SR4007
Research Topics in Sports Science and Sports Studies
Course Handbook 2018-2019
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Cover image:

Confocal micrograph of fluorescently labelled HeLa cells.
Nuclei are labelled in blue, tubulin in green and actin fibres in red.

Courtesy of:
Kevin Mackenzie
Microscopy and Histology Core Facility
Institute of Medical Sciences University
of Aberdeen
http://www.abdn.ac.uk/ims/microscopy-histology
Course Summary

This course provides a detailed coverage of research topics in Sport Science and Exercise and Health Science. It will emphasise different factors, which contribute to overall health, sport, exercise performance, and consider any relevant adaptations that occur in response to different types of training. It will include a detailed consideration of seven research topics, and focus on the factors particular to each.

Course Co-ordinator: Dr Derek Ball (ext. 7456) derek.ball@abdn.ac.uk

Course Aims & Learning Outcomes

To enable students to be able to:

- Demonstrate relevant literature search skills and techniques.
- Demonstrate relevant presentation skills and techniques.
- Demonstrate relevant writing and abstract preparation skills.
- Demonstrate critical thinking and analysis of scientific papers
- Develop a detailed understanding of research topics and literature relevant to Sports Science and Exercise and Health in areas of physiology, nutrition, exercise, health, fitness and performance.

Other topics will be included to reflect the fast moving research interests within the School of Medical Sciences.

Course Teaching Staff

Course Co-ordinator(s):
Dr Derek Ball (DB), Medical Sciences

Other Staff:
Ms Mel Bickerton (MB), Med Lib
Dr Jenny Gregory, (JG), Medical Sciences
Professor Alison Jenkinson (AMJ), Medical Sciences
Dr Nimesh Mody (NM), Medical Sciences
Dr Michael E Scholz (MES), Medical Sciences
Dr Derek Scott (DAS), Medical Sciences
Dr Derryck Shewan (DS), Medical Sciences
Assessments & Examinations

Students are expected to attend all lectures, tutorials, and presentation sessions and to complete all class exercises by stated deadlines. It is imperative that any reasonable excuses for the late handing in of work are made to the course organiser (Dr Derek Ball) before the deadline date. Otherwise the work will not be marked and the class certificate, which is required to sit the examination, may be withheld. The minimum performance acceptable for the granting of a class certificate is attendance at all of the presentation sessions, and presentation of all set course work, written and oral.

Continuous assessment: 30% of the course assessment is based on material to be submitted and/or presented during the course. Each student will complete the following continuous assessments: one oral presentation, two questioning the presenter and three abstracts. Continuous assessments will thus be divided as: a grade for the oral presentation 25% and questioning (2*12.5%) and separate grades for the two best written assignments (50%).

Written Examination: 70% of the course assessment is based on one three-hour written paper. Students will answer three essay questions from a choice of six.

Common grading scale (CGS) grade: The overall performance of the student is expressed as a grade awarded on the common spine marking scale (see attached sheet).

The degree examination for this course will be held in the May/June examination diet.

Class Representatives

We value students’ opinions in regard to enhancing the quality of teaching and its delivery; therefore in conjunction with the Students’ Association we support the Class Representative system.

In the School of Medical Sciences, we operate a system of course representatives, who are elected from within each course. Any student registered within a course that wishes to represent a given group of students can stand for election as a class representative. You will be informed when the elections for class representative will take place.

What will it involve?
It will involve speaking to your fellow students about the course you represent. This can include any comments that they may have. You will attend a Staff-Student Liaison Committee and you should represent the views and concerns of the students within this meeting. As a representative you will also be able to contribute to the agenda. You will then feedback to the students after this meeting with any actions that are being taken.

Training
Training for class representatives will be run by the Students Association. Training will take place within each half-session. For more information about the class, representative system
visit www.ausa.org.uk or email the VP Education & Employability vped@abdn.ac.uk. Class representatives are also eligible to undertake the STAR (Students Taking Active Roles) Award with further information about this co-curricular award being available at: www.abdn.ac.uk/careers.

**Problems with Coursework**

If students have difficulties with any part of the course that they cannot cope with, alone they should notify the course coordinator immediately. If the problem relates to the subject matter general, advice would be to contact the member of staff who is teaching that part of the course. Students with registered disabilities should contact Mrs Jenna Reynolds (medsci@abdn.ac.uk) in the School Office (based in the Polwarth Building, Foresterhill), or Mrs Sheila Jones (s.jones@abdn.ac.uk) in the Old Aberdeen office associated with the teaching laboratories, to ensure that the appropriate facilities have been made available. Otherwise, you are strongly encouraged to contact any of the following as you see appropriate:

- Course student representatives
- Course co-ordinator
- Convenor of the Medical Sciences Staff/Student Liaison Committee (Professor Gordon McEwan)
- Medical Sciences Disabilities Co-ordinator (Dr Derryck Shewan)

All staff are based at Foresterhill and we strongly encourage the use of email or telephone the Medical Sciences Office. You may have a wasted journey travelling to Foresterhill only to find staff unavailable.

**Lecture Synopsis**

All teaching will take place at the University’s Medical School site. In each of the following modules, each class member will be assigned to cover one of the listed topics. A short presentation on this topic should be prepared for the seminar session on the last day of the module. This should be planned to last not more than 10 min, and should include suitable visual aids. All members of the class and the Module Tutor will be expected to contribute to this discussion. The aim of the presentation is to begin the discussion by highlighting the key areas. A brief written summary (abstract) of the topic (not to exceed one A4 page) should be prepared and submitted online through TurnitinUK on the SR4007 MyAberdeen course page by 2.30pm, on either the Monday or Wednesday, of each module as indicated in the timetable. This should highlight the key issues to be covered. Electronic copies of all original abstracts will be posted on MyAberdeen.

**Module 1:** Nutrition – Prof A Jenkinson

**Module 2:** Sport & Exercise Pharmacology - Dr D Scott
Module 1

Nutrition

Tutor: Professor A Jenkinson

Learning Outcomes

To understand the role of nutrition in high performance level and consider how specific nutrients might enhance performance. Specifically to:

1. Understand the effects of macronutrient intake on elite performance
2. Understand the effects of micronutrient intake on elite performance
3. To assess whether different forms of nutritional supplementation can affect health or performance.

Topics to be discussed in detail:

1. Power athletes and protein requirements
2. Iron depletion in athletes
3. Caffeine and sports performance or health
4. Bicarbonate or citrate loading – effects on sports performance
5. HMB (β-hydroxy-β-methylbutyrate) and sports performance or health
6. Glutamine supplementation and sports performance or health
7. Fatty acid supplementation and sports performance or health
8. Vitamin D – a cause for concern for athletes?

Reading list

General Reading:


Research papers and related material
Module 2

Sport & Exercise Pharmacology

Tutor: Dr D Scott

Learning Outcomes

In recent years, drug and supplement use have increased substantially in athletes and patients, so an understanding of how these substances affect their health and exercise capacity is essential. We need to understand how certain drugs might impact on exercise capability and performance and thus, recommend the best forms of exercise for a person taking medication. Since some medications can be viewed as “performance-enhancing”, it also allows us to know when medications can be reasonably taken by athletes to treat a condition before it could be considered that they are receiving an unfair advantage.

This module aims to provide a brief introduction to how some of the more commonly prescribed drugs can affect exercise performance in patients and athletes. Students will receive some basic instruction in pharmacology, and we will mainly focus on drugs acting upon the cardiovascular and respiratory systems. We will NOT be considering steroids in this module.
Topics to be included are:

1. Outline of the most commonly-used and abused drugs in cardiovascular and respiratory disease.
2. Who decides which drugs can be used to treat patients and athletes?
3. How do drugs affect physical activity in patients?
4. How do drugs affect physical activity in athletes?
5. How can exercise change the effect of drugs?
6. How can exercise reduce the need for drug therapy for many chronic medical conditions?

Topics to be discussed in detail:

1. What are the challenges of using heart rate as a measure of exercise intensity/capacity in patients taking cardiovascular drugs?
2. Do certain types of sports have higher rates of abuse of certain prescription drugs than others?
3. Define a general exercise and drug regime for a white, male, 24 year old student who has had a blood pressure of 150/90mmHg for a period of several months. Provide experimental or peer-reviewed evidence for your regime.
4. Define a general exercise and drug regime for a black, female, 60 year old doctor who has had a blood pressure of 150/90mmHg for a period of several months and arthritis that causes her severe pain. Provide experimental or peer-reviewed evidence for your regime.
5. What advice regarding exercise, training and medication would you give to a professional triathlete who says they are asthmatic?
6. Using the some of the prescription drugs discussed in the lecture, explain who decides on what is legal to use by athletes during sports events and what the legislation is regarding these medications. You should give some explanation of how athletes prove that they really require drug treatment for a medical condition and are not cheating.
7. Physical activity and cardiovascular drugs in patients
8. Physical activity and respiratory drugs in patients
9. Discuss the effects of diuretics on exercise performance.

Reading list

General Reading:


Reviews:


Students who wish to find out more about the official guidelines on how we treat patients who suffer from asthma and cardiovascular problems can access them at www.sign.ac.uk. SIGN (and other organisations such as NICE in England and Wales) review all of the available information to determine what the most effective treatments are for various conditions. The references at the end of the guidelines may be very useful to you. Please note that some of these guideline documents are very large, so avoid printing the whole document. Some of them have summary statements and diagrams that can simplify things for you.

Module 3

Satellite cells: muscular stem cells in sport, exercise and regeneration

Tutor: Dr M Scholz

The adult muscle is terminally differentiated, multinucleated and mitotically inactive. Adult skeletal muscle cells are in the G0-Phase of the cell cycle and incapable of re-entering the cell cycle and starting to proliferate again.

Satellite cells are stem cells of the adult muscle, resting inactively between the muscle fibre and the basal lamina. They are activated by exercise, overload or injury. Once activated, they start to proliferate and, after some cycles of division, they differentiate and fuse to the existing myotubes and to each other.

A small proportion becomes quiescent again and replenishes the stem cell pool. Reduced activity and numbers of satellite cells are related to atrophy and ageing. Thus, they are
important for maintenance, growth (hypertrophy) and regeneration of the muscle during sport and exercise, diseases or injury.

Learning Outcomes

To understand the role of satellite cells in sport, exercise and regeneration. More specifically, to investigate:

1. Understand the cell cycle and its regulation in stem cells.
2. Understand what stem cells are, and how are they characterised.
3. Understand what muscle satellite cells are.
4. Understand the concept of the myonuclear domain.
5. Assess the importance of satellite cells in muscle regeneration and maintenance.
6. Assess the importance of satellite cells in exercise-induced adaptation and muscle hypertrophy.
7. Understand regulation of satellite cells under different conditions

Topics to be discussed in detail:

1. What makes a satellite cell a satellite cell?
2. Activation and control of satellite cells
3. Satellite self-renewal – why do we not run out of muscle stem cells?
4. Myonuclear domains in muscle adaptation and diseases
5. Satellite cells and hypertrophy.
6. Satellite cells, hypertrophy and hyperplasia – an ongoing controversy
7. Satellite cells and doping – steroid effects and testosterone
8. Satellite cells, atrophy and aging

Reading list

Research papers and related material


Module 4

Exercise, Inflammation and Cardiovascular Health

Tutor: Dr N Mody

Learning Outcomes
To understand the role of physical activity/exercise in reducing markers of chronic low grade inflammation, thus improving cardiovascular health. More specific outcomes are to:

1. Consider the burden of excess adiposity
2. Assess the importance of fat depot location
3. Understand the role of inflammatory cytokines in cardiovascular health
4. Investigate the effect of exercise on these cytokines
5. Analyse the importance of exercise intensity in health

Topics to be discussed in detail:

1. Subcutaneous vs. Visceral fat
2. Tumour Necrosis Factor-alpha and insulin resistance
3. Interleukin-6, body weight and glycaemic control
4. Adiponectin and insulin resistance
5. Leptin and cardiovascular disease
6. Leptin as a treatment for obesity
7. Effect of exercise on chronic low grade inflammation
8. Effect of walking on chronic low grade inflammation
9. High intensity exercise and glycaemic control

Reading list

Research papers and related material

Body mass index, adiposity, subgroups, caveats and paradoxes


Portal theory (visceral fat, increased free fatty acid)

• Björntorp P. Arteriosclerosis. 1990 Jul-Aug;10(4) :493-6. [link](http://atvb.ahajournals.org/content/10/4/493.long)
• Lafontan M, Girard J. Diabetes Metab. 2008 Sep;34(4 Pt 1) :317-27.

Chronic low-grade inflammation and inflammatory cytokines in cardiovascular health / the anti-inflammatory effect of exercise.

• Petersen AM, Pedersen BK.; 2005 Apr J Appl Physiol. 98(4):1154-62. PMID: 1577205
These three are reviews on the anti-inflammatory effect of exercise.

**TNF-alpha**


**IL-6 (and interaction with TNF-α)**


**Leptin**


Adiponectin

Combs TP, Berg AH, Obici S, Scherer PE, Rossetti L.
Holland WL, Miller RA, Birnbaum MJ, Summers SA, Scherer PE.
Tao L, Gao E, Goldstein BJ, Ma XL.
Circulation. 2007 Mar 20;115(11):1408-16. PMID: 17339545
Chen H, Montagnani M, Funahashi T, Shimomura I, Quon MJ.
J Biol Chem. 2003 Nov 7;278(45):45021-6. PMID: 12944390
Okamoto Y, Kihara S, Funahashi T, Matsuzawa Y.
Circulation. 2002 Nov 26;106(22):2767-70. PMID: 12451000
Shibata R, Sato K, Ouchi N, Walsh K.
Shibata R, Ouchi N, Murohara T.
Vaiopoulos AG, Marinou K, Christodoulides C, Koutsilieris M.

Exercise

Module 5

Fatigue: is this a central or peripheral phenomenon?

Tutor: Dr Derek Ball

Learning Outcomes

The overarching theme for this topic is to explore the concept of fatigue in relation to muscle and nerve function. It will examine whether the fatigue experienced by an athlete is mainly a central signal generated in the CNS, or a peripheral failure of motor nerves and/or muscle fibres in their attempt to continue function appropriately to entirely normal CNS signals. The content will range from the phenotype of muscle fibre types related to their contractile and metabolic profile, central control of motor unit recruitment, normal synaptic function and reflexes, the metabolic processes activated to meet ATP turnover, the accumulation of by-products of metabolism and substrate depletion.

At the end of the presentations on all the topics, you will have an understanding of:

1. Muscle fibre type and myosin expression determine the contractile characteristics.
2. The importance of the CNS in the control of movement.
3. The importance of reflexes in the control of movement.
4. Neuromuscular transmission and muscle contraction in different fibre types.
5. How the elements of muscle recruitment, muscle energetics contribute to and are affected by fatigue.
6. Explore other aspects of fatigue that are not directly related to muscle metabolism for example, cardiac function as a consequence of prolonged sustained activity.

Topics to be discussed in detail:

1. Energetics of muscle contraction
2. Substrate depletion and fatigue
3. Metabolite accumulation and fatigue
4. Central control of movement
5. Central mechanisms of fatigue
6. Molecular mechanisms of contraction in different muscle fibre types
7. Muscle adaptation to activity and training
8. Motor nerve terminal function
9. Peripheral mechanisms of fatigue

Reading list

Research papers and related material

Module 6

Applied Physiology

Tutor: Dr M Scholz

Learning Outcomes

Establish the link between fundamental physiology and experiments and measurements to assess characteristics and performance of organ systems important for exercise. The neuromuscular system and endurance will be the main focus.

Topics to be discussed in detail

1. Mechanical components of the skeletal muscle - Passive versus active force production
2. Dependencies of muscle force and power
3. Dependencies of muscle contraction velocity
4. Cross innervation and its influence on fibre types
5. Endurance fitness – direct versus indirect assessment
6. Measurements to assess neuro-muscular performance – direct assessments
7. Assessment of muscle performance – 1 rep max, MVF production
8. Assessment of neuro-muscular performance using stimulation
9. Comparison of contraction types
10. Determinants of endurance
11. Skeletal muscle fibre type determination
Reading list

• Skeletal Muscle (2nd Edition), Form and Function, Brian MacIntosh, Phillip Gardiner, Alan McComas, Human Kinetics © 2006


• Validity of 20-MST for predicting VO$_{2\text{max}}$ of adult Singaporean athletes” J Sproule, C Kunalan, M McNeill, H Wright, Br J Sports Med 1993;27:202-204


• The measurement of maximal (anaerobic) power output on a cycle ergometer: a critical review. Driss T, Vandewalle H, Biomed Res Int. 2013; 2013:589361


**Practical/Lab/Tutorial Work**

**Abstract Guidelines**

An abstract for an Oral, Poster or Demonstrated Communication is intended to provide a means of communicating new work in progress, as well as completed work. The following guidelines are adapted from those used by the Physiological Society for Meetings Abstracts. Some of the advice they give on their website (www.physoc.org) is not as relevant to you since you are not presenting your own original data, but summarising the research findings of others.

- The text allowance for an abstract for this course is one side of A4 paper, with line and a half spacing, and your font size should not be less than 10 pt (your reference list may be in a slightly smaller size font as long as it is still legible). Use a clear font that is easy to read.
- There is no requirement to include full experimental protocols in your abstract. However, sufficient information must be given within the text, or by reference to published work, to indicate how the experiments were performed.
- The authors must include within the abstract a clear description of the results and all the appropriate data to support any conclusion they wish to make.
- Where references are included in the text, the author should make sure that these are listed correctly at the end of the abstract. If you are unsure as to how to cite references properly, please obtain a copy of Journal of Physiology to find out.
- If numerical data are presented as mean values, the standard deviation or standard error must be given, stating which is used; n values must also be given. If statistical significance is stated, then the statistical test must be named.
- All abbreviations must be explained within the text, except those that are listed in the online version of the Instructions to Authors for The Journal of Physiology (http://www.jphysiol.org/misc/abbreviationslist.pdf). Abbreviations should be those accepted in the field; new abbreviations should be avoided whenever possible. Authors are reminded that a large number of abbreviations within an abstract can detract from the sense.
- Tables and figures should be no larger than 8 cm X 8 cm. Please indicate the approximate position of the table or figure within the text, and also include an informative table heading or figure legend. Tables should not normally contain more than 30 values and graphs should not normally contain more than three curves.
- Figures must be fully labelled. Axis labels and lettering on figures should be in a lower case sans serif typeface (8 point); use capital, italic letters (A, B, etc.) to
- If you have any queries about the layout/content of your abstract, then ask!

**Practical/Lab Work**

There will be two practical classes in the Health Science Building Applied Physiology research labs

1. Indirect VO$_2$max testing and
2. Strength and Power Assessment

Practical classes will be assessed within Module 7: Applied Exercise Physiology.

**University Policies**

Students are asked to make themselves familiar with the information on key institutional policies which been made available within MyAberdeen ([https://abdn.blackboard.com/bbcswebdav/institution/Policies](https://abdn.blackboard.com/bbcswebdav/institution/Policies)). These policies are relevant to all students and will be useful to you throughout your studies. They contain important information and address issues such as what to do if you are absent, how to raise an appeal or a complaint and how seriously the University takes your feedback.

These institutional policies should be read in conjunction with this programme and/or course handbook, in which School and College specific policies are detailed. Further information can be found on the University’s Infohub webpage or by visiting the Infohub.

The information included in the institutional area for 2018/19 includes the following:

- Absence
- Academic Appeals & Complaints
- Assessment (Common Grading Scale)
- Codes of Practice on Student Discipline (Academic and Non-Academic)
- Class Certificates
- Recording of Lectures
- Exam Results
- Transcripts
- MyAberdeen
- TurnitinUK
- Feedback
- Communication
- Aberdeen Graduate Attributes
- The Co-Curriculum
## Medical Sciences Common Grading Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Grade Point</th>
<th>Category</th>
<th>Honours Class</th>
<th>Description</th>
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</table>
| A1    | 22          | Excellent    | First         | • Outstanding ability and critical thought  
• Evidence of extensive reading  
• Superior understanding  
• The best performance that can be expected from a student at this level |
| A2    | 21          |              |               |             |
| A3    | 20          |              |               |             |
| A4    | 19          |              |               |             |
| A5    | 18          |              |               |             |
| B1    | 17          | Very Good    | Upper Second  | • Able to argue logically and organise answers well  
• Shows a thorough grasp of concepts  
• Good use of examples to illustrate points and justify arguments  
• Evidence of reading and wide appreciation of subject |
| B2    | 16          |              |               |             |
| B3    | 15          |              |               |             |
| C1    | 14          | Good         | Lower Second  | • Repetition of lecture notes without evidence of further appreciation of subject  
• Lacking illustrative examples and originality  
• Basic level of understanding |
| C2    | 13          |              |               |             |
| C3    | 12          |              |               |             |
| D1    | 11          | Pass         | Third         | • Limited ability to argue logically and organise answers  
• Failure to develop or illustrate points  
• The minimum level of performance required for a student to be awarded a pass |
| D2    | 10          |              |               |             |
| D3    | 9           |              |               |             |
| E1    | 8           | Fail         | Fail          | • Weak presentation  
• Tendency to irrelevance  
• Some attempt at an answer but seriously lacking in content and/or ability to organise thoughts |
| E2    | 7           |              |               |             |
| E3    | 6           |              |               |             |
| F1    | 5           | Clear Fail   | Not used for Honours | • Contains major errors or misconceptions  
• Poor presentation |
<p>| F2    | 4           |              |               |             |
| F3    | 3           |              |               |             |
| G1    | 2           | Clear Fail/Abysmal | - | • Token or no submission |
| G2    | 1           |              |               |             |
| G3    | 0           |              |               |             |</p>
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<td>13:00-14:00</td>
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<td>Introduction to course: Introduction to Honours</td>
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<td>Introductory lecture - Module 3: Satellite Cells</td>
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<td>MES</td>
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<td>Fri 12 Oct</td>
<td>14:00-16:00</td>
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<td>Interim report and troubleshooting</td>
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**Week 14**

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**Week 15**

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**Week 16**

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**Week 17**

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<td>Wash Up/Exam Preparation</td>
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<td>Fri 1 Dec</td>
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**Staff**

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<tr>
<th>Name</th>
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<tbody>
<tr>
<td>Dr Derek Ball (DB)</td>
<td>Medical Sciences (Course Co-ordinator)</td>
</tr>
<tr>
<td>Ms Mel Bickerton (MB)</td>
<td>Med Sch Lib</td>
</tr>
<tr>
<td>Dr Jenny Gregory (JG)</td>
<td>Medical Sciences</td>
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<tr>
<td>Prof Alison Jenkinson (AMJ)</td>
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<tr>
<td>Dr Nimesh Mody (NM)</td>
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<tr>
<td>Dr Derryck Shewan (DS)</td>
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<tr>
<td>Dr Michael E Scholz (MES)</td>
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<td>Dr Derek Scott (DAS)</td>
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