform to the instructions on the form.

Wednesday, 19th July

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| 08:00 | Conference Office Opens (Foyer: Fisher Building). Staff from the Department of Anatomy at Cambridge will be manning the Registration Desk. Exhibitors may also begin to set-up their areas today (Pythagorus Building) |
| 08:00-09:00 | Journal Committee meeting (Fisher Building). |
| 09:00-11:00 | Editorial Board Meeting for Editors and Associate Editors of " <i>Clinical Anatomy</i> " (Fisher Building). |
| 11:00-11:30 | 30 minute break (coffee and biscuits). |
| 11:30-13:00 | BACA/AACA Council meetings held in parallel (Fisher Building). |
| 13:00-14:00 | BACA/AACA buffet lunch - available to those registered for the days events |
| 14:00-15:30 | BACA/AACA Joint Council Meeting |
| 15:30-16:00 | 30 minute break (tea/coffee and biscuits) |
| 16:00-17:00 | BACA - Business Meeting (Fisher Building) |
| 16:00-17:00 | AACA Annual Business Meeting (Fisher Building) |
| 17:00-18:00 | Free Time |

- 18:00-19:00** **Opening of Conference - Palmerstown Room**
All delegates assemble for:
- Welcome to Cambridge
 - BACA Presidential Address
 - Award the BACA Honoured Member - Professor R.M.H. McMinn
 - AACA Presidential Address
 - Award to AACA Honoured Member - Professor S.C. Marks Jr.

19:30-23:00 Buffet Supper/President's Reception. The bar will be open from 6 to 11 pm. Dress is casual (venue: Hall). Tickets for delegates attending that did not purchase the "Meeting Package" are available for £25 per person.

Thursday, 20th July

PosterSession 1: Aben through McWhorter go up at 08:30 and are removed at 17:00.

0:830 **Registration:** **Foyer, Fisher Building**

Coffee and biscuits

09:00-10:30 **Platform Session 1:** **Palmerston Room**

"History & Education"

Chairman: Dr. I. G. Parkin

- 0:900** 1. **B. Logan, & H. Ellis.** Teaching Anatomy in Cambridge then and now.
- 09:15** 2. **G. R. Aben, E. J. Potchen, A. E. Sierra, & C. Griggs.** The delivery of anatomy education in North America, 1999.
- 09:30** 3. **M. A. Casey.** Computer-assisted grading of gross anatomy practical exams.
- 09:45** 4. **M. J. Holterman, G. Blew, D. Dillon, R. Abdulla, O. Ashiru, D. Bolender, R. Morreale, C. Paidas, J. Pentecoste, K. Thornburg, A. Noe, E. Lockett, D. Sweet, W. Discher, F. Strange, W. Lennon, R. Moore, M. Doyle, & M. Pullen.** The Human Embryology Digital Library: a valuable resource for embryology research and education.
- 10:00** 5. **O. Plaisant, E. A. Cabanas, & V. Delmas.** Differences in the teaching of anatomy in American and European medical schools.
- 10:15** 6. **M. A. Tavares, C. Santos, & M. C. Silva.** Teaching developmental anatomy in a program of Clinical Anatomy at the Medical School of Porto.

10:30-11:00 **Coffee and biscuits :** **Undercroft, Pythagoras Building**

11:00-12:30 Platform Session 2: Palmerston Room

"Vascular I"

Chairman:

- 11:00** 7. **S. Aharinejad**, D. Abraham, R. Hofbauer, & R. Schaefer. ET-1 and VEGF mRNA expression levels correlate with mitochondrial morphology in cardiac biopsies of patients with heart failure before and after transplantation.
- 11:15** 8. **C. Dimopoulos**, M. Loukas, E. Walcak, & T. Wagner. The location and the morphology of the ventricular false tendons.
- 11:30** 9. **L. Lotek**, A. Barczak, M. Loukas, C. Dimopoulos, E. Walcak, & T. Wagner. The location and morphology of muscle of Lancisi in the adult human heart.
- 11:45** 10. **M. Loukas**, C. Dimopoulos, E. Walcak, & T. Wagner. The incidence and the morphology of Chiari's network.
- 12:00** 11. **A. Noorani**, S. Ray, A. M. Noorani, A. Irvine, R. Dourado, & K. G. Burnand. The variation in the branching patterns of the external carotid artery: a new classification based on cadaveric dissection and angiography.
- 12:15** 12. **D. J. Porta**, W. J. Tietjen, & T. A. Kress. A comparison of three different low-cost infrared technologies in the imaging of cutaneous vasculature and contusions.

11:00-12:30 Platform Session 3: Boys Smith Room

"Pelvis and Spine"

Chairman: Dr. David Peck

- 11:00** 13. **H. Gruber**, P. Kovaks, J. Piegger, & S. Poisel. Basic anatomy of the pudendal nerve relevant to its sonography and anaesthesia.
- 11:15** 14. **M. Tunnicliff**, & R. J. Pusey. Gluteal function after total hip replacement.
- 11:30** 15. **F. E. Patrick**, J. S. Boyd, & A. Li. Patterns of pelvic fracture in the dog and the consequences for treatment.
- 11:45** 16. **M. C. Delano**, O. M. Qahwash, & L. M. Ross. Morphological variations of the lumbosacral osseous complex: MR features and clinical implications.
- 12:00** 17. **B. Moriggl**, L. Kirchmair, P. Kovacs, & E. R. Brenner. Color Doppler ultrasound investigation of the inferior gluteal artery and sciatic nerve.
- 12:15** 18. **S. Naique**, R. Porter, A. A Cunningham, & S. Hughes. Scoliosis in an orangutan.

12:30-13:45 Buffet Lunch Main Dining Hall (included in day's Registration fee)

13:45-15:15 Platform Session 4: Boys Smith Room

"Skull"

Chairman: Dr. Marita Nelson

- 13:45** 19. **G. T. Lebona**, & A. I. Ejorh. Observations on the orbital groove in South African blacks.
- 14:00** 20. **G. E. Wise**, & R. L. Grier. Effects of dexamethasone on tooth eruption.
- 14:15** 21. **D. K. K. Wong**, T.V. Yeung, & H. Ellis. Wormian bones: a review of their aetiology and clinical associations.
- 14:30** 22. **K.E. Polland**, S. Munro, G. Reford, A. Lockhart, G. Logan, L. Brocklebank, & S. W. McDonald. The morphology of the mandibular canal in the edentulous jaw.
- 14:45** 23. **H. K. Whittet**, & G. Roblin. Endoscopic endonasal surgical management of cerebrospinal fluid rhinorrhoea.
- 15:00** 24. **I. Jenkins**. 3-Dimensional computer modelling approaches to anatomy in vertebrate palaeobiology.

13:45-15:15 Platform Session 5: Palmerston Room

"Lower limb"

Chairman: Dr. Art Dalley, Jr.

- 13:45** 25. **S. J. Kavros**. Posterior tibial tendon dysfunction with relationship to the location of tendon tear.
- 14:00** 26. **J. M. Boon**, & M. J. Van Wyk. Determination of a safe area for the incision during harvesting of autogenous tendons for anterior cruciate ligament reconstruction.
- 14:15** 27. **J. Piegger**, E. Brenner, R. Burger, & W. Platzer. Side differences of the talar trochlea: Aspects for diagnosis, therapy and prosthesis design.
- 14:30** 28. **A. H. Weiglein**, G. Peicha, J. Labovitz, & F. J. Seibert. Anatomical basis for diagnosis and treatment of Lisfranc injuries.
- 14:45** 29. **F. I. Qureshi**, A. A. Shetty, & H. Ellis. The anatomical significance of the popliteal artery in knee surgery.
- 15:00** 30. **V. Thorisdottir**, & C. Buckland-Wright. M. Popliteus relationship to the lateral meniscus – preliminary results.

ABSTRACTS OF PLATFORM SESSIONS on THURSDAY, July 20th:

1. LOGAN, Bari, and Harold ELLIS, Department of Anatomy, University of Cambridge and King's College, London, UK. **Teaching Anatomy in Cambridge then and now.**

The University of Cambridge proudly claims to have the oldest Chair of Anatomy in the United Kingdom. George Rolfe obtained this appointment in 1707 and held the post until 1728. However, the story goes back much earlier than this since medical degrees were instituted about 1460. By 1528, David Edwardes was appointed to teach and examine in Anatomy and published the first book in English to be dedicated to this subject. The first medical scholarship in this country was established at Caius College in 1571, and this college continues its medical tradition.

Since then, the story of Anatomy in Cambridge has passed through interesting, sometimes stormy and often quite distinguished times. Thus the first professor, George Rolfe, appointed in 1707, was deprived of his chair for neglect of his duties. Sir Busick Harwood, in contrast, appointed in 1785, carried out extensive experiments in blood transfusion and located olfaction in man to a small area in the roof of the nasal cavity.

Today, the Department of Anatomy welcomes its many friends both at home and abroad to the third combined BACA/AACA meeting and we hope that this historical introduction will serve as a fitting opening to the conference.

2. ABEN, Gerald R., E. James POTCHEN, Arlene E. SIERRA, and Chris GRIGGS, Department of Radiology, Michigan State University, MI, USA. **The delivery of anatomy education in North America, 1999.**

The delivery of Anatomy education to medical students in North America is perceived to have been changing over the last 25 years. A three question survey was prepared and mailed to the Chair of Anatomy at 160 schools of medicine in North America. A survey response rate of 30% (49/160) was achieved. Of the 49 schools responding, 20 schools reported that Ph.D.'s exclusively provided instruction. The remaining schools report that anatomy is taught by a variety of faculty. Where physicians are used in the anatomy program, it appears that the physicians provide primarily clinical correlation. No undergraduate anatomy prerequisites were reported. On average, 163.8 (SD 45.1 Range 56 - 282) hours were spent in the anatomy lab. Of those reporting lecture hours, approximately 49.6 hours (SD 21.3 Range 15 - 100) of lecture were given. This preliminary study of anatomy education in North America provides a framework for a much needed systematic review of anatomy. Further analysis is needed to more clearly define the correlation between time spent and what is covered to the performance of the students on standardized exams. Finally, we are embarking on a correlate investigation of what anatomy education is used by practicing physicians.

3. CASEY, Michael A., Department of Cell Biology, University of Alabama School of Medicine, University of Alabama at Birmingham, Birmingham, AL, USA. **Computer-assisted grading of gross anatomy practical exams.**

The task of constructing and grading practical exams is well known to anatomists. With grading, the difficulty of the task is proportional to the number of students in the course, and the number of questions on the exam. In our gross anatomy course, 165 medical students are given 4 practical exams, each with 100 questions. Such an exam usually takes 5-6 hours for 4 faculty members to grade by hand. From 1996 to 1998 we employed a system whereby students identified labeled structures on cadavers, and later transferred their answers to Scantron® sheets

for computer grading. While this approach eliminated faculty hand-grading, the students were faced with the tedious, error-prone task of entering 100 answers on Scantron® sheets, after having completed a 2-hour lab practical. This year, we employed software (Question Mark®) which enabled students to easily and rapidly record their answers by computer after the practical exam. For each question, students were shown a page on their computer screen displaying 20-40 possible answers. Students then selected (point and click) the structure written down earlier in the lab. This method offers the rigor of a fill-in-the-blank practical exam, the speed of computer grading, and the elimination of faculty grading time.

4. HOLTERMAN, Mark J., Greg BLEW, Doug DILLON, Raid ABDULLA, Oladapo ASHIRU, David BOLENDER, Robert MORREALE, Charles PAIDAS, Jeff PENTECOST, Kent THORNBURG, Adrienne NOE, Elizabeth LOCKETT, Deborah SWEET, William DISCHER, Fred STRANGE, William LENNON, Reagan MOORE, Michael DOYLE, and Mark PULLEN, Department of Surgery, University of Illinois at Chicago, IL, Rush Medical School, IL, Medical College of Wisconsin, WI, Johns Hopkins University, MD, Oregon Health Sciences University, OR, Armed Forces Institute of Pathology and Human Developmental Anatomy Center, MD, Lawrence Livermore National Laboratory, CA, San Diego Super Computer Center, CA, Eolas Technologies, IL and George Mason University, VA, USA. **The Human Embryology Digital Library: a valuable resource for embryology research and education.**

This project is developing a high-speed network that allows medical professionals, biological scientists and educators to communicate detailed information about the development of the human embryo in a visual form. Through the use of a series of medical collaboration workstations linked via the Next Generation Internet we are using advanced collaborative and visualization software to prepare a canonical map of the developing human embryo. Microscopic sections from sequentially staged embryos from the Carnegie Human Embryology Collection are being digitally photographed and then archived as rapidly accessible data sets for distribution over high speed Internet connections. As a result, physicians, embryologists and embryology educators will be able to visualize and manipulate high-resolution image data collaboratively for clinical case management, facilitation of embryology research and medical education. These data sets are being used in three separate but related advanced applications: 1) Annotation and Modeling –organ systems and tissue types labeled on each microscopic section with fully rendered 3-D models; 2) Embryology Education – computer assisted, “embryologically correct” animations; 3) Clinical Management Planning – collaborative analysis and diagnosis of in utero birth defects by geographically dispersed experts.

5. PLAISANT Odile, Emmanuel A. CABANIS, and Vincent DELMAS, Institut d'Anatomie Université Paris V-Necker, France and Service de Radiologie, Hôpital des Quinze Vingts, Université Paris VI-Pitié-Salpêtrière, France. **Differences in the teaching of anatomy in American and European medical schools.**

It is generally accepted that the teaching of Anatomy in medical schools differs markedly between countries. However, variations in culture and pedagogy do not provide the only explanations for such differences. The present study involves a comparison between the United States and various European countries in terms of course organization and the manner by which students are admitted to the first year of medical school. We compared the training in anatomy at five American medical schools, at five European schools outside France and at nine French schools. We took cognizance of the ages of the students, the number of hours of teaching, the number of hours of dissection, and of pedagogic philosophy. The information obtained showed that there are major differences between universities (and between countries). In particular, the

age on entering medical school is lower in Europe than in the States and the manner of teaching anatomy is very different in France compared to other European countries and to the United States (especially with respect to the number of hours spent in the dissecting room). The comparison provides some basis for assessing the perceived importance of anatomical knowledge in the medical curriculum and for evaluating the most effective way of teaching the subject.

6. TAVARES, Maria A., Catarina SANTOS, and Maria Carolina SILVA, Institute of Anatomy, Medical School of Porto, Portugal. **Teaching developmental anatomy in a program of Clinical Anatomy at the Medical School of Porto.**

Within the view that knowledge of developmental anatomy has fundamental application in clinical practice, sessions in “anatomic variations and congenital malformations” were introduced in the program of Clinical Anatomy. For each section of the program a session of 2 hours was devoted to these topics. Handouts were specially prepared for these sessions. A questionnaire was designed to evaluate students’ opinion about the inclusion of these topics in the programme of the discipline, their agreement with the quality and time given to these sessions, the role of the teaching staff, difficulty and relevance of the topics, structural aspects of handouts, its usefulness to follow the teaching process and its relationship with the slides used in sessions. Among the 142 students attending the discipline in the 1998/99 academic year, 107 answered the questionnaire. Data description indicated that 92.5% agreed with the inclusion of this topic in Clinical Anatomy. The quality of sessions was favoured by 82.1% and 71.7% agreed with the time given to this topic. To investigate the relationship between the items regarding the structural aspects of handouts and its usefulness, a principal component analysis was undertaken. As demonstrated by the scores given to these sessions, its organisation and handouts, these sessions favoured and stimulated the students for further study on the subject, a major objective of any the teaching /learning process. (Supported by Program PRAXIS XXI – Project PCSH/C/CED/157/96).

7. AHARINEJAD, Seyedhossein, Dietmar ABRAHAM, Reinhold HOFBAUER, and Romana SCHAEFER, Departments of Anatomy, Medical Biochemistry, University of Vienna, Vienna, Austria. **ET-1 and VEGF mRNA expression levels correlate with mitochondrial morphology in cardiac biopsies of patients with heart failure before and after transplantation.**

Endothelin (ET)-1 tissue concentrations increase in dilated cardiomyopathy (CMP). ET-1 upregulates gene expression of vascular endothelial growth factor (VEGF) and VEGF upregulates ET converting enzyme (ECE) levels. To examine correlation of mitochondrial morphology with gene expression of ET-1 and VEGF, we investigated cardiac biopsies in 20 CMP patients at transplantation, and biopsies of implanted donor grafts up to six months after surgery, using RT-PCR and TEM. Normal, not-implanted hearts served as controls. ET-1 and VEGF gene expressions were significantly elevated in CMP and in the donor hearts vs. controls ($p < 0.05$). VEGF gene expression declined within 3 weeks and ET-1 within 1 week after transplantation back to normal. Weekly TEM studies of cardiac biopsies within six months after transplantation showed that the number of normal mitochondria increased from 39.4 in CMP to 78.3 in transplanted hearts, and that the number of edematous and degenerated mitochondria decreased from 5.7 and 54.9 in CMP to 0.8 and 20.8 in transplanted hearts, respectively ($p < 0.05$). High VEGF expression in CMP tissue might be due to hypoxia and lead, by induction of ECE, to elevated ET-1 levels. Decrease of VEGF and ET-1 mRNA expression significantly

correlates with recovery of mitochondrial morphology. VEGF and ET-1 can serve as sensitive measures of cardiac function in cardiac transplantation. Supported by grants from Herzfelder foundation to S.A.

8. DIMOPOULOS, Chris, Marios LOUKAS, Ewa WALCAK, and Teresa WAGNER, Department of Pathology, Institute of Rheumatology, Warsaw, Poland. **The location and the morphology of the ventricular false tendons.**

False tendons are fibrous strings that originate from the ventricular endocardium, but do not insert into the atrioventricular valve leaflets. The incidence and distribution of left ventricular false tendons (FT) were studied in a series of 70 autopsy specimens of human hearts from subjects evenly distributed by sex and age. After macroscopic observation the FT were cut and eosin hematoxylin staining was performed. FT were observed in 30 specimens (42.8%), and their incidence was greater in hearts from male than from female subjects (25 male 83.3% p less than 0.01). Neither the incidence nor the location of FT varied appreciably with age. Of the 30 specimens containing false tendons, 9 (30%) exhibited 2 or more. Of these, 50% were located between the posteromedial papillary muscle and the ventricular septum, between the two papillary muscles, between the anterolateral papillary muscle and the ventricular septum, and between two aspects of the free wall; also false tendons with three or more points of insertion (weblike) were observed. Morphometric evaluation of the false tendons was performed, the range of the FT ranged from 4mm to 21mm. However 13 (43.3%) of the FT irrespectively from their location were carrying conduction tissue fibers which may implicate to the appearance of arrhythmias.

9. LOTEK, Loukas, Artur BARCZAK, Marios LOUKAS, Chris DIMOPOULOS, Ewa WALCAK, and Teresa WAGNER, Department of Pathology, Institute of Rheumatology, Warsaw, Poland. **The location and morphology of muscle of Lancisi in the adult human heart.**

The muscle of Lancisi (ML), is a muscular structure of the right ventricle and part of the medial papillary complex which lies superior to the septal band and anterior to the membranous septum. However the ML is the point that demarcates the entrance of right the bundle branch towards the septal and moderator band. Our investigation included 60, formalin fixed, adult human hearts. Careful dissection of the right ventricular wall performed from the apex to the septal band without cutting off the moderator band. With this new way of dissection the visualization of the ML it was very easy and clear. We paid special attention also, to the medial papillary complex and specifically to the ML and its variant positions on the septal band and moderator band, collectively know as Septomarginal Trabeculation (SMT). Based on our observations the ML varied into 3 positions. In 25 (41.6%) of our specimens the ML was situated on the bifurcation of SMT, in 24 (40%) cases the ML lied at the posterior extremity of SMT and in 11(18.3%) hearts the ML was found between the posterior extremity and the bifurcation of SMT. Concluding, we believe that our investigation can be a helpful tool to surgeon trying to identify the root of right bundle branch during operations concerning congenital heart disease and especially ventricular septal defects.

10. LOUKAS, Marios, Chris DIMOPOULOS, Ewa WALCAK, and Teresa WAGNER, Department of Pathology, Institute of Rheumatology, Warsaw, Poland. **The incidence and the morphology of Chiari's network.**

Advances in cardiac surgery and invasive cardiology turned the attention of anatomists in a rare condition occurring to the human hearts the "Chiari's network". The aim of the study we performed was to describe and classify the morphology, the morphometry and the distribution of the "Chiari's network" in a clinical useful way. We studied 110 human hearts collected at necropsies at the department of Pathology at Institute of Rheumatology. The form of the "Chiari's network" was observed and its dimensions and attachments were counted and computed. Following our results, "Chiari's network" was present in 5 of 110 specimens (prevalence 4%) with a very characteristic appearance of a membranous fenestration which involves the inferior vena cava, thebesian valve, crista terminalis and interatrial septum. Concluding, as far as we are able to judge the fact that the "Chiari's network" exists in 4% of the hearts and it can be an important natural fact of preventing or causing thrombus formation, implicates its clinical significance in the day-to-day practice of invasive cardiology and cardiac surgery

11. NOORANI, Alia¹, Sudip RAY¹, Ali M. NOORANI³, A. IRVINE², R. DOURADO², and Kevin G. BURNAND¹, ¹Department of Surgery and ²Radiology, St.Thomas' Hospital, Guy's, King's and St.Thomas' School of Medicine and ³Imperial College School of Medicine, London, UK. **The variation in the branching patterns of the external carotid artery: a new classification based on cadaveric dissection and angiography.**

Although the external carotid artery (ECA) is an important collateral in the presence of internal carotid artery (ICA) occlusion there is little work on variations in ECA anatomy, and no simple classification. The anatomy of 92 ECAs was therefore studied (49 cadaveric dissections, 43 angiogram reviews) to assess the variation in branching and to devise a classification system based on the origin of the occipital artery. The ECA was classified as Type I when the occipital artery arose below the origin of the superior thyroid artery, Type II when it arose between the origins of the superior thyroid and lingual arteries, Type III when it arose between the origins of the lingual and facial arteries, and Type IV when it arose above the facial artery. Seventy-four (80%) of the 92 ECAs studied gave rise to all their branches independently. There were 17 (19%) cases of a common linguo-facial trunk and just one case (1%) of a common thyro-lingual trunk. The Type IV ECA was the most common variant (32%) and Type I the least common (1%). Further studies are needed to define the potential clinical importance of the trunk length and its branching patterns during procedures such as ICA/ECA endarterectomy.

12. PORTA, David J.¹, William J. TIETJEN¹, and Tyler A. KRESS², ¹Bellarmino College, Department of Biology, Louisville, KY. ²Engineering Institute for Trauma and Injury Prevention, Department of Industrial Engineering, University of Tennessee, Knoxville, TN, USA. **A comparison of three different low-cost infrared technologies in the imaging of cutaneous vasculature and contusions.**

In the last 40 years, Infrared (IR) imaging technology has been utilized for various industrial, law enforcement, and military purposes (surveillance, night vision, etc.). Medical applications are a relatively recent advancement. IR penetrates the skin to a depth of 3 mm. Much of the IR light is reflected, however, blood appears to absorb the energy and thus appears dark on an IR-illuminated image. Although there are numerous expensive camera systems on the market, we present a comparison of three relatively inexpensive (<\$800) systems that could be used to map

cutaneous vasculature (for phlebotomy, identification of tumors, etc). Additionally, a non-invasive system that can identify blood pooling under the surface of skin, especially heavily pigmented epithelium, would serve a forensic purpose when one is trying to document a specific injury by patterns of contusion. The systems examined were: 1) The Electrim EDC-1000 camera with Mnemonic, Inc. PC software; 2) The Sony CCD-TRV66 Hi8mm video camera with infrared-based "Nightshot;" and 3) The Epson PhotoPC 700 digital still camera. The strengths and weaknesses in terms of resolution, expense, ease of use, image storage, and necessary ambient conditions (lighting, temperature, and the use of filters) are described for each of the imaging systems.

13. GRUBER, Hannes, Peter KOVACS, Johannes PIEGGER, and Sepp POISEL, Institute for Anatomy and Histology, Leopold-Franzens-University, Innsbruck, Austria. **Basic anatomy of the pudendal nerve relevant to its sonography and anaesthesia.**

Idiopathic or traumatic impairment of the pudendal nerve as well as inflammation or neoplasm lead to neuralgia and/ or dysfunction of the pelvic floor. Cadavers of 33 female and 29 male adults ranging in age between 48.08 and 94.58 years have been explored (n=116). In the deep gluteal region the pudendal nerve, the internal pudendal vessels and their relation to the ischial spine and the sacrospinous ligament have been measured by means of an electronic gliding calliper. Additionally we delineated the internal pudendal arteries of ten living voluntary probationers by Doppler-sonography. Based on our measurements we can define a spatial relationship between the pudendal nerve and its branches and the internal pudendal artery at the sacrospinous ligament. Thus the Doppler-sonography of the internal pudendal artery can be used as guidance for a new sonography-guided access to the pudendal nerve. This knowledge should enable acute as well as chronic anaesthetic infiltration of the impaired pudendal nerve with approximately 100 percent accuracy of aim without disturbing other structures.

14. TUNNICLIFF, Malcolm, and Richard J. PUSEY, Department of Trauma & Orthopaedics, Basildon Hospital, UK. **Gluteal function after total hip replacement.**

In the classical antero-lateral approach to the hip joint the interval between gluteus medius and tensor fasciae latae is developed to allow access to the joint. In hip replacement it is common practice to release the anterior third of gluteus medius and to divide the tendon of gluteus minimus to allow easy insertion of the femoral prosthesis. There may be damage to the muscles during insertion and sometimes it is difficult to repair the defect and this approach has been criticised because it gives rise to permanent weakness of the gluteal muscles and abduction of the hip joint. Gluteal function has been studied in a group of patients who had hip replacements six months previously and the results are presented.

Gluteal function was studied in 17 patients who underwent this approach for total hip replacement; 16 had regained normal power and only one patient reported long term pain following this approach. This would suggest that abductor power is preserved to near normal in the majority of patients.

15. PATRICK, Fiona E., John S. BOYD, and Alex LI, Division of Veterinary Anatomy, Glasgow University Veterinary School, Glasgow, UK. **Patterns of pelvic fracture in the dog and the consequences for treatment.**

As a follow on from an earlier study in which we devised a classification system for small animal pelvic fractures, we investigated patterns of fracture in the dog, the incidence of certain fracture combinations and the consequences for the resultant treatment. Our data was obtained

from animals referred to the Royal Veterinary College, London and Glasgow University Veterinary School over a period of nine years and presented to the People's Dispensary for Sick Animals, Glasgow in 1999 and 2000. Pelvic fractures are relatively common in the dog and constitute 20 to 30 % of all fractures seen in veterinary practice. They are frequently multiple and it is not unusual for animals to display lesions in up to six sites. These fractures are usually difficult to treat and are often further complicated by extensive extrapelvic damage. A large number of these cases are treated conservatively with a varying degree of success reported in the literature. There are four commonly documented indications for surgical fixation. If an animal displays one or more of these criteria it is seen as a possible candidate for surgery. Our results showed that the ten most common fracture pattern combinations in the dog satisfied at least one and sometimes up to all four of the surgical criteria. Despite this over 25% of these were successfully treated conservatively. Using our findings we attempted to update the specific criteria for surgery and deduce which specific fracture patterns respond most positively to a particular treatment protocol.

16. DELANO, Mark C., Omar M. QAHWASH, and Lawrence M. ROSS, Department of Radiology and Division of Anatomy and Biologic Structure, and the College of Osteopathic Medicine, Michigan State University, East Lansing, MI, USA. **Morphological variations of the lumbosacral osseous complex: MR features and clinical implications.**

Vertebral segmentation anomalies at the lumbosacral junction create ambiguity in the interpretation of magnetic resonance (MR) imaging studies of the lumbar spine. Lumbosacral transitional vertebrae are found in roughly 3-20% of the population. Careful description of anatomic features utilized in reporting disease in the patients is a critical component of appropriate clinical care. Specific types of transitional anomaly have been associated with lower back pain, dermatomal variations, higher incidence of disc herniation and spondylolisthesis, and nomenclature and operative errors. The nomenclature applied to this region is variable, and is based on embryologic and traditional grounds. A descriptive overview of lumbosacral transitional anomalies is presented in the context of classification schemes, clinical significance, and demonstration through MR imaging. In the presence of transitional anomaly, altered anatomy, function, and stresses lead to a characteristic distribution of degeneration and an illustrated effect on certain normal and pathological conditions, but not necessarily an increased incidence of pathology. Unresolved dispute regarding a primary causative relation with lower back pain remains. A literature review was conducted with a retrospective study of illustrative cases. An approach to the identification and classification of lumbosacral transitional anatomy is presented.

17. MORIGGL, Bernhard, Lukas KIRCHMAIR, Peter KOVACS, and Erich R. BRENNER, Anatomische Anstalt, Ludwig Maximilians University, Munich, and Institute of Anatomy and Histology, University of Innsbruck, Innsbruck, Austria. **Color Doppler ultrasound (CDUS) investigation of the inferior gluteal artery (IGA) and sciatic nerve (SN).**

Due to a lack of reliable diagnostic tools, rare causes of atypical sciatica may easily be overlooked. This study aims at demonstrating the normal sonographic anatomy of the IGA and SN within the gluteal region as a basis for a promising new application of CDUS. In conformity with a previously reported basic anatomical study (94 gluteal regions from 49 cadavers of adult individuals) 23 healthy test persons (12 male, 11 female; aged 18-43) were bilaterally investigated by means of CDUS (Sonoline versa Plus, color-flow-imaging system; 5 MHz curved array): Location of the trunk of the IGA within the "infrapiriform foramen" was referred

to a line connecting the posterior superior iliac spine (PSIS) with a self defined ischial tuberosity point (TP). In addition, the caliber of the IGA was measured immediately prior to division, in case of SN penetration at that very point too. The SN was localized referring to bony landmarks and scanned at different levels throughout the region in two planes. We found the IGA just on or lateral to the PSIS-TP line in 12% of cases. Piercing of the SN by the IGA or its descending branch* (external diameter 4.7mm and 2.7mm*, respectively) was seen in 11%. No statistically significant sex or side differences could be evaluated. A precise determination of the relationship IGA/SN was possible in all cases, as was the SN-course in the entire region. Apart from an atypically running SN and /or muscle variants ("piriformis syndrome"), SN penetration by the IGA has to be considered in the differential diagnosis if atypical sciatica occurs. According to the results presented, CDUS can be regarded as a valuable and non-invasive imaging tool in early diagnosis.

18. NAIQUE Satyajit, Richard PORTER, Andrew A. CUNNINGHAM, and Sean HUGHES, Imperial College School of Medicine and Institute of Zoology, London Zoo. **Scoliosis in an orangutan.**

Scoliosis is rare in primates other than man and this has aetiological significance. We have found only one report of an adult male chimpanzee with a congenital hemivertebra but none with idiopathic scoliosis. In 1994 a new foamy retrovirus was identified from orangutans, one of which was "Dodo" at the London Zoo, a 28 year old male which died with encephalopathy. It had marked scoliosis. Method. The spine was examined by plain X ray, CT and a 3-D plastic model was produced by rapid prototyping. The spine was then dissected. Results. The right sided curve extended from D8 to L1 - Cobb angle of 58° - apex at D11. There were the same number of ribs and intervertebral foraminae on each side. The vertebral canal and foramen tended to remain in their original orientation whilst the vertebral bodies at the apex rotated 45 degrees towards the convexity. The reconstructed model allowed detailed examination of the bony anatomy. Discussion. Although the curve is short, we believe that this scoliosis is probably idiopathic. If correct it is the first idiopathic scoliosis to be recorded in a primate other than man. CT and rapid prototyping provided an unusual opportunity to examine in detail the bony anatomy. Features were similar to those described in humans with idiopathic scoliosis.

19. LEBONA, Gregory T., and Anthony I. EJORH, Department of Human Anatomy, Medical University of Southern Africa, Medunsa, South Africa. **Observations on the orbital groove in South African blacks.**

Low (1946), in describing an anomalous middle meningeal artery, referred to a groove in the lateral wall of the human orbit. According to Royle (1973), the orbital groove lodges an anastomosis between the infraorbital and middle meningeal vessels. Diamond (1990) showed it to be an artefact produced by an abrupt thinning of bone. Incidences of 8.5-45% have been reported in various racial groups. This study, based on the review of 340 adult skulls, deals with the incidence and character of the orbital groove in South African blacks. The groove was found in 216 of the 680 orbits (31.8%) representing 156 subjects (45.9%). Sixty skulls (38.5%) had a bilateral groove, 72 (46.1%) showed it on the right side and 24 (15.4%) on the left side. A vertical cleft crossed the orbital plate of the greater wing of the sphenoid in varying degrees of length, width and depth from the lateral limit of the superior orbital fissure to the posterior end of the inferior orbital fissure. Each groove was continuous with that made by the orbital branch of the middle meningeal artery. In 2 cases (1.8%) the groove arose from a foramen meningo-orbitale. Our overall incidence of 31.8% accords well with 34.4% reported in the UK (Royle, 1973), but is considerably higher than 8.5% cited for the USA (Diamond, 1990). The

morphological data presented in this study correlate with that in other reports. The consistency at which the orbital groove was found to be continuous with the orbital markings of the middle meningeal artery supports the hypothesis that it serves as a conduit for a vascular shunt. Verification by dissection is, however, essential.

20. WISE, Gary E., and Robert L. GRIER, IV, Department of Veterinary Anatomy and Cell Biology, Louisiana State University, Baton Rouge, LA. **Effects of dexamethasone on tooth eruption.**

Alveolar bone resorption is a requirement for tooth eruption. Dexamethasone, a steroid that stimulates bone resorption, was injected daily into newborn rats from days 1 - 10 at a concentration of 100 ng/g body wt. Controls were injected with 0.9% saline. The injections of dexamethasone accelerated the time of eruption by 3 days for mandibular incisors, 1 day for maxillary incisors and had no effect on molar eruption as compared to controls. Differences were significant at $P < 0.001$ using the rank sum test. Dexamethasone also accelerated the time of eyelid opening and stunted growth in terms of body weight and hair. These results demonstrate that dexamethasone, like epidermal growth factor, enhances incisor eruption but not molar eruption. This suggests that the signals for the initiation of tooth eruption differ between rat incisors (teeth of continuous eruption) and rat molars (teeth of limited eruption). Thus, caution must be taken in extrapolating eruption effects in rodent incisors to human teeth in view of the fact that human dentition is of limited eruption. (Sponsored by Grant No. DE08911-09 to GEW from the NIDCR).

21. WONG, Duncan K. K., T. Valerie YEUNG, and Harold ELLIS, Division of Anatomy and Cell Biology, Guy's, King's and St Thomas' School of Biomedical Sciences, London, UK. **Wormian bones: a review of their aetiology and clinical associations.**

The aetiology of wormian bones and their associations with various clinical disorders have long fascinated anatomists and anthropologists, as well as clinicians. This paper reviews both the genetic and stress adaptation models for wormian bone development and how the two differ; it is necessary to combine both models to give a fuller picture to explain the expression of wormian bones. The clinical associations of wormian bones and their role as radiological markers to aid clinical diagnoses are also discussed.

In our research of wormian bone development, the lambdoid sutures of 38 fetal (aged 5-9 months gestation), ten infant (aged 0-24 months) and 148 adult (aged 16 years and above). Caucasian skulls were examined. The fetal lambdoid sutures were found to be straight and contained no wormian bones. Wormian bones and sutural interdigitations were found to be well developed in the lambdoid sutures of the ten infant skulls. The infant lambdoid sutures were morphologically similar to the adult sutures in terms of wormian bone expression and interdigitations. Our study supports the hypothesis that physical stresses in early postnatal life play a major role, if not entirely responsible for shaping sutural morphology.

22. POLLAND, K. E.¹, S. MUNRO¹, G. REFORD¹, A. LOCKHART¹, G. LOGAN², L. BROCKLEBANK², and S. W. McDONALD¹, ¹Laboratory of Human Anatomy, ²Dental School, University of Glasgow, Scotland. **The morphology of the mandibular canal in the edentulous jaw.**

Detailed descriptions of the human mandibular canal are few, especially in edentulous subjects. There is wide recognition that atrophy of the alveolar process following tooth loss results in an inferior alveolar neurovascular bundle close to or exposed on the bony surface of the alveolar

border. Sometimes mandibles show multiple canals. In panoramic radiographs of edentulous mandibles the canal is easily seen posteriorly but less readily visualised anteriorly. In the small number of specimens we have studied, a thin but distinct layer of bone bounded the mandibular canal between the mandibular and mental foramina, although it could have many deficiencies, which could be sizeable, where the neurovascular bundle was exposed to the surrounding yellow marrow. Anterior to the mental foramen, in the edentulous mandible, the neurovascular bundle was frequently largely surrounded by marrow rather than bone, but often the canal and neurovascular bundle were absent. Histology confirmed that the bony wall of the canal was composed largely of parallel bony lamellae, although occasionally individual osteons were present. Sometimes the compact bone of the cortex of the mandible formed part of the wall of the canal. Histology also showed the inferior alveolar nerve to be a large trunk near the mandibular foramen but to become broken into smaller bundles more anteriorly.

23. WHITTET, Heikki B., and Graham ROBLIN, Department of Otorhinolaryngology, Singleton Hospital, Swansea, UK. **Endoscopic endonasal surgical management of cerebrospinal fluid rhinorrhoea.**

Cerebrospinal fluid rhinorrhoea may occur spontaneously or be the result of trauma or other pathological processes occurring at the skull base or olfactory cleft. Traditional external or neurosurgical approaches are not ideal in managing this condition often because of associated post surgical morbidity. An endonasal endoscopic approach offers a more precise localization of the anatomical site of leakage and a minimally invasive means of surgical repair. The authors demonstrate the relevant anatomical points with appropriate endoscopic illustrations, CT cisternography and MR imaging.

24. JENKINS, Ian, Department of Earth Sciences, University of Bristol, Bristol, UK. **3-Dimensional computer modelling approaches to anatomy in vertebrate palaeobiology.**

An analysis of cranial anatomy and function in synapsid ('mammal-like') reptiles across the Permo-Triassic time boundary 248 million years ago has elucidated novel feeding mechanisms in some of these very ancient specialised carnivores. A multidisciplinary approach demonstrates that the ecological niches occupied by the plentiful and highly successful sabre-toothed synapsid predators of the Late Permian - the gorgonopsids, were filled after their disappearance at end-Permian extinction event by moschorhinds, members of the distantly related therocephalian synapsids. Use of modern anatomical data from various fields allows a rigorous appraisal of functional cranial anatomy in these animals. The hypotheses of function generated by this modern anatomical information is tested, and upheld by the application of Finite Element Analysis (FEA), a 3-D computer modelling technique used by engineers in problems of structural mechanics. Therocephalians of the Permian Period shown different feeding adaptations to those of contemporaneous gorgonopsids, but the 'gorgonopsid ecomorph' niche that was left vacant by the extinction event of 248 MYA was filled by a group of therocephalians that re-evolved the gorgonopsid cranial type - the moschorhinid therocephalians. Biomechanical models of this type are dependant upon detailed and rigorous anatomical techniques familiar to clinical and veterinary anatomists.

25. KAVROS, Steven J., Mayo Medical School, Department of Orthopedic Surgery, Mayo Clinic and Mayo Foundation, Rochester, MN, USA. **Posterior tibial tendon dysfunction with relationship to location of tendon tear.**

Dysfunction of the tibialis posterior tendon is a clinical entity causing unilateral acquired flatfoot deformity in adults. There has been much written and published pertaining to Achilles tendon rupture. Complete or partial tibialis posterior tendon ruptures occur infrequently in the young athlete. In the middle aged to elderly population, chronic tenosynovitis progressing to tendinosis and eventual partial tendon rupture is not uncommon. An MRI study is not usually necessary for an experienced foot and ankle specialist to make a clinical diagnosis. A retrospective MRI study of the tibialis posterior tendon, in patients with diagnosed posterior tibial tendon dysfunction, was done to identify the common location of the tendon pathology. Twelve subjects, eight female and four male, were used in the study. The ages ranged from 43 to 74 years. Partial tendon ruptures were commonly found 30 mm to 80 mm proximal to its insertion upon the tuberosity of the navicular. The region from posterior superior to inferior distal to the medial malleolus was the most prevalent location for a partial tear leading to unilateral acquired flatfoot deformity.

26. BOON, Johannes M., and Mattys J. VAN WYK, Department of Anatomy, University of Pretoria, Pretoria, South Africa. **Determination of a safe area for the incision during harvesting of autogenous tendons for ACL (anterior cruciate ligament) reconstruction.**

Lower leg paresthesia following injury to the infrapatellar nerve during incision for the harvesting of semitendinosus and gracilis tendons for ACL reconstruction has been well documented. The purpose of this study was to determine a safe area and angle where an incision on the medial aspect of the tibia could be made for the harvesting of these tendons with the knee in flexion without cutaneous nerve damage. Eight right knees and seven left knees were dissected. Landmarks on the knee (inferior border of the patella, tibial tuberosity and a point medial to the patellar tendon) were identified from where the distances to the infrapatellar branch and saphenous nerve were measured with a vernier calliper. A safe area (Average \pm 2SD) on the right knee was determined to be on the tibial tuberosity plane between 4.69 and 5.61 cm with a safe angle of incision of 66.18 degrees. A safe area (Average \pm 2SD) on the left knee was determined to be on the tibial tuberosity plane between 3.32 and 4.41 cm with a safe angle of incision of 65.40 degrees. No safe area was found on the right and left on the infrapatellar plane. We believe that our results may assist orthopedic surgeons to avoid cutaneous nerve damage and, therefore, patient discomfort.

27. PIEGGER, Johannes, Erich BRENNER, Ralph BURGER, and Werner PLATZER, Institute for Anatomy and Histology, Leopold-Franzens-University, Innsbruck, Austria. **Side differences of the talar trochlea: Aspects for diagnosis, therapy and prosthesis design.**

On studying the talus and its trochlea differences between the right and the left side were found. Several measurements on macerated bones as well as on wet specimens showed up side differences in length, widths and the angle of the medial and lateral borders of the superior surface of the trochlea. Especially this angle is larger in left specimens. This fact indicates a higher incongruency at the left side. Thus increased internal rotation or „wobbling“ movements in the left talocrural joint are possible. In this study, we want to prove the findings of our basic study on cadavers in computed tomography. The measurements from six cadaver-feet were compared with those from three living voluntary probanders (six feet). Therefore, the CT-images were measured directly. Also 3-dimensional reconstructions of the joint were created

from these images. We can show that the side differences can be evaluated also in computertomography. The knowledge about the side differences is important for diagnosis, has an influence on therapy and is essential for the designing of individual prosthesis.

28. WEIGLEIN , Andreas H.¹ Gerolf PEICHA², Johnathan LABOVITZ³, and Franz J. SEIBERT², ¹Institute of Anatomy, ²Department of Trauma Surgery, Karl-Franzens-University Graz, Austria, Europe, and ³Department of Podiatrics, Northville, MI, USA. **Anatomical basis for diagnosis and treatment of Lisfranc injuries.**

Plantar hyperflexion causes rupture of Lisfranc's ligament with consequent diastasis of the first and second metatarsals. Diagnosis is obtained by weight-bearing, sometimes also by abduction stress anteroposterior and lateral x-rays. Axial MR views, however, allow to visualize Lisfranc's ligament directly. Evaluation of MRs and successful results of treatment depend on understanding the anatomy of Lisfranc's ligament. In 84 cadaveric feet we studied the anatomy of Lisfranc's joint and ligament. The tarsometatarsal joints or Lisfranc's joint connects the midfoot and the forefoot. The proximal end of the second metatarsal is tightly recessed between first and third cuneiform locking the entire tarsometatarsal complex. Strong dorsal, plantar and interosseous ligaments connect the tarsus with the metatarsals. But there are no ligaments between the first and second metatarsals. The main stabilizer of the 1-2 intermetatarsal joint is Lisfranc's ligament (cuneo1metatarsal2 interosseous ligament). This strong oblique ligament extends from the plantar-lateral aspect of medial cuneiform to the plantar-medial aspect of second metatarsal. A strong ligament also connect the middle cuneiform with the second and third metatarsals (cuneo2metatarsal3,4 interosseous ligament). Sometimes the lateral cuneiform is connected to the third and fourth metatarsals by a cuneo3metatarsal3(4) interosseous ligament. Lisfranc's ligament measures 1 cm in height and 0,5 cm in width. In 22 % two separate bands are present. In 18% a anterior and a posterior band, in 4 % a dorsal and a plantar band.

29. QURESHI, Ford I., Anthram A. SHETTY, and Harold ELLIS, Department of Anatomy, Guy's, King's & St Thomas' Medical Schools, London, UK. **The anatomical significance of the popliteal artery in knee surgery**

Severe life threatening injuries of the popliteal artery (PA) can occur during total knee replacements and high tibial osteotomies. These procedures are performed with the knee in 90 degrees of flexion and at between levels of 1-1.5cm below the posterior tibial joint line, therefore in close proximity to the PA. There are conflicting ideas of exactly how close the PA lies to the posterior surface of the tibia when the knee is flexed to 90⁰.

Using duplex ultrasonography we assessed the knees of 100 volunteers to determine the distance of the PA from the posterior tibial surface at 0⁰ and 90⁰ of flexion. At 1cm below the joint line, we found the PA was closer to the posterior tibial surface in 24.7 % of knees. This was also the case for 11.76% knees at 1.5cm below the joint line. 6% of the knees had a high anterior tibial branch from the anterior aspect of the PA and just proximal to popliteus. Therefore, the position of this vessel must also be borne in mind during surgery. We provide a detailed anatomical account to help explain our findings from cadaveric knee dissections, arterial angiography and static MRI studies. We suggest that there is less chance of damaging the PA if knee surgery is performed with the knee in 90⁰ of flexion.

30. THORISDOTTIR, Vigdis, and Chris BUCKLAND-WRIGHT, Division of Anatomy, Cell and Human Biology, King's College London, London, UK. **M. Popliteus relationship to the lateral meniscus – preliminary results.**

Popliteus muscle unlocks the extended knee by laterally rotating the femoral condyle. Aim: Popliteal insertion into the lateral meniscus was examined to determine its pattern of attachment. Methods: The Popliteus muscle was exposed in 20 (15:Rt) P.M. knees (10 M) and traced from its origin to its insertion. The proximal muscle region, medial to the Popliteal tendon, which appeared to blend with the capsule and lateral meniscus, was cut out as a block and prepared for routine histology. Results: In 20/20 cases fibres from the medial part of Politeus blended with the posterior capsule of the joint. Histologically, collagen fibres arising from the muscle exhibited 3 different patterns: i) insertion into the capsule superior to the meniscus n=2; ii) insertion into the capsule posterior to the meniscus n=8; iii) either loose, weak connective tissue n=6 or no fibrous connection to the capsule posterior to the meniscus n=3; 1 specimen was indeterminate due to damage. Conclusion: Popliteus acts directly on the meniscus in 10/19 cases as collagen fibres insert into the posterior capsule and lateral meniscus; and indirectly via rotation of the femoral condyle in 9/19 cases were fibrous attachment is weak or absent.

5:15-17:00 POSTER SESSION 1: & Tea Uppercroft Pythagoras Building

Viewing of Poster Demonstrations D1 - D47 (Aben through McWhorter)

DEMONSTRATIONS (Poster Presentations)

- D1. **Abd-El-Basset, E.M.** Bacterial endotoxin induces changes in the organization and expression of actin and modulation of the cell membrane of microglia in tissue culture.
- D2. **Abdel Meguid, E.M.,** A. Rashed, & C. Garabedian. Anatomical study of the branches of the left pulmonary artery to the upper lobe of left lung.
- D3. **Aker, F. D.,** & J.J. Jasionowicz. Computer slides shows in the teaching and learning of neuroanatomy.
- D4. **Akita, K.,** T. Kawashima, K. Sato, & T. Sato. A case of the cutaneous branch to the deltoid region originating from the lateral pectoral nerve.
- D5. **Akita K.,** T. Shimokawa, K. Yamaguchi, & T. Sato. Midmedial and discotemporal muscle bundles of the temporalis and their innervation.
- D6. **Al-Khatib, M.,** & M. von Luedinghausen. Pterygo-spinous osseous lamina, ligament and muscle: its frequency, shape and clinical relevance.
- D7. **Barczak A.,** L. Lotek, C. Dimopoulos, M. Loukas, E. Walcak, & T. Wagner. The tendon of infundibulum, an anatomical observation of the aorto-pulmonary trunk connection.
- D8. **Bolender, D.L.,** P. C. Frommelt, & C. Snyder. An interactive computer based learning program for medical students and house staff using case studies of congenital heart disease.
- D9. **Boon, J.M.,** C.J. Jacobs, and J.H. Meiring. Improving clinical relevance in problem oriented teaching in undergraduate anatomy.

- D10. **Boon, J.M.,** J.H. Meiring, & M.D. Scheefers. Clinical anatomy for family physicians - a distance learning delivery.
- D11. **Bremer C.,** T.J. Filler, G. Kreft, P. Reimer, & E. T. Peuker. Anatomical correlation to MR-imaging of laser induced liver lesions.
- D12. **Carmichael, S.,** & W. Pawlina. A new visual tool to teach clinical anatomy.
- D13. **Chandraraj, S.,** & C. A. Briggs. Age changes in the cervical (C5/6) intervertebral disc.
- D14. **Chaudhuri, J. D.,** & S. Krishnan. Liver and skeletal muscle changes in experimentally induced fetal alcohol syndrome.
- D15. **Chockalingam, N.,** G. Giakas, & P. H. Dangerfield. A computer assisted system for reliable assessment of spinal deformities.
- D16. **Clement, H. G.,** N. P. Tesch, W. Grechenig, B. Unger, F. Anderhuber, & G. Feigl. 3-dimensional representation with ultrasound and reconstruction of the arcus palmaris superficialis.
- D17. **Curry, B.,** T. Strickler, & P. Walcott. Unusual course of the ulnar nerve in the hand.
- D18. **De Caro, R.,** V. Macchi, A. Parenti, G. P. Feltrin, & P. F. Munari. The transverse hepatic scissura.
- D19. **Dimopoulos C.,** M. Loukas, E. Walcak, & T. Wagner. Anatomic and clinical data of the valve of coronary sinus (Thebesian valve).
- D20. **Discher, W. F.,** A. Noe, E. Lockett, & D. Sweet. Human embryology digital library and collaboratory support tools.
- D21. **Durham, L. J.,** N. McCoy, & P. B. Nava. Care and maintenance of the cadaver - A survey.
- D22. **Filler, T. J.,** & E. T. Peuker. Telematic based teaching in anatomy.
- D23. **Filler, T. J.,** F. Schmael, & E. T. Peuker. The ansa galeni and its importance to neck surgery.
- D24. **Firbas, W.,** F. Kabelka, W. Heinrich, and M. Krejs. Growth analysis of the human foot.
- D25. **Freel, C. D.,** K. O. Gilliland, J. M. Burgoon, W. C. Dunty, C. J. Smith, O. W. Henson, & N. A. Gramger. Integrating computer resources with practical dissection: the use of web-based dissection guides in pre-laboratory preparation.
- D26. **Gould, D. J.** Enhancing the clinical relevance of an anatomy multimedia program.
- D27. **Graney, D. O.,** R. Holmberg, & S. Golard. The digital age and dissection. Using Adobe® Photoshop® layered illustrations in the teaching of gross anatomy.

- D28. **Grkovic, I.,** C. A. Briggs, N. Eizenberg, & P. J. Barker. Anatomeia™ - A new approach to medical education developments in anatomy.
- D29. **Guelfguat, M.,** W. B. Zucconi, & N. Solounias. An anomalous tendon of the peroneus brevis muscle: anatomical and clinical significance.
- D30. **Hasanovic, A.** The demonstration of the collaterals of coronary arteries using the method of coronary angiography, dissection and injection-corrosion method.
- D31. **Heylings, D. J.,** S. Taylor, C. Lamb, E. Kearney, & J. Megaw. The effectiveness of training in safe lifting techniques, and EMG study.
- D32. **Huebner, K.U.,** A. Schlager, R. Burger, M. Schmuth, & L. Spoell. Healing of burns after treatment with 670-nm-low-power laser light.
- D33. **Jenkins, D. B.** & T. C. Ocheltree. The parotid gland and its relationship to the pterygomandibular space.
- D34. **Jevoor, P. S.,** B. R. Potturi, & S. M. Antin. Unilateral agenesis of pectoral muscles.
- D35. **Kagan, I. I.,** S. B. Tulupov, & A. V. Shatzkich. Differences in macromicroscopical anatomy and topography of ciliary body area and posterior part of the eyeball.
- D36. **Kirchmair, L.,** & B. Moriggl. Paraspinal color Doppler sonography concerning blood vessels at the level of lumbar intervertebral foramina.
- D37. **Koshi, R.,** G. Chandy, & M. M. Mathan. Enteric microvascular endothelial response to toxic stimuli in acute infective diarrhoea.
- D38. **Kovacs, P.,** H. Behensky, G. Bodner, Erich Brenner, & B. Moriggl. Can high resolution ultrasonography reliably assess artificial tendon lesions?
- D39. **Kyalyan, G. P.,** & N. H. Sargsyan. Peculiarities of the ultrastructural changes of the liver acinus in duodenal ulcer complicated with decompensated pylorostenosis.
- D40. **Lachman, N.,** R. D. Acland, E. A. Vanker. A morphometric study of the extra-coronary collaterals.
- D41. **Lamb, C.,** D. McCay, N. Gillen, D. J. Heylings. Temporalis a further note on the distal attachments.
- D42. **Loukas M.,** C. Dimopoulos, E. Walcak, & T. Wagner. Anatomical dimensions of triangle of Koch in perspective of catheter ablation procedures.
- D43. **Loukas, M.,** C. Dimopoulos, E. Walcak, & T. Wagner. The clinical anatomy of the high take off arteries.
- D44. **Luedinghausen, M. von,** G. Schindler, D. Hayakawa & M. Matsuura. A follicular or dentigerous (tooth-containing) cyst in the premaxilla of an otherwise toothless older man.

- D45. **McCay, D.**, N. Gillen, S. Taylor, & D. J. Heylings. The preparing of a biomechanical model of the muscles of mastication.
- D46. **MacPherson, B. R.**, Web-based databasing: a simple answer to a complex instructional issue.
- D47. **McWhorter, D. L.** & M. S. Cole. Introducing critical appraisal of biomedical literature to first-year medical students in histology.

ABSTRACTS OF POSTER SESSIONS - THURSDAY, JULY 20TH:

D1. ABD-EL-BASSET, Ebtessam M., Department of Anatomy, Faculty of Medicine, Kuwait University. **Bacterial endotoxin induces changes in the organization and expression of actin and modulation of the cell membrane of microglia in tissue culture.**

There are at least three forms of microglia in the brain, i.e., the resting, the activated, and the phagocytic microglia, each having different shape and each representing a different function state. The signals promoting the morphological changes which adapt microglia to specific functions are still unknown. In this study the majority of non-stimulated microglia in tissue culture initiated from neopallia of newborn Balb/c mice are ameboid in shape with many short processes that extend into lamellipodia. When microglia are treated with bacterial wall lipopolysaccharide (LPS) most of the microglia acquire a large, round, and flat shape. Using florescent labeling with phalloidin shows that the F-actin network appears diffusely arranged through out the cytoplasm of non-stimulated microglia. When microglia are treated with LPS the F-actin network is reorganized into filamentous bundles extending into microspike-like projections. Changes in organization of F-actin are associated with the modulation of the cell membrane as revealed by scanning electron microscopy. The non-stimulated microglia has large membrane folds and few large blebs in both ameboid and small round cells. In LPS treated cells most of the membrane folds and blebs at the cell periphery disappear with the appearance of many microspike-like projections. The immunoblotting shows that LPS treated microglia upregulate their actin protein. These changes in the organization of F-actin and cell membrane may reflect adaptation of activated microglia to specific functional activity of the cell, such as, increases in their phagocytic activity. Supported by Kuwait Univ. through grant # MA 037.

D2. ABDEL MEGUID, Eiman M., Ahmed RASHED, and Carlo GARABEDIAN, Department of Anatomy, Faculty of Medicine, University of Alexandria, Egypt. **Anatomical study of the branches of the left pulmonary artery to the upper lobe of left lung.**

A systematic study of the arterial vascularization of the lobes of the lungs is necessary since it is of utmost practical importance. The constantly increasing number of lung operations being performed makes a surgically oriented investigation of the pulmonary artery anatomy more important. At operation, where segments are often not identifiable on account of shrinkage and distortion following a disease, it may be virtually impossible to be certain of the course of any particular vessel which is of considerable importance in segmental resection. The upper lobe of the left lung is characterized by the greatest variability in the type and patterns of vascularization. This study aimed to determine the morphological features of the branches of the left pulmonary artery which vascularize the upper lobe of the left lung and to classify the patterns of this vascularization. This study was carried on 50 left lungs taken from dead human bodies of both sexes whose ages varied from 20-80 years. The left pulmonary artery and its branches were

dissected, injected with red latex, examined and measured then photographed. It was found that the upper lobe of the left lung is penetrated by 2-5 branches from the left pulmonary artery. Their directions were examined and their branches were identified. Whenever it seemed that the base of two vessels could be occluded by a single ligature, they were considered branches of a common trunk. There were three kinds of branches ramifying from the left pulmonary artery; trunk, segmental and subsegmental branches.

D3. AKER, F. David¹, and Jodi J. JASIONOWICZ², ¹Department of Anatomy and Cell Biology, Temple University School of Medicine and ²Temple University School of Dentistry, Philadelphia, PA. **Computer slides shows in the teaching and learning of neuroanatomy.**

The time frame for the instruction of the neuroanatomy course to freshmen dental students at Temple University is very concentrated. Consequently, development of neuroanatomy computer slide shows began about 2 years ago to complement the course and aid in learning the subject matter in the restricted time frame. Even though limited in content initially, 90% of the 1998 class evaluated the shows as good to excellent, with 82 % recommending expansion of the shows. For 1999 the shows were revised and expanded and the students were given open access to the shows. Again, the students were asked to give an overall evaluation. With 95 students responding, the results were: excellent=48%, good=45%, average=6%, fair=1% and poor=0%. Further, students were asked to evaluate individual shows as being very helpful, moderately helpful or not helpful in the learning of the subject matter or they did not use the shows. The findings on these questions were: Spinal Cord Show - 67%, 28%, 5%, 0%; Brainstem Show - 64%, 29%, 7% 0%; Gross Brain Show - 65%, 29%, 6%, 0%; Brain Sections Show - 58%, 38%, 3%, 1%; Touch Pathway Show - 56%, 31%, 9%, 4%; Pain Pathway Show - 55%, 31%, 9%, 5%. These results seem to indicate very strong support for such learning aids, especially when course content is quite compressed. The shows have been very beneficial as an adjunct to the instruction of neuroanatomy in lecture and laboratory and have given the students an additional medium to assist in the assimilation of the basic and clinical aspects of the neuroanatomy.

D4. AKITA Keiichi¹, Tomokazu KAWASHIMA², Kenji SATO², Tatsuo SATO¹, ¹Unit of Functional Anatomy, Graduate School, Tokyo Medical and Dental University, Tokyo, JAPAN. ²School of Allied Health Sciences, Faculty of Medicine, Tokyo Medical and Dental University, Tokyo, JAPAN. **A case of the cutaneous branch to the deltoid region originating from the lateral pectoral nerve.**

During dissection practice, a cutaneous branch to the deltoid region which originated from the lateral pectoral nerve was found bilaterally in one Japanese male (2 of 48 sides. 4.2%). The branch originated from the superior surface of the lateral pectoral nerve, ran on the superior surfaces of the coracoid process and the coracoacromial ligament, and pierced the deltoid muscle close to the tip of the acromion. The distribution area of this cutaneous branch was similar to the cutaneous branches of the suprascapular nerve (Horiguchi M., J. Anat. 130:191-195, 1980). In addition, the cutaneous branches of the suprascapular nerve were found in two sides (4.2%) in the present dissection practice. The branch from the suprascapular nerve has been reported in man and lower primates. However, a detailed description of such a branch from the lateral pectoral nerve is not currently available in the literature.

D5. AKITA Keiichi, Takashi SHIMOKAWA, Kumiko YAMAGUCHI, and Tatsuo SATO, Unit of Functional Anatomy, Graduate School, Tokyo Medical and Dental University, Tokyo, JAPAN. **Midmedial and discotemporal muscle bundles of the temporalis and their innervation.**

For an accurate assessment of jaw movement, it is critical to understand the comprehensive formation of the masticatory muscles and their innervation. Detailed dissection was performed on 26 head halves of 14 Japanese cadavers in order to obtain precise anatomic information of the muscle bundles which attach to the temporomandibular joint disc. After complete removal of the bony elements, a muscle bundle (midmedial muscle bundle) was found between the lateral pterygoid and the temporalis in all specimens, and the discotemporal muscle bundle was found in 6 specimens. In addition, it was observed that the zygomaticomandibularis attached to the anterolateral area of the disc. On the anterior area of the articular capsule and the disc, the upper head of the lateral pterygoid, the midmedial bundle and the discotemporal bundle were attached mediolaterally. It is suggested that various muscle bundles contribute to specific mandibular movements in the anteromedial to anterolateral directions. Here, we show the positional relationships between the masticatory muscles and various transitory bundles and their innervating nerves, and discuss the formation of the masticatory muscles which are related to disc movement based on innervation findings.

D6. AL-KHATIB, Mohammed, and Michael von LUEDINGHAUSEN, Department of Anatomy, University of Wuerzburg, Wuerzburg. **Pterygo-spinous osseous lamina, ligament and muscle: its frequency, shape and clinical relevance.**

The lateral infratemporal approach is increasingly used in operations to remove large tumours of the upper aerodigestive system, and of the skull base when they have expanded into the para- and retropharyngeal space. The pterygo-spinous complex (psc), the lateral lamina of the pterygoid process, the styloid process and its vagina represent important landmarks at the borderline area between the infratemporal fossa and the parapharyngeal space. These landmarks, and especially those of the structures of the psc, may hamper the approach and the surgical procedure. To determine the frequency, shape and function of the structures of the psc, we studied 180 macerated skulls and 64 fixed halves of head specimens. We also measured the distances between the osseous landmarks and calculated the widest and narrowest access to the median part of the skull base and the parapharyngeal space. The psc consisted either of a complete osseous arch (13% of the cases), or a ligament (44%) or a muscle (9%). Our investigation underlines the fact that surgeons employing the lateral infratemporal approach must be prepared to meet with anatomical hindrances caused by variations in the form of the components of the psc.

D7. BARCZAK Artur, Loukas LOTEK, Chris DIMOPOULOS, Marios LOUKAS, Ewa WALCAK, and Teresa WAGNER, Department of Pathology, Institute of Rheumatology, Warsaw, Poland. **The tendon of infundibulum, an anatomical observation of the aorto-pulmonary trunk connection.**

The heart, as we know, is a muscular tissue supported by collagenous structures forming the fibrous skeleton of the heart. A structure by the name, the Tendon of Infundibulum appeared in the literature with no definite information about its structure or even its existence. The Tendon of Infundibulum was described as a strip of fibrous tissue structure situated between the aortic and pulmonary trunk. Our investigation involved 60, formalin fixed, adult human hearts. Microsurgical instruments were used to observe macroscopically all the connections between the

aorto-pulmonary trunk. From the 60 hearts, 55 were seemed to encompass many fascial bands attended by connective tissue, while the rest 5, no connection was observed between the two trunks. However these fascial bands are not concrete structures cannot be termed Tendons. The above findings are just apiece to the puzzle called the Tendon of Infudibulum. However as far as we are able to judge the term Tendon of Infudibulum erroneously has been introduced in many medical textbooks since the literature can not still prove its existence.

D8. BOLENDER, David L., Peter C. FROMMELT, and Carolyn SNYDER, Departments of Cell Biology, Neurobiology and Anatomy and Pediatric Cardiology, Medical College of Wisconsin, Milwaukee, WI. **An interactive computer based learning program for medical students and house staff using case studies of congenital heart disease.**

Cardiac development is a dynamic, 4 dimensional event which is often difficult to understand when presented in a static, 2 dimensional format. We sought to develop an interactive learning module in which normal and abnormal cardiac development is portrayed in a dynamic fashion. Macromedia Director was used as a unifying platform on which to organize animated sequences of development, echocardiographic images, dialog boxes and quizzes. For each of the major cardiac anomalies, the student will be able to access diagrams of normal heart anatomy, animated sequences illustrating normal heart development, animation of normal and abnormal blood flow patterns, echocardiograms showing the morphological and physiological aspects defect and dialog boxes describing events relate to the defect. Echocardiograms are chosen from cases identified as being particularly useful for illustrating anatomic abnormalities and physiologic changes associated with a specific cardiac defect. Quizzes pertaining to each cardiac defect are provided in order for the student to determine their understanding of the material. The interactive learning program should be useful for basic instruction of medical students as well as for review of cardiac anomalies by students and house staff. (Sponsored by a grant from the Learning Resources Fund of the Medical College of Wisconsin).

D9. BOON, Johannes M., Corrie J. JACOBS, and Jan H. MEIRING, Department of Anatomy, University of Pretoria, Pretoria, South Africa. **Improving clinical relevance in problem oriented teaching in undergraduate anatomy.**

Problem oriented medical curricula claim to be based on the fact that the clinical sciences facilitate and encourage the understanding of basic sciences. The question was asked whether the correlation of anatomy in the Abdomen and Mammary gland Block in the new Pretoria medical curriculum, with clinically relevant content i.e. relevant physical examination, clinical case studies, imaging anatomy, clinical procedures and clinical presentations, facilitates the understanding of human anatomy and enhances the development of clinical thinking, fundamental to clinical practice. The clinical anatomy component in the Abdomen and Mammary gland Block (11 weeks) in the third year, was developed by using standardized patients, cadaver material, skeletons, X-rays, CT scans, MRI's and multimedia programs. Student perceptions were assessed by a Likert scale questionnaire. Most (60%) thought that integrating the physical examination enhanced the understanding of the relevant anatomy. Only 20% felt that clinical case studies and associated imaging anatomy did not give them a better understanding of the anatomy. Over half of the group (57%) thought that the block laid a good foundation in the understanding of surgical procedures. Most (60%) were confident that the clinical presentations enhanced the anatomical understanding. It seems evident that the integration of clinically relevant content facilitated and encouraged the understanding of anatomy and developed critical thinking.

D10. BOON, Johannes M., Jan H. MEIRING, and Maria D. SCHEEPERS, Department of Anatomy, University of Pretoria, Pretoria, South Africa. **Clinical anatomy for family physicians - a distance learning delivery.**

Family physicians in developing countries are highly dependent on their anatomical knowledge in order to make clinical decisions and to perform various clinical procedures. Changing needs due to logistical and financial constraints in continued medical education of family physicians require new innovations of educational delivery. Distance learning provides a learning tool over distance and adds certain values to the educational process e.g. self directed and life long learning. An integrated clinical anatomy CD-ROM was developed for the Masters in Family Medicine program to equip students with relevant anatomy necessary for patient care. Clinically relevant content is integrated with clinical case studies, imaging anatomy, illustrations and images of prosections. Emphasis during the content development was strongly focussed on the application of anatomical knowledge on specific outcomes for family physicians. Various educational features such as a learning schedule, self-assessment exercises and communication via bulletin board and email, were incorporated into the CD-ROM in order to produce an educational program rather than a learning resource. Responses of students were positive so far, and most of our students are able to communicate with us via electronic means. We believe that improving the clinical anatomy competency of family practitioners by this new delivery mode may have an important influence on patient care.

D11. BREMER Christoph¹, Timm J. FILLER, Gerald KREFT², Peter REIMER², and Elmar T. PEUKER, ¹Center for Molecular Imaging Research, Massachusetts General Hospital, Harvard Medical School, Boston, MA, USA, ²Dept. of Clinical Radiology, University of Muenster, Germany Institute of Anatomy, Clinical Anatomy Division, Westfalian Wilhelms-University of Muenster, Vesaliusweg 2-4, D-48149 Muenster, Germany. **Anatomical correlation to MR-imaging of laser induced liver lesions.**

Laser -induced interstitial thermotherapy (LITT) is currently under investigation for the treatment of primary and metastatic tumors. Exact non-invasive lesion monitoring is critical for a save guidance of the intervention. LITT was performed ex vivo on small cubic pig liver samples. MR images were obtained in 1 minute intervals during and after LITT, and the heating effects were measured using a thermosensitive MR-sequence. The samples were cut centrally in the coronal plane and lesion size was measured macroscopically. After fixation, histological and electronmicroscopical examinations were performed. Characteristics of the laser induced cell damage were qualitatively described and different degrees of liver damage defined accordingly. Macroscopically measured lesion size correlated closely to the value obtained by MRI. Four areas adjacent to the laser applicator were identified according to the histological characteristics and the staining properties. The first two inner sections represent the core zone of complete tissue ablation, while the outer sections are referred to as the transitional zone with sublethal tissue damage. MRI after cooling of the tissue correlates well to the histological core zone while it underestimates the transitional zone substantially.

D12. CARMICHAEL, Stephen, and Wojciech PAWLINA, Department of Anatomy, Mayo Clinic Rochester, MN, USA. **A new visual tool to teach clinical anatomy.**

Clinical anatomy is best taught in the dissection laboratory. As learners discover the intricacies of the human body by dissection, they observe the details of structures and their relationships, embedding this information in their memory. But Clinical Anatomists often must instruct large groups of learners in a lecture setting where this approach is not feasible. We present a teaching

tool that allows a lecture presentation that is visual, dynamic, and effective at transferring information from teacher to learner. Using a computer and a video projector, we demonstrate the use of animated Microsoft PowerPoint® to teach Clinical Anatomy. Learners are given handouts of simple line drawings of relevant anatomy, and these same drawings are projected on the screen. The drawing is sequentially filled out and labeled. The completed slides are posted on the web site for the course, so that students can verify the accuracy of their notes. The response of the students at the end of the course was overwhelmingly positive. This technique requires a considerable initial investment of faculty effort, but little additional effort is needed for subsequent presentations.

D13. CHANDRARAJ, Seba., and Christopher A. BRIGGS, Department of Anatomy & Physiology, Royal Melbourne Institute of Technology, and Department of Anatomy & Cell Biology, University of Melbourne. **Age changes in the cervical (C5/6) intervertebral disc.**

Vascular factors have been identified as a predisposing factor in the genesis of intervertebral disc disease (Yasuma et al, 1986, 1991, Chandraraj et al 1997, Briggs et al 1997). In this study cervical spines aged between 20-80 years were obtained from the autopsy room, sectioned horizontally and sagittally and processed for paraffin embedding. 5 micron sections were stained with H & E, Mallory's trichrome, Toluidine blue and haematoxylin-alcian blue. At 20 years the annulus was characterised by regular convex arrangement of fibres with only small regions of peripheral disorganisation. The nucleus showed distinct metachromasia. The end-plate revealed some weak spots and there was evidence of early Schmorl's nodes in some sections. At 39 years the inner annular fibres tended to be disorganised and fragmented with evidence of mucoid degeneration. The direction of the inner fibres tended to be reversed, being concave towards the centre of the disc with a reduction in metachromasia. Cracks were increasingly seen at the periphery of the annulus with nuclear material herniating along them. The end-plate was thinner and showed evidence of calcification. By 80 years there were typical large cracks throughout the entire disc. Metachromasia was reduced in both the annulus and nucleus and in the end-plate there was a ring of metachromasia around the remaining chondrocytes although the end-plate as a whole exhibited reduced metachromasia with thinning of areas of vascular erosion. Common age-related features of the annulus and nucleus involve disorganisation of collagen fibres and mucoid degeneration. This appearance is indicative of a common predisposing factor, namely regression of vessels within the disc.

D14. CHAUDHURI, Joydeep D., and Subramaniam KRISHNAN, Department of Anatomy, Faculty of Medicine, University of Malaya, Kuala Lumpur, Malaysia. **Liver and skeletal muscle changes in experimentally induced fetal alcohol syndrome.**

The aim of this study was to identify the anatomical and embryological basis of the teratogenicity of alcohol in the context of Fetal Alcohol Syndrome (FAS). FAS is an irreversible condition in children following maternal alcohol consumption during pregnancy. Current literature mentions physical and mental retardation, cardiac septal defects and minor joint abnormalities as major features, with occasional reports of liver and skeletal muscle involvement. Chick embryos were divided into four groups. In the first group C1, the embryos were left untouched, while embryos in the remaining three groups, C2, E1 and E2 were treated with distilled water, 50% and 75% alcohol respectively, using standard techniques. On gestation day 21, the embryos were killed using ethical procedures. C1 and C2 group embryos appeared normal. Significant reduction in body parameters of E1 and E2 embryos, without external and internal organ deformities, was observed. However on microscopic examination, there was increased fibrosis of liver with destruction of liver architecture and fibrosis of skeletal muscle

with occasional areas of necrosis. These findings confirm the deleterious effects of alcohol on liver and skeletal muscle as reported in humans. (Supported by Grant No: F 0467/1999B, University of Malaya).

D15. CHOCKALINGAM, Nachiappan¹, Giannis GIAKAS², and Peter H. DANGERFIELD³,
¹Sport, Health and Exercise, School of Health, Staffordshire University, Stoke-on-Trent,
²SATRU, Department of Geriatric Medicine, University of Manchester, Hope Hospital, Salford,
³Department of Human Anatomy and Cell Biology, University of Liverpool, Liverpool. **A computer assisted system for reliable assessment of spinal deformities.**

Various methods have been reported for an accurate assessment of spinal deformities such as scoliosis, kyphosis and lordosis. However, the Cobb method remains the standard clinical measurement for scoliosis assessment and appraisal. This measurement depends on various subjective factors including the identification of the curvature end-vertebrae and the definition of the vertebral pedicles. The observer is also required to draw a number of lines manually onto the radiograph in order to measure the angles. This procedure makes the measurement even more subjective. The present study aimed to develop a simple computerised method for measuring the level of spinal deformities. The spine is considered as a line, which can be divided in to as many parts as desirable, which need not be according to the number of vertebrae. This enables the observer to measure the deformity with higher resolution and accuracy. An postero-anterior radiograph is digitised using conventional scanning techniques and the resulting image analysed, using a simple, user friendly computer program, developed using MATLAB. This program measures the angle between each point in the "spinal line" and every other point in the same line. These equidistant points start and end between the points chosen by the observer. Once all the angles are calculated, the maximum angle and the points through which this angle is measured are recorded and made available to the clinician. The simplicity of the procedure is such that it can be used by inexperienced observers, which is one of the major advantages of this program. The program offers the clinician a quantified and accurate method for consistently recording the deformity of a scoliosis, overcoming some of the inaccuracies of the traditional measuring of the Cobb angle.

D16. CLEMENT, Hans G., Norbert P.TESCH, Wolfgang GRECHENIG, Bärbel UNGER, Friedrich ANDERHUBER, and Georg FEIGL, Institute of Anatomy, Karl-Franzens-University; Department of Traumasurgery, Department of Pediatric Surgery, Department of Radiology, University Hospital, Graz, Austria. **3-dimensional representation with ultrasound and reconstruction of the arcus palmaris superficialis.**

For many surgical operations concerning the hand the non-invasive delineation of the arcus palmaris superficialis and its surrounding structures represents valuable additional information. The aim of this study was therefore to render possible a representation of the superficial palmar arc by means of the latest linear and 3-dimensional ultrasound probes. To this effect 30 hands of 15 probationers who showed no pathological changes were examined with a 3D-ultrasound probe with high resolution (7.5-10 MHz) and the ultrasound apparatus Voluson 530D fabricated by Kretz-Technik. When restricted to one screen-level 7 hands showed the arcus with at least three digital palmar arteries branching off. In 3-dimensional sequence 26 hands showed the branching-off of the remaining arteries. In 16 cases the branch communicating with the arcus palmaris profundus could be depicted. For only four hands a picture of the palmar arc could not be reconstructed. Accompanying structures like nerves and structures like fascia, ligamenta and tendons with their sheaths - so far only depictable with MR - presented themselves with

astonishing plasticity. This new method gives the surgeon an inexpensive and at all times reconstructable possibility of orientation when planning an operation.

D17. CURRY, Brian, Tim STRICKLER, and Phil WALCOTT, Department of Biomedical Sciences, Grand Valley State University, Allendale, MI, USA. **Unusual course of the ulnar nerve in the hand.**

The ulnar nerve normally divides into superficial and deep branches after passing through the canal of Guyon. The deep branch passes deep between the origins of abductor digiti minimi and flexor digiti minimi brevis with the deep branches of the ulnar vessels while the superficial branch passes over the proximal end of flexor digiti minimi brevis with the ulnar artery and vein. In the present case, routine dissection of a cadaver revealed flexor digiti minimi brevis originating by a thin tendinous slip from the pisiform, rather than from the hook of the hamate, and by a broader than normal band from the deep layer of the flexor retinaculum (transverse carpal ligament). The ulnar nerve divided into superficial and deep branches just proximal to this band, but both branches passed deep to the band while the ulnar artery and vein remained superficial to the band. The superficial branch emerged distal to the band and divided into the usual sensory branches. The hypothenar region was well muscled and similar to the other hand, suggesting no impingement of the ulnar nerve branches deep to the origin of flexor digiti minimi brevis.

D18. DE CARO Raffaele, Veronica MACCHI, Anna PARENTI, Gian P FELTRIN, Pietro F. MUNARI, Institutes of Human Anatomy, Pathology and Radiology, Padova, Italy, **The transverse hepatic scissura.**

The transverse hepatic scissura (THS) is customary represented with a transverse plane drawn at the level of the right and left portal vein branches. Intravenous injections of radioopaque resins were performed in 30 isolated livers. After formalin fixation, they underwent CT and MR scans and a 3D elaboration of images was performed on a workstation using Advantage Windows software. The analysis of the images and of the corrosion casts shows that the lateral segmental portal branches (SPB) are arranged mainly on the horizontal plane and they give rise to pyramidal-shape segments. At the segments' boundary the apical portion of the antero-inferior segments (VI and III) overlaps the inferior portion of the postero-superior segments (VII-II). On the other hand, the medial SPB are arranged mainly on a sagittal plane and they give rise to parallelepiped-shape segments. Their secondary branches show T divisions which give rise to ventral branches twice long in comparison with the dorsal ones. Thus the basal portion of the superior segments (VIII-IVa) anteriorly overlaps the apical portion of the inferior segments (V-IVb). So, from the anatomical point of view, the so-called THS in reality corresponds to a curved plane with infero-posterior concavity which passes through the oblique boundaries between the anterior and posterior lateral segments, and the superior and inferior medial segments.

D19. DIMOPOULOS Chris, Marios LOUKAS, Ewa WALCAK, and Teresa WAGNER, Department of Pathology, Institute of Rheumatology, Warsaw, Poland. **Anatomic and clinical data of the valve of coronary sinus (Thebesian valve).**

Advances in cardiac surgery and invasive cardiology turned the attention of anatomists to the coronary sinus (CS) and its valve, the Thebesian Valve (TV). The aim of the study we performed was to describe and classify the morphology of the TV in the clinical useful way. The studies was carried out on 100 hearts obtained from the routine medicolegal autopsies performed in our department. Only those case were no pathologies of the heart (except of changes connected with

the age) were found, were taken into consideration. The form of the TV was observed and dimensions of the ostium of the CS with the TV (area index-AI) was counted and computed. Following our results, six most common types of the TV were distinguished. Our study revealed that the most common type of the TV is a simple non fenestrated semicircular fold of endocardium (type I in our classification) which occurred in 59 cases (59.%) with approximate AI of 43.6%. We noticed that it is possible to define precisely the border of the ostium of the CS. Inferior and partially lateral and medial side of the border of the ostium of the CS, is formed by attachments of the TV. Concluding, as far as we are able to judge the fact that the TV exists in 88 (88.%) cases and closes more than 50% of the ostium of the CS in 42 cases (42%), implicates its clinical significance in the day-to-day practice of invasive cardiology and cardiac surgery.

D20. DISCHER, William F., Adrienne NOE, Elizabeth LOCKETT, and Deborah SWEET, National Museum of Health & Medicine, Washington D.C., USA. **Human embryology digital library and collaboratory support tools.**

As a participating agency of the Next Generation Internet (NGI), the National Library of Medicine (NLM) has provided grants to medical institutions. The Human Developmental Anatomy Center (HDAC) of the National Museum of Health and Medicine (NMHM) is currently participating in one of these awards, the Human Embryology Digital Library and Collaboratory Support Tools, headed by George Mason University. This project proposes to develop technologies to create collaborative/consultative environments among multiple, distributed researchers to make clinical and educational advancements. The high performance test-bed network with large petabyte archive and analysis ability uses existing government funded gigabit/second network to connect HDAC with key sites across the nation.

D21. DURHAM, Linda J., Nina McCOY, and Pedro B. NAVA, Division of Human Anatomy, Loma Linda University, Loma Linda CA and Western University, Pomona CA, USA. **Care and maintenance of the cadaver - A survey.**

In order to find the most effective methods in cadaver utilization, we gathered information about preservation, storage, and maintenance of cadavers in donor programs across the U.S. Survey's were sent to 124 medical schools with directed questions regarding storage; embalming; length of utilization; problems experienced; and methods used to rectify the problem. When a wetting solution was used, we requested the contents, as well as student maintenance instructions. Of the 64 respondents (52%), mold and dessication were the most common problems (36% reporting each). Remarkably, 31% reported no problems of any kind. Fifty-three (83%) had trained in-house embalmers to prepare and maintain cadavers. Student instruction on cadaver maintenance during dissection was almost a universal protocol (98%). Glycerin was the most common agent employed to counteract dessication, while phenol was the most common additive used to protect against molding. Furthermore, 80% of the institutions reporting "no problems" routinely utilized these reagents. We concluded that trained embalming staff and quality chemical formulas, especially those containing phenol and glycerin; careful maintenance of the bodies through the use of wetting solutions containing phenol; and cover materials combining muslin wrap with a plastic cover, produced specimens that lasted longer and exhibited fewer problems in the dissection laboratory.

D22. FILLER, Timm J., and Elmar T. PEUKER, Institute of Anatomy, Clinical Anatomy Division, Westfalian Wilhelms-University of Muenster, Vesaliusweg 2-4, Muenster, Germany. **Telematic based teaching in anatomy.**

Although multimedia based courses and tutorials via the Internet seem to serve best for a more effective teaching and new didactics, respective anatomical offers are scarce and thus practice and experience are limited. Substantial advantages of web based tutorial systems are an intensive use of the feedback possibilities, the opportunity for continuous updating of the contents, the favourable distribution, and faster utilization of improved techniques. This presentation introduces the adaption of current techniques and the development of concepts and notions of modern Internet based teaching in anatomical education for medical students and doctors. An online transmission of a microscopical course as an interactive practical teleteaching was performed by the way of asymmetric data transfer via the ADSL-technology. Multicasting was used as well and has also been applied for a multimedial online teaching. Different specialties were joined together for interdisciplinary courses via!

the Internet. These new technologies lead to enhanced efficiency in teaching and enlarge the educational offer. Specific Internet adapted teaching and learning projects have to be developed.

D23. FILLER, Timm J., F. SCHMAEL, and Elmar T. PEUKER, Institute of Anatomy and Department of Otorhinolaryngology, Clinical Anatomy Division, Westfalian Wilhelms-University of Muenster, Germany. **The ansa galeni and its importance to neck surgery.**

The exposure of the recurrent laryngeal nerve (NLR) is a standard procedure e.g. in surgery of the thyroid gland and Zenker's (pharyngoesophageal) diverticulum. However, inspite of electrophysiological monitoring disturbance of phonation is often found after surgery in this region. The aim of this study was to describe and systematize the nerve supply with special focus on anastomosis, i.e. ansa galeni (Ramus communicans cum nervo laryngeo inferior, NLI). On 8 embalmed cadavers the laryngeal region was dissected and the supplying nerves were exposed under magnification. Ramification and anastomosis were coloured and photographically documented. Data were collated for N. laryngeus superior ramus externus (NLSE) and ramus internus (NLSI), NLR, and NLI. A typical ansa galeni was found in 6 of 8 specimen on both sides. Only in one case there was no ansa galeni detectable. In agreement with our observations an iatrogenic lesion of this anastomosis may lead to unexpected postoperative disturbances of phonation, although the NLR was preserved.

D24. FIRBAS, Wilhelm, Felix KABELKA, Wolfgang HEINRICH, and Manfred KREJS, Department of anatomy, University of Vienna, Austria. **Growth analysis of the human foot.**

In pursuing the noxious influence of foot wear on the morphology of the human foot a series of measurements in 1008 individuals of different ages in our local population was performed. About 700 were young children, because of our interest of the starting time of the deformatting process. In each individual 14 measurements were taken. Various dimensions of the foot and of different toes were measured and three angles in toes determined. These measurements were used for growth diagrams. It became clear, that the starting time for deformation of the foot skeleton is in the first year of childhood. The results of this investigation should give the base for developing anatomically designed shoes, at least when providing shoes for professionals.

D25. FREEL, Christopher D., Kurt O. GILLILAND, Jennifer M. BURGOON, William C. DUNTY, C. Jan SMITH, O. William HENSON, and Noelle A. GRANGER, Department of Cell Biology and Anatomy, University of North Carolina School of Medicine, Chapel Hill, NC, USA. **Integrating computer resources with practical dissection: the use of web-based dissection guides in pre-laboratory preparation.**

We have observed that many medical students enter the anatomy labs with minimal dissection experience. Pre-laboratory lectures provide insight into the dissection but are often temporally removed from class due to reductions in anatomy instruction hours, leaving students to prepare individually. Recent advances in computer educational technology have produced a number of commercially-generated resources that students can use to study anatomical details. Course directors must choose the software that best fits their syllabus' objectives, while keeping a balance between time spent on dissection and that with outside references. To address this, we have embarked on a project that aims to prepare each student for dissection and integrate curriculum-specific portions of many external software references. Anatomy graduate students have begun to produce internet-based dissection guides that can be utilized before and after laboratory. They consist of condensed synopses of the dissector coupled with short streaming-videos. Each movie demonstrates several steps of the dissection, focusing on proper identification, performing difficult cuts, and locating hard-to-find structures. The guides also provide grounds to incorporate other software packages. The dissection guides produced for the fall 1999 course were met with success, and additional guides will be constructed this summer.

D26. GOULD, Douglas J., Department of Anatomy and Neurobiology, University of Kentucky Chandler Medical Center, Lexington, KY, USA. **Enhancing the clinical relevance of an anatomy multimedia program.**

The objective of the current project is to increase the clinical relevance of an existing anatomy multimedia program on the formation, structure, and function of the brachial plexus. This in-house program consists of an animation of embryological development, novel illustrations, scrolling text, and a printable sample-testing element all packaged on a CD-ROM. Students using the program are enrolled in first year medical, dental, physician assistant, and physical therapy anatomy courses and were asked to voluntarily evaluate the program by completing a survey questionnaire and by providing additional written comments. Students' evaluations of the program highlighted its ease of use, clear and intuitive navigation, and validation that the use of illustrations and animations were extremely beneficial to their understanding and retention of the material. However, a common criticism, indicated in the written comment section of the survey, underscored the lack of demonstrated clinical significance in the program. This issue was addressed by inclusion of photographs illustrating clinical conditions and relevant pathologies. Photographs provided by The Christine M. Kleinert Institute for Hand and MicroSurgery of Louisville, KY, were combined with "posed" photographs of subjects in order to represent a broad range of injuries. Evaluation of the new clinical element is ongoing, preliminary results indicate that users are very pleased with the photograph's illustration of clinical conditions and the accompanying description of the injuries. As the program continues to evolve it will continue to serve as a premiere ancillary for the study of the brachial plexus for those students in a lab-based course as well as provide a stand-alone substitute for students in courses without a lab component. (Sponsored by a gift from the Lexington Clinic Foundation).

D27. GRANEY, Daniel O., Robert HOLMBERG* and Shelley GOLARD*, Department of Biological Structure and University of Washington, Seattle, Washington, USA. The digital age and dissection. Using Adobe® Photoshop® layered illustrations in the teaching of gross anatomy.

Few anatomists today would dispute the fact that the time allocated to dissection has steadily decreased in the curricula of health sciences schools in Europe, the United States, United Kingdom and world wide in general. The first principle of this work was not to replace dissection, but to find a means by which students could better prepare for and review the limited dissection experience available to them. Another challenge for faculty is the technological revolution occurring in education. At every level of teaching today, the faculty is under pressure from students and administrators to incorporate technology into their teaching by converting and expanding syllabi into digital documents and to develop web sites with multi-levels of interactivity. To meet this challenge Adobe® Photoshop® was used to create a series of illustrations of regional anatomy of the head and neck that could be used to illustrate syllabi and to provide some form of interaction with students. Because Photoshop® enables the artist to build anatomical structure in layers from bone to skin, any number of structures (muscles, blood vessels, nerves, etc) can be turned on or off to customize the illustration for varying purposes. More specifically, using a sequence of illustrations, a region of anatomy can be built layer by layer with accompanying text to enhance the structure, concepts and relationships. While this can be done on paper, it is best demonstrated on the computer either as a standalone program or one accessible by the web. In electronic form a student can virtually dissect from skin to bone or build the anatomy by successive mouse clicks as each layer is added or subtracted on screen. In its current state of development the program has been developed to operate with an Internet browser using Java/Jamba™ code. Medical and Dental students are given the program on a CD or alternatively can access it from a course web page. While web use is effective for students accessing the program on campus or via a high-speed ethernet connection from off-campus, it is not usable with a standard 56k phone modem because of the intensive graphics display. The course syllabus has been enhanced with numerous illustrations, and students are asked to use the Virtual atlas both for lecture and lab preparation as well as review. The results of a two-year evaluative study will be presented.

D28. GRKOVIC, Ivica, Christopher A. BRIGGS, Norman EIZENBERG, and Priscilla J. BARKER, Department of Anatomy & Cell Biology, The University of Melbourne, Parkville 3052, Australia. **Anatomeia™ - A new approach to medical education developments in anatomy.**

Anatomeia™ is an interactive CD-ROM that provides multiple perspectives for each of the 8 modules of the human body, each organised into 4 major perspectives. 'Dissection' includes practical (including emergency) procedures. 'Imaging' incorporates sectional and endoscopic anatomy. 'Regions' incorporates surface and functional anatomy. 'Systems' incorporates conceptual and clinical anatomy. Anatomeia™ is unique in that it uses real human bodies (prepared and photographed in each stage of dissection, layer by layer from skin to bone) complemented by sections, imaging and procedures that enable the user to both construct and deconstruct the human body interactively. Creative visuals with graphic overlays, diagrams and explanations provide a simpler conceptualisation of the complex reality. The user can choose the order and rate in which they study the body, their direction of learning about it (by construction or by deconstruction) and the degree of detail (with optional text, overlays and 'rollover' identifications at every screen). The viewer can alter their approach at any time and view the same anatomical structure from a different perspective (eg. a lumbar puncture followed by an x-

ray of the spine then dissection of the back). An observed benefit of the program is that, in comparison to traditional teaching methods, students are more actively engaged in learning tasks, leading to a deeper understanding of human structure, and stronger basis for clinical diagnosis and management. The content for each module will be available for distribution on a single CD-ROM, alternatively all eight modules could be available on one CD. Practitioners will also be able to choose combinations of modules. Selections from modules on the back and abdomen will be presented.

D29. GUELFGUAT, Mark, William B. ZUCCONI, and Nikos SOLOUNIAS, Department of Gross Anatomy, New York College of Osteopathic Medicine, NY, USA. **An anomalous tendon of the peroneus brevis muscle: anatomical and clinical significance.**

An aberrant tendon of the peroneus brevis muscle was encountered during a routine cadaveric dissection. While passing in the retromalleolar groove, the peroneus brevis tendon flattened and reached 0.5 mm in thickness. Then, prior to running under the inferior peroneal retinaculum, the tendon split forming anterior and posterior portions. The posterior part fanned inferiorly as a flat aponeurotic sheet and inserted into the calcaneus. Its attachment extended anteriorly from the middle of the osseo-aponeurotic canal formed by the inferior retinaculum until the middle of the calcaneofibular ligament posteriorly. The anterior division at the origin constituted a narrow cord (2 mm in diameter). Passing under the inferior peroneal retinaculum, the tendon conically widened, assumed its normal diameter, and continued the usual course. Although numerous congenital variations of the peroneus brevis tendon have been already described, none of them mentioned a combination of the calcaneal attachment with wasting of the tendon. This variation is clinically significant because the peroneus brevis tendon has been commonly used as a donor for split grafts in reconstruction of the lateral ankle instability. A complete transfer of the tendon has been utilized in repairs of the Achilles tendon ruptures and treatment of spastic equinovarus.

D30. HASANOVIC, A., Department of Anatomy, University of Sarajevo, Bosnia and Herzegovina. **The demonstration of the collaterals of coronary arteries using the method of coronary angiography, dissection and injection-corrosion method.**

Collateral circulation has always attracted the attention of anatomists, pathologists, surgeons as well as clinicians. Its real significance is expressive in a case with occlusion of coronary arteries (angina, myocardial infarction, congenital cardiovascular malformations etc.). Therefore, the aim of the investigations was to demonstrate the different types of collaterals of the coronary arteries using the method of coronary angiography, dissection and injection-corrosion method. The investigations were carried out on the human cadaveric hearts from the Department of Anatomy, and on patients at the Cardiology Department and the Radiology and Oncology Institute of Clinical Centre in Sarajevo. Clinical investigations were retrospective and prospective on patients that were treated in hospital, and on patients that just arrived in hospital (based on findings of coronary angiography). The investigations results show the existence of the different types of collaterals: intercoronary and intracoronary collaterals. We established collaterals in a case with occlusion of the right and left coronary artery and its branches. Our patients were classified into three groups: 1. Patients with good collaterals and good left ventricular function. 2. Patients with good collaterals and impaired left ventricular function. 3. Patients without collaterals. On the anatomical material we found different types of collaterals as well.

D31. HEYLINGS, David J., Samantha TAYLOR, Clare LAMB, Emma KEARNEY, Julie MEGAW, School of Biomedical Science/Anatomy, Medical Biology Centre, Queen's University of Belfast. **The effectiveness of training in safe lifting techniques, and EMG study.**

Despite concentrated effort in health and safety training, low back pain (LBP) has reached epidemic proportions. The effectiveness of an industrial health and safety training package to prevent LBP was evaluated in a gait analysis laboratory. Ten healthy subjects were examined and the surface EMG activity was recorded simultaneously in the right and left quadriceps and erector spinae muscles during a "freestyle lift" of a 3.5 kg. load. No discernible pattern of muscle activity between either side or between any of the four muscle groups was noted. Muscle activity across the midline was not symmetrical and quadriceps activity was low in most subjects, indicating a non safe lifting technique. All of the subjects underwent training in safe manual handling procedures, which emphasised the use of lower limbs and balancing the load between both sides. The EMG recordings were repeated. Muscle activity was now more balanced across the midline and many subjects demonstrated a considerable increase in the activity of the quadriceps muscles. The study demonstrated clearly the effectiveness of training in safe lifting techniques in the short-term.

D32. HUEBNER, K.U., A. SCHLAGER, R. BURGER, M. SCHMUTH, and L. SPOELL, Clinic of Orthopaedics, University of Innsbruck, Munich, Germany. **Healing of burns after treatment with 670-nm-low-power laser light.**

Recent investigations have reported contradictory results in the influence of low-power laser light on wound healing. Low-power laser with a power output of 250mW and an emitted laser light of 670 nm have been insufficiently investigated to date. We investigated the effect of a 250 mW/670 nm laser light on the healing of burning wounds in rats. Thirty rats were burned on both flanks. One wound was irradiated with 670 nm laser light (2 J/cm²) whereas the other side remained untreated. Macroscopic evaluation of the wounds was performed daily. Ten, 20 and 30 days after burning ten rats were sacrificed and the wounds histologically evaluated. Neither macroscopic nor histological examination of the irradiated wound showed accelerated wound healing when compared to the control wounds. In the present study irradiation of burns with 250 mW/670 nm laser

D33. JENKINS, David B. and Thomas C. OCHELTRREE, Section of Anatomy, Southern Illinois University School of Dental Medicine, Alton, IL., USA. **The parotid gland and its relationship to the pterygomandibular space.**

A possible complication of the classic inferior alveolar nerve block is temporary facial paralysis on the side of the injection. One explanation presented in the literature for such paralysis is entry of the syringe needle into the capsule of the parotid gland and subsequent anesthesia of the branches of the facial nerve that pass through the gland. Such an injection would indicate that either the needle passed posteriorly beyond the mandibular foramen (the normal target area for the injection) to enter the gland or that the parotid gland extends into the pterygomandibular space to lie near the mandibular foramen. Some published descriptions and illustrations provide support for the latter. This study was initiated to examine the presence and extent, if any, of the parotid gland within the pterygomandibular space. Ten dissected cadaver specimens and 157 computerized tomographic images were examined. Only six of the scans showed even minimal projection of the gland into the space, but no similar relationship was observed in the cadaver specimens. These preliminary results suggest that if temporary facial paralysis occurs during a

classic inferior alveolar nerve block only after injection directly into the parotid capsule, such paralysis is due to faulty technique and not the presence of the gland within the pterygomandibular space. (Sponsored by the SIU School of Dental Medicine Research).

D34. JEVOOR, Praful S., Butchi R. POTTURI, and Sharad M. ANTIN, Department of Anatomy J.N. Medical College, Belgaum , India. **Unilateral agenesis of pectoral muscles.**

A case of agenesis of pectoral muscles is presented. A male aged 22 years presented with a well marked depression in the right infra clavicular area. Physical examination revealed absence of the costal components of attachment of the pectoralis major muscle. Ribs were felt beneath the skin. CT scan of the thorax demonstrated absence of the pectoralis minor and sternocostal head of pectoralis major. There were no physical or radiological evidence of associated abnormalities of the upper extremity on the affected side. Functional tests particularly of adduction and internal rotation movements of the shoulder joints were normal. These findings suggest that the anomaly of partial agenesis of muscles do not result in significant functional deficiency, as result of compensation by the other muscles. Interestingly, the patient approached the hospital for pain in the leg and not for the anomaly observed. The study was carried out, as little documentation is available on the functional deficits caused by such anomaly on the movements of the shoulder.

D35. KAGAN, Iliia I., Sergey B. TULUPOV, and Anna V. SHATZKICH, Department of Operative Surgery and Clinical Anatomy, Orenburg Medical Academy, Orenburg, Russia. **Differences in macromicroscopical anatomy and topography of ciliary body area and posterior part of the eyeball.**

The purpose of the research is to obtain data for the improvement of the microsurgery on the eyeball. Differences in anatomical structure and histotopography of the ciliary body, scleral venous sinus, sclera, posterior part of the eyeball wall and intra-ocular part of the optic nerve were investigated on 50 eyeballs of adult cadavers by the preparation of meridional and frontal sections in 4 eyeball segments: superior, inferior, medial and lateral. Histotopographical sections were dyed by method of Van Gieson and hematoxylin-eosin. It was found that there were differences in anatomical structure and topography of the ciliary body and the scleral venous sinus in diverse segments of the eyeball. Length of the ciliary body ranges from 1.2 to 4.2 mm in different segments, while the thickness is from 0.6 to 1.4 mm. On average the ciliary body is longer in the medial segment ($3.2+0.25$ mm) and shorter in the superior segment ($2.9+0.12$ mm). The scleral venous sinus may have different forms and dimensions in diverse eyeballs and diverse segments of the same eyeball. The diameter of the scleral venous sinus varies: horizontal - from 0.1 to 0.7 mm, vertical – from 0.05 to 0.15 mm. On average this sinus has the most clear space in the medial segment ($0.45+0.09$ mm), the least - in the superior segment ($0.33+0.06$ mm). Circular zone of the sclera behind the corneal limbus with the width up till 2.1mm is a projection of the scleral venous sinus, iridocorneal and iridociliary angles. The projection of the posterior border of the ciliary body ranges from 1.6 to 5.5 mm behind corneal limbus, in medial and lateral segments nearer to limbus, than in superior and inferior segments. The posterior ciliary arteries and ciliary nerves enter the sclera around optic nerve by radius from 9 to 12 mm. The findings could be useful in performing microsurgical operations on the eyeball.

D36. KIRCHMAIR, Lukas, and Bernhard MORIGGL, Institute of Anatomy and Histology, University of Innsbruck, Innsbruck, Austria; Anatomische Anstalt, LMU-Munich, Munich, Germany. **Paraspinal color Doppler sonography concerning blood vessels at the level of lumbar intervertebral foramina.**

Paraspinal vessels are at risk during several special techniques of regional anesthesia (e.g. psoas muscle compartment block, lumbar plexus block) and minimal invasive surgery at the lumbar spine. Systemic toxicity and severe bleeding are the main complications. This study aims at developing a practical, non-invasive method for preoperative evaluation and a base for US-guided injections. Following a pilot study (evaluation of suitable echo planes, reproducibility and equipment; N=5), healthy test persons (N=21; 13 male, 8 female; aged 18 to 43) were investigated by means of a 5 MHz curved narray probe. By using bony land marks, the well known arteries and veins could be clearly visualized from Th 12 to L4 in the vast majority of volunteers (90%). Description of detailed topographical relationship between vessels and intervertebral foramina was possible with reference to a defined and reproducible triangular field. However, individual geometry of the pelvis made it difficult to perform sonography at L4/L5 (30% only), and reliable imaging of vessels at L5/S1 was nearly impossible. According to the results of our study, color Doppler imaging is a promising and non-invasive tool for assessment of the individual paraspinal vascular situation in the lumbar region for both, ultrasound guided injection techniques and preoperative planning.

D37. KOSHI, R., G. CHANDY, and M. M. MATHAN, Department of Anatomy and Gastrointestinal Sciences, Christian Medical College, Vellore, India. **Enteric microvascular endothelial response to toxic stimuli in acute infective diarrhoea.**

Endothelial cells are highly specialized cells with numerous sensory and modulator functions. Our earlier work has shown light microscopic changes in the gut vasculature of patients with acute infective diarrhoea. In this study, electron microscopic changes in duodenal and rectal mucosal vasculature in 12 patients with cholera and 14 patients with bacillary dysentery are presented. Mucosal tissue biopsies were collected within 72 hours of the onset of illness and before any specific treatment for diarrhoea was begun. Informed consent was obtained in all cases and the study was approved by the College Ethical Committee. Changes were seen mainly in the capillaries and venules. In the capillaries, luminal surface of endothelial cells showed increase in microvillous-like projections and surface blebs. There were signs of endothelial cell activation including cell hypertrophy, increase in rough endoplasmic reticulum and Wiebel-Palade bodies. Cell injury with swelling of mitochondria, dilatation of endoplasmic reticulum and Golgi, rarefaction and fragmentation of cytoplasm was also seen. Vascular permeability was altered and RBCs were seen migrating through the vessel wall. In venules, neutrophils and lymphocytes were adhering to the luminal surface of activated endothelial cells. There was accumulation of actin filaments at the cell periphery and widening of intercellular spaces. Increased platelet activity led to platelet adherence, aggregation and thrombus formation. Changes in the endothelial lining of the enteric mucosal vasculature in acute diarrhoea could contribute to the pathogenesis of the disease.

D38. KOVACS, Peter, Hannes BEHENSKY, Gerd BODNER, Erich BRENNER, and Bernhard MORIGGL, Institute of Anatomy and Histology, Department of Orthopedics, Department of Radiology, University of Innsbruck, Innsbruck, Austria; Anatomische Anstalt, LMU-Munich, Munich, Germany. **Can high resolution ultrasonography reliably assess artificial tendon lesions?**

Partial tendon lesions with more than 60 % of the cross-sectional area should be repaired surgically. Whether or not dimensions of artificial partial tendon lesions can be reliably assessed sonographically (to decide about surgical treatment), was the objective of our study. The tensioned tendon of the tibialis anterior muscle of human cadavers was cut twice (transversely, different depths) along its dorsal surface (N=50). Width and depth of the lesions were measured with a 10 MHz linear probe (with stand-off pad) and by means of a slide calliper. Just proximal to the cuts, tendon thickness was also measured. The cross-sectional area of the tendon and the lesion was calculated by approximation. Lesions dividing the tendon by less than 60 % were classified as "A-cuts", the remaining as "B-cuts". Seven total divisions were excluded. The measurements for all cuts (N=43) correlated with 0.82 for the width and 0.80 for the depth. Despite poor correlation for depths of "B-cuts" (0.42), which we assume was due to subtotal lesions, we conclude that high resolution ultrasonography is able to assess the degree of partial tendon lesions. Thus, it can be regarded as a helpful tool in weighing the pros and cons for surgical repair.

D39. KYALYAN, Gohar P., and Narine H. SARGSYAN, Department of Human Anatomy, Yerevan State Medical University, Armenia. **Peculiarities of the ultrastructural changes of the liver acinus in duodenal ulcer complicated with decompensated pylorostenosis.**

This report is a fragment of the complex clinicomorphological research and includes the results of the electronic microscopic investigation of parenchymal-vascular changes in the liver of the 18 patients in second maturity with duodenal ulcer complicated with decompensated pylorostenosis. The hepatocytes (H) of the I zone were hypertrophic and had round nucleus in shape with condensation of chromatin in clods and edematous enlightened carioplasm. There were hyperplasia of rough endoplasmic reticulum and mitochondria (M) in the cytoplasm. Most of M were of middle size with edematous enlightened matrix and unusual shape resembling of honeycombs. The smooth endoplasmic reticulum (SER) rarely appeared. There were collagen fibers in perisinusoid space and between the H. In the same cases in III zone of acinus H with double nucleus and H with hypertrophic nucleus revealed more and again in edematous state. Primary and secondary lysosomes appeared in cytoplasm, hyperplasia of I type of SER. The collagen fibers appeared between the H. In our opinion an interesting discovery is the enlargement of sinusoid profile due to the fragmentation of one sinusoid into smaller ones with a common wall. Enlargement of biliary canal profiles is determined due to the same mechanism. Cytollemma composing the biliary canal wall is necrotic, in some places dystrophic. Cytoplasm of neighbour hepatocytes are in deep edematous state. Thus, the data of the investigation allow to estimate inflammatory destructive affection of the liver, which has compensating-adapting character.

D40. LACHMAN, Nirusha, Robert D. ACLAND, Ebrahim A. VANKER, Erle AUSTIN, Brian A. ARONSON, and K.S. SATYAPAL, Technikon Natal; University of Louisville; University of Durban Westville. **A morphometric study of the extra-coronary collaterals.**

Collateral vessels from bronchi, diaphragm, mediastinum, and vasa vasorum of great vessels form anastomoses with branches of coronary arteries. Extra-coronary collaterals [ECC's], are thought

to be a source of unwanted bleeding during cardiac surgery. In addition, they are being seen as potential supplementary vessels that may be therapeutically enhanced to sustain a compromised myocardium. Although Hudson's [1921] presentation provided a basis for localization of ECC's, its value is limited by use of invasive exploration techniques and technological limitations. To enable clinicians to manipulate ECC's, their detailed morphometry, not previously described, needs to be documented. This study employs a minimally invasive technique that allows cannulation of coronary ostia endoscopically. In pilot investigations, ostia were visualised using an endoscope through the right subclavian artery. Coronary arteries were cannulated with through-lumen Fogarty catheters. Lead Oxide-Microfil® solution was injected fluoroscopically to produce complete filling of the coronary tree. After allowing the injection mass to solidify, a detailed micro-dissection was carried out. ECC's were identified and measured, using calibrated metric rods. In pilot investigations it was possible to trace ECC's to points of origin, count number of connections and measure length and external diameter of main branches. Data from our results will be presented.

D41. LAMB, Clare, Deirdre McCAY, Nicola GILLEN, David J. HEYLINGS, School of Biomedical Science/Anatomy, Medical Biology Centre, Queen's University of Belfast.
Temporalis a further note on the distal attachments

Sixteen temporalis muscles were examined in eight cadavers as part of the project to develop a biomechanical model of the muscles of mastication, to identify particularly the insertion of the deep head to the ramus of the mandible. Dissection confirmed the presence of an attachment of temporalis to the anterior aspect of the mandible, descending distally towards the 3rd molar tooth. The deep (anterior) head had attachments to the lingual aspect of the ramus, whilst the superficial anterior fibres descended distally, mirroring the attachment of the deep head but attached to the anterior and anterolateral aspect of the ramus. It was also noted that a group of posterior fibres passing anteriorly towards the coronoid process, gained attachment on their deep surface to the anterolateral aspect of the capsule of the temporomandibular disc. The authors believe these fibres may have a role in drawing posteriorly or at least tethering this aspect of the disc during action of the superior head of lateral pterygoid which attached to the medial aspect of the capsule and disc.

D42. LOUKAS Marios, Chris DIMOPOULOS, Ewa WALCAK, and Teresa WAGNER, Department of Pathology, Institute of Rheumatology, Warsaw, Poland. **Anatomical dimensions of triangle of Koch in perspective of catheter ablation procedures.**

Triangle of Koch contains the compact part of the atrioventricular node and is anatomically demarcated by the anterior extension of Eustachian valve or ridge (Tendon of Todaro), the membranous septum, and the part of septal and anterior leaflets of the tricuspid valve. Inferiorly, Koch's triangle ends at the site of the ostium of the coronary sinus. Catheter ablation procedures for several types of reentrant tachycardias are based on identifying these anatomical landmarks. Variability in the dimensions of Koch's triangle thus may be clinically relevant. We examined 80 hearts. Anatomical landmarks measured were the distance from the central fibrous body to the nearest edge of the coronary sinus (length of triangle of Koch) and the distance from the tricuspid annulus to the nearest edge of the coronary sinus (height of triangle of Koch) were measured using caliber. The overall length varied between 15 and 38 mm, with a mean of 26.3 +/- 4.5mm. The overall height varied between 5 and 26 mm, with a mean of 15+/-4mm. In conclusion triangle of Koch shows considerable individual variations in size. Given the fact that the absolute figures for the range in size of the compact atrioventricular node is much less than that of triangle of Koch, these variations have implications for catheter ablation procedures.

D43. LOUKAS, Marios, Chris DIMOPOULOS, Ewa WALCAK, and Teresa WAGNER, Department of Pathology, Institute of Rheumatology, Warsaw, Poland. **The clinical anatomy of the high take off arteries.**

The aim of this study was to describe and classify the Coronary Aortic Orifices in a clinically useful way. The study was carried on 70 hearts obtained from the routine medicolegal autopsies without any cardiac abnormalities. Macroscopic and microsurgical methods were applied for the measurements of the structures. The aortic valve had 3 leaflets in all specimens. The left coronary artery arose within the left posterior aortic Sinus (of Valsava) in 48 (68.5%) specimens, above the sinotubular junction in 17 (24.2%) and at the level of the junction in 5 (7.1%) hearts. The right coronary artery arose within the anterior aortic sinus in 50 (71.4%) specimens, above the junction in 12 (17.1%) and at the level of the junction 8 (11.4%) An accessory coronary orifice was found in the anterior aortic sinus in 23 (32%) specimens. The coronary arterial orifices are usually located within the aortic sinuses below the sinotubular junction, but are rarely centrally located. We also determined the position of the zones of apposition between leaflets, the size of the leaflets, the number, position and shape of the coronary arterial orifices, and their relation to the sinotubular junction. Concluding, as far as we are able to judge the fact that high take off arteries exists in 24.2% for left coronary artery and 24% for right coronary arteries, implicates an increased risk for sudden cardiac death in the day-to-day practice of invasive cardiology and cardiac surgery.

D44. LUEDINGHAUSEN, Michael von¹, Gerhard SCHINDLER², Daisuke HAYAKAWA¹ and Mitsuhiko MATSUURA¹, ¹Department of Anatomy, and ²Department of Radiology, University of Wuerzburg. **A follicular or dentigerous (tooth-containing) cyst in the premaxilla of an otherwise toothless older man.**

A unilocular follicular or dentigerous cyst with a diameter of 12 mm was found incidentally in the premaxilla of a 65-year-old man through a midsagittal section of the head. The osseous walls of the cyst had a thickness of less than 1mm. The lining coat was pinkish and granular. In the floor of the cyst there was a slender, complete incisor tooth, fully developed and fixed in a transverse position. The patients` alveolar processes were completely devoid of teeth. Post mortem histology of the lining coat revealed a non-keratinizing, stratified squamous epithelium. Post mortem computer tomography showed the cyst containing the tooth in its transverse position and gave an indication of how it would have appeared during his lifetime. Although a dentigerous cyst is a benign lesion, its epithelial lining has the potential to undergo proliferation, growth and neoplastic change: development of a squamous carcinoma has been reported. Thus early diagnosis and complete removal are indicated. Because of its malignant potential on the one hand and rare occurrence in the premaxillary region on the other hand this case has been considered worthy of documentation.

D45. McCAY, Deirdre, Nicola GILLEN, Samantha TAYLOR, and David J. HEYLINGS, School of Biomedical Science/Anatomy, Medical Biology Centre, Queen's University of Belfast. **The preparing of a biomechanical model of the muscles of mastication.**

The construction of a computerised biomechanical model of the human muscles of mastication would be beneficial in the understanding the normal mechanics of and dysfunction of the temporomandibular joint. One problem in constructing such a model is the estimation of the muscle forces involved. This project was designed to generate a morphometric map of the muscles involved in a male and a female cadaver. The length, width and thickness of the

muscles were measured using a set protocol and this data will be used to generate a profile of muscle forces. As muscles were detached, their area of attachment was recorded and outlined on the bone with small pilot holes to ensure the area of attachment was accurately recorded on the casts made of the skull and mandible. This data was supplemented by measurements taken from a further six cadavers (3 male and 3 female), which also noted differences in bony attachments, muscle bulk, size and angle of insertion. The data generated clearly demonstrated that it would be inappropriate to use a single head to model forces acting on both the male and female temporomandibular joint.

D46. MacPHERSON, Brian R., Anatomy & Neurobiology, University of Kentucky, Lexington, KY, USA. **Web-based databasing: a simple answer to a complex instructional issue.**

Learning Objectives are used in most courses taught in our department. The objectives are meant to be a study guide to the student. If they know the material for that lecture, they should be able to answer the objectives. Every year the students complain that answers are not provided for the objectives. While this complaint has instructional merit, a list of answers means that they simply memorize the list. A curriculum stressing critical thinking and extrapolation of answers from a knowledge base shouldn't rely on memorization of answers. Database software is perfectly designed to provide a single answer to a single learning objective. The program developed utilized Filemaker Pro as the database software. Claris HomePage was used to construct a web-based template that would display the required fields from the database to the student. The learning objectives can only be accessed individually with answers displayed one-at-a-time, the previous answer screen disappearing before the search for the next objective answer can begin. Use of the program can be tracked by a web log feature in Filemaker. Student use during the first year ran at approximately 82%, its value to the students rated a 4.52/5.0. Analysis of the web logs indicated that roughly 50% of the users checked every answer sequentially, others checked random answers. Approximately 25% of the students used the database for a purpose that was not initially obvious to the developer - a quiz engine. Minor adjustments are being made to enhance and expand its utilization in other departmental courses.

D47. McWHORTER, David L. and Maria S. COLE, Department of Anatomy, The University of Health Sciences College of Osteopathic Medicine, Kansas City, MO, USA. **Introducing critical appraisal of biomedical literature to first-year medical students in histology.**

Because first-year medical students are accustomed to note taking and reading textbooks, they have difficulty understanding and critically evaluating primary publications. To address this problem, we devised a program to introduce critical reading of biomedical literature throughout our 21-week histology course. During weeks one through four, students were randomly divided into groups and taught how to conduct a MEDLINE search. Groups were required to submit an abstract from a biomedical publication containing histological and clinical elements for approval by week eight. Subsequently, students were asked to attend seminars that described such topics as biostatistics and biomedical publication content. By week 15, groups were required to write and submit for review, a one-page descriptive abstract and the answers to a series of critical appraisal questions. During weeks 16-19, students revised their abstracts and prepared a four-minute oral presentation. Groups were evaluated based on professionalism, organization, clarity, critical analysis, and abstract quality. Although we lack a quantitative assessment of this approach, student, faculty and administration feedback was enthusiastic. Because many clinicians lack formal research training, we believe introducing critical appraisal skills to first-year medical students will help them become discriminating readers of clinical research.

17:00-18:00 BACA LECTURE Palmerston Room

Mr. A. T. Raftery: "Recent Developments in Renal Transplantation"

18:00 Close of Days Meeting

19:00 Reception - Chapel Cloisters or Hall

19:30 Grand Banquet (venue: Hall). Dress informal (jacket and tie). Tickets for delegates who did not purchase the "Meeting Package" are £50 per person.

Distiguished Guest of Honor
Sir Terence A.H. English, KBE,
Master St. Catherine's College, Cambridge

Friday, 21st July

PosterSession 2: Ma through Zucconi go up at 8:30 and are removed at 17:00

9:00-10:30 Platform Session 6: Palmerston Room

"Upper limb"

Chairman:

- 09:00** 31. **J. D. Collins**, E. H. Saxton, & T. Q. Miller. Traumatic injuries of the brachial plexus as displayed by MRI, MRA: Contusion and avulsion.
- 09:15** 32. **A. Hennerbichler**, C. Etzer, C. Papp, & O. Gaber. Anatomical basis of the lateral arm flap in combination with a vascularized bone graft of the humerus.
- 09:30** 33. **H. Lee**, & R. A. Berger. Anatomy of the terminal articular branch of the posterior interosseous nerve.
- 09:45** 34. **M. Rodríguez-Niedenführ**, T. Vázquez, P. Golanó, I. G. Parkin, & J. R. Sañudo. Extensor digitorum brevis manus: anatomical, clinical and radiological relevance.
- 10:00** 35. **D. Choi**, M. Rodríguez-Niedenführ, T. Vázquez, I. G. Parkin, & J. R. Sañudo. Variations in the pattern of branching from the musculocutaneous to median nerves are not uncommon, but clinically important.
- 10:15** 36. **P. C. Amadio**, C. Zhao, T. Momose, M. Zobitz, & K. N. AN. Friction and the work of finger movement.

09:00-10:30 Platform Session 7: Boys Smith Room

"Vascular II"

Chairman: Dr. Ralph Ger

- 09:00** 37. **D. Abraham**, D. Cejka, H. AbrI, R. Hofbauer, & S. Aharinejad. Correlation of angiogenic and angiostatic molecules with tumor-related angiogenesis in a murine model of human testicular cancer.
- 09:15** 38. **H. Abri**, D. Abraham, & S. Aharinejad. Vascular sprouting and intussusceptive vascular growth occur reactive to hypoxia as distinct mechanisms of angiogenesis in later stages of tumor growth.
- 09:30** 39. J. Tantau, & **P. P. Le Floch-Prigent**. One case of sling pulmonary artery and arteria lusoria in a new-born with a Goldenhar syndrome.
- 09:45** 40. **C. Shukla**, A. Hanouka, & H. Ellis. The aetiology of congenital coarctation of the aorta - A review.
- 10:00** 41. **B. Hillen**, & W. W. van Breenen. Predicting collateral capacity of the circle of Willis in healthy volunteers, a pilot study.
- 10:15** 42. **M. Brozici**, A. van der Zwan, & B. Hillen. Anastomoses between the pial arteries: Cross-communications or collaterals.

10:30-11:00 Coffee and biscuits Undercroft, Pythagoras Building

11:00-12:30 Platform Session 8: Boys Smith Room

"CNS and Trunk"

Chairman:

- 11:00** 43. **G. S. Bales**. A metastudy of spinal level input to individual limb muscles.
- 11:15** 44. **S. Zia**, F. W. J. Cody, & D. J. O'Boyle. Impairment of unilateral elbow-joint position sense by Parkinson's disease.
- 11:30** 45. **R. E. Stephens**, W. R. Addington, & K. H. Wendel. Voluntary cough dysfunction and laryngeal cough reflex with acute unilateral cerebral hemispheric infarcts.
- 11:45** 46. **I. M. Best**. Fracture mechanism and subsequent repair.
- 12:00** 47. **K. S. Satyapal**, B. Singh, A. A. Haffajee, J. V. Robbs, & J. M. Kalideen. Anatomical basis for use of donor left kidney in transplantation.
- 12:15** 48. **N. Nair**, & S. R. Pai. Cystic duct duplication - a case report.

11:00-12:30 Platform Session 9: Palmerston Room

"Education"

Chairman: Dr. Todd Olson

- 11:00** 49. **R. Burger**, K. H. künzel, E. Brenner, & O. Gaber. DICOM, a new approach in modern medical education.
- 11:15** 50. **G. Feigl**, G. Schwarz, C. Dorn, & F. Anderhuber. Teaching anatomy in postgraduate courses for regional anaesthesia by simulating arterial pulse.
- 11:30** 51. **D. R. Hilbelink**. "Minding the Gaps" in the Anatomy of the Visible Human Male.
- 11:45** 52. **B. R. MacPherson**, M. Cooper, T. Dolan, & K. Wong-Rutledge. An animated tutorial for the autonomic nervous system.
- 12:00** 53. **B. Vidic**. How to ensure proper place for structural sciences in the present-day medical curriculum.
- 12:15** 54. **R. D. Acland**. The auditory ossicles and their movements: a three-dimensional presentation.

12:30-13:45 Buffet Lunch Main Dining Hall (included in day's Registration fee)

13:45-15:15 Platform Session 10: Palmerston Room

"Head and Neck"

Chairman: Professor H. Ellis

- 15:15** 55. **D. W. Furnas**. The superficial musculoaponeurotic plane in facial surgery.
- 15:30** 56. **K. O. Gilliland**, & C. D. Freel. An identity crisis for the accessory nerve.
- 15:45** 57. **N. Lachman**, R. D. Acland, & C. Rosse. The "cranial root" of the accessory nerve: an anatomic myth revisited.
- 16:00** 58. **P. H. Dangerfield**, C. J. Roche, S. E. King, & H. M. Carty. Rotation of the atlanto-occipital joint, investigated using CT and MRI.
- 16:15** 59. **S. S. Backhouse**, & S. T. Browning. The importance of anatomical knowledge when planning minimally invasive access to the anterior ethmoid artery.
- 16:30** 60. **G. Roblin**, H. B. Whittet, & P. Ebden. The anatomical basis of simple snoring and obstructive sleep apnoea.

ABSTRACTS OF PLATFORM SESSIONS, July 21st:

31. COLLINS, James D., Ernestina H. SAXTON, and Theodore Q. MILLER, Departments of Radiology and Neurology, UCLA School of Medicine, CA, USA. **Traumatic injuries of the brachial plexus as displayed by MRI, MRA: Contusion and avulsion.**

Acute and chronic injuries alter fascial planes and adjacent tissues, compromising the neurovascular supply to upper extremity. Blunt trauma to the shoulder girdle and traction injury of the brachial plexus cause avulsion of cervical and thoracic nerve roots (Clin.Anat, 12:A 201). Shoulder girdle fractures cause contusion. Patients present with loss of the use of the hand or the arm. Bilateral MRI and MRA displays sites of contusion and avulsion of the brachial plexus. The signal intensities of landmark anatomy are altered on T1 weighted images. Fast Spin Echo (FSE) confirms edema and high signal intensity of extravasated cerebrospinal fluid (CSF) from the ruptured dura of the nerve roots. Fractured humerus with contusion (automobile); contusion of the shoulder girdle (baseball), and avulsion of cervical nerve roots (horse and motorcycle) were selected for this presentation. Imaging was conducted on the 1.5 Tesla GE Signa, T1 weighted and selective Fast Spin Echo (FSE) sequences were acquired. Low signal intensities of dural cysts and displacement of nerve roots were demonstrated. Bilateral MRI of the brachial plexus distinguishes between avulsion and stretching of nerve roots. MRI is the definitive modality for evaluation of patients with suspected contusion and avulsion injuries of the brachial plexus.

32. HENNERBICHLER, Alfred, Christian ETZER, Christoph PAPP, and Othmar GABER, Institute of Anatomy, University of Innsbruck and Department of Plastic surgery, Salzburg. **Anatomical basis of the lateral arm flap in combination with a vascularized bone graft of the humerus.**

In plastic and reconstructive surgery, the lateral arm flap is a frequently used transplant for reconstruction of soft tissue defects. Using this graft with an adherent bony fragment is useful when not only a soft tissue damage but also a bony defect or pseudoarthrosis has to be treated. For this purpose, we investigated 12 cadavers by injecting red latex milk into the subclavian arteries. The vessels, muscles and the humeral bone were dissected, focusing the lateral part of the humerus and recording the variance of the periosteal arteries of the humerus. In addition, in 15 humeral bones the lateral cortical bone and the spongial bone were investigated. The main supplying vessel of the lateral arm flap is represented by the radial collateral artery, which originates from the deep brachial artery. It splits into a posterior branch and an anterior branch, which accompanies the radial nerve, gives branches to the adjacent muscles and the radial nerve, but does not supply the lateral arm flap. The posterior branch has 13 -21 vessels for the surrounding muscles, 10 -14 vessels for the lateral aspect of the humeral bone and one or two vessels for the lateral arm flap. The thickness of the lateral cortical bone was 1.2 mm at the height of the lateral humeral epicondyle and 0.9 mm at 2.5 cm above the epicondyle. Under this thin cortical bone we found a spongial bone of very compact structure. Up to now this graft has been used in three patients with excellent results. It is not necessary to use the anterior branch of the radial collateral for the graft, because it has no impact to the vascularization of this flap.

33. LEE, Hyeyeon, and Richard A. BERGER, Department of Anatomy, Yonsei University College of Medicine, Seoul, Korea, and Orthopedic Biomechanics laboratory, Mayo Clinic, Rochester, MN, USA. **Anatomy of the terminal articular branch of the posterior interosseous nerve.**

The posterior interosseous nerve(PIN) terminates as a sensory nerve, which is considered to transmit principally afferent signals from the wrist. Little is known about the specific types of afferent signals transmitted through the PIN and little is known about the details of the distribution of the terminal branches. In an effort to further understand the potential role of resection the PIN for pain control in patients with intractable wrist pain, a study of eighteen adult cadavers was undertaken. Using surgical microscope, the course of the terminal branches of the PIN was recorded in detail. The PIN was consistently found on the floor of the 4th extensor compartment where it typically was accompanied by the posterior division of the anterior interosseous artery. Typically, the PIN widened into what is referred to as a nodosa enlargement. The average diameter of the PIN proximal to the nodosa enlargement was 0.75 mm and the diameter of the nodosa enlargement ranged from 1.1 to 3.5 mm. The nodosa enlargement was mostly found superficial to the DRU ligament only (33.3%), superficial to the DRC ligament only (27.8%) or superficial to both the DRU and DRC ligaments (22.2%). The branch to the DRU ligament arose proximal to the nodosa enlargement (61.1%), there it entered the joint between the DRU and dorsal radiomarginal arcuate ligaments. Between one and three branches arose from the nodosa and entered the DRC, typically through its middle thirds. Most specimens had two branches that entered the DIC, typically through its proximal and middle thirds. In 77.8% of dissections, individual branches were identified in variable combinations that entered the dorsal inter -osseous ligaments within the carpal rows. The most consistent termination(83.3%) of the PIN occurred at the 3rd CMC joint.

34. RODRÍGUEZ-NIEDENFÜHR Marc, Teresa VÁZQUEZ, Pau GOLANÓ, Ian G. PARKIN, and José R. SAÑUDO, Unit of Anatomy and Embryology, Autonomous University of Barcelona, Spain. Department of Morphological Sciences, University Complutense of Madrid, Spain. Department of Morphological Sciences, University of Barcelona, Spain. Department of Anatomy, University of Cambridge. Great Britain. **Extensor digitorum brevis manus: anatomical, clinical and radiological relevance.**

The extensor digitorum brevis manus (EDBM) is a supernumerary muscle in the dorsum of the hand. It has been frequently misdiagnosed as dorsal wrist ganglion, exostosis, tendon sheath cyst or synovitis. Its presence in a living subject, confirmed by MRI, will be presented together with a review of the hitherto reported cases and with the results of an anatomical study on a large statistically reliable sample of human cadavers. This was carried out on 128 adult cadavers (59 males and 69 females). The EDBM was found in 3 cadavers (2.3%), 2 male (3.4%) and 1 female (1.5%). In 1 cadaver it was bilateral and in 2 unilateral (1 left, 1 right), i.e. it was found in 4 out of 256 upper limbs (1.56%). It originated from the dorsal wrist capsule within the compartment deep to the extensor retinaculum for the extensor digitorum (4th) and inserted into the extensor hood of the second finger in 1 case (25%) and into that of the third finger in 3 cases (75%). In all cases, it was innervated by the posterior interosseous nerve and its blood supply was provided by the posterior interosseous artery.

35. CHOI David, Marc RODRÍGUEZ-NIEDENFÜHR, Teresa VÁZQUEZ, Ian G. PARKIN, and José R. SAÑUDO, Department of Anatomy, University of Cambridge, Great Britain. Unit of Anatomy and Embryology, Autonomous University of Barcelona, Spain. Department of Morphological Sciences, University Complutense of Madrid, Spain. **Variations in the pattern of branching from the musculocutaneous to median nerves are not uncommon, but clinically important.**

Variations in branching between the musculocutaneous and median nerves in the arm are not as uncommon as were once thought. Aberrations are important for several reasons: in the correct interpretation of clinical neurophysiology; in trauma to the shoulder and the anatomy of anterior repairs; and in the understanding of median nerve dysfunction. Median nerve deficits, the “Simian hand”, may be elicited by damage of the musculocutaneous nerve. Also, though rare, entrapment syndromes of the musculocutaneous nerve at the coracobrachialis muscle may present like a carpal tunnel syndrome. There have been many attempts in the literature to classify these variations, some more helpful than others. This led us to perform a study of 90 cadavers (180 arms). Abnormal branches between the musculocutaneous and median nerves were seen in 47 arms (26.1%), 3 cadavers had bilateral abnormalities, and 41 unilateral. The side or sex of the cadaver was not associated with the presence of an abnormal branching pattern. We classify the variations in three main patterns: pattern 1, fusion of both nerves (7 arms); pattern 2, the presence of one aberrant branch (37 arms); pattern 3, two aberrant branches (3 arms). Further variations are described, and the classification systems in the literature are reviewed.

36. AMADIO, Peter C, Chunfeng ZHAO, Toshimitsu MOMOSE, Mark ZOBITZ, and Kai-Nan AN, Department of Orthopedics, Mayo Clinic and Mayo Foundation, Rochester, MN, USA. **Friction and the work of finger movement.**

The movement of a tendon within the digital fibrous sheath requires that the tendon force exceed those forces opposing motion. These forces consist of friction between tendon and sheath, the dead weight of the part to be moved, friction within the joint to be moved, and the viscoelastic force of any soft tissues that must be deformed. We have established a method to measure and analyze these forces in vitro, and the factors that affect them. Specifically, the effects of lubrication and roughness of the tendon surface, and soft tissue edema have been shown to significantly affect the work of flexion. The forces needed to move the tendon are also affected by the lever arm between tendon and the joint axis. Clinical implications of these properties of tendon gliding will be demonstrated through examples of tendon grafting, pulley reconstruction, and tendon repair. (Supported by grant AR44391 from the US Public Health Service National Institute of Arthritis and Musculoskeletal and Skin Diseases).

37. ABRAHAM, Dietmar, Daniel CEJKA, Hojatollah ABRI, Reinhold HOFBAUER, and Seyedhossein AHARINEJAD, Departments of Anatomy, and Medical Biochemistry, University of Vienna, Vienna, Austria. **Correlation of angiogenic and angiostatic molecules with tumor-related angiogenesis in a murine model of human testicular cancer.**

Expansion of solid tumors beyond microscopic dimensions requires the recruitment of new blood vessels from pre-existing vasculature, a process called angiogenesis. To switch on angiogenic phenotype, upregulation of angiogenic growth factor stimulators, and downregulation of endogenous angiogenesis inhibitors are necessary. It is evident that colony stimulating factor-1 (CSF-1) potentiates tumor growth and invasion, and we have shown that CSF-1 promotes angiogenesis in vivo. Our aim was to find correlations between mRNA expression of angiogenic and angiostatic factors and tumor-related angiogenesis. Highly malignant human testicular non-

seminomatous germ cells were injected into the testes of SCID-mice. Angiogenesis was monitored chronically using intravital video microscopy (IVM). The mRNA levels of CSF-1, the angiogenic vascular endothelial growth factor B (VEGF-B), and the angiostatic thrombospondin-1 (TSP-1) were assessed in testes of tumor and control mice, using RT-PCR on days 7, 14, 21, 28 and 37 after cancer cell or Ringer solution injection. Vascular sprouting had a rapid rate during the first 14 days of tumor growth and decreased thereafter until day 28 to increase again. In tumor bearing mice, CSF-1 and TSP-1 mRNA levels were markedly upregulated vs. controls, while VEGF-B mRNA levels were not. These results suggest that angiogenic CSF-1 leads to upregulation of angiostatic TSP-1 and vice versa. Both molecules may serve as tumor markers and prognostic tools in human malignant testicular non seminomatous germ cell tumor.

38. ABRI, Hojatollah, Dietmar ABRAHAM, and Seyedhossein AHARINEJAD, Department of Anatomy, University of Vienna, Vienna, Austria. **Vascular sprouting and intussusceptive vascular growth occur reactive to hypoxia as distinct mechanisms of angiogenesis in later stages of tumor growth.**

Tumor growth relies on growth of new blood vessels from preexisting ones, a process called angiogenesis. Hypoxia stimulates angiogenesis and rapid tumor growth causes hypoxia. To examine the effect of hypoxia on tumor-related angiogenesis at the microcirculatory level, we studied neovascularization using intravital video-microscopy. Malignant human non-seminomatous germ cells were injected into testes of SCID mice and the tumor vasculature was observed chronically up to five weeks after cancer cell or Ringer solution injection, and data were assessed per unit area. In sham-mice, the number of capillary sprouts (NCS), the intercapillary distance (ICD; indicative of oxygen diffusion distance), holes in vessels (INT; indicative of intussusception), total (TMVD; all vessels), functional microvascular density (FMVD; blood-perfused vessels), were 3.7, 18.6, 0, 1334, 1151, respectively. In tumor bearing mice, NCS, ICD, INT, TMVD, FMVD on days 7, 14, 21, 28, and 37 after cancer cell injection were 13.8, 10.3, 7.4, 8.8, 9.6; 36.5, 32.3, 47.9, 137; 2, 0, 2, 16, 12; 1668, 1590, 1158, 847, 1457; 1260, 1226, 789, 319, 937; respectively. The NCS in tumor mice was significantly higher than in sham mice, regardless of tumor stage. Decrease of NCS correlated with increase of ICD and was associated with occurrence of INT. Both TMVD and FMVD correlated with NCS. Our data show that vascular sprouting alone does not occur reactive to hypoxia; it is accompanied by INT at least in later stages of tumor. INT might be a supportive mechanism for tumor-related neovascularization.

39. TANTAU, Julia, and Patrice, P. LE FLOCH-PRIGENT, Department of Pathology, Hôpital Cochin and Institute of Anatomy, Paris-Ouest School of Medicine, Paris, France. **One case of sling pulmonary artery and arteria lusoria in a new-born with a Goldenhar syndrome.**

The autopsy of a new-born showed two vascular anomalies associated (but independent) a sling pulmonary artery and an arteria lusoria. The sling pulmonary artery was born from the origin of the right pulmonary artery (with a normal course but toward a right lung without fissure or segmentation). As usual, the sling pulmonary artery passed on the right end of the lateral carina then on the upside face of the origin of the right bronchus printing there a depression in gutter, and continuing in contact with the posterior faces of the origin of the right bronchus, of the tracheal bifurcation and of the origin and extra-pulmonary way of the left bronchus reducing their caliber and ending into a left lung with two completely separated lobes. The cartilagenous rings of the trachea were complete, its course (looking short) was initially slightly curved to the left, the oblique toward the bottom and the right, and curved with a right convexity; these directions looked in relation with the anomalies of the cervico-thoracic spine. The ductus

arteriosus was opened with a perimeter of 8 mm. The literature of these two vascular anomalies which first one is rare, are discussed.

40. SHUKLA, Chitranjan., Allen HANOUKA, and Harold. ELLIS, Department of Anatomy, Kings College, UK. **The aetiology of congenital coarctation of the aorta - A review.**

There is much speculation on the aetiology of congenital coarctation of the aorta of which there are 2 distinct types, isthmal hypoplasia and the localised juxtaductal shelf. This review discusses the main theories and their drawbacks including:

- 1) The Skodaic theory of obliterating ductal tissue extending into the aorta.
- 2) The flow theory of vessel diameter being proportional to fetal blood flow.
- 3) Hutchins's theory that coarctation is a consequence of the ductus arteriosus forming a branch point.
- 4) The embryonic theory of abnormal cranial migration of the 7th intersegmental artery.
- 5) The genetic theory associating coarctation with genetic/familial factors.
- 6) Abnormal neural crest cell migration theory.

Unfortunately no theory provides the answers to the cause of this condition. The anatomy has been well documented but its relationship to the physiology is not clearly defined.

We propose that a way forward would be to study flow dynamics in fetuses from 6 weeks gestation onwards using echocardiography. However this may prove to be irreproducible and therefore we may have to be content with accepting the condition as a consequence of multiple factors interacting or perhaps due to an unidentified factor.

41. HILLEN, Berend, Willem W. van BREENEN, Department of Functional Anatomy, University Medical Centre Utrecht, The Netherlands. **Predicting collateral capacity of the circle of Willis in healthy volunteers, a pilot study.**

With modern imaging modalities (CT, MR, US) many parameters on the cerebral vascularisation and circulation can be measured, but it is not easy to get an overall picture from these data. One reason for this is the large variability of the circle of Willis influencing the cerebral haemodynamics. Recently mathematical models of the cerebral circulation have been used successfully in studies on groups of patients to interpret the results in a qualitative way. The present study was designed to assess the value of mathematical models of the cerebral circulation in individual cases quantitatively. Two healthy male volunteers, 20 years and 23 years of age were submitted to a MR protocol. Firstly, baseline measurements of flow in the afferent vessels and diameters of all segments were made. With these data the mathematical model could be tuned to the individual case. Subsequently the volunteer was asked to compress his carotid artery unilaterally and the measurements were repeated. Without prior knowledge of the data the flow changes in the experiments were calculated with the model and compared to the outcome of the MR measurements. The first results made clear that cerebral autoregulation (not included in the model) interfered strongly. However, the number of measurements allowed to adjust the resistances in the model manually and still have independent variables to compare the changes in the carotid and basilar arteries after unilateral carotid compression. After manipulation of the resistances the model closely predicted the measured flows in two remaining afferent vessels. These results are promising, especially in view of the fact that the two circles of Willis were remarkably different. The inclusion of autoregulation in the model is imperative for further developments.

42. BROZICI, Mariana, Albert van der ZWAN, Berend HILLEN, Department of Functional Anatomy, Utrecht, The Netherlands. **Anastomoses between the pial arteries: Cross-communications or collaterals.**

Cerebrovascular disease is an important problem of neurology and neurosurgery. The presence of anastomoses between pial arteries and their physiological significance is still controversial (Powers, *Ann Neurol*, 29, 1991). We are interested if the anastomoses can function as collaterals, i.e. "subsidiary vascular channels which provide a secondary mechanism against failure of the primary vessel" (Fields, *Handbook of clinical neurology*, 1972). We conducted a study on the anastomoses along three lines, viz.: mathematical model, experiments, morphological study. A mathematical model was designed based on a morphological study of the anastomoses' location and dimensions. The model computes several quantities not accessible from brain scans, such as the boundary shift of the distribution territories of the anterior (ACA) and posterior cerebral arteries (PCA), and the pressure at the anastomose level, when the middle cerebral artery (MCA) is occluded. To provide model validation and input values, flow measurements were done on fresh human brains in the cerebral arteries for different input pressures and arterial patency conditions. The simulation results were similar with the flow measurements. Both indicate that fluid dynamics laws govern the anastomoses' response at MCA occlusion. We further hope to demonstrate that anastomoses can provide a valuable collateral circulation in patients with severe cerebrovascular disease.

43. BALES, Gerald S., Department of Anatomy, Western University of Health Sciences, Pomona, CA, USA. **A metastudy of spinal level input to individual limb muscles.**

The association of spinal levels with individual muscles is useful both for clinical testing to determine lesion levels, and for predicting functional deficits from known lesion levels. Not all anatomy references give spinal levels for individual muscles and those that do vary. Very few reference the primary literature. The study purpose was to (a) document the variation in spinal level - muscle association published in mainstream anatomy books, (b) detect patterns of agreement / disagreement, (c) hypothesize causes for the pattern(s) (d) achieve a "consensus" for each muscle, and (e) revise the association of spinal levels with functional groups where justified. Sixteen books representing a variety of sizes, styles and purposes, were analysed. A subset of these authors also indicated predominance or constancy of levels. For each author, spinal levels to each muscle were tabulated. For each muscle, spinal levels were arranged across texts, sorted by increasing spinal level, and summarized in a histogram (# of authors giving each level). A non-arbitrary consensus proved impossible to formulate. Eight or more authors indicating a level was arbitrarily chosen as a criterion for inclusion of a level in the final summary.

44. ZIA, Shagufta, Frederick W. J. CODY, and Donald J. O'BOYLE, School of Biological Sciences and Department of Psychology, Manchester, UK. **Impairment of unilateral elbow-joint position sense by Parkinson's disease (PD).**

The discrimination of bilateral differences in elbow joint angles is impaired by PD (Zia et al., 2000). In the experiment reported here, unilateral elbow-joint position sense was studied, with ethics committee approval, in 24 patients with idiopathic PD (while 'on' L-dopa medication) and 24 control subjects. The two elbow joints of each subject were tested individually and sequentially. On each trial, subjects were required to identify the angle of the test joint, in the absence of direct vision of the arm, by visual reference to a graduated angular scale, placed beside the arm, which comprised a series of lines representing each of 7 test angles across a

range of 90-108 deg, at intervals of 3 deg. 10 trials were run at each test angle. Under both passive and active contraction conditions, and on each side, the mean unsigned error across all test angles and the standard deviation about the mean unsigned error were significantly larger among PD patients than controls ($p < 0.00005$ in each case, Mann-Whitney). These results indicate that both the mean accuracy and the precision of unilateral discrimination of elbow joint angle were impaired in our PD patients. Zia, S, Cody, F.W.J. & O'Boyle (2000). Joint position sense is impaired by Parkinson's disease. *Annals of Neurology*, 47 (2), 218-228.

45. STEPHENS, Robert E., W. Robert ADDINGTON, and Karen H. WENDEL, Department of Anatomy, University of Health Sciences, Kansas City, MO. **Voluntary cough dysfunction and laryngeal cough reflex with acute unilateral cerebral hemispheric infarcts.**

During stroke, voluntary cough (VC) and the laryngeal cough reflex (LCR) may be impaired and pose a risk for aspiration pneumonia. This study assessed the effect of unilateral middle cerebral artery (MCA) infarctions in right-handed subjects on their ability to elicit VC, and separately assess the LCR using the reflex cough test (RCT). This study involved 30 right-handed subjects with a mean age of 61 years, no previous history of stroke or asthma, and MCA infarcts as independently seen on CT or MRI. Sixteen subjects had right MCA infarcts and 14 had left MCA infarcts. VC responses and RCT results were compared with the side of the cerebral hemispheric MCA infarct. The LCR was tested using nebulized tartaric acid (RCT). The LCR was normal in all 30 subjects and none developed aspiration pneumonia. Eleven subjects with a left MCA hemispheric infarct had an abnormal VC (78.6%) and cough apraxia. Sixteen subjects with right MCA infarcts could produce a VC. Individuals with left MCA infarcts were more likely to have an abnormal VC than those subjects with right MCA lesions ($p < .001$). VC responses were independent from RCT results and may not reliably indicate airway protection and aspiration pneumonia risk.

46. BEST, Irwin M., Morehouse School of Medicine, Department of Surgery, Atlanta, GA, USA. **Fracture mechanism and subsequent repair.**

Significant forces transmitted to occupants and pedestrians during motor vehicle collisions often results in fractures and other injuries. Similarly, the energy transferred from firearms results in significant bone and soft tissue disruption. We evaluated our data to determine the relationship between vascular injuries, fractures, and mode of injury. Between March 1997 and July 1999, patients with diminished or absent pulses were evaluated by a vascular surgeon for treatment. These vascular repairs and the mode of injury were recorded. Other non-vascular surgical procedures and the presence of fractures were noted. The mechanism of injury was divided into blunt and penetrating trauma. These were further subdivided into motor vehicle collisions (MVC), gun shot wounds (GSW), shotgun wounds (SGW) and stab wounds (SW). We identified the pedestrians (PED) as a subset of motor vehicle collisions. Forty-seven consecutive patients were evaluated. Thirty percent (14/47) of the trauma patients had fractures. Eight of these, 57% (8/14) were due to MVA, $P < 0.00007$ and 43% (6/14) were due to penetrating trauma from gunfire $P < 0.05$. Eighty percent (4/5) PED had fractures $P < 0.02$. Twenty-one percent (3/14) patients with fractures required vascular surgery repair, $P < 0.02$. These three patients had penetrating trauma whereas none of the patients with blunt trauma required a vascular repair. In addition, 93% (13/14) patients with fractures required other non-vascular surgery, $P < 0.04$. The data were evaluated by Chi square analysis. $P < 0.05$ was significant. Our conclusions indicate that: 1. Motor vehicle collisions and victims of firearms had a significant number of fractures. 2. In this setting, only the victims of firearms needed surgical repair of vascular injuries. 3. Nearly all the patients with fractures required other non-vascular surgical procedures.

47. SATYAPAL, Kapil S., Bhugwan SINGH, Ariff. A. HAFFAJEE, John V. ROBBS, and Jaikrishna M. KALIDEEN, Department of Anatomy, University of Durban-Westville and Department of Surgery, University of Natal, Durban, RSA. **Anatomical basis for use of donor left kidney in transplantation.**

In centers confronted with a scarcity of cadaveric kidneys, there is controversy whether right, left or kidneys with additional renal arteries should be used in live related transplantation. This study reviews the anatomical basis for selecting the appropriate kidney and its impact on transplantation. A database comprising cadaveric and clinical subsets were analyzed. Total sample size analysed was 1244 kidney pairs (cadaveric =305; clinical =939 ^ 61 live related left kidney transplants. Results : ARA (%) : Right - first : second = 18.6 : 4.7 : Left-first : second = 27.6%, 4.4%. Additional Renal Veins (%) : Right - first : second = 26%, 3.3%; Left ^ first only = 2.6%. Length of Renal Vein (cm) Right 2.4±0.7, Left 5.9±1.5. Other venous variations encountered were on the left only (renal collar 0.3%, retro-aortic vein 0.5%). In the live related transplant series 24.6% ARA were encountered (first 19.7%; second 4.9%). Post-operative course and outcome of patients was not associated with increased morbidity. Whilst greater length of left renal vein (LRV) afforded easier technical manipulation it is interesting to note that its length is shorter than reported in literature. ARV are infrequent on left and when encountered, smaller caliber vessel may be ligated with impunity due to rich intra-renal anastomosis. In selecting donor kidney, surgeon has to balance prospect of fewer ARAs on right against benefit of longer LRV. Solution to this dilemma will arise from a randomised clinical study. In our practice, consistent use of left kidney has not affected clinical outcome.

48. NAIR, Narga, and Shakuntala R. PAI, Department of Anatomy, Kasturba Medical College, Manipal, Karnataka, India. **Cystic duct duplication - a case report.**

In a cholecystectomy it is not so much the gall bladder itself as the extra hepatic biliary apparatus and the blood vessels that present difficulties. Marked variations in the biliary duct system are less common than are variations in the arteries of this region. We report a case where an extremely rare ductal anomaly coexisted with a coeliac vascular anomaly which poses a surgical hazard especially with the advent of laparoscopic cholecystectomy. Dissection of an adult female cadaver revealed a normal cystic duct draining the gall bladder. In addition to the above, emerging from the body of the gall bladder proximal to the main cystic duct, was an accessory cystic duct 0.8 cm long and 1.0 cm wide that drained into the right hepatic duct at an acute angle. The cystic artery in Calot's triangle arose from an accessory right hepatic artery. The rarity of the case is discussed in the light of a literature survey.

49. BURGER, Ralph, Karl-Heinz KÜNZEL, Erich BRENNER, and Othmar GABER, Department of Anatomy and Histology, Univ. Innsbruck, AT. **DICOM, a new approach in modern medical education.**

The use of the DICOM - data-format, "Digital Imaging and Communication in Medicine", opens new ways not only in science but also, and above all, in medical education. DICOM-Viewers are freely available and thus allow an advantageous application on all possible and existing platforms. The availability on networks allows for an evaluation of the data independently from the recorders and the usage and processing within modern multimedia applications, as they exist in almost each modern lecture-hall or computer-laboratory. The lessons get consequently new starting points, since it can be mediated, that for instance a CT- or MR-Scan is no static two-dimensional picture but a "living" recording, which can be experienced in all possible parameter like bone-windows, soft tissue-windows etc. Students receive therefore the opportunity, with

help of these media, to engage themselves with modern radiological techniques. A real motivating "Learning by doing" can take place.

50. FEIGL, Georg, G. SCHWARZ, C. DORN, and F. ANDERHUBER, Institute of Anatomy, Karl Franzens University Graz, and Department of Anesthesiology, University Hospital of Graz, Austria. **Teaching anatomy in postgraduate courses for regional anaesthesia by simulating arterial pulse.**

The success of peripheral nerve blocks depends on a profound knowledge of topographical anatomy and needs much training, that can be performed in cadavers. Cadavers, however, are lacking arterial pulses, which are used as landmarks for peripheral nerve blocks in e.g. the axillary fossa or the femoral triangle. Therefore, we simulated arterial pulse using Fogarty catheters, in order to get lifelike conditions. The simulation of arterial pulses was combined with flap dissections. The relevant regions were dissected in eight cadavers fixed by Thiel's method. The layers superficial to the nerves were flapped aside. The respective flap was refixed with clips. Proximally or distally to the dissected region, the artery was opened with a scalpel. The Fogarty catheter was inserted into the vessel and pushed forward to the region of interest. Air was pressed into the balloon of the catheter rhythmically to imitate an arterial pulse. Then the block was performed with orientation by the artificial arterial pulse. With this technique of simulating arterial pulse, the anesthesiologists were able to exercise the techniques of nerve blocks much easier. Moreover, they were able to control the position of the needle and hence the success of the exercise.

51. HILBELINK, Don R., Department of Anatomy, University of South Florida, Tampa, FL, USA. **"Minding the Gaps" in the Anatomy of the Visible Human Male.**

Gaps exist in the anatomy of the Visible Human Male (VHM). The most obvious are the three gaps produced by the saw cuts used to divide the specimen into four manageable segments for the sectioning process. We filled these gaps using slices produced by an image morphing process. To ensure anatomical accuracy, each morphed image was segmented into its anatomical structures and the data incorporated into a three-dimensional (3D) model database for visual analysis. Anatomical detail of each image was then digitally corrected using the information gained from the 3D computed models. A second level of gap is purely anatomical and not physical. These gaps are contained in the anisotropic voxels ($1/3 \times 1/3 \times 1$ mm) produced by the sectioning and image capture processes. The gaps become most apparent when 3D models are computed from the data set. Inserting two new morphed images between each of the original digital images filled these gaps. These images were produced using the same image morphing, anatomical segmentation, 3D modeling, and digital image correction processes used for the first set of gaps. Completion of this process results in a new image data set for the VHM that is similar, in both slice number and resolution, to that of the Visible Human Female. A third anatomical gap is represented by the differences in resolution of the digital images and the photographic negatives originally produced during the sectioning process. Optical scanning of the photographic negatives, at maximum technical resolution, could produce a new, significantly higher resolution digital image data set of the original transverse images. The filling of this gap awaits the National Library of Medicine's decision to scan the negatives and to release a new image data set for the Visible Human Male.

52. MacPHERSON, Brian R.¹, Martha COOPER², Thomas DOLAN², and Kathryn WONG-RUTLEDGE², ¹Anatomy & Neurobiology and ²Medical Arts and Photography, University of Kentucky, Lexington, KY, USA. **An animated tutorial for the autonomic nervous system.**

One of the most difficult conceptual areas in anatomy for students in basic anatomy courses through to medical and graduate courses is the organization and functional arrangement of the autonomic nervous system. We compiled a set of three computer-assisted instruction modules designed to take the student sequentially through the divisions of the nervous system and how they differ, the specific organization and functionality of the autonomic nervous system and a lecture on the concept of referred pain (visceral afferents). Basic storyboards were constructed from lecture notes. Base artwork for still and animated images was sketched by hand and imported into Photoshop for applying a professional appearance. Images to be used in the animations were imported into Macromedia Flash where moving elements were created and animated over the base artwork. Still images and animations were composited in Macromedia Director where text was added, as well as interactivity. The three modules were burned onto CD's for student evaluation and access. The final product will contain a set a databased learning objectives for each module as well as a quiz module for self assessment. We expect this learning aid to significantly enhance lecture presentations as well as allow students to progress through the material at their own pace, review areas that they found unclear, as well as provide feedback on how well they actually understand the material in an exam format.

Supported by an Instructional Technology Grant from the UK Medical Center.

53. VIDIC, Branislav, Department of Cell Biology and Biochemistry, TTUHSC School of Medicine, Lubbock, TX. **How to ensure proper place for structural sciences in the present-day medical curriculum.**

The need for anatomical information in the current medical and/or postdoctoral (residency) training is gradually increasing. However, the subject of human anatomy has been losing ground in the medical curricula worldwide. Some of responsible reasons for this unfortunate phenomenon are: a) Classical dissection is time-consuming and expensive; b) Number of well-trained anatomists is in decline; c) More advanced predoctoral students and, even more so residents are under time constraints to properly review anatomical material by routine dissection; and, d) Shortage of cadaveric material. To alleviate such curricular inadequacies at the TTUHSC an attempt is being made to produce AV tapes of regional dissections of the entire human body. Each tape presents step-wise dissection combined with cross sectional and digital imaging views, and occasionally correlates dissected (normal) with pathologically altered structures. At the end of each tape a list of objectives emphasizes important components of regional anatomy and their correlation with presently used diagnostic techniques and/or clinical cases and circumstances. It is strongly believed that the introduction of these tapes into the curriculum will: a) allow anatomy students to perform more independent dissection with clearly outlined objectives and to appreciate relevance of dissected material to the practice of medicine; and, b) facilitate review of regional anatomy by predoctoral students and residents.

54. ACLAND, Robert D., Department of Surgery, University of Louisville, Louisville, KY, USA. **The auditory ossicles and their movements: a three-dimensional presentation.**

Most students learn about the movements of the malleus, incus and stapes only as a diagrammatic concept. Few teachers or students have the chance to see the working of these exquisite structures as a three-dimensional reality. To make clear educational video images of the auditory ossicles in action, microdissections were done in fresh cadavers from a lateral

approach. The tympanic membrane and lateral wall of the tympanic cavity were removed. The points of attachment of the ligaments of the incus and malleus were left intact. The ossicular chain was preserved in situ. All three bones could be set in motion by moving the manubrium of the malleus. The dissected specimens were arranged so that they could be rotated about a vertical axis during the recording of video images. A video camera mounted on a surgical microscope was used to create moving images of the structures in situ, and images of the individual ossicles. The images to be shown in this presentation were created for The Video Atlas of Human Anatomy.

55. FURNAS, David W., Division of Plastic Surgery, University of California, Irvine, CA, USA. **The superficial musculoaponeurotic plane (SMAP) in facial surgery.**

When Mitz and Peyronie elucidated the superficial musculoaponeurotic system (SMAS) of the face, their work stimulated reports from many investigators. However, the surgical importance of the superficial surface of the SMAS as a surgical dissection plane was overlooked. I consider the superficial musculoaponeurotic plane (SMAP) as a continuum which includes the superficial surfaces of the platysma, the facial analogues of the platysma, the orbicularis oculi, the superficial temporal fascia, and the frontalis muscle. Dissection on this plane liberates a thick flap of skin and subcutaneous tissue which retains most of its territorial arteries. The bed of the dissection plane is a continuous layer of fine muscle fibers, thin aponeurotic sheets and strands, loose areolar tissue and, in the periauricular area, frank fibrous tissue. The roof of the plane is a lobular surface of subcutaneous fat. The SMA plane provides a safe approach to conspicuous parts of the face by means of inconspicuous incisions. The SMAP flap provides a well vascularized continuous sheet of facial integument with maximum flexibility for manipulation in reconstructive or aesthetic surgery.

56. GILLILAND, Kurt O., and Christopher D. FREEL, Department of Cell Biology and Anatomy, University of North Carolina School of Medicine, Chapel Hill, NC, USA. **An identity crisis for the accessory nerve.**

The current classification system in gross anatomy has no appropriate category for the spinal root of the accessory nerve. This nerve currently shares the number XI with the cranial root of the accessory nerve – a nerve that has traditionally been given its own name while being classified with the vagus. Texts often state that the accessory nerve is associated with the sixth branchial arch and that it innervates the sternocleidomastoid and trapezius. It would seem more appropriate to state that the cranial root of the accessory nerve is associated with the sixth branchial arch and the muscles of the larynx and that the spinal root of the accessory nerve innervates the sternocleidomastoid and trapezius. The literature currently describes this nerve as a "cranial nerve" because of its brief intracranial course and its temporary association with the cranial root of the accessory nerve and the vagus, but the nerve seems more likely to be "accessory" to the cervical spinal nerves. A review of the literature and a study of embryology and phylogeny indicates that it may be appropriate to dissociate the nerve semantically from others to which it has no functional connection and to acknowledge its uniqueness.

57. LACHMAN, Nirusha, Robert D. ACLAND, and Cornelius ROSSE, Natal Technikon, University of Louisville, University of Washington, USA. **The "cranial root" of the accessory nerve: an anatomic myth revisited.**

The accessory nerve is described as having a cranial and spinal root. According to standard descriptions the cranial root is formed by rootlets that emerge from the medulla between the

olive and the cerebellar peduncle. These are considered to join the spinal root, travel with it briefly, then separate within the jugular foramen to become part of the vagus nerve. In careful dissections we were unable to confirm this description. In fresh specimens we exposed the posterior cranial fossa by a coronal cut through the mastoid process, explored the jugular foramen, and examined and photographed the dissections under magnification. We chose the distal end of the cerebellar peduncle as the landmark for the distal end of the medulla. In all specimens we examined, all medullary rootlets emerging between the olive and cerebellar peduncle united into a single nerve trunk within the jugular foramen; we identified this nerve as the vagus. We also identified the spinal root of the accessory nerve formed by cervical rootlets. In no instance did we observe any medullary rootlet joining the spinal root; nor could we demonstrate any connection between the spinal accessory and vagus nerves within the jugular foramen. Our findings question the existence of an eleventh cranial nerve and strongly suggest that the "cranial root" of the accessory nerve is a myth.

58. DANGERFIELD, Peter H., Clare J. ROCHE, Susan E. KING, and Helen M. CARTY, University of Liverpool and Royal Liverpool Children's Hospital, Alder Hey. **Rotation of the atlanto-occipital joint, investigated using CT and MRI.**

A series of joints comprise the vertebral column, each of which is capable of a specific range of movement. A study has been undertaken into the physiological range of rotation at the atlanto-occipital joint to further investigate these movements. The understanding of such movements, together with their interpretation using imaging conditions, are important if the consequences of trauma or any underlying spinal deformity are present in an individual. Using dynamic Magnetic Resonance Imaging, 28 healthy volunteers were examined with their head rotation maximum to the right and left sides in turn. Sourced from the collections in the Human Anatomy Department, an anatomical specimen of the atlanto-occipital joint was imaged using axial and coronary Computed Tomography. The specimen was fixed in varying degrees of rotation for this procedure. The results indicate that health volunteers exhibit a significant but incomplete loss of contact between the articular surfaces of C1 (atlas) and C2 (axis). The range of motion to the right was between 20 and 48.5 degrees (mean 32.4 degrees) and to the left was between 13 and 52.75 degrees (mean 3.2 degrees). Statistical significance between left and right movement was not demonstrated. The instantaneous axis of rotation was examined for the joint and was found to be located within the odontoid peg (dens). The results have established that there is considerable range of movements possible between the bones of the atlanto-occipital joint in normal subjects with striking appearances under imaging which could be misinterpreted as a pathological subluxation. The siting of the instantaneous axis of rotation within the odontoid is also important in furthering the understanding of the movement of this joint.

59. BACKHOUSE, Steven S., and Simon T. BROWNING, Department of Otorhinolaryngology, Singleton Hospital, Swansea, UK. **The importance of anatomical knowledge when planning minimally invasive access to the anterior ethmoid artery.**

Knowledge of regional anatomy and anatomical variations is a prerequisite to safe surgery. We describe the regional anatomy around the medial canthus of the eye and the medial orbital wall in relation to ligation of the anterior ethmoid artery. This procedure is performed in intractable epistaxis where more conventional nasal packing has failed. Recently a minimally invasive technique using rigid endoscopes has been described. A 1.5cm medial canthal incision is created and extended to underlying bone. Periosteum is raised and the endoscope inserted to allow further dissection posteriorly along the frontoethmoid suture towards the anterior ethmoid artery.

Titanium clips are used to close the vessel and the wound closed. This process minimises postoperative bruising and scar contracture.

60. ROBLIN, Graham¹, Heikki B. WHITTET¹, and Phillip EBDEN², ¹Department of Otorhinolaryngology, Singleton Hospital, Swansea, UK, and ²Department of Respiratory Medicine, Prince Philip Hospital, Llanelli. UK. **The anatomical basis of simple snoring and obstructive sleep apnoea.**

Simple snoring and obstructive sleep apnoea (OSA) represent two extremes of a condition which has been estimated to affect as much as 40% of the adult population. The inspiratory noise of simple snoring may arise from excessive vibration of the uvula and soft palate alone or by incursion of the tonsillar or lateral pharyngeal wall during inspiration, and may be addressed by a variety of surgical manoeuvres. Obstructive sleep apnoea is characterized by both snoring or stertorous inspiration with oxygen desaturation, increased effort of inspiration and a raised hyperpnoea – apnoea index. The obstructive element may result from tongue base causes, epiglottic flutter or complete lateral pharyngeal incursion, or indeed any combination of these regions. This may result in significant daytime somnolence and an increased risk of cardiorespiratory morbidity. Confirmation of OSA may be made by formal sleep studies in a properly equipped sleep laboratory, and an indication of simple snoring by the absence of clinical features suggestive of OSA. The authors illustrate and discuss these issues by demonstrating the use of the technique of sleep nasendoscopy to target treatment options.

15:15-17:00 POSTER SESSION 2 & Tea Uppercroft Pythagoras Building

Viewing of Poster Demonstrations D48 - D93 (Ma through Zucconi)

POSTER DEMONSTRATIONS

- D48. **Ma, T. P.** On-line interactive program for practice questions.
- D49. **Maranillo E.,** X. Leon, M. Quer, & J. R. Sanudo. Extralaryngeal anastomoses between the laryngeal nerves.
- D50. **Matsuura, M.,** K. Ohno, H. Shima, Y. Matsui, K. Michi¹, K. Egawa, R. Takiguchi, & M. von Luedinghausen: Clinico-anatomical study of the craniofacial bones provided for cranio-facial implants.
- D51. **Mayr, J.,** W. Grechenig, H. G. Clement, N. P. Tesch, F. Anderhuber, & G. Feigl. The apophysis of the calcaneus during growth - a correlation between sonoanatomy and standard x-ray.
- D52. **Mazzurco, J. D.,** T. J. Cain, D. P. Way, & R., M. Dephilip. Correlation between selected preclinical pathway in the medical curriculum and student usage of computer pretests in the gross anatomy course.
- D53. **Morrigl, B.,** I. Yousry, G. Fesl, & T. Yousry. Initial segment and vascular relationships of the hypoglossal nerve (NXII) in MRI.

- D54. **Murakami, G.**, T. J. Sato, & T. Mawatari. Pitfall in pulmonary lobectomy or segmentectomy when the aberrant lobulation is present: an anatomical study.
- D55. **Nagy, F.**, & G. L. Nieder. Multilayered QTVR dissection of the hand.
- D56. **Nair, N.** Student-centred learning of anatomy.
- D57. **Nedwed, S.**, W. Michlits, & S. Aharinejad. Valvular density alone cannot account for sites of chronic venous insufficiency and ulceration in the human lower extremity.
- D58. **Nelson, M. L.**, & C. D. Sparks. Unusual aortic arch variation: distal origin of common carotid arteries.
- D59. **Norton, N. S.**, M. A. Jergenson, L. C. Barritt, & T. H. Quinn. Variation of the pathway of the lateral cord of the brachial plexus.
- D60. **Oh, C-S.**, K-S. Koh, H-J Kim, & I-H Chung. A morphological study on the anastomosis between the accessory nerve and the posterior root of cervical nerve.
- D61. **Ohmachi, N.**, & M. von Luedinghausen. Peculiarities of the atrial vessels in the dog, compared to those in the human heart.
- D62. **Oommen, A.** Effect of N,N-Dimethyl glycine on motor cortical neurons.
- D63. **Oxberry, B. A.** Self-published CD-ROMs provide students with reliable, easy access to the image intensive learning resources that are utilized in Gross Anatomy and Neuroanatomy courses.
- D64. **Pawlina, W.**, S. W. Carmichael, T. R. Viggiano, K. E. Rarey, M. C. Duerson & N. S. Hardt. Professionalism in medicine: A role for the gross anatomy course.
- D65. **Peicha, G.**, J. Labovitz, A. Weiglein, & F. J. Seibert. Anatomical predisposition and risk of injury for fractures and dislocations of the Lisfranc joint. An anatomical and radiologic study.
- D66. **Peuker, E. T.**, J. Alberty, & T. J. Filler. The innervation of the auricle.
- D67. **Phillips, M. N.**, M. Zhang, & Andre M van Rij. Valves are abundant in small superficial veins of the human lower limb.
- D68. **Phillips, M.**, & R. Parker. Clinical anatomy of head injury.
- D69. **Reed, R. B.**, & R. W. Henry. Plastination for laboratory preservation.
- D70. **Reeves, R. E.** Out with the old, in with the new: teaching gross anatomy in a restructured medical school curriculum.
- D71. **Richards, A. T.**, & T. H. Quinn. Why is a salivary fistula following superficial parotidectomy so rare?

- D72. **Rosenheimer, J. L.,** S. M. Saiki, H. S. Buchanan, T. P. Caudell, S. Lozanoff, D. C. Alverson, & R. B. Friedman. Project T.O.U.C.H. (Telehealth Outreach for Unified Community Health): A Hawaii and New Mexico Telehealth Collaboration.
- D73. **Saito T.,** & K. Tanuma. Pathway of body fluid from thoracic paravertebral region to celiac ganglion made by attachment of the crus of diaphragm.
- D74. **Sakamoto, H.,** H. H. Aung, K. Akita, & T. Sato. Branching pattern of the pelvic plexus (inferior hypogastric plexus) and its relationships.
- D75. **Sato, T.,** H. Sakamoto, S. Heima, K. Higuchi, Y. Tsuboi, & K. Akita. Video demonstration of the composition and distribution of the autonomic nerves in the thorax, with special reference to the cardiac plexus.
- D76. **Satyapal, K. S.,** L. Ramsaroop, P. Partab, & B. Singh. Limited sympathetic ganglionectomy: An anatomical basis.
- D77. **Saxton, E. H.,** T. Q. Miller, & J. D. Collins. Thoracic outlet syndrome (TOS) misdiagnosed as compression neuropathies as displayed by MRI and MRA.
- D78. **Selvaratnam, L.,** J. D. Chaudhuri, N. M. Kassim, S. S. Thwin, & K. Subramaniam, Designing a new Anatomy Resource Centre (ARC), an interactive learning nucleus for anatomy.
- D79. **Severson, A. R.,** & D. J. Forbes. Using a computer-based educational tool for learning neuroanatomical structures.
- D80. **Sheetz, J. H.,** Fully automated computer-based histology practical exams.
- D81. **Shimokawa, T.,** K. Akita, & T. Sato. Topographical analysis of the extraocular muscles based on their innervation.
- D82. **Slavin, B. G.,** P. B. Schaff, G. Albrecht, & J. Pripstein. Combining surface anatomy and physical examination instruction.
- D83. **Stewart, F.** The perineum by dissection - a new approach.
- D84. **Tesch N. P.,** W. Grechenig, H. G. Clement, J. Mayr, & G. Feigl. Is it possible to differentiate the musculature of the hypothenar sonographically?
- D85. **Thomas, P. P.,** R. E. Stephens, & D. L. McWhorter. Teaching the relationship between gross anatomy and histology to first-year medical students.
- D86. **Tsunoda, A.,** T. Sato, & K. Akita. Arcuate eminence and the middle cranial fossa surgery.
- D87. **Uz, A.,** H. Ç. Ugur, & O. Tekdemir. Is the asterion a reliable landmark for the lateral approach to posterior fossa?

- D88. **Velkey, J. M.**, J. P. Naftel, M. D. Ard, G. A. Hoskins, & T. P. Ma. Development and assessment of an online digital electron micrograph atlas for medical histology education.
- D89. **VU, D.**, M. Todd, A. D. Mello, T. Vu, J. Rhee, M. Halmagyi, G. Parker, & J. S. Magnussen. Variability and clinical relevance of the planes of the semicircular canals.
- D90. **Vu, D.**, & T. Vu. "The Eye and Orbit" an anatomy computer-assisted instructional program using 3-dimensional computer models and Quicktime VR.
- D91. **Wright, K. R.**, S. E. Weller, P. J. McMillan, J-M. Tieche, & J. Leonora. Sucrose-induced decrease in bone specific gravity in growing rats is inhibited by carbamoyl phosphate.
- D92. **Zhang, M.**, & P-C. An. Liliequist's membrane is a fold of the arachnoid mater: a study with sheet plastination and scanning electron microscopy.
- D93. **Zucconi, W. B.**, & M. Guelfguat. The importance of teaching variant anatomy in undergraduate medical education with the discussion of a representative case report of duplicated IVC.

ABSTRACTS FOR POSTER DEMONSTRATIONS, July 21st:

D48. MA, Terence P., Department of Anatomy, University of Mississippi Medical Center, Jackson, MS, USA. **On-line interactive program for practice questions.**

To increase the usefulness of our Dental Gross Anatomy web site, we added an interactive practice test question package. There are three components to the package: authoring, editing, and testing. In the authoring component, faculty members can submit multiple choice (3-6 choices) or true/false questions to one of 15 subject categories. The ability to include graphics is in development. A web page (HTML file) is automatically generated and the question is added to one of 15 possible subject categories. In the editing component, faculty can revise the question, change its content, or completely delete the question. At present, the system does not allow for renumbering of questions, but that may be included in future versions. In the testing component, students select individual questions from the different subject areas for review. Once an answer is submitted, the student is immediately advised whether or not their selection was correct. There is an added utility for faculty to include an explanation of the answer. A simple bulletin board message system was also integrated into the package to facilitate asking questions of the faculty. In the past year, students reported finding this practice test package to be extremely useful in preparing for examinations.

D49. MARANILLO Eva, Xavier LEON, Miquel QUER, and Jose R. SANUDO, Unit of Anatomy and Embryology. Autonomous University of Barcelona. Spain. Department of ENT. Sant Pau Hospital of Barcelona. Spain. **Extralaryngeal anastomoses between the laryngeal nerves.**

The possible explanation for the variable position adopted by the vocal cords after a similar recurrent palsy has been subjected to study since the nineteenth century. Several theories have been proposed: extralaryngeal division of the recurrent nerve (RN) in abductor and adductor

fibres, topographic organization of the fibres within the RN, activity of the intact cryothyroid muscle, aberrant reinnervation, and recently the existence of an intralaryngeal anastomosis from the external laryngeal nerve (ELN) to the RN responsible for a dual motor innervation of the thyroarytenoid muscle (from RN and ELN). In this report we show three unilateral cases (2 left and 1 right) of an extralaryngeal anastomosis between the above-mentioned nerves. The anastomotal branch was located over the inferior pharyngeal constrictor covered by the lateral lobe of the thyroid. In one case the anastomotal branch was also in connection with the internal laryngeal nerve through a foramen thyroideum. In another case it was connected with the sympathetic cervical trunk. The existence of this extralaryngeal anastomosis needs further research to establish its incidence and possible neurophysiological role in the motility of the vocal cords.

D50. MATSUURA, Mitsuhiro¹, Kohsuke OHNO¹, Harunobu SHIMA¹, Yoshiro MATSUI¹, Ken-ichi MACHI¹, Kaoru EGAWA², Reiji TAKIGUCHI², Michael von LUEDINGHAUSEN³, ¹First Department of Oral and Maxillofacial Surgery, ²First Department of Oral Anatomy, School of Dentistry, Showa University, Tokyo, Japan, ³Department of Anatomy, University of Wuerzburg, Wuerzburg, Germany. **Clinico-anatomical study of the craniofacial bones provided for cranio-facial implants.**

To clarify the anatomical basis for cranio- facial rehabilitation and treatment with implants, we determined the height, width, and thickness of the cortical bones at important sites in 31 German cadaver specimens obtained from the investigator's (MvL) dissection room. 1. Orbita: at the supraorbital and lateral orbital margins the area of bone available as a site for the fixation of ocular epitheses ranged from 2.7-15.7mm in length and from 3.7-10.9mm in width; the thickness of the cortical bone was 2.2-3.7 mm. 2. Temporal bone region: at a site 20mm from the external acoustic canal (for the fixation of auricular epitheses) the height of bone was 2.3-8.8mm, and the thickness of the cortical bone was 1.2-2.8mm. At the site 30mm from the external acoustic canal (for the fixation of a bone-anchored hearing aid) the height of the bone was 2.0-8.8 (average 5.6)mm, and the thickness of the cortical bone was 0.9-3.5 (2.3)mm. 3. Median site of the frontal and nasal bones: At this site (for the fixation of nasal epitheses) the distance between the frontal sinus and inferior margin of the nasal bone was 13.5-37.5 (25.6)mm and the width 2.4-11.0 (7.6) mm.

D51. MAYR, Johannes, Wolfgang GRECHENIG, Hans G. CLEMENT, Norbert P. TESCH, Friedrich ANDERHUBER, and Georg FEIGL, Institute of Anatomy, Karl-Franzens-University, Department of Traumasurgery, University Hospital, Department of Pediatric Surgery, University Hospital, Graz, Austria. **The apophysis of the calcaneus during growth - a correlation between sonoanatomy and standard x-ray.**

The aim of this study was to elaborate the sonoanatomy in the region of the Achilles tendon's insertion during growth as well as its typical changes. Special attention was directed to the description of the tendon itself, the blood circulation and the transitional zone between cartilage and vessel. 100 healthy children aged between 1 and 18 years were examined using linear soundprobes of high frequency without forerun. The children were subdivided into 4 agegroups. Group 1 - aged 0 to 3 years - showed no ossification of the apophysis and bright reflections, that could be identified as vessels in Doppler-sonography. Group 2 - aged 3 to 6 years - showed beginning ossification of the apophysis, the cartilage was totally without bright reflections indicating the presence of vessels. Group 3 - aged 6 to 10 years - showed increasing interlocking of bone and cartilage, and finally in group 4 - aged older than 10 - an apophysis was depictable only in the form of clefts or not at all. The Achilles tendon could be delineated quite well at any

age. Concluding one can say, that the area of apophysis and insertion shows a typical sonoanatomy at any stage of growth, a factor to be considered when assessing pathological changes.

D52. MAZZURCO, Jason D., Timothy J. CAIN, David P. WAY, and Robert M. DEPHILIP, Ohio State University College of Medicine and Public Health, Columbus, OH, USA. **Correlation between selected preclinical pathway in the medical curriculum and student usage of computer pretests in the gross anatomy course.**

The preclinical curriculum in medicine at Ohio State University offers three distinct pathways: a lecture-discussion pathway (LDP), an independent study pathway (ISP), and a problem-based learning pathway (PBLP). Entering students select a pathway based on their self-perceived learning style. Gross anatomy is the only course that is common to all three pathways. Recently, a self-evaluation component developed using the WebCT computer application was added to the course. A self-evaluation pretest, consisting of multiple choice questions and digitized images of dissections, was available to students before each of the four formal examinations in the gross anatomy course. Students had free access to the pretests and could log on as often as they wished. The WebCT application has the ability to track student usage. The aim here was to correlate student usage of the pretests with (i) selected pathway of the preclinical curriculum and (ii) performance on the formal examinations. We determined that as a group the PBLP students accessed the pretests fewer times per formal examination (1.83 times/examination) than the LDP students (2.3 times/examination) and the ISP students (2.6 times/examination). Also, as individuals, only 80% of the PBLP students accessed the pretests, while 87.5% of the LDP students and 87.25% of the ISP students accessed the pretests. However, students in the different pathways performed similarly on the four formal examinations. The PBLP students averaged 82%, the LDP students averaged 83%, and the ISP students averaged 81%. Thus, while we observed differences in student usage based on preclinical pathway, we observed no differences in the performance of students on the formal examinations.

D53. MORIGGL, Bernhard, Indra YOUSRY, Gunther FESL, and Tarek YOUSRY, Anatomische Anstalt, Munich, and Department of Neuroradiology, Klinikum Grosshadern, Ludwig Maximilians University, Munich, Germany. **Initial segment and vascular relationships of the hypoglossal nerve (NXII) in MRI.**

Although distortion/compression of NXII-roots either by the vertebral artery (VA) or the posterior inferior cerebellar artery (PICA) may cause clinical symptoms, the initial segment (cisternal and intracanalicular) of NXII has not been systematically investigated by MRI so far. We examined 34 probands (=68 NXII) with a mean age of 36y using a three dimensional Fourier transformation constructive interference in steady state (3D-CISS) sequence. An additional T1-weighted contrast enhanced magnetisation prepared acquisition gradient echo (MPRage) sequence was performed in 11. NXII roots were analysed with respect to identification, course and vessel-contact. Analysis was supported by corresponding anatomic cryo-sections. 3D-CISS sequence data set analysis was based on the original 3D slices with an effective thickness of 0.66mm. At least one root of NXII could always be identified in its complete cisternal course using 3D-Ciss sequence. A total of 174 nerve roots was detected, 43.7% of which were distorted by either the VA or the PICA. NXII was partly surrounded by CSF(subarachnoidal evagination) within his canal in 69 sides, 9 of them doubled. Evagination varied in length between <than 1 to >3mm. In 3D-Ciss images visualisation of the intracanalicular course of NXII was possible in roughly 80%, whereas contrast enhanced MPRage sequence showed this part of the nerve in all cases.

We conclude that NXII roots, their anatomical course and neurovascular relationship can be reliably assessed using 3D-CISS sequence. For sufficient evaluation of the NXII within its bony canal application of contrast enhanced MPRage sequence is suggested. To our opinion, both techniques are valuable imaging adjuncts in the clarification of NXII symptoms.

D54. MURAKAMI, Gen, Toshio J. SATO, and Tohru MAWATARI, Department of Anatomy, Sapporo Medical University, Sapporo, Japan. **Pitfall in pulmonary lobectomy or segmentectomy when the aberrant lobulation is present: an anatomical study.**

The left upper anterior fissure (LUAF, giving an appearance similar to a right lung: 22/202) corresponded to the border between S3 and S4 in 13 of the 22 specimens. Thus, the aberrant lobe comprised of either the entire lingual lobe or a smaller area. The upper division bronchus, B1+2+B3, was longer than that in the control group, and A4 and A5 frequently formed a single trunk originating at the interlobar surface. Therefore, segmentectomy along LUAF, if conducted, would appear to be easier than usual. However, the aberrant lobe was not drained by a single vein, but often by two veins. Moreover, one of these did not enter the superior pulmonary vein, but merged with the inferior vein. Whereas in the right posterior pulmonary lobe (right PPL, resembling a separated S6: 25/202), the aberrant fissure corresponded to the border between S6 and other inferior segments in 23 of the 25 specimens. The other 2 cases had a fissure dividing S8. Usually, B7 was not independent, but formed a common trunk with B* or B8. Notably, in combination with the right PPL, unusual communicating vessels (2-4 mm in diameter) were sometimes (36% of the 25) observed running between A6 (or V6) and A2 (or V2), and A3, as well as between the former and other inferior segmental vessels. Consequently, even though the aberrant pulmonary fissure may be a good landmark for lobectomy or segmentectomy, there is an associated pitfall.

D55. NAGY, Frank , and Gary L. NIEDER, Department of Anatomy, Wright State University School of Medicine, Dayton, OH, USA. **Multilayered QTVR dissection of the hand.**

Dissection of the hand is most useful if considered in layers and by compartments. Unfortunately, as one demonstrates superficial structures anteriorly, it is often necessary to remove these structures in order to visualize the more posterior architecture. Similarly, to achieve visualization of the deep arterial arch and the deep ulnar nerve, overlying tendons and muscles may have to be removed. Reviewing hand anatomy in that particular preparation, therefore, becomes difficult. To circumvent this problem, we created a multi-layered computer dissection of the hand using Quick Time Virtual Reality (QTVR). Using this approach, each dissected layer was digitally photographed at 10 degree increments from 30 degrees - 150 degrees along a longitudinal axis and at 10 degree increments from 45 degrees - 135 degrees from side to side at each mark on the longitudinal scale. Images were then linked using QTVR Authoring Studio 1.0 enabling one, with a computer, to dissect layer by layer and side to side using only the computer mouse. This preserves the integrity of the preparation for unlimited "dissections" and enables one to review the anatomy as frequently as necessary.

D56. NAIR, Narga, Department of Anatomy, Kasturba Medical College, Manipal, India. **Student-centred learning of anatomy.**

The aim of this study is to carry out an ongoing process of curricular reform that would facilitate student centered learning of anatomy. The objectives of this study are: 1. Integration of basic and clinical medical science in the one year study of anatomy, so as to produce a more effective

general medical practitioner. 2. Assimilation of problem solving skills imperative in the life of a doctor. 3. Define the core curriculum in the study of the anatomy of the upper limb. 4. Encourage self directed learning, to promote life long learning and continuing one's own medical education. The method consisted of comparing the curriculum carried out in the one and a half year course with the one year course. The merits and demerits of both courses are presented. An integrated curriculum for learning upper limb anatomy is presented as an alternative to the existing course.

D57. NEDWED, Stephan, Wolfgang MICHLITS, and Seyedhossein AHARINEJAD, Department of Anatomy, University of Vienna, Vienna, Austria. **Valvular density alone cannot account for sites of chronic venous insufficiency and ulceration in the human lower extremity.**

Class 6 chronic venous stasis is associated with abnormal venous hemodynamics, and ulceration, and is believed to be due to venous valvular insufficiency. We have noticed such ulcers frequently in cutaneous areas over bones (medial and lateral malleolar) but never in sites over muscles. To test whether cutaneous areas over muscles contained more valves, we cast six human legs and examined their microvenous valvular anatomy. Biopsies were obtained from cutaneous regions overlying the 1. Tibialis anterior; 2. Pretibial; 3. Medial (malleolar); 4. Lateral (malleolar); 5. Dorsum pedis; 6. Plantar; 7. Great toe, dorsal aspect, and from muscular regions of 8. Gastrocnemius; 9. Tibialis anterior; and 10. Peroneus. The total number of valves was determined in a scanning electron microscope and normalized to specimen's size. The mean number of valves was calculated. Cutaneous regions 1-7 were compared to each other and then to the muscular regions 8-10. Venous valves were observed in both cutaneous and muscular regions, but their number was not different when cutaneous regions 1 and 2 were compared to the regions 3, 4, 5, and 7 ($p = 0.53$), or when medial and the lateral malleolar regions were compared ($p = 0.38$). However, the comparison of the cutaneous regions 1-7 with the muscular regions 8-10 showed that the number of valves was significantly higher in the cutaneous region ($p < 0.05$). This study shows that cutaneous regions of the human lower extremity have more valves than muscular areas. Thus, valvular quantity alone cannot account for the higher clinical incidence of ulceration in cutaneous areas. It is likely that muscular pumping and/or valvular quality is an important factor in preventing the development of venous stasis and ulceration in the lower extremity.

D58. NELSON, Marita L., and Chad D. SPARKS, Department of Pathology, University of Hawaii School of Medicine, Honolulu, HI, USA. **Unusual aortic arch variation: distal origin of common carotid arteries.**

As part of a larger study on the risks of stroke from extracranial vascular disease, the aortic arch and its branches were removed en bloc at autopsy from men of Japanese ancestry born in Hawaii. Of the 193 arterial trees examined, 182 (94.3%) had a typical branching pattern, e.g., brachiocephalic trunk, left common carotid, and left subclavian arteries, in that order. Two specimens had only two branches arising from the aortic arch, a common trunk uniting the brachiocephalic and left common carotid arteries and a left subclavian artery. Nine individuals (4.6%) had four branches off the aortic arch; in eight of these cases (4.1%), the left vertebral artery originated directly off the aortic arch just proximal to, or as a common trunk with the left subclavian artery. A unique aortic arch branching pattern was found in one of these men. The four arteries arising from the arch of the aorta were, in sequence: right subclavian, left subclavian, right common carotid and left common carotid. The literature on aortic arch variations will be reviewed and the possible embryonic development of these branching patterns

and their clinical significance discussed. (Sponsored by Grant No. 961574 from the Hawaii Community Foundation).

D59. NORTON, Neil S., Margaret A. JERGENSON, Laura C. BARRITT, and Thomas H. QUINN, Departments of Oral Biology and Biomedical Sciences, Schools of Dentistry and Medicine, Creighton University, Omaha, NE, USA. **Variation of the pathway of the lateral cord of the brachial plexus.**

It is accepted that the union of ventral rami from the caudal four cervical nerves (C5-8) and the first thoracic nerve (T1) forms the brachial plexus. These major ventral rami (C5-T1) unite to form the three trunks of the brachial plexus: the Superior Trunk (C5 & 6); the Middle Trunk (C7) and the Inferior Trunk (C8 & T1). Each Trunk further divides into Anterior and Posterior divisions. The Posterior divisions of all of the Trunks give rise to the Posterior Cord; the Anterior divisions of the Inferior Trunk forms the Medial Cord; the Anterior divisions of the Superior & Middle Trunks give rise to the Lateral Cord. These three Cords are named based on their relationship to the second part of the Axillary artery. We report a rare anomaly in which there is unilateral variation in the pathway of the Lateral Cord of the brachial plexus of a 78-year-old man. Normally, the Lateral Cord passes on the lateral aspect of the 2nd part of the Axillary artery and gives rise to the Musculocutaneous nerve which enters the Coracobrachialis, and the Lateral Root of the Median nerve. The entire Lateral Cord, in this particular case, entered the Coracobrachialis. After entirely passing through the muscle, the Lateral Cord split into the Musculocutaneous nerve and Lateral Root of the Median nerve. It is known that the Coracobrachialis can compress the Musculocutaneous nerve as it passes through resulting in weakness of the flexors of the arm as well as paresthesia along the lateral aspect of the forearm. It is hypothesized in this case that compression of the Lateral Cord by the Coracobrachialis would cause similar deficits as well as weaknesses of some of the flexors of the forearm.

D60. OH, Chang-Seok¹, Ki-Seok KOH², Hee-Jin KIM³, and In-Hyuk CHUNG⁴, ¹Department of Anatomy, Chonnam University Medical School, Kwang Ju, ²Department of Anatomy, Kon Juk University, Choong Ju, ³Department of Oral Biology, Yonsei University College of Dentistry, ⁴Department of Anatomy, Yonsei University College of Medicine, Seoul, Korea. **A morphological study on the anastomosis between the accessory nerve and the posterior root of cervical nerve.**

This study was performed to identify the anastomosis between the accessory nerve and the posterior root of cervical nerve below the level of C1 segment. One hundred spinal cord segments of Koreans were studied under the surgical microscope. In order to trace the posterior root of cervical nerve after the anastomosis, some accessory nerves were stained by osmium tetroxide. The anastomosis was classified into 5 types, according to whether the accessory nerve and cervical posterior root crossed each other, and also to the site and direction of the bridging fiber between them. The posterior root of a cervical nerve was observed to course caudally along the main trunk of accessory nerve after the anastomosis, and reach the spinal cord by way the posterior root at a different level of the cervical segment. An accessory spinal rootlet was also observed to course caudally along the main trunk of accessory nerve, and join a posterior root at the anastomotic site at a different cervical level. The latter finding suggests the possibility that the motor fibers of accessory nerve from the spinal cord may innervate the trapezius muscle through the cervical nerve. This alternative innervation may explain that not all patients had the shoulder syndrome even though the main spinal accessory nerve was sacrificed in the standard radical neck dissection

D61. OHMACHI, Nobuko, and Michael von LUEDINGHAUSEN, Institute of Anatomy, University of Wuerzburg, Wuerzburg, Germany. **Peculiarities of the atrial vessels in the dog, compared to those in the human heart.**

Hitherto, the vessels of the heart in the dog have not been reported in morphological detail. The hearts of 25 German shepherd dogs (Alsatians) were removed, fixed and injected with coloured gelatine for microanatomical examination using a stereomicroscope. The sinuatrial node was nourished by the right atrial distal branch or the right atrial intermedial branch in 96% of the cases and by the left atrial proximal branch in 32%. In one case, only a well-developed left sinuatrial nodal branch supplied the sinuatrial node. In 28% of the cases, both right and left sinuatrial nodal branches were observed. Furthermore the sinuatrial nodal branches were not only connected with one other atrial artery but also with mediastinal “non-coronary” branches. The “posterior ascending branch” of the dominant sinuatrial nodal branch formed a “vascular circle” with the “anterior ascending branch” around the opening of the cranial vena cava. Most atrial veins drained always the myocardium of the right and left atria into “coronary” veins. However, some atrial veins emptied into mediastinal “non-coronary” veins in 60% of the cases and also opened directly into the left or right atrium except two cases. The supply of the sinuatrial node and myocardium of the atria appears to be more secure, even in the instance of failure of some of the vessels of the heart to function, in the dog than in the human.

D62. OOMMEN, Anitha, Department of Anatomy, Fr. Muller's Medical College, Mangalore, India. **Effect of N,N-Dimethyl glycine on motor cortical neurons.**

Previous studies done on the spinal cord of albino mice (BALB-C strain) showed cytotoxic effects of N,N-dimethyl glycine (DMG), a methylated glycine, which is an ergogenic nutrient. The present study was undertaken to determine the effect of DMG on the dendrites of motor cortical neurons. DMG dissolved in distilled water was given to 21-day old albino mice at a dose of 20mg/kg for 30 days. The mice were then sacrificed and the motor cortex dissected and stained by Golgi technique. Using the camera lucida the dendritic spines, branching points and intersections of the motor neurons of the cerebral cortex were counted. The results were compared with normal control and saline control animals. The results were analysed using ANOVA test. There was a statistically significant increase in the dendritic branching points, intersections and dendritic spines in the DMG-treated mice. These findings suggest dendritic proliferative changes within the motor cortex and may support the stamina-building property of DMG.

D63. OXBERRY, Brett A., Department of Anatomy and Cell Biology, Temple University School of Medicine, Philadelphia, PA, USA. **Self-published CD-ROMs provide students with reliable, easy access to the image intensive learning resources that are utilized in Gross Anatomy and Neuroanatomy courses.**

Over the past few years we have digitized most of our in-house collection of cross sectional images, diagnostic images, brain sections, video clips and other learning resources that we utilize to teach our Gross Anatomy and Neuroanatomy courses. However, providing students with reliable, easy access to these image intensive, digital learning resources presented numerous challenges. Web-based only formats typically impose technical limitations that can compromise image quality and the level of user interactivity that can be employed. Low bandwidth telecommunications connections can also be frustrating, unreliable and expensive when students want to access image intensive Web-based resources from their homes or other locations that lack the high bandwidth connections available within institutions. To overcome these problems

we employed the following strategy. We utilized the ToolBook authoring system to design resources that would engage students in the learning process by promoting rich interactions with the visual information. Then we self-published the resources on CD-ROMs to provide our students with inexpensive, reliable, anywhere access to the information. Student evaluations of the CD-ROMs have confirmed that they place a high value on more sophisticated navigation and design features that enable them to interact with the information present in images and that they appreciate the ubiquitous, easy access that the CD-ROM distribution media provides.

D64. PAWLINA, Wojciech, Stephen W. CARMICHAEL, Thomas R. VIGGIANO, Kyle E. RAREY, Margaret C. DUERSON and Nancy S. HARDT, Mayo Medical School, Rochester, MN, and University of Florida College of Medicine, Gainesville, FL, USA. **Professionalism in medicine: A role for the gross anatomy course.**

Professionalism in medicine requires the physician to exhibit those attitudes and behaviors that places the patient's interest above physician's self-interest. The learning climate of medical schools should nurture the development of professionalism throughout all four years of the curriculum. For most medical students, initial contact with professional values occurs during the first-year gross anatomy course, where students spend a large amount of time early in their training. As a first step in establishing benchmarks to assess the professional development of medical students and to better understand the educational environment, a peer assessment was administered to first-year medical students. A fourteen-item questionnaire, adapted from the American Board of Internal Medicine Project Professionalism, was distributed to medical students after the end of the gross anatomy course. Three medical school classes were surveyed, two from one institution, and one from another institution. Collectively, seventy-five percent of the students voluntarily responded. The surveys indicated that first year medical students are aware of professional values, and regularly observed these values in their classmates and faculty. It is concluded that the environment of the gross anatomy course, through both the didactic and laboratory instruction, is an important factor for the early development of professional values.

D65. PEICHA, Gerolf, Jonathan LABOVITZ, Andreas WEIGLEIN, and Franz J. SEIBERT, University of Graz, Austria, Medical School, Department of Traumatology, Anatomic Institute. **Anatomical predisposition and risk of injury for fractures and dislocations of the Lisfranc joint. An anatomical and radiologic study.**

The base of the second metatarsal is recessed proximally into a "mortise" between medial and lateral cuneiform. This mortise is considered as the "keystone" for stability of the Lisfranc joint. The aim of this study was to investigate if there is a correlation between anatomical morphology of the mortise and occurrence of injuries to the Lisfranc joint. For that purpose, the following data were measured in 84 cadaver feet (no preexisting injury) and compared to 33 patients with injuries to the tarsometatarsal joint (data were collected using standard radiographs): A (medial depth of the mortise), B (lateral depth), C (length of the second metatarsal). Subsequently we calculated the mean depth $A+B/2$, and C/A , C/B and $C/\text{mean depth}$ as ratios for the lever arm. The average medial depth A in the cadaver group was 11.61 mm vs. 8.95 mm in the patient group (statistically significant), the average mean depth $A+B/2$ was 8.31 mm vs. 6.85 mm (significant), the average ratio $C/\text{mean depth}$ was 9.08 vs. 11.08 (significant). We conclude of these data that the "mortise" in patients with injuries to the Lisfranc joint is flatter than in the control group and that this population group is anatomically predisposed for this kind of injuries. Moreover, further statistical evaluation showed that the risk of injury to the Lisfranc joint is significantly higher, if the mortise of the second ray is flatter.

D66. PEUKER, Elmar T., Juergen ALBERTY, and Timm J. FILLER, Institute of Anatomy and Department of Otorhinolaryngology, Clinical Anatomy Division, Westfalian Wilhelms-University of Muenster, Germany. **The innervation of the auricle.**

The innervation of the auricle is the theoretical basis of different reflex-therapies (e.g. ear acupuncture). A detailed knowledge on vascularization and innervation of the outer ear is crucial for plastic and reconstructive surgery in this region. However, data on the innervation as provided by the scientific publications are incomplete and inconsistent. The aim of this study was to describe the system of nerve supply. Therefore on 7 embalmed cadavers the complete runs of nerves and vessels supplying the outer ear were exposed under magnifying glasses. Ramifications were coloured and photographically documented. A heterogenous distribution of cranial branchial nerves and somatic cervical nerves was found: R. auricularis n. vagi, N. auriculotemporalis (NV3), N. auricularis magnus, and N. occipitalis minor. Data were collated for antihelix, lobulus, antitragus, tragus, helix ascendens, scapha, helix anterior, crus helices, crura anthelices, cavum conchae, cymba conchae, and upper, middle, and lower third of the dorsal surface of the auricle. The amount of nerve fibres compared to other head regions appeared to be rather high.

D67. PHILLIPS, Mark N.^{1,2}, Ming Zhang¹, Andre M van Rij², ¹Department of Anatomy and Structural Biology; ²Department of Medicine and Surgery, University of Otago, Dunedin, New Zealand. **Valves are abundant in small superficial veins of the human lower limb.**

Venous valves are important for the prevention of blood reflux in veins. This is especially true for the veins of the lower limb where the effect of gravity is the greatest. Venous valves in large superficial veins of the lower limb have been extensively studied^{1,2}. Very few studies have investigated the valves in the intermediate and small superficial veins of the human lower limb³. Commonly anatomical texts state that no valves are present in veins of smaller than 2 mm in diameter. In this study, venous valves have been identified in small superficial veins and venules as small as 10µm in diameter in the subcutaneous tissue of five lower limbs, using microdissection, E12 sheet plastination, and scanning electron microscopy of venous casts. Sixty-eight percent of the valves (808/1190) were in post-capillary venules (10-50µm in internal diameter) and collecting venules (51-150µm). Using scanning electron microscopy of resin casts from sixteen sites, the mean density of valves in veins smaller than 1mm in diameter was 10.67±4.1 per cm³. The presence of valves in small veins and venules implies a mechanism for the forward propulsion of blood in these veins.

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D68. PHILLIPS, Melissa, and Roger PARKER, Department of Anatomy, Kings College, Guy's Campus, LONDON. **Clinical anatomy of head injury.**

Tissue layers form potential spaces for fluid collection and pathways for spread of infection. Head injury is one of the most common presentations in accident departments. An intracranial space occupying fluid collection is the most important pathology to recognise with head injury. The various anatomical tissue planes of the head produce four vascular layers and six important tissue spaces. Those features from extracranial tissue layer are diagnostic when such pathology occurs. Intracranially, the need for speedy appreciation of the clinical features of raised

intracranial pressure with its focal signs enforces the need to understand the anatomy of the vascular layers and sites associated with any local pathology.

D69. REED, Robert B., and Robert W. HENRY, College of Veterinary Medicine, The University of Tennessee, Knoxville, TN, USA. **"Plastination for laboratory preservation"**.

Changes in the first year veterinary curriculum combined small and large animal gross anatomy into one year long course. Time allotted for gross dissection was reduced by 20 percent. Without time for each lab group to dissect both a dog and a horse, each group was assigned only one species of cadaver for the entire year. With this laboratory protocol, students spent most of their time on assigned specimens and less time on the respective comparative portions. When studying other specimens, structures had already been dissected and students missed the opportunity to observe several relationships of many structures. This resulted in students being more knowledgeable in one species than the other. To ensure that students spent adequate amounts of time on each species studied, we had every group dissect the canine while we provided each group with prosected plastinated large animal specimens for study on separate days. This approach ensured that every student spent time studying each species. The time saver came in the form of the students not having to dissect large animal cadavers. However, plastination did not restore the students ability to take note of all structural relationships during dissection as the large animal specimens had been prosected.

D70. REEVES, Rustin E., Department of Pathology and Anatomy, University of North Texas Health Science Center, Fort Worth, TX, USA. **Out with the old, in with the new: teaching gross anatomy in a restructured medical school curriculum.**

At the University of North Texas Health Science Center, we have recently switched from a traditionally taught medical school curriculum to an integrated systems-based curriculum, with an emphasis on clinical applications. Teaching gross anatomy under the guidelines of the new curriculum has proven to be a great challenge for our anatomy faculty. The most obvious challenge has been the preservation of the cadavers for a much longer period of time. Under the old curriculum, cadavers were maintained over a four month period with a minimal amount of loss due to fungal problems. However, under the new curriculum, cadavers are maintained for nearly seven months, and we have seen a slight increase in the number of cadavers affected by mold. Other less obvious, but formidable tasks associated with the change are: 1) keeping students motivated and focused following long breaks between dissections, 2) restructuring of traditional dissections to accommodate the new curriculum, 3) adjustment of faculty schedules to fit the random scheduling of both lectures and labs, 4) redesign of lecture materials and test questions to fit a more clinically-oriented curriculum, and 5) incorporation of computers in the lab for assisting students with dissection procedures. As the first year of our new curriculum draws to a close, these challenges will be addressed and remedies will be prescribed before the process begins again in the fall. Overall, we can say that the design and incorporation of the new systems-based curriculum has performed very well, and with a few slight modifications, should do even better in the future.

D71. RICHARDS, Alan T., and Thomas H. QUINN, Departments of Surgery and Biomedical Sciences, Creighton University School of Medicine, Omaha, NE, USA. **Why is a salivary fistula following superficial parotidectomy so rare?**

Although anatomically the parotid gland is a single entity, it is clinically divided into superficial and deep lobes by the facial nerve. The majority of benign tumors are situated in the superficial

lobe and superficial parotidectomy is the standard treatment. Postoperatively fistulas between gland and skin are rare. The anatomy of the parotid duct was studied by radiography (sialography) and by cadaver dissections. The main duct is situated within the deep lobe. It has no major divisions, but has many branches entering it in a single plane. The branches subdivide within the lobes of the gland. The duct leaves the gland deep to the buccal branch of the facial nerve and runs horizontally across the masseter to enter the oral cavity. A personal (AR) series of 314 superficial parotidectomies also was analyzed. These operations were performed for tumors or for inflammatory and obstructive lesions. Only one fistula occurred in the postoperative period, which closed spontaneously within two weeks. During superficial parotidectomy, the main duct is not compromised since it has its origins in the “deep lobe”. This could be the reason for the low incidence of salivary fistulas.

D72. ROSENHEIMER¹, Julie L., Stanley M. SAIKI¹, Holly S. BUCHANAN², Tom P. CAUDELL², Scott LOZANOFF¹, Dale C. ALVERSON² and Richard B. FRIEDMAN¹; ¹University of Hawaii, HI, and ²University of New Mexico, NM, USA. **Project T.O.U.C.H. (Telehealth Outreach for Unified Community Health): A Hawaii and New Mexico Telehealth Collaboration.**

Both the Universities of New Mexico and Hawaii train medical students using a problem-based learning (PBL) curriculum. Likewise, both universities train students in remote locations. To enhance learning between medical centers utilizing similar curricular methods and to improve the quality of delivery of educational services to dispersed locations, we are deploying our PBL curricula using telehealth technologies. Both schools with the support from their respective High Performance Computing Centers (HPCCs) are integrating the use of telehealth technologies into the educational curriculum. Project T.O.U.C.H. has developed a PBL case of brain injury utilizing 3-D functional brain image manipulation, interactive video and virtual environments to augment learning for students at each school and at remote sites. Participants are second-year medical students at both schools and selected remote sites, their tutors and rural preceptors. The HPCCs are providing the models, images and computer simulations for this project. The students, tutors and preceptors utilize these modalities transmitted over the internet Access Grid to improve learning and understanding of a variety of concepts relevant to a clinical problem. These methods can be used interactively across sites or individually. This collaborative project between the two states serves as a model for training students in rural environments.

D73. SAITO Toshiyuki, and Kumiko TANUMA, Department of Anatomy and Anesthesiology, Nippon Medical College, Tokyo, Japan. **Pathway of body fluid from thoracic paravertebral region to celiac ganglion made by attachment of the crus of diaphragm.**

For the development of thoracic paravertebral anesthesia, to study the fluid communication with other tissue is important. Fluid communication between lower thoracic region and celiac ganglion through the diaphragm was examined. After a dye was injected into the endothoracic fascia in the lower thoracic paravertebral region, its trail to the celiac ganglion was examined in fifteen cadavers. After the dye was injected in the paravertebral region it reached the celiac ganglion in nine cadavers. The dye reached the ganglion along the major and minor splanchnic nerves. It came out from the splitting of the crus of the diaphragm. In the remaining six cadavers dye spreading was on the way to the ganglion along the crus of diaphragm. In conclusion, we found a fluid communication between the lower thoracic paravertebral region and the celiac ganglion in a significant percentage of cadavers. Therefore, we should be aware of the insidious fluid travel, and its effect and side effect, whenever a drug is administered in the lower thoracic paravertebral region.

D74. SAKAMOTO, Hirokazu, Htar Htar AUNG, Keiichi AKITA, and Tatsuo SATO, Unit of Functional Anatomy, Tokyo Medical and Dental University Graduate School, Tokyo, Japan. **Branching pattern of the pelvic plexus (inferior hypogastric plexus) and its relationships.**

Although numerous reports have focused on the composition of the pelvic plexus, few describe its branching pattern. To provide comprehensive data on the branching pattern and distribution of the visceral branches for the development of future function preservation surgical techniques, detailed dissections under a stereomicroscope were performed in 10 pelvic-halves of 5 adult males. Interestingly the visceral branches were not distributed equally, rather were relatively separated into the following nerve groups: A group) nerves supplying the fundus of the bladder, B group) nerves running along the groove between the bladder and prostate, C group) nerves descending along the posterolateral margin of the prostate, and D group) nerves to the rectum. In particular, C group nerves, supplied not only the prostate but also the external urethral sphincter and the ventralmost portion of the levator ani and finally terminated as the cavernous nerve. This group is considered important clinically as these nerves are related to sexual and voiding functions. The relationships between the branching patterns and the visceral fasciae, and in particular Denonvillier's fascia will be discussed in detail.

D75. SATO, Tatsuo, Hirokazu SAKAMOTO, Sadaaki HEIMA, Katsura HIGUCHI, Yoko TSUBOI, Keiichi AKITA, Unit of Functional Anatomy, Tokyo Medical and Dental University Graduate School, Tokyo, Japan. **Video demonstration of the composition and distribution of the autonomic nerves in the thorax, with special reference to the cardiac plexus.**

In order to achieve ultimate function preservation in the modern radical lung and esophageal cancer operative procedures, precise knowledge of the topographical anatomy of the autonomic nerves is crucial. An actual dissection of these autonomic nerves is demonstrated.

The manner of descent of cervical sympathetic branches and the vagus nerves is shown, as well as their topographical relationships to the major vessels, trachea, esophagus and lymphatics. In front of the tracheal bifurcation, these nerves converge to form the complex cardiac plexus.

This plexus then not only contributes to the formation of the coronary plexuses but also to the lungs and esophagus. The different arrangement of these nerves on the right and left sides are shown.

D76. SATYAPAL, Kapil S, Lelika RAMSAROOP, Prawesh PARTAB, and Bhugwan SINGH, Department of Anatomy, University of Durban-Westville and Department of Surgery, University of Natal, Durban, RSA. **Limited sympathetic ganglionectomy: An anatomical basis.**

Selective thoracoscopic ganglionectomy, employing a technique that limits the dissection to the second ganglion and its immediate connections is established practice for upper limb sympathetic denervation. This study aimed to investigate incidence and clinical significance of alternate neural connections. The study comprised two subsets : I) Clinical : 686 cases palmar hyperhidrosis treated by limited T2 ganglionectomy by thoracoscopic dissection; II) Cadaveric : 22 fetuses [gestational age : 18 weeks-full term] and 19 adult cadavers dissected bilaterally between T1-T5 (n=41). All neural connections of sympathetic ganglia were noted. Limited sympathectomy yielded a success rate of 99.5%; failure rate (0.5%) due to missed chain and nerve regeneration. The spectrum of neural connections encountered were: a) additional neural connections between intercostal nerves T1-2 noted in 18.2% bilaterally [nerve of Kuntz] and 4.5 % unilaterally b) collateral ganglionic connection observed in 4.5% (T2-3, left only) c) alternate neural connections found between upper 3 thoracic ganglia and upper 5 intercostal nerves. This study reveals that whilst alternate connections like nerve of Kuntz are important neural

variations, they do not appear to impact on current surgical technique for upper limb sympathetic denervation undertaken for palmar hyperhidrosis, chronic regional pain syndrome, Raynaud's disease and chronic obliterative vascular disease.

D77. SAXTON, Ernestina H., Theodore Q. MILLER, and James D. COLLINS, Departments of Neurology and Radiology, UCLA School of Medicine, CA. **Thoracic outlet syndrome (TOS) misdiagnosed as compression neuropathies as displayed by MRI and MRA.**

The diagnosis of TOS is made by history and physical examination. Patients with TOS present with numbness, tingling, pain in the hands and arms. They may have weakness and atrophy of the intrinsic hand muscles, and sensory deficits. The symptoms resemble entrapment neuropathy of the ulnar and median nerves (cubital and carpal tunnel syndromes, respectively). Nerve conduction studies and electromyography (EMG) often are equivocal. Patients undergo cubital and carpal tunnel release or nerve transpositions without relief. Over one hundred patients presented with persistent symptoms following surgery. Bilateral MRI and MRA of the brachial plexus was requested to evaluate for TOS. Five patients were selected for this presentation because of their instructive histories. Imaging was conducted on the 1.5 Tesla GE Signa, with 5.5 software, 4.0 mm thickness and saline waterbags along side the neck to enhance signal to noise ratio. T1 weighted coronal, transverse, transverse oblique, sagittal, coronal abduction external rotation, selected Fast Spin Echo, and 2D Time of Flight MRA sequences were obtained. This presentation stresses the importance of an accurate history, detailed physical and neurologic examination, monitored bilateral MRI in the evaluation of patients suspected of having TOS. Electrophysiological tests may not differentiate entrapment neuropathies from TOS.

D78. SELVARATNAM, Lakshmi, Joydeep D. CHAUDHURI, Normadiah M. KASSIM, San San THWIN, and Krishnan SUBRAMANIAM, Department of Anatomy, Faculty of Medicine, University of Malaya, Kuala Lumpur, Malaysia. **Designing a new Anatomy Resource Centre (ARC), an interactive learning nucleus for anatomy.**

With a shift away from traditional teacher-centred learning, the onus of understanding anatomy falls increasingly on students who become more dependent on learning aids. Thus, the existing anatomy resource centre/museum was redeveloped into an exhibition setting conducive to interactive self-discovery and small group learning of clinically-relevant anatomy. The organisational layout of the ARC is based on body systems, in line with a newly established integrated medical curriculum. Anatomical material includes potted and plastinated cadaveric specimens, clinical photographs, models, posters and diagnostic images positioned on posterboard cum benchtop modules. This modular design allows for flexibility and creativity in reconfiguring the entire internal layout. Clinical scenario highlights remain a predominant feature throughout the ARC. A focal point includes activity stations for interactive learning through multimedia computers and educational software, including the option for group student assessment via links with the main computer laboratory. A mobile seating gallery with slide/computer projection facility has been incorporated to encourage small-group teaching and for conducting workshops in collaboration with the adjoining Clinical Skills Laboratory. It is envisaged that such a centre would meet the challenges of tomorrow's doctors in facing changing patterns in health care in the new millenium. (Financed by Faculty of Medicine, University of Malaya: UM-16-0-123135 (MDL-1)/ 7th Malaysia Plan).

D79. SEVERSON, Arlen R., and Donna J. FORBES, Department of Anatomy and Cell Biology, University of Minnesota, Duluth, School of Medicine, Duluth, MN, USA. **Using a computer-based educational tool for learning neuroanatomical structures.**

To facilitate the learning of relationships and terminology of neuroanatomical structures, an interactive computer-based learning tool was developed utilizing gross specimens, brain sections and magnetic resonance images (MRIs). Gross specimens were prepared and photographed at the UM School of Medicine-Duluth. Photographs were taken of brain sections from the Yakovlev collection at the Armed Forces Institute of Pathology in Washington, D.C., and MRIs were obtained at the UM Medical School-Minneapolis. Using the program, students study the organization of the brain from intact and dissected gross specimens and a series of whole brain sections with corresponding MRIs in the coronal, horizontal and sagittal planes. Identification Mode is used to select a structure to be identified from a name list appearing on the side of the specimen, section or MRI. Clicking on the structure's name provides a transparent colored overlay or arrows identifying the structure in the image. No lines or other obstructions hide details on the images. Quiz Mode allows one to assess recognition of neuroanatomical structures. The program is delivered on CD-ROM for use on PC or Macintosh computers, permitting the user an opportunity to study the gross specimens at their convenience, and to study brain sections and MRIs not readily available. The program facilitates learning structures on gross specimens and brain sections, and also helps integrate neuroanatomical knowledge in the interpretation of MRIs. (Sponsored by MMF and UM-AHC).

D80. SHEETZ, James H., Department of Cell Biology, University of Alabama at Birmingham (UAB), Birmingham, AL, USA. **Fully automated computer-based histology practical exams.**

In a continuing effort to acclimate students to computer generated exams, automated computer-based practical exams have been developed for a Cell and Tissue Biology course for medical students. Practical exams are generated using the Question Mark(R) software program. Digitized images for exams are acquired by capturing images with a video-camera equipped microscope utilizing a computer video capture card. When displayed on a computer monitor screen, each question contains text of the question, the image related to the question, and a space for typing the correct answer. Students can navigate through multiple images at different magnifications within each question screen. The program monitors each student's response and displays the student's grade when they finish their exam. This program also randomizes the question sequence, an important feature when the same exam has to be given to different groups of students. After completion of the exam, printouts showing their grade and individual responses are generated and distributed to each student. Responses from students have been overwhelmingly positive. This format for generating histology practical exams allows building question libraries that will provide flexibility in generating future exams. It also demonstrates a format that can be incorporated into generating exams for other disciplines.

D81. SHIMOKAWA, Takashi, Keiichi AKITA, and Tatsuo SATO, Unit of Functional Anatomy, Tokyo Medical and Dental University Graduate School, Tokyo, Japan. **Topographical analysis of the extraocular muscles based on their innervation.**

For comprehensive knowledge of the minute anatomy of the ocular nerves, fasciae and muscles, we dissected under a stereomicroscope 16 sides of 8 cadavers (4 males and 4 females). In particular, we investigated nerve innervation of the extraocular muscles, and the positional relationships between the muscles and supplying nerves. The oculomotor and abducent nerves ran together near the annulus tendineus communis within the orbit. However, a tendinous

membrane was present between these nerves (in 10 sides), and therefore, these nerves were separated into medial and lateral sides of the membrane, respectively. This membrane extended between the superior and inferior rectus muscles, and connected these muscles. The lateral rectus muscle and the abducent nerve were located lateral to the membrane. In two sides, which we examined in detail, small branches of the inferior division of the oculomotor nerve were observed to be distributed to the membrane from its medial surface. Based on these findings, the superior and inferior rectus muscles were considered not independent, but continuous by means of the membrane. The muscles innervated by the oculomotor and abducent nerves are generally classified as the same ring which surrounds the optic nerve and eyeball. However, based on the present findings, the muscles innervated by the oculomotor and abducent nerves were considered to make inner and outer rings, respectively.

D82. SLAVIN, Bernard, G., Pamela B. SCHAFF, Gene ALBRECHT, and Jeremy PRIPSTEIN, Keck School of Medicine, University of Southern California, Departments of Cell and Neurobiology and Family Medicine, Los Angeles, CA, Rush Medical College, Chicago, IL, USA. **Combining surface anatomy and physical examination instruction.**

Traditional medical school curricula have separated basic and clinical sciences instruction. We hypothesized that combining physical examination teaching with surface anatomy instruction would result in a better understanding of physical examination skills and their underlying anatomical bases. Beginning in 1998-1999 we developed a uniquely integrated instructional program consisting of four Introduction to Clinical Medicine (ICM) sessions (4 hours each) which were scheduled to coincide with surface anatomy instruction as follows: (I) Approach to the Patient/Upper Limb/Vital Signs, (II) Heart/Lung, (III) Abdomen, (IV) Head and Neck. These sessions were taught jointly by clinicians and anatomists. Students received instruction in small groups, and for sessions II and III, artists' models were employed. Students were thus able to mark the relevant anatomy on the models' skin using wax pens, and then conduct the appropriate physical examination. Detailed laboratory instructions containing specific goals and objectives, as well as references to anatomy and physical examination texts, guided students through the exercises. Students have evaluated the sessions enthusiastically. For 1999-2000, more than 80% of the 180 participating Year I medical students rated the sessions as very enjoyable and agreed that the sessions met the stated objectives. Faculty surveys were equally positive. The combined instruction in surface anatomy and ICM is now a permanent curricular change at Keck School of Medicine. This combined effort has led to student and faculty appreciation of the importance and effectiveness of integrating basic and clinical science teaching

D83. STEWART, Fiona, Pott's Point, New South Wales 2011, Australia. **The perineum by dissection - a new approach.**

An understanding of the relations of the viscera and their supply within the true pelvis above the pelvic diaphragm and below it in the perineum, with the urogenital diaphragm, ischioanal fossae, rectum, anus and regional supply is essential to the medical student and the surgeon. Dissection of the perineal region on the cadaver has always posed a problem in the dissection room. The lithotomy position is not a chosen posture for embalming and storage and it is unsuitable for general dissection of the trunk. A dissection approach has been developed to give a quick and effective appreciation of the region's relations. Dissection of the trunk (or abdominopelvic viscera) and inguinal/femoral triangle regions and the back is completed and then this approach to perineal dissection is easily performed. The urogenital diaphragm, anal triangle and ischioanal fossae are revealed with their supply. These regions are readily palpated

and examined from above and below the pelvic diaphragm. Once their relations are established the supply from the true pelvis is dissected and confirmed.

D84. TESCH Norbert P., Wolfgang GRECHENIG, Hans G. CLEMENT, Johannes MAYR, and Georg FEIGL, Institut of Anatomie, Karl-Franzens-University, Department of Traumasurgery, University Hospital, Department of Pediatric Surgery, University Hospital, Graz, Austria. **Is it possible to differentiate the musculature of the hypothenar sonographically?**

The aim of this study was to see if the musculature of the hypothenar can be discerned exactly. Using sound probes with 10 to 20 Mhz the hypothenar region of 10 healthy experimentees aged between 5 and 50 years was examined in longitudinal and cross-section. According to the muscles' anatomical courses standard sections showing each muscle individually were elaborated. Each muscle was identified by means of an isolated test of its function. In addition to that the angle between the muscle fibres and the median line of the hand was measured on 20 upper extremities conserved after Thiel. The angles were determined in correlation to each muscle's width. In each case the individual muscles could be identified with high certainty. The muscle fasciae, which show sonographically as bright reflections, allowed to delimitate different individua from each other quite well. Sonography with high frequency sound probes is therefore a very apt means of description of the hypothenar's musculature. It allows an assessment of pathological processes in the region of the little finger's ball. It must be noted however, that because of the muscles' different 3-dimensional orientation only parts of each muscle will be hit directly in each setting. The resulting areas low in echo are artefacts and must not be considered pathological.

D85. THOMAS, Pamela P., Robert E. STEPHENS, and David L. McWHORTER, Department of Anatomy, The University of Health Sciences College of Osteopathic Medicine, Kansas City, MO, USA. **Teaching the relationship between gross anatomy and histology to first-year medical students.**

Understanding the relationship between microscopic anatomy and macroscopic anatomy is a challenge faced by first-year medical students. To address this problem, we aligned the histology course with the gross anatomy course and conducted a real-time laboratory exercise. Presentation of the same microscopic and macroscopic anatomy topics generally occurred within the same week of instruction throughout both courses. During an initial gross anatomy laboratory that included an upper limb fresh dissection, a real-time laboratory exercise was conducted. Multiple video camera recording with a distributed monitoring system allowed students to observe unfixed pieces of cadaveric biceps brachii muscle to be frozen, sectioned, stained, and viewed under a Zeiss Axiolab light microscope within approximately ten minutes. The intent of the laboratory exercise was to show the relationship between a three-dimensional gross anatomical structure and a two-dimensional histological section, while demonstrating the process of tissue preparation. These two procedures may be modified and/or used to improve student understanding of the relationship between gross anatomy and histology.

D86. TSUNODA, A.¹, T. SATO², and K. AKITA², ¹Evolutionary Anatomy Unit, Dept. of Anatomy and Developmental Biology, Rockefeller Building, University Street, London. ²Second department of Anatomy, Tokyo Medical and Dental University, Japan. **Arcuate eminence and the middle cranial fossa surgery.**

Arcuate eminence is arc-like bony protrusion on the middle cranial fossa and formally has been believed to be a protrusion of the superior semicircular canal. In addition, this structure is seen as

a useful landmark in skull base surgery, especially for middle cranial fossa approach, although some reports cast doubt on its anatomical correspondence to the superior semicircular canal. Twenty-eight cadavers were examined about the arcuate eminence, especially its correspondence to the superior semicircular canal and inferior surface of the temporal lobe. Arc-like eminence on the petrous bone were observed in 90% of specimens, however, they did not exactly corresponded to the superior semicircular canal and such eminence corresponded to sulci of the temporal lobe. On the other hand, smooth and even domy eminence corresponded to each superior semicircular canal was observed in only 15% of specimens. The arcuate eminence was listed as an important landmark in the middle cranial fossa approach. However, in order to drill out the internal auditory canal safely, surgeons should rely on other landmark or apply other methods.

D87. UZ, Aysun¹, Hasan Çalar UGUR², and Obrahim TEKDEMİR¹, ¹Department of Anatomy, ²Department of Neurosurgery, Faculty of Medicine, University of Ankara, Turkey. **Is the asterion a reliable landmark for the lateral approach to posterior fossa?**

An anatomical study was conducted to gain orientation regarding the posterolateral approaches. The asterion is defined as the junction of the lambdoid, parietomastoid, and occipitomastoid sutures. This anatomical point has been widely used as a landmark in lateral approaches to posterior fossa. Although there are many common practices in posterolateral approaches, studies providing accurate anatomical knowledge as to what is the correct point to start a craniotomy are limited in number. Therefore, this study was conducted in an attempt to determine the reliability of the asterion for the posterolateral approaches as a surgical landmark.

D88. VELKEY, J. Matthew, John P. NAFTEL, March D. ARD, Glenn A. HOSKINS, and Terence P. MA, Department of Anatomy, University of Mississippi Medical Center, Jackson, MS, USA. **Development and assessment of an online digital electron micrograph atlas for medical histology education.**

Teaching cellular ultrastructure is a vital component of medical histology education. Usually, expensive supplemental materials such as published electron micrograph (EM) atlases and EM photographic plates produced in-house are included. To address the need for a low-cost medium allowing a large number of students access to EM photographs, we used readily available computer hardware and software to convert EM plates produced in-house into a digital EM atlas for our course. We placed the atlas on our institution's local area network (LAN) for on-campus access and on our Web site for access via the Internet. At the conclusion of the course, we conducted a survey to assess the impact of the atlas. Survey results indicate that only 33% of the respondents used the atlas at all due to perceived disadvantages associated with LAN and Web access such as low image resolution (due to data compression) and long download times (due to slow modem speeds). However, a clear majority (65% of respondents) indicated that they would have used the atlas more if it had been available in CD-ROM format to allow off-line access to higher resolution images. On the basis of our experiences, we intend to expand the availability of the atlas to include a CD-ROM version, and we anticipate student usage of this resource will increase in the upcoming 2000-01 academic year.

D89. VU, Dzung, Mike TODD, Adrian D. MELLO, Thao VU, Jin-oh RHEE, Michael HALMAGYI, Geoff PARKER, and John S MAGNUSSEN, School of Anatomy, University of New South Wales, St. George Hospital and Departments of Neurology and Radiology, Royal Prince Alfred Hospital, Sydney, Australia. **Variability and clinical relevance of the planes of the semicircular canals.**

Modern imaging techniques allow a far better appreciation of the intricacies of the structures of the inner ear than was previously thought possible outside the realms of cadaveric studies. Whilst previous cadaveric work has delivered critical data regarding the average angles and planes of semicircular canals, the interpretation on a case by case basis has been far from feasible. We have used high-resolution computed tomographic (CT) imaging of cadaveric specimens and patients to examine the variability and in-plane curvature of the semicircular canals. Subsequent anatomical sections through the canal planes are to be performed. It is clear that assumptions regarding the average angle of each canal have to be altered when accurate vestibular function testing is to be accomplished. Subtle in-plane curvatures of each canal, add a new level of detail to the accuracy of models already under development of the movement of fluid within the canals. The data collected from CT studies, when combined with an external anatomical plane, allows for the accurate placement of the semicircular canals within the 3-dimensional space of the skull. This allows further refinement of existing vestibular function testing not previously possible, removing several possible confounding factors from the model.

D90. VU, Dzung, and Thao VU, School of Anatomy, University of New South Wales, Sydney, Australia and St. George Hospital, Kogarah, New South Wales, Australia. **"The Eye and Orbit" an anatomy computer-assisted instructional program using 3-dimensional computer models and Quicktime VR.**

"The Eye and Orbit" is an interactive computer-assisted learning program that uses conceptual and reconstructive approaches to facilitate the understanding of spatial anatomy of the orbit and its contents. Simplified 3-dimensional (3D) computer models of complex bones such as the sphenoid were generated (using Microscribe© 3D digitizer) with their major parts and features rendered in different colors. Animations were then created in Quicktime© movie format to show the parts flying in and assembling into complete bones, or bones into the orbit. Quicktime VR© movies of 3-D models, actual bones, and dissections allow learners to rotate these objects on screen in order to look at them from different angles. Although this "virtual reality" capability cannot and must not be a replacement for the study of actual specimens, it provides a powerful tool for self-directed learning and revision. The program has been used and highly rated by first year medical students of our medical course.

D91. WRIGHT, Kenneth R., Samantha E. WELLER, Paul J. McMILLAN, Jean-Marc TIECHE, and John LEONORA, Departments of Pathology and Human Anatomy, and Physiology and Pharmacology, Loma Linda University, Loma Linda, CA, USA. **Sucrose-induced decrease in bone specific gravity in growing rats is inhibited by carbamoyl phosphate.**

Previous studies have shown that a high-sucrose diet fed to weanling rats for 5 weeks caused a decrease in the density, bending strength and calcium and phosphorus content in long bones (J. Nutr. 128: 1807-1810, 1998). In a similar study, we fed male Sprague-Dawley rats a high-sucrose diet for 5 weeks, while control animals received standard lab chow. Two groups of animals received the high sucrose diet supplemented with carbamoyl phosphate in concentrations of either 6.25 or 3.125 mmol/kg of diet. Carbamoyl phosphate has been shown to modify the effects of high sucrose diet on the formation of dental caries in rats [J. Dent. Res. 54(3):570-577,

1975]. The animals were sacrificed by decapitation and then perfusion fixed. Femurs and tibiae were removed and cleaned of soft tissues. The specific gravity of the bones, as well as volume, wet weight, length and ash weight were measured. Analysis of variance was followed by Bonferroni post hoc tests. We saw no differences in wet weight, length, or ash weight between groups. However, the specific gravities of the femurs of the high-sucrose animals was significantly less ($p < 0.01$) than controls or animals fed high sucrose supplemented with carbamoyl phosphate at both levels. The same was true of the specific gravity of tibiae ($p < 0.02$). The two groups fed carbamoyl phosphate were not significantly different from the group fed normal lab chow. We conclude that carbamoyl phosphate modifies the effect of a high sucrose diet on bone growth.

D92. ZHANG, Ming, and Po-Chung AN, Department of Anatomy and Structural Biology, University of Otago, Dunedin, New Zealand. **Liliequist's membrane is a fold of the arachnoid mater: a study with sheet plastination and scanning electron microscopy.**

The subarachnoid space consists of a number of subarachnoid cisterns. They are separated from each other by incomplete arachnoid walls with openings of various sizes or complete walls without openings 1,2 . It has never been investigated whether these two types of the walls have the same property. Liliequist's membrane is an arachnoid wall in the basilar cisterns. Descriptions of its attachments, subdivisions and relationship with surrounding structures are very conflicting 1-5. This study, using the modified E12 sheet plastination method and scanning electron microscopy, investigated the property of Liliequist's membrane. Thirty-eight cadavers were used, 3 for the plastination and 35 for the gross anatomy dissection, two of which were further examined under the scanning electron microscope. The results indicate (i) Liliequist's membrane is an avascular fold of the arachnoid mater; (ii) the carotid-chiasmatic walls, which separate the chiasmatic cistern and carotid cisterns and had been considered to be parts of Liliequist's membrane^{1,5}, are vascular and incomplete trabecular walls, have a close relationship with the perforating arteries and should not be considered as a part of Liliequist's membrane, and (iii) Liliequist's membrane does not directly attach on temporal lobes and oculomotor nerves.

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2. Vinas FC, et al. *Neurol Res* 16:417 - 424, 1994.
3. Liliequist B. *Acta Anat (Basel)* 185 [Suppl]:1-108, 1959.
4. Yasargil MG, et al. *J. Neurosurg.* 44:298-302, 1976.
5. Brasil AV. *Neurosurgery* 32:956-961, 1993.

D93. ZUCCONI, William B., and Mark GUELFUAT, Department of Anatomy, New York College of Osteopathic Medicine, NY, USA. **The importance of teaching variant anatomy in undergraduate medical education with the discussion of a representative case report of duplicated IVC.**

Variant anatomy recognized during routine cadaveric dissection offers great learning potential. This knowledge may be applied toward enhancing the understanding of an array of subjects essential to a comprehensive undergraduate medical education. Such findings provide an alternative perspective through which to view common morphology and its structural and functional importance. It also provides a framework within which to review the embryogenesis of the structure in question, and through the help of qualified faculty, yields insight into its potential surgical, medical and radiologic implications. The frequency of clinically relevant anatomic variation is high enough to allow the gross anatomy laboratory to serve as an excellent teaching platform. Here, we introduce the student to anatomy, a foundation for future medical education and also to the concept of patient individuality, and therefore to the subsequent

individualization of medical and surgical therapies. This year we encountered a duplicated inferior vena cava which has a reported incidence of up to 3.0%. This case presentation illustrates an approach to such a finding as the embryologic, clinical, and radiologic correlates are briefly discussed.

17:00-18:00 AACA LECTURE Palmerston Room

Dr Ruth M. Hart: “What's Rembrandt Got To Do With It”

18:00 Close of Meeting

19:30 Traditional English fish and chip supper and bar (venue: Hall).
Dress casual. Tickets for this event for those who did not purchase the "Meeting Package) are £25 each.