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ARCHIVES OF ANATOMY
EDITORIAL BOARD

1. Editorial – Bem-vindos aos *Archives of Anatomy*

Jorge Fonseca (Editor-in-Chief de Archives of Anatomy)
jorgedafonseca@hotmail.com

A Direção eleita para o biénio de 2018 – 2020, propôs-se a renovar a revista científica e órgão oficial da AAP/SAP, *Archives of Anatomy*. Para o levar a cabo esta renovação esta renovação foi eleito, com a atual Direção, uma nova liderança editorial, com um novo Editor-in-Chief, Jorge Fonseca do IUEM e dois Co-Editores: a Prof.ª Paula Proença do ICBAS-UP e o Prof. Paulo Vera Cruz da FCM-UNL. Pretende-se trazer para o nosso *Archives of Anatomy* uma perspetiva que inclua investigadores das ciências morfológicas básicas e clínicos que se reveem na relação entre a investigação básica, translacional e clínica. Depois dos anos iniciais, notavelmente liderados pelo Prof. Ivo Furtado, este caminho apresenta-se como o mais promissor. Não é uma tarefa simples, dada a enorme oferta editorial de revistas on-line que está hoje disponível e que todos os dias nos chegam ao e-mail com convites agressivos e promessas variadas. Por outro lado, como o Prof. Ivo Furtado já tinha salientado num editorial anterior, a exigência curricular na carreira académica e também nas carreiras clínicas, passa pela publicação em revistas indexadas e com fator de impacto. Publicações não indexadas, mesmo as que incluem cuidadosa revisão por pares, têm menor valorização. E hoje é menos complexo o acesso a publicação em revistas indexadas, embora seja, muitas vezes, mais dispendioso. Por outro lado, as ciências morfológicas sofrem hoje de uma "moda" que as tende a desvalorizar junto de estudantes e jovens profissionais de saúde. Alavancar uma revista como a nossa *Archives of Anatomy* é uma tarefa hercúlea. Mas não desistimos. Vamos procurar seguir várias opções:

- Cada vez mais, iremos trazer aos sócios da SAP/AAP os resultados e estudos apresentados nas nossas reuniões científicas. Nesse sentido, temos um desafio para todos os que irão apresentar os seus trabalhos na próxima Reunião Científica de 25 de maio: para além de resumos dos trabalhos que irão apresentar, escrevam um *conference paper* mais desenvolvido. Não sendo um artigo e não impedindo a posterior publicação de resultados mais desenvolvidos, um *conference paper* permite uma leitura científica sólida, que chegará a todos os nossos sócios da SAP/AAP.

- Tentaremos que a nossa revista possa tornar-se um "primeiro passo" na publicação científica dos nossos mais jovens colegas desafiando-os a publicar as suas apresentações nas nossas reuniões científicas da SAP/AAP e os seus trabalhos finais de Mestrados Integrados e Licenciaturas. Muitos dos projetos dos nossos jovens investigadores, efetuados em meio académico ou clínico não atingem dimensão para publicações internacionais, mas têm a relevância nacional que justifica a publicação nos *Archives of Anatomy*. A grande maioria dos estudos apresentados nas nossas reuniões é de elevada qualidade e merece ser publicada e divulgada para além da sua apresentação oral ou em poster. Os nossos revisores estão focados em apoiar os nossos jovens investigados na obtenção de manuscritos com a maior qualidade. Há aqui também uma perspetiva

didática na qual queremos ser exemplares. Muitas vezes os revisores das publicações científicas constituem-se como um obstáculo difícil de transpor ou até como o adversário dos autores. Os *Archives of Anatomy* querem ser o parceiro dos investigadores. A colaboração de revisores experientes pode ser uma ajuda interessante para jovens a iniciar-se na escrita de artigos científicos. Pensamos que este também pode ser um caminho interessante.

Vamos fechar simbolicamente o número de 2018 com um estudo muito interessante do Prof. Pedro Oliveira focando a renovação do ensino da Anatomia: *An anatomy course based on cognitive load theory – descriptive essay*. Estamos certos que entusiasmará todos os que estão envolvidos no ensino das ciências morfológicas.

Necessitamos que todos na nossa Sociedade Anatómica transformem os vossos projetos, os resultados da vossa investigação nas ciências morfológicas, básicas, translacionais e clínicas em artigos científicos. Nesta fase de desenvolvimento dos *Archives of Anatomy*, não pretendemos competir com as grandes publicações internacionais mas sim contribuir para a divulgação dos projetos de investigação dos membros da nossa Sociedade Anatómica. Mas se os sócios da SAP/AAP não olharem para a nossa *Archives of Anatomy* com a consciência de que é um pilar da nossa sociedade, a nossa revista pode perder-se. Necessitamos da colaboração de todos…

Jorge Fonseca, Editor-in-Chief

2. An anatomy course based on cognitive load theory – descriptive essay

Pedro Oliveira
pedromaoliveira@hotmail.com

Abstract

Background

Anatomy is an essential learning for a medical student and is also of paramount importance for clinical reasoning, yet we continue to have reports of decrease in its knowledge. An anatomy course design may be challenging as we should encourage students to learn enough anatomy to manipulate concepts and we should also seek to achieve deep learning typologies. At the beginning of a course it may be preferable to use a surface approach that allows the student to properly manipulate terminology and basic anatomical detail, to bypass the conceptual gateways towards clinical reasoning. Cognitive load theory, that assumes a limited working memory and an unlimited long-term memory, has been used to address this challenge. We propose a methodology based on cognitive load theory, with the proper schemas to pass surface knowledge into the long-term memory.

Description

The course "musculoskeletal anatomy: foundations for medical undergraduates towards deep learning" is used as an example of a methodology based in cognitive load theory. The course, that is destined to first year medical students, uses a student-based perspective and should occur during four-weeks in a total immersion environment. The students are invited to fulfil seven sequential tasks that will serve as the schemas to enhance surface knowledge acquisition. Proper assessment and the use of multitasking technologic environment will work as additional motivators to enable the acquisition of fundamental concepts to achieve a constructed form of knowledge.

Conclusion

A methodology based on cognitive load theory in a student-based perspective may be proper for the study of anatomy and may allow the student to acquire essential surface knowledge and consolidate it in long-term memory which will be essential to him as a clinician.

Keywords

Medical education, anatomy, cognitive load theory, teaching, learning

Introduction

Anatomy is a basic science and – remains as – one of the scientific foundations of clinical reasoning and medical practice [1]. The decline in anatomical knowledge reflects a formative – or deformative (!) – problem and has been cited as one reason for increasing surgical errors and the consequent increases in medico-legal litigation [2].

We hereby essay on a course based on contemporary educational concepts – most of them already known to Anatomy, but not as we propose – whose goals are through a student-based approach to apply a model that allows both surface knowledge acquiring, which will be used for future deep learning, and critical thinking that is essential to bypass the conceptual gateway in the direction of clinical reasoning.

This descriptive essay corresponds to our thoughts about anatomy and fosters discussion. It uses as an example a course that we entitled "musculoskeletal anatomy: foundations for medical undergraduates towards deep learning", but whose format can be applied to other subjects in the morphological and basic sciences.

In teaching and learning anatomy it may be necessary to recognize that in the early phases of the study of a new topic a surface approach is needed. Nevertheless, there should be conditions and support for development of clinical engagement to enable a student to advance towards deep learning [3]. The initial surface approach aims at what was described by Hattie [4] as the threshold concepts or conceptual gateway and may include terminology and basic anatomical detail.

This presents a challenge for anatomy course design as, on the one hand, we should encourage students to learn enough anatomy to manipulate concepts and, on the other hand, we should seek to foster deep learning typologies. This is because although surface knowledge involves knowing a fact, learning at this level can result in quite limited levels of understanding and will not lead to relational or elaborated thinking characteristic of deep learners [4].

We argue that applying cognitive load theory (CLT) – as described by others before, e.g. Khalil et al., [5] –, with the proper schemas, it will be possible to overcome working memory and pass surface knowledge into the long-term memory, even with an unusual high burden of work and contents to address, as in the case of anatomy.

CLT has its origins in the late 1980s by John Sweller and has been further developed for medical education by John Young and Jeroen Van Merrienboer. CLT, which is a theory based on a model of human cognitive architecture, assumes a limited working memory and an unlimited long-term memory [6]. So, when presenting a new anatomical content, we are asking the student to transport it from the working – limited – memory to the long-term – unlimited – memory. In the reason of this the working memory will act as a bottleneck that can be dealt by the proper cognitive schemas.

We agree with the quote by Jerome Bruner "learning is a process, not a product", and in that sense it may be described as the construction and mechanization of schemas, a concept that is also described by Young et al., [6]. The *tasks* to be fulfilled throughout the course that we propose, will serve as the schemas to enhance surface knowledge and foster future deep learning bypassing the bottleneck, to achieve expertise which comes from constructed forms of knowledge stored as schemas in long-term memory that will be of use in clinical practice.

Course Description

The course "musculoskeletal anatomy: foundations for medical undergraduates towards deep learning" is destined to first year medical, physiotherapy, or other health sciences students, and will set the surface knowledge - terminology and basic anatomical detail - which may be also addressed as the threshold concepts or conceptual gateway necessary for future deep learning and vertical integration as well as for clinical reasoning.

The course contents will be divided in four *modules*, each of these to include the study of a chapter of the musculoskeletal anatomy. Each *module* will be studied in *segments* and include four *topics*: bones and skeleton (B); joints and its components (J); muscles and movements (M); peripheral nervous system (PNS) somatic efferences to muscles and relation to movements (table 1).

Table 1 – Course contents organization

Module	**Contents**	**Segments**	**Topics**
1	Axial – head	cranium, face	B, J, M, PNS
2	Axial – trunk	vertebral column, thorax	B, J, M, PNS
3	Appendicular – upper extremities	shoulder, arm, forearm, hand	B, J, M, PNS
4	Appendicular – lower extremities	hip, tie, leg, foot	B, J, M, PNS

The course dynamics (table 2) will use a student-centred approach, and interaction for learning will include three sequential *phases* where the student will have to accomplish *tasks*. Prior to the study of a *segment,* within a *module,* the students will be given the objectives as a to-do/to-know list. The students will also be given the materials, namely handbooks, where students can read, draw and colour the contents.

Table 2 – Course dynamics

Phase 1 - online sharing and discussion platform (flipped-learning concept)

- *task* 1 - (individual) prepare the given materials
- *task* 2 - (individual) post a musculoskeletal anatomy image/video and comment it
- *task* 3 - (individual) assess the comment posted by a colleague

Phase 2 - laboratory class (team-based learning)

- *task* 4 - (team) study an anatomical structure in the cadaver/model and prepare a photo or short video of the studied anatomical structure for laboratory class presentation
- *task* 5 - (team) print a 3d structure, identify it and present it in laboratory class
- *task* 6 - (team) guide the mock-exam resolution

Phase 3 - wrap up, case-based lecture

- *task* 7 - (individual) send a question for lecture discussion and attend lecture

Phase 1 - online sharing and discussion platform (flipped-learning concept)
Phase 1 will use a flipped-learning concept and an online platform where students will share and comment images or videos, properly cited, for a given anatomic *segment* within each *module*, and have their shared material and comment assessed by colleagues.

To accomplish *phase* 1 student should start by individually completing *task* 1. Then they should perform *tasks* 2 and 3: in *task* 2 share, in a chosen platform, content related to the proposed *segment*, either it is an image, or a video e.g. found in the internet, and make a structured comment on the main anatomic components learned, relations to other structures in that *segment,* etc; and in *task* 3 comment at least two shares/comments of colleagues in both correction and completeness. *Tasks* 2 and 3 will be monitored by a teacher or teaching assistant.

Phase 2 - laboratory class (team-based learning)
Laboratory classes will use team-based learning and peer interaction in a methodology think-pair-share. The students will do the laboratory class on the structures they have first described in the online platform. Phase 2 will have *tasks* 4, 5 and 6: *task* 4 will be the team (think-pair) study on human cadaveric material through prosection, study of plastinated specimens or plastic models. This *task* will be useful for determining anatomic position; the students will be required to do pictures or short movies presenting the structures, for later presentation in laboratory class (e.g. if the student is seeing a specimen of the upper extremity the movie could include mention to the related joints, muscles, movements that the muscles allow, along with explanation of innervation). The movie can be done with a mobile phone, and the presentation and interaction will be monitored by a teacher or teaching assistant.

In *task* 5 the students will have to convert a computer tomography scan file (Digital Imaging and Communications in Medicine - DICOM) into printable stereolithography (STL) and 3D print the files in a laboratory printer. The students will have access to a databank where they can select the image, then convert and print, and identify the main anatomic details by colouring or numbering. This *task* will also be shared in laboratory class with their colleagues. The presentation and interaction will be monitored by a teacher or teaching-assistant.

Task 6 the last to occur in the laboratory class will be a period for solving and discussing mock exams. The discussion will be guided by teams of students and use the methodology think-pair-share. First, each student should answer on his own and send the answer with the mobile phone or computer to a quiz available at the online platform (think); in the second step each student should check the answer with the colleague sitting near and re-answer at the online platform (pair). In the final step the students guiding the mock-exam resolution will answer and give their reasons and will discuss their option with the group (share). This *task* will be monitored by a teacher or teaching assistant.

Phase 3 - wrap up, case-based lecture

Lecture will work as wrap up of the studied contents and will present clinical cases for discussion within class. The teacher and teaching-assistants will also address any doubts from the previous *phases* 1 and 2.

It is important to notice that the case-based lecture will make use of a clinical cases, but the presentation of clinical cases is not intended to be case-based learning or problem-based learning. The objective of using cases is to increase learning, thinking and motivation within class, as well as transport surface knowledge to critical reasoning. We believe that the use of complete case-based learning or problem-based learning may be a disadvantage for this course that is intended for students that don´t have prior basic medical knowledge. Clinical cases will be sent to students prior to class, so that the students may study them and accomplish *task* 7, by sending questions for in-class discussion.

Course frame

This course should be framed in an introductory semester devoted to basic sciences in which anatomy is included. Each group of 12-15 students will be assigned to this course in total-immersion for four weeks. Daily schedule will include self-manage and laboratory/lecture time. Laboratory classes will occur every Monday, Wednesday and Thursday for four hours. Lectures will occur Tuesday and Friday for two hours.

Assessment and grading

Most of the *tasks* that the student must perform will be assessed in qualitative terms, by peers, teaching assistants and teachers. The students will be given early feedback on their work so that the tasks can be used to improve teachers teaching and students learning. The tasks will also be graded and contribute to the final grading. The tasks that won't be graded are also formative and constitute learning experiences.

Although the course aims at acquisition of surface knowledge of the musculoskeletal anatomy, critical thinking is valued. The formative component of the course is thought to be more important for future deep learning and clinical reasoning, so it will be valued in 60 points in a scale of 100 points (table 3). Summative examination will also be valued, as it allows to evaluate students 'achievements, but to a lesser degree than the formative component to demotivate "last-minute memorization" – cramming – and to pass the message that what really matters is continuous hard work in the *tasks* during the *modules*.

Table 3 – Course grading

Task	**Description**	**Value**	**Type**
1	prepare the given materials	-	formative
2	Posting and description of an image or video in the online platform	15	formative
3	Comment to a colleague posting	15	formative
4	Image or video presentation in laboratory class	15	formative
5	3d-printed model presented in laboratory class	10	formative
6	guide the mock-exam resolution	-	formative
7	Question sent for in-lecture discussion	5	formative
OSPE	Objective structured practical examination	20	summative
Exam	Module exam	20	summative
	Final score	**100**	

Discussion

At the end of this course it is expected that the student acquires the knowledge of anatomic terminology and basic anatomical detail of the musculoskeletal anatomy that will allow him to be a clinician.

The learning of key concepts and threshold anatomic concepts within the context of this course occurs by constructed understanding which builds upon surface and deep learning, as it happens for understanding movement - or lack of it! The learner should shape its own ideas to allow him to identify general rules for future integrated clinical reasoning and set the bases for autonomous life-long learning.

The seven *tasks* that we described allow decreasing the extraneous cognitive load imposed to the student that "wants" to learn anatomy, in order to bypass the bottleneck of working memory to reach long-term memory, as described by the CLT.

The strategies for encoding (acquiring of information) will occur throughout the *tasks* performed in *phases* 1, 2 and 3. Consolidation and retrieval of information will occur mainly during *phases* 2 and 3.

Anatomy is heavily time-dependent, as there is much to learn and much detail. Regarding teaching methodologies, *phase* 1 online sharing and discussion platform is considered adequate as asynchronous online discussion forums can be an effective tool for improving student learning outcomes as evidenced by final marks in gross anatomy teaching [7]. In courses that used forums moderated by staff as a learning methodology, where students were encouraged to post new threads and answer queries in threads started by others, the total number of posts by each student made a significant direct contribution to final mark [7]. The online platform must allow the staff to register as teachers and enrol students in a class created within the platform and execute the several *tasks* that require the online tool.

We do think that the online constitutes a "new geography" that is mandatory to be used complementary to the "old geography" within classroom, as it enhances interaction, critical thinking and learning.

In *phase* 2 the methodology think-pair-share and peer teaching will enhance learning as well as increase motivation for participation in the process of acquiring anatomical knowledge [8]. Mock exam resolution driven by students is also an important *task* in both consolidation and retrieval, although it will not be graded. Laboratory classes allow for interaction and acquiring of knowledge in prosection of the cadaver. Contact with the cadaver is referred by the students as one of the most striking learning experiences they have during the course [1]. The use of the cadaver is of paramount importance for the future clinician as it confers reality to anatomy, allows developing the three-dimensional notion of body and structures, and enables the development of an ethical attitude and respect that is due to the body [9].

Some of the *tasks* that we propose in *phase* 2, like 3D-printing, are innovative and attractive to students, improving at the same time the three-dimensional perception of the human form. 3D-printing shows itself as an asset in anatomy learning to be used adjacent to cadaveric materials and other widely used tools in anatomy education [10}. The laboratory class is based on student-centred methodologies, namely team-based learning, reported by students to increase content learning, skill development, and retention [11], while at the same time providing effective supplement to cadaveric prosection, improving both students' grades and perceptions of teamwork [12].

In *phase* 3, the lecture will wrap up the contents, and the students will be able to do both consolidation and retrieval of the contents, through the discussion of the clinical cases and relating the cases with the anatomical structures they have learned. The clinical cases provide an example of top-down strategy, that is preceded by bottom-up learning of the anatomical structures. The use of cases will also help understanding how anatomical knowledge relate to the future daily clinical practice and increase interest in class, thus increasing both extrinsic and intrinsic motivation.

We believe that total immersion in a multitasking technologic and highly interactive course, with use of internet, forum discussion and 3D printing, will also function as intrinsic motivator.

Total immersion also has the advantage of having the students focused on the contents that are interrelated facilitating acquisition thus diminishing the cognitive load of those contents. We would like to emphasize that each *module* starts with individual study of the given materials. We believe that the *tasks* that follow compel the student to perform this essential step properly.

The composite grade, that includes the *tasks* that the student will perform in the course will act as an extrinsic motivator. One other (indirect) aim of the compartmentation of the grading is to discourage the strategic approach that many students use for studying anatomy, that aims at efficacy regarding grades. This is achieved by having grading assigned to various *tasks* a during the course.

First year students are often immature, and this context should be accounted for. We think that, for this course, acquiring surface knowledge - terminology and basic anatomical detail - may be the correct approach for future deep learning. The point

needs to be made that we do not regard surface knowledge as invariably something to be avoided, or that only deep learning should be fostered [3].

Conclusion

A course like the one we propose is feasible and quick to implement and it addresses some of the cognitive difficulties of learning a dense science like anatomy. Complex learning as well as clinical reasoning should be preceded by solid work and knowledge in this foundational discipline, anatomy. A methodology based on CLT may be adequate for this.

Competing interests

The author declare no competing interests.

Acknowledgements

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3. LIII Reunião Científica da SAP (Sociedade Anatómica Portuguesa) e VI Reunião AAP (Associação Anatómica Portuguesa)

LIII Reunião Científica da Sociedade Anatómica Portuguesa (SAP)
VI Reunião Científica da Associação Anatómica Portuguesa (AAP)

Inovação em Anatomia

25 de maio 2019 - Instituto Universitário Egas Moniz

Programa

8 - 9	Abertura do secretariado; afixação de posters
9.15 - 9.30	Abertura da Reunião Científica, Professor Doutor Ivo Furtado, Presidente da SAP-AAP
	Sessão I - moderadores, Prof.ª Drª. Lia Neto e Prof. Dr. Bruno Colaço
9.30 - 9.45	O uso de fóruns *online* no ensino da anatomia - Prof. Dr. Pedro Oliveira, IUEM
9.45 - 10.30	Comunicações orais
10.30 - 11.00	*Coffee Break*
11.00 - 11.30	Apresentação dos posters
	Sessão II - moderadores: Prof.ª Drª. Maria João Oliveira e Prof. Dr. António Bernardes
11.30 - 11.45	Reabilitação oral implanto-suportada com recurso a compensação cirúrgica *Le Fort I"* - Mestre António Sousa da Silva, IUEM
11.45 - 12.30	Comunicações orais
	Conferência, moderador, Prof. Dr. Diogo Pais
12.30 - 13.15	If Anatomy seems to be too much to decline in medical curriculum, what can be done about it? - Prof. Dr. Bernard J Moxham, Cardiff University
13.15 - 15.00	Almoço e Posters
	Videoconferência
15.00 - 15.45	Apresentação projeto HDM (*Human Dissection Models*) e inteligência artificial MATEO, Prof. Dr. Ismael Herrera Vazquez e Prof.Dr. Juan Pablo Reyes, UNAM - Universidad Nacional Autónoma de México
	Sessão III - moderadores: Prof.ª Drª. Paula Proença e Prof. Dr. Diogo Casal
15.45 - 16.00	X-Ray Vision: A mental representation of the body of a young and an elderly person - Prof. Dr. José Grillo Evangelista (IUEM e Faculdade Belas Artes)
16.00 - 16.30	Comunicações orais
16.30 - 17.30	Concurso de Investigação em Ciências Morfológicas, entrega de prémios, Prof. Dr. Diogo Pais e Prof.ª Drª. Alexandra Brito
17.30 - 17.40	Informações Reunião ISCAA 2020 - Prof.ª Drª. Lia Neto
17.40 - 17.50	*Coffee Break*
17.50	Assembleia Geral Extraordinária da SAP/AAP

Fernando Vicente
Dibujo Figura 3 (2007)

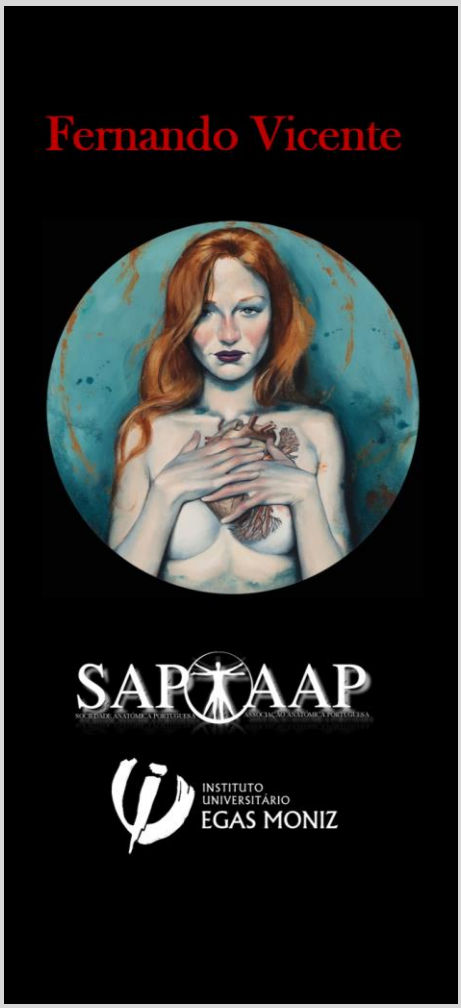
Estimados Colegas,

No dia 25 de maio de 2019, realizar-se-á a LIII Reunião Cientifica da SAP (Sociedade Anatómica Portuguesa) e VI Reunião AAP (Associação Anatómica Portuguesa) no Instituto Universitário Egas Moniz, cujo tema central será "A Inovação em Anatomia".

A reunião contará com a participação de prestigiados colegas nacionais e internacionais e convido-vos a submeterem trabalhos científicos, sob a forma de comunicação oral e/ou poster.

Os resumos devem ser submetidos até 4 de maio de 2019 no link
https://docs.google.com/forms/d/e/1FAIpQLSewvzYBp4pSJqO5GZDJl5YdOH2fRanvc8iT2l2uUJH-BG8Ixg/viewform?usp=sf_link

Contamos com a participação de todos, até breve, Saudações Académicas,
Maria Alzira Cavacas, Presidente da Comissão Organizadora da LIII Reunião Científica da SAP/ VI Reunião Científica da AAP, mcavacas@egasmoniz.edu.pt



4. Mensagem do Editor-in-Chief, a propósito da LIII Reunião Científica da SAP (Sociedade Anatómica Portuguesa) e VI Reunião AAP (Associação Anatómica Portuguesa)

Caros Associados da SAP/AAP,

Os *Archives of Anatomy*, convidamos os autores de apresentações da LIII Reunião Científica da SAP (Sociedade Anatómica Portuguesa) e VI Reunião AAP (Associação Anatómica Portuguesa) a escreverem um conference paper (mais desenvolvidos que os abstracts), entre 1500 e 2000 palavras para publicação nos Archives of Anatomy.

com um Abraço

Jorge Fonseca, Editor-in -Chief Archives of Anatomy