

SPORT SINGAPORE

SPORT MEDICINE TRAINEE PROGRAMME

SPORTS SCIENCE CENTRE

03 November 2015

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1. INTRODUCTION

The Joint Committee on Specialist Training (JCST) oversees and is responsible for the Sports Medicine Subspecialty Training (SpMed SST) Programme. The SpMed SST programme is intended to be parallel to, and as rigorous as the established medical subspecialties. It is a competency-based training comprises a 3-year Sports Medicine Subspecialty Training.

The Trainee is required to fulfill a 6 month placement at an Accredited Training Centre with the objective of becoming “proficient in applying the principles of sport science (i.e. sports biomechanics, sports & exercise physiology, sports nutrition, sports psychology, strength and conditioning) in the management of competitive and recreational athletes”. During this time the Trainee is expected to continue to attend combined teaching sessions and run at least three hospital-based clinic sessions a week, in order to stay in touch with clinical work.

Specific objectives, in relation to sports science, have been set by the JCST, ref *JCST Sports Medicine Subspecialty Training Requirement (03 November 2015)* Section 1.8 identifies these as:

Specific Areas
Proficiency in performing exercise testing, including:
Anthropometry (including skinfolds)
Graded-exercise stress test
Exercise-induced asthma test
Direct measurement of oxygen uptake
Anaerobic capacity tests
Strength, power and agility tests
Ability to critically evaluate Sports Medicine and Sports Science literature
Conduct applied research in Sports Medicine and Sports Science

2. SPORTS SCIENCE TRAINING PROGRAMME

The Sport Science Department of the Singapore Sports Institute has developed the sports science curriculum for the SpMed SST programme based on the objectives and requirements identified by the JCST. The curriculum is based on the assumption that the SpMed Trainee will have approximately 90 days of training in sport science over a six month period, due to clinical and other training programme requirements.

The following sections set out the training programme for each of the five sports science disciplines; sports biomechanics, sports nutrition, sports & exercise physiology, sports psychology, and strength & conditioning. Each discipline sets out learning objectives, activities and deliverables (if any). In addition, a criterion is set to ensure that personnel designing and delivering the training programme are “qualified” as required by the JCST.

2.1 SPORTS BIOMECHANICS

Learning Objective 1:

To understand sports biomechanics and become familiar with the laboratory, tests and equipment.

Activity:

- Provision of relevant reading material on how Biomechanics is used to enhance athletic performance and prevent injuries
- Introduction to the laboratory and various sports-specific testing protocols
- Exposure to field- and laboratory-based testing

Deliverables:

Summary of learnings from reading material provided including a critique of 1 chosen journal paper. A list of questions regarding observations of the equipment and experimental protocols used

Learning Objective 2:

To become familiar with and understand 2D video capture, data post-processing and analysis (performance analysis).

Activity:

- Learn to calibrate the field of view to be filmed
- Learn to use video cameras to film appropriately
- Learn to process 2D footage to obtain basic kinematic data such as joint angles, velocity and acceleration
- Develop a simple project to film a movement of choice with a question-to-answer in mind regarding that movement, analyze the movement and discuss with the supervisor

Deliverables:

Write a short report on the project that investigates a basic sporting movement (e.g., walking, running, jumping, swing, etc.), report the calculated parameters (joint angles, velocity, acceleration), and discuss those findings. The report should have 5 sections: Introduction, Methods, Results, Discussion and Conclusion.

Learning Objective 3:

To understand and become familiar with video-based 3D motion analysis with the use of

- 1) The Vicon 3D Opto-reflective Infrared Camera and
- 2) Kistler Piezoelectric Force Plates

Activity:

- Learn about marker placement on the body
- Learn about different musculoskeletal models
- Learn to calibrate capture volumes
- Learn to perform static and dynamic calibrations of athletes to be assessed
- Learn to operate the Vicon 3D motion analysis system
- Learn how to conduct 3D motion analysis – including determination of key parameters, designation of the test, number of cameras and capture rate, calibration of space, synchronized video capture and process, setup of spatial model for calculation of centre of mass (COM), automatic and manual digitisation of video image, data calculation and process etc.
- Learn how to collect Force Plate data
- Learn how to perform data post-processing on camera and force plate data to calculate kinematics and kinetics via inverse dynamics

Deliverables:

Conduct 3D motion analysis of basic sport techniques (walking, running, jumping, swing etc) with the Vicon system and calculate the desired parameters (3D joint angles, velocities, accelerations, joint moments, etc). Discuss critically the limitation and errors of the test.

Recommended Text Book

Hay, J.G. & Reid, J.G. (1 9 8 2) . Anatomy, Mechanics & Human Motion (2nd ed).

Recommended Further Reading

Human Body Dynamics (Aydin T)

Three-Dimensional Analysis of Human Moment (Paul Allard, etc.)

Journal of Biomechanics

2.2 SPORTS NUTRITION

Learning Objective 1:

To become familiar with and understand the controversy surrounding the requirements for one macronutrient in sport nutrition, and to be able to clearly delineate how or whether advice/recommendations popular with the general public should be applied to athletes.

Activity:

Either attend a presentation delivered by Sports Nutrition department staff, or if one is not available, facilitate a discussion session with SND staff on a macronutrient of your choice.

Also search on social media (Twitter, Facebook and other internet mediums) what the 'popular' approach is regarding your macronutrient, and what objectives those recommendations aim to achieve.

Deliverables:

Provide a 2 page summary of your observations, and your critical analysis of whether these approaches/recommendations should be used with athletes. Are these objectives relevant to any athletes? If so, which ones? Which athletic group would be ill-advised to follow these recommendations, and why? Conclude your report with two paragraphs on how you will apply this 'filter' of popular advice to your sports medicine practice.

Learning Objective 2:

To become familiar with the latest research regarding sports nutrition

Activity:

To conduct a literature search on ONE of the following area in sports nutrition: Important nutrients to optimize recovery from endurance or resistance or team sport exercise; Potential applications of Probiotics to athletes; or Nutrients to include in the training diet to improve high intensity intermittent exercise performance.

Deliverables:

Literature review – max 2000 words. Finish your Literature Review with three key messages for athletes that you could deliver in practice, stating caveats/contraindications (for example regarding which populations) as applicable.

Learning Objective 3:

To observe practical sessions of a sports nutritionist working with athletes (clinical/workshop sessions).

Activity:

To observe at least 3 nutrition activities delivered by SND staff. Where possible, attend and contribute to a Cooking Workshop, an education seminar, and a one-on-one Consultation.

Deliverables:

List three new learnings from each activity that you attended. This could be knowledge gained, it could be techniques employed, or misconceptions that were challenged. Provide a process flowchart of each session (e.g., baseline screening or identifying target audience, assessment of diet issues or needs assessment for workshop, diagnoses, intervention proposed/delivered and suggested method of monitoring). Put together a short summary that will help other sports physicians understand the role of a sports nutritionist and how to refer to and work with one.

Learning Objective 4:

To identify 3 physiological 'problems' that can limit athletic performance (in sports or exercise domains of your choice), and provide nutrition 'solutions' to those problems.

Activity:

To be familiar with the performance 'problems' faced by Team Singapore athletes, and to understand nutrition interventions in either the training diet or competition diet that may help address those performance issues.

Deliverables:

A summary report on three different performance problems and nutrition solutions should be shared with SND staff.

Learning Objective 5:

To appreciate and recognize the risks of intentional and inadvertent doping among athletes arising from the use of nutrition supplements

Activity:

Explore the research literature, supplement testing programmes, the WADA and Anti-Doping Singapore websites plus other 'grey literature' to identify recent publications, presentations or papers addressing the potential or actual contamination risks of sports nutrition supplements, preferably identified by laboratory testing of supplements for WADA prohibited substances.

Deliverables:

A Summary report, presentation or discussion on your research findings. Also present a recent case study of a doping prosecution case, sharing with the SND the circumstances that led to the return of a positive test by an elite international athlete, from any sport.

Recommended Text Book

Burke, L. & Deakin, V. (2006). *Clinical Sports Nutrition* (3rd ed). McGraw Hill, Australia.

Recommended Websites:

Sports Dietitians Australia: www.sportsdietitians.com.au

Informed Sport: www.informed-sport.com

WADA: www.wada-ama.org

Recommended Further Reading

Burke, L. (2007). *Practical Sports Nutrition*. Human Kinetics.

McArdle, W.D., Katch, F.I., & Katch, V.L. (2005). *Sports and Exercise Nutrition* (2nd ed). Lipincott Williams & Wilkins, USA

International Journal of Sports Nutrition and Exercise Metabolism

2.3 SPORTS PHYSIOLOGY

Learning Objective 1:

To understand the role of Sports Physiology and its service model; to understand the rationale and importance of evaluating acute responses and chronic adaptations in athletic performance.

Activity:

- Introduction to the role of Sports Physiology and service model
- Learn about the importance of validity/specificity, reproducibility/sensitivity in test protocols
- Observe and/or assist in laboratory (including clinical) and field testing

Deliverables:

Write a service plan for an allocated sport. The format of the literature review should include the following: literature review on the physiological demands and characteristics of the sport, practical applications/guidelines for training programme, proposed test protocols (laboratory & field, general & sport-specific), gaps and future directions.

Learning Objective 2:

Cognizant of the broad spectrum of specific factors which can affect athletic performance (e.g., diet, environmental, ergogenic aids) and principles of training

Activity:

- Understand the variables and components of training (intensity, duration, volume, load, etc.)
- Understand the concepts of general adaptation syndrome, periodization and tapering
- Understand the various training models (e.g., polarized, lactate threshold, high intensity interval training, etc.)

Deliverables:

To devise practical training programmes for various appropriate fitness components for the allocated sport. To assist and/or conduct a training session.

Learning Objective 3:

To understand the importance of athlete monitoring in achieving optimal sporting performance; to understand and be familiar with the auxiliary training interventions and recovery methods

Activity:

- To understand the various forms of athlete monitoring (biomarkers, performance indicators, physiological markers, subjective ratings, well-being questionnaires, etc.)
- To learn about hypoxic exposure, heat acclimation, respiratory muscle training, electromyostimulation, ischemic preconditioning, cold water immersion, precooling, etc.
- To assist and/or conduct auxiliary training and recovery session

Deliverables:

To develop a guideline/chart of 5-10 practical and useful biomarkers (blood, urine, saliva, sweat, etc.) associated with inflammation, immunity, oxidative stress, etc.

Recommended Text Book

McArdle, W.D., Katch, F.I., & Katch, V.I. (2006). Exercise Physiology: Energy, Nutrition, and Human Performance (6th ed). Lippincott Williams & Wilkins, Baltimore, USA.

Recommended Further Reading

MacDougall, J.D., Wenger, H.A., & Green, H.J. (1991). Physiological testing of the high performance athlete (2nd ed.). Human Kinetics, IL, USA.

Maud, P.J., & Foster, C. (2002). Physiological assessment of human fitness (3rd ed.). Human Kinetics, IL, USA.

Tanner, R.K. & Gore, C.J. (2013). Physiological tests for elite athletes (2nd ed.). Australian Sports Commission, Human Kinetics: IL, USA.

2.4 SPORTS PSYCHOLOGY

Learning Objective 1:

To become familiar with and understand the theory of sports psychology.

Activity:

Lecture series – 45-60 minutes/lecture x 6 lecture topics delivered by Sports Psychology department staff.

Deliverables:

Summary of each lecture. Include the following subheadings for each: lecture topic,
- 1-2 A4 pages/lecture.

Lecture No.	Topic
1	Introduction to Sports Psychology, roles of a sports psychologist, application of theory, peak performance environment, how the various Sports science departments work together.
2	Psychological Skills Training (PST), i.e., Goal Setting, Imagery, Self-talk, Relaxation, etc.
3	Team-related topics i.e., Team Cohesion, Team Building, Communication, Leadership, Roles, etc.
4	Arousal-Performance, Anxiety, Stress Management
5	Applications of Sports Psychology equipment i.e., Biofeedback, VTS, etc.
6	Others (working with athletes with physical and intellectual disabilities, mood and eating disorders)

Learning Objective 2:

To become familiar with the latest research regarding one of the above topics and its applicability.

Activity:

To conduct a literature search on ONE of the above topics, and detail how it applies in our work with high performance athletes.

Deliverables:

Literature review – max 2000 words.

Learning Objective 3:

To understand how to integrate psychological skills into a training programme.

Activity:

To draw up a 6-8 weeks Psychological Skills Training programme for an athlete or a team.

Deliverables: Report – max 2000 words.

Learning Objective 4:

To observe practical sessions of a sports psychologist working with athletes and/or coaches.

Activity:

To observe at least 2 workshops delivered by SP department sport psychologist.

Deliverables:

Provide a summary of each workshop and an evaluation of the content and recommendations for future workshops – 1-2 A4 pages/workshop.

Recommended Text Book

Weinberg, R.S. & Gould, D. (2007). *Foundations of Sport and Exercise Psychology* (4th ed.). Champaign, IL: Human Kinetics.

Recommended Further Reading

Andersen, M.B. (2000). *Doing Sport Psychology*. Champaign, IL: Human Kinetics.

Gardner, F.L., & Moore, Z.E. (2005). *Clinical Sport Psychology*. Champaign, IL: Human Kinetics.

Richard, R., & Wiese-Bjornstal, D.M. (1999). *Counseling in Sports Medicine*. Champaign, IL: Human Kinetics.

2.5 STRENGTH & CONDITIONING

Learning Objective 1:

To obtain the knowledge and skills to understand, apply and design strength & conditioning programmes, including basic training principles and variables to enhance sports performance.

Activity:

The Trainee will complete SSI's Strength and Conditioning Course (Introductory Basic Level).

The objectives of the course are:

- Combine various Strength and Conditioning training variables to enhance strength, power and agility capabilities
- Create a more effective strategy by incorporating appropriate sports-specific interventions
- Correctly perform basic strength training exercises specific to sports performance
- Design a holistic strength training program for sports
- Ensure overall safety of the user when performing the exercises

Trainee will receive a copy of SSI's S&C CD-ROM that contains further information on the activities and exercises.

Deliverables:

Full attendance for all units covered and PASS achieved of a practical assessment.

Recommended Text Book

Baechle, T.R. & Earle, R.W. (2008). *Essentials of Strength Training and Conditioning* (3rd ed). National Strength and Conditioning Association, Human Kinetics: IL, USA.

3. QUALIFIED SPORTS SCIENCE TRAINERS

The JCST requires that personnel designing and delivering the SpMed Trainee are appropriately qualified. In 2013, the Sports Science Centre established a career pathway for sports scientists in order to provide a clear, sustainable and internationally comparable framework for Sport Singapore. This framework will help guide and drive the professional development requirements for staff and the education/career choices for young Singaporeans considering pursuing a career in the sport sciences.

Position descriptions and person specifications were gathered from various high performance sport systems in the UK, Australia, NZ, Germany, and the USA. Staff also had extensive knowledge and understanding of the structure and roles of support personnel in China, Korea, Japan, Malaysia, Canada, France and Spain.

We have 4 main levels (associate scientist, scientist, senior scientist, and principal/chief scientist) in our career progression structure. Each level has specific academic, professional and experiential requirements. Within this, a position overview, managerial responsibilities, scope of practice and person specifications have also been developed.

In meeting the JCST requirements for personnel to be appropriately qualified, individuals must meet the Sport Singapore criteria for practitioner, or higher, in their respective discipline. Where possible, Sport Singapore will assign a Senior Practitioner to design and deliver the programme.

4. GENERAL GUIDELINES

Please refer to Annex 1 of General JCST Guidelines on the following:

- Leave Guidelines
- Training Deliverables
- Retrospective Recognition
- Changes to Training Period
- Part-time Training
- Overseas Training
- Withdrawal of Traineeship
- Exit Certification