THE UNIVERSITY OF NEW SOUTH WALES

School of Medical Sciences

Faculty of Medicine

NEUR3101

Muscle and Motor Control

Semester 1, 2012
Course Outline

Table of Contents

COURSE STAFF:

Convenor: **Dr Stewart Head** s.head@unsw.edu.au
Department of Physiology
Ph 9385 2555 Office: Wallace Wurth 308
Office Hrs: Thursdays 2-3pm

Co-Convenor: **Dr Cindy Lin** c.lin@unsw.edu.au
Exercise Physiology
Ph 9385 8311 Office: RM11 32 Botany St
Office Hrs: Thursdays 2-3pm

Guest Lecturers:
Dr Andrew Moorhouse a.moorhouse@unsw.edu.au
Dr Richard Vickery richard.vickery@unse.edu.au
Dr Arun Krishnan arun.krishnan@unsw.edu.au
Dr John Morley j.morley@uws.edu.au
Dr Anthony Kee a.kee@unsw.edu.au
Dr Janet Taylor j.taylor@powmri.edu.au NeuRA
Dr Penelope McNulty p.mcnulty@unsw.edu.au NeuRA
Dr Richard Fitzpatrick r.fitzpatrick@unsw.edu.au NeuRA
Dr Anna Hudson a.hudson@neura.edu.au NeuRA

Technical Officer: **Mr Balu Daniel** d.balu@unsw.edu.au
School of Medical Sciences

Program Officer: **Ms Sue Cheng** sue.cheng@unsw.edu.au
School of Medical Sciences

Course details

Credit Points: 6 UOC

Course Pre-requisites

PHPH2101- Physiology 1A or PHPH2121- Principles of Physiology A or PHSL2501- Human Physiology A or NEUR2201- Neuroscience Fundamentals

Course Description

This course examines how movement is controlled from brain to skeletal muscle. The major themes are the contribution of the brain and spinal cord to the control of movement, muscle function, motor learning, movement disorders, fatigue and ageing. A series of advanced practical classes will range from experiments with isolated mammalian muscle to human studies with electromyography. The lectures, practicals and tutorials will be complemented by a series of expert seminars which provide insight into current research in the field and reinforce the relationship between integrative neuromotor function, movement physiology and the cellular and molecular physiology underlying muscle and motor control.

Course Aims

To encourage the development of:

1. an understanding of how the brain and spinal cord interact to produce different movements
2. an understanding of skeletal muscle function and adaptation
3. an understanding of the mechanisms of motor learning and factors that influence motor learning
4. an awareness of the mechanisms and current treatments of various neuromuscular disorders
5. an appreciation of current techniques and future directions in movement neuroscience research

Understanding the motor system is a vibrant research area in brain sciences, spanning, for example, the molecular genetics of muscle tissue, the cellular physiology of motoneurones, the plasticity of nerve cells in the brain, animal models of diseases of movement, unravelling systems physiology in human subjects, and engineering control theories to identify the fundamental principles of motor control. In this course, you will be encouraged to learn and understand more about the physiology of the neuromuscular system. The emphasis is on how the central nervous, sensory and muscular systems work together to produce movements and how this is disrupted by disease and normal ageing.

Student Learning Outcomes

This term is used to describe what it is that you should be able to do, explain or understand if you have learned effectively in the course. For each lecture, tutorial, practical and assessment item, the expected learning outcomes will be explicitly stated. The assessment in the course will be matched as closely as possible to the stated learning outcomes. That is, the assessment will test how well you have achieved the learning outcomes of the course. The general learning outcomes for the course are as follows:

At the end of the course you should:

- Be able to communicate a mature understanding of how skeletal muscle and the nervous system work to generate controlled movements at a level sufficient for effective communication with health care professionals.
- Have an understanding of the key theoretical concepts in the field of movement neuroscience in order to allow easy extension of your understanding beyond the material covered in this course to specific topics that may be important in future clinical, research or educational contexts.
- Have an awareness of current and (likely) future directions in movement neuroscience research and an ability to independently research the literature to address questions related to the field that may arise in your future professional activities.
- Be competent in the use of basic EMG and nerve stimulation techniques for research and clinical procedures.

Graduate Attributes Developed in this Course – *for Medical Science and Science Students*

- the skills involved in scholarly enquiry
- an in-depth engagement with disciplinary knowledge in its interdisciplinary context
- the capacity for analytical and critical thinking
- the ability to engage in independent learning
- Information Literacy – the skills to locate, evaluate and use relevant information
- the skills of effective communication

Graduate Attributes Developed in this Course – *for Exercise Physiology Students*

- Understand the relationship between physical activity and health
- Apply clinical skills and knowledge relevant to cardiopulmonary, metabolic, musculoskeletal and neuromuscular rehabilitation
- Engage in independent and reflective learning for the betterment of professional clinical practice, following an evidence-based approach
- Communicate effectively with patients, colleagues and other health professionals

Rationale for the inclusion of content and teaching approach

How the course relates to the exercise physiology profession **(for students in program 3871-Exercise Physiology)** A solid understanding of mechanisms by which humans plan and execute movement is central to a comprehensive training program in exercise science, and critical for effective professional practice in exercise rehabilitation.

How the course relates to other courses in the Exercise Physiology program – The information and ideas presented in this course will build upon material on muscle and nervous system and function from the second level Anatomy and Physiology courses you have taken. This course also provides a conceptual base that is essential for the neuromuscular and musculoskeletal rehabilitation courses later in the program

Teaching Strategies

Lectures – This approach is used to present relatively large amounts of information at a time on specific topics throughout the course. PDF copies of the lecture notes will be available on Vista (see below in COURSE RESOURCES section) prior to each lecture, so you should be able to think about and develop an understanding of the lecture concepts as they are presented, rather than writing voluminous notes. However, there will be information and explanations presented in lectures in addition to those covered in the notes that you should take down if they help you to understand the material. The lecturer will also try to allow some time for interaction and activities in each lecture to provide you with an opportunity to clarify or reinforce the ideas that have been presented. You should take these opportunities to think about the information that has been presented and ask questions to enhance your understanding.

Practicals – The purpose of the practical components of the course are twofold. The first purpose is to help you to develop technical skills that will be relevant in your professional career. It is essential that you obtain some hands-on experience with the major research and/or clinical techniques in human motor control, before you begin your practicum or the clinical rehabilitation courses. The second purpose is to use experiments to demonstrate and reinforce key theoretical concepts that have been covered in lectures. The questions contained in the practical outlines will guide your learning in this respect.

Tutorials – This format provides a more informal learning environment than a lecture. The sessions in weeks 2-6 will be structured around a “classic” research paper chosen from a field relevant to the course content from the preceding week. Students will be requires to read the paper (which will be available on Blackboard) before the tutorial. Students will then be encouraged to participate either by speaking or active listening in the structured discussion based around the classic paper. The purpose of these sessions is to enable the students to gain a core understanding of the scientific basis of the discipline. For details of the tutorials in week 7-12 please see the timetabled slots. Attendance of these seminars is compulsory.

Expert Seminars – Expert seminars will be delivered in two of the tutorial slots throughout the session. The purpose of these seminars is to expose students to the latest research questions and techniques in muscle and motor control, and to provoke thought about the core material in the course as well as future directions in the field. Attendance of these seminars is compulsory and the content of the expert seminars is broadly examinable.

Independent study – There is insufficient time in the lectures, tutorials and practicals for you to develop a deep understanding of the concepts covered in this course. In order for you to achieve the learning outcomes that will be assessed, you will need to revise the material presented in the course regularly. You will probably also need to do additional reading beyond the lecture materials in order to learn effectively. Relevant additional resources will be cited in each lecture.

Assessments – These tasks have been chosen as tools to enhance and guide your learning as well as a way of measuring performance, and are therefore central teaching strategy in this course.

Assessment

Assessment of your learning in the course will be achieved through examinations. The examination format tests your ability to recall and communicate knowledge of the subject matter without outside resources and in a time-constrained context. These requirements are similar to those encountered when dealing with a client or patient in a face-to-face setting, or when communicating with other health professionals or researchers. The examinations will be designed to determine how well you have achieved the general learning outcomes outlined above, and the specific learning outcomes outlined in each lecture/practical/tutorial.l The classic paper assignment will assess your ability to access and interpret the scientific literature in the field of muscle and motor control, and to demonstrate your understanding of the material by designing your own hypothetical experimental paper. You may be required to perform similar tasks in many professional settings within exercise physiology practice or medical research. For example, you will refer to the scientific literature to inform clinic exercise prescription, such as with a particular neural disorder, or present a scientific case for using a particular training method.

.

Summary of Assessment	**% Total Marks**	**Due Date**
ASSESSMENT TASK 1 - PROGRESS EXAMINATION	**25%**	week 7 Thursday 19th April
ASSESSMENT TASK 2 - END OF SESSION EXAMINATION	Multichoice: **25%** Short answer: **25%**	Exam period
ASSESSMENT TASK 3 – CLASSIC PAPER ASSIGNMENT	25%	Assessment task due in Friday May 11th (Week 10)

ASSESSMENT TASK 1 *- PROGRESS EXAMINATION*

The purpose of this exam is to test your understanding of the concepts covered in the course during weeks 2 – 7 (lectures 1 – 14, only Tuesdays lecture 14 in week 7, laboratories 1 - 3). The format will be a mixture of multiple choice and short answer questions. The exam will be held during the lecture timeslot, thus all students are required to attend on this day. A practice exam will be available on Blackboard a week prior to the progress exam.

ASSESSMENT TASK 2 *- END OF SESSION EXAMINATION*

The purpose of this exam is to test your understanding of the concepts covered in the course, including the ENTIRE COURSE (including weeks 2 - 7). The format will be multiple choice and short answer questions. The exam will be held during the end of session exam period in 2 separate sessions. A practice exam will be available on blackboard in the final week of the teaching session.

ASSESSMENT TASK 3 *– CLASSIC PAPER ASSIGNMENT.*

Classic paper assessment component

In the tutorial on week eight, Students will be assigned one of the five classic papers presented in the tutorials weeks 2 to 6. The papers will be assigned randomly and is important that students make sure they attend all the classic paper tutorials. Attendance at the tutorials is compulsory.

Section1 This will be 50% of this assessment.

For the written classic paper assignment students will provide a synopsis of the assigned classic paper both from their reading of the paper and the notes they made on the discussion which will take place during the tutorial. It is in the student's best interests to ensure that they are prepared for each tutorial and participate in the discussion either directly or by active listening. This section must be no longer than 1000 words. Any text beyond this limit will be deleted. This section is structured to include:

1. Background of physiological context (10% 200 words)

2. Experimental approach, including techniques used and data analysis (10% 200 words).

3. Principal findings (10%, 200 words)

4. Statement of why this is a “classic” paper i.e. uptake and development of the field from this point (20%, 400 words).

Section 2 This will be 50% of this assessment.
In the second section of the assignment students will use the paper as the foundation in order to design an experiment to advance the hypothesis and findings laid out in the classic paper, extending the research.

1. This should be in the format of an experimental aim. (15% 300 words)

2. Provide an experimental design and methods designed to test their aim(15% 300 words)

3. Finally the students should undertake a thought experiment and predict the type of data they would expect to generate in their hypothetical experiments. The data in this section should be in the form of Tables, diagrams or graphs, students need to put some thought into the best way of analysing their data and they can use either one or a combination of these formats including figure legends – pay particular care to the labelling of the diagrams and figures. (20% 400 words).

Assessment of your learning in the course will be achieved through examinations and a research assignment. The examination format tests your ability to recall and communicate knowledge of the subject matter without outside resources and in a time-constrained context. These requirements are similar to those encountered when dealing with a client or patient in a face-to-face setting, or when communicating with other health professionals or researchers. The examinations will be designed to determine how well you have achieved the general learning outcomes outlined above, and the specific learning outcomes outlined in each lecture/practical/tutorial. The classic paper assignment will assess your ability to access and interpret the scientific literature in the field of muscle and motor control, and to demonstrate your understanding of the material by designing your own experimental paper and predicting the type of data you would expect to generate from your hypothetical experiments. You may be required to use the skill gained from this exercise in many professional settings within exercise physiology practice or medical research. For example, you will refer to the scientific literature to inform clinic exercise prescription, such as with a particular neural disorder, or present a scientific case for using a particular training method

Learning Outcomes for the Assignment

- To develop and refine the skills needed to obtain information on a topic in muscle and motor control from scientific journals
- To improve your ability to interpret and assess scientific articles
- To develop your ability to comprehend and extend a field of scientific research.

Submission of Assessment Tasks
Assignments are to be submitted electronically through Turnitin via Blackboard.

Penalties for late submission of assignments – In cases where an extension has NOT been granted, the following penalties will apply: For assignments submitted after due date, a penalty of 50% of the maximum marks available for that assignment will be incurred. A further 25% of the maximum possible allocated marks (i.e., a total of 75%) will be deducted from assignments which are two (2) days late. Assignments received more than two (2) days after the due date **will not be allocated a mark,** however, these assignments **must** still be submitted to pass the unit.

Assignment Marking Criteria

	High Distinction	Distinction	Credit	Pass	Fail	Mark
Classic paper Section 1 • Background of physiological context • Experimental approach, including techniques used • Principal findings and data analysis • Statement of why this is a "classic" paper	Well presented, Clearly written, Concise, Comprehensive overview	Neatly presented, Clearly written Concise, Good overview	Neatly presented Acceptable written expression Good	Neatly presented, Some errors in written expression Adequate overview	Incorrect length, Untidy, Poorly written Incomplete overview	/10
Classic paper Section 2 an experimental aim experimental design and methods designed to test their aim thought experiment	Clearly written, Concise Insightful critique Including original ideas	Clearly written, Concise critique. Including some original ideas	Clearly written, Possibly with original ideas	Some errors in written expression acceptable summary but lacking original thought	Poorly written Inadequate Unable to demonstrate understanding of the task	/10

Academic honesty and plagiarism
Plagiarism is using the words or ideas of others and presenting them as your own. Plagiarism is a type of intellectual theft and is regarded by the university as academic misconduct. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. The University has adopted an educative approach to plagiarism and has developed a range of resources to support students. The Learning Centre can provide further information via http://www.lc.unsw.edu/plagiarism.

Week	Date	Laboratory Mon WW2O2: 9-12 Mon WW202: 2-5pm	Lecture 1 Tuesday 9-10 am Biomed D	Lecture 2 Friday 3-4 pm Biomed B	Lecture 3 Friday 4-5 pm Biomed B	Tutorial /Seminar Thursday 1-2pm Biomed D
2	5 Mar		L1 – Course introduction ***SH/CL***	L2 – Muscle: mechanisms of force generation (incl. mechanics) ***SH***	L3 – Muscle: mechanisms of force generation (incl. EC coupling) ***SH***	Tutorial (Classic paper discussion) ***SH***
3	12 Mar		L4 – Motor Unit recruitment and control. The size principle. ***CL***	L5 – Motoneurones (tests of the size principle, synaptic integration, PICs,) ***CL***	L6 – Brain control of movement (the ascending and descending tracts) ***CL***	Tutorial (Classic paper discussion) ***CL,***
4	19 Mar	Isolated mammalian muscle - force-fusion, Slow and fast twitch Grp1,2 ***SH*** Note **4hrs**	L7 – Neuromuscular junction ***AM***	L8 – Skeletal muscle damage and regeneration ***SH***	L9 – Muscular dystrophies (role of the dystrophin associated complex in muscle and CNS) ***SH***	Tutorial (Classic paper discussion) ***CL***
5	26 Mar	Isolated mammalian muscle - force-fusion, Slow and fast twitch Grp 3 ,**AM only** ***SH*** Note **4hrs**	L10 – Rhythmic movement: CPGs & locomotion ***CL***	L11 – CPGs, Spinal plasticity and motor learning ***CL***	L12 – Motor units and microneurography ***PM***	Tutorial (Classic paper discussion) ***CL***
6	2 Apr	EMG – motor unit activation, EMG:force relation **3hrs** ***CL***	L13 – The genetics of speed and endurance in skeletal muscle ***SH***	**NO LECTURE**	**NO LECTURE**	Tutorial (Classic paper discussion) ***SH***
Mid-session break-Easter Recess 6th April - 15th April						

7	16 Apr		L14 – Skeletal muscle growth and development ***SH***	L15 – Spinal control of movement – muscle and cutaneous afferents and reflexes ***CL***	L16 – Spinal control of movement – different pathways (e.g. reciprocal 1a-inhibition, presynaptic inhibition) ***CL***	**PROGRESS EXAM Set by CL**
8	23 Apr	EMG – Hoffmann Reflex **3hrs** ***CL***	L17 – Cortical reorganisation with motor learning ***AK***	L18– Mechanisms of muscle cramp ***SH***	L19 – Muscle building drugs – clinical applications ***SH***	Progress exam discussion & classic paper allocation **CL/SH**
9	30 Apr		L20 – Muscle fatigue: mechanisms of force generation (incl. histochemistry, enzymes) ***SH***	L21 – Cerebellum in motor control: learning & disorders I ***AK***	L22 – Cerebellum in motor control: learning & disorders 2 ***AK***	**Dr Anna Hudson** Control of Respiratory Muscles
10	7 May	Neurons in Action :- Synaptic integration **3hrs Note room.** Mon 9-12 G2/G4 **or** Mon 2-5 106/108	L23– Spinal Cord injury, Stroke and rehabilitation ***CL***	L24 – Neural aspects of fatigue ***JT***	L25 – Neural aspects of fatigue ***JT***	Tutorial (Muscle practical discussion, integrating the practical and the lectures.**SH**
Assessment task due in via Turnitin Friday May 11th						
11	14 May		L26 – Motor learning – generalisation and transfer, practice and feedback ***CL***	L27 – Muscle damage and muscle pain ***SH***	L28 – Sensorimotor control – voluntary movement, feedback and feedforward control (e.g. reach to grasp or catching, homunculus) ***RV***	*Expert seminar* ***Dr Anthony Kee*** Muscles and genes
12	21 May		L29 – Balance and motor learning ***RF***	L30 – Basal Ganglia in motor control, including Parkinson's disease ***CL***	L31 – Aging in skeletal muscle (sarcopenia) and the nervous system ***SH***	VIDEO ***CL***
13	28 May		L32 – Neural and motor learning adaptations to training and disuse ***BB***	L33 –Cortical control of movement 1 ***JM***	L34 – Exam preparation:- Practice questions ***SH***	**NO TUTORIAL**

COURSE RESOURCES

Blackboard

Information about the course and a number of electronic study resources can be accessed via the UNSW **Blackboard** system. Blackboard is an internet-based set of Course Tools designed to enable online learning.

You can use blackboard to download lecture notes, access your grades, find reference material in the course (such as this document), and communicate with the lecturer and your peers.

Lectopia

The Lectopia system (iLecture) provides digital audio recordings of lectures that can be accessed via streaming media over the web or as a podcast (if permitted by the lecturer). Lecture slides may be embedded in these presentations.
http://telt.unsw.edu.au/lectopia/content/default.cfm?ss=1

UNSW Library

The University Library provides a range of services to assist students in understanding how to identify what information is required for assignments and projects; how to find the right information to support academic activities; and how to use the right information most effectively.
Homepage: http://info.library.unsw.edu.au

Reserve (MyCourse)

Many items (books and journal articles) set as recommended reading for courses will be located in **Reserve**, which is on Level 2 of the Main Library. Some of the journal articles will be available in electronic format via **MyCourse**, for Medical students there will be direct links to many of these from within the Medicine program WebCT course sites or eMed Map. To search for these items, go to http://info.library.unsw.edu.au/Welcome.html and click on **MyCourse.**

Textbooks

Enoka, RM (2008). *Neuromechanics of Human Movement*. 4th edition. Human Kinetics Publishers, Champaigne IL: USA. ISBN: 0736066799 Library call no. MBQ 612.76/160

Students in Advancced Science (Neuroscience) or Medical Sciences may prefer to use the textbook:
Bear MF, Connors B and Paradiso M. (2007). *Neuroscience: Exploring the Brain*. 3rd Edition, Lippincott Williams & Wilkins: USA. ISBN-10: 0781760038 Library call no. MBQ 612.8/187 F

Suggested Reference Books

Shumway-Cook and Woollacott (2007). Motor Control: Translating research into clinical practice. Lippincott Williams and Wilkins (3rd Ed). ISBN: 9780781766913. Library call no. 612.7/24 A

Kandel ER, Schwartz JH and Jessell TM. (2001). *Principles of Neural Science.* 4th Edition. McGraw Hill. New York: USA. ISBN-10: 0838577016 Library call no. MBQ 612.8/204

Latash, ML (1998). *Neurophysiological Basis of Movement*. Human Kinetics Publishers, Champaigne IL: USA. ISBN: 0880117567 Library call no. MBQ 612.76/152

Rothwell JC (1994). *Control of Human Voluntary Movement*., 2nd edition, Chapman and Hall: UK.ISBN: 0412477009 Library call no. MB 612.8252/7

Schmidt RA and Wrisberg CA (1999). *Motor Learning and Performance* 2nd edition, Human Kinetics Publishers. Champaigne IL, USA. ISBN: 0880115009 Library call no. MB 152.334/24 F

Tipton CM (2006). American College of Sports Medicine ACSM's ADVANCED EXERCISE PHYSIOLOGY. Baltimore, Md.: Lippincott Williams & Wilkins . Level 7, Main Library (MBQ 612.044/111 A) (will be in the high use collection)

Suggested Reference Journals

Nature Neuroscience, Nature Reviews Neuroscience, The Journal of Neuroscience, The Journal of Physiology, The Journal of Applied Physiology, Experimental Brain Research Clinical Neurophysiology The Journal of Motor Behaviour Progress in Neurobiology, Muscle and Nerve.

Course Evaluation and Development

Student feedback is welcome and taken seriously. A Course and Teaching Evaluation and Improvement (CATEI) survey will be provided in the final weeks of the course to formally gather student feedback.

In response to feedback from previous students we have: 1) Altered the format of the tutorials so that they're now more structured and based around a classic research paper, and 2) increased the duration of the practical sessions and expanded on the details provided in the instructions for practical classes.3). Removed 1 EMG practical which was thought to be repetitive and replaced it with a computer based exercise using the program NEURONS IN ACTION

Health and Safety (HS)

Class activities must comply with the NSW Occupational Health & Safety Act 2000 and the Occupational Health & Safety (OHS) Regulations 2001. It is expected that students will conduct themselves in an appropriate and responsible manner in order not to breach HS regulations. Further information on relevant HS policies and expectations is outlined at: http://www.ohs.unsw.edu.au/

Examination procedures and attendance requirements

Attendance is expected at all lectures, practicals and tutorials for this course. Attendance at all practicals, tutorials and clinicals will be recorded. Students who do not participate in these sessions for any reason other than medical or misadventure, will be marked absent and will be awarded a grade of FAIL for the entire course. If absent for medical reasons, a medical certificate must be lodged with the lecturer within 7 days of the time period of the certificate's expiry. No consideration will be given after this time. Although lectures will be available on ilecture, student participation is encouraged in both the lectures and the tutorials and these are important to attend.

Deferred Exams

It is intended that supplementary exams for the School of Medical Sciences in Semester 1, 2012 will be held in the week commencing Monday 9th July, 2012. If you miss an exam for medical reasons you must supply adequate documentation (including a medical certificate). Your request for consideration will then be assessed and a deferred exam may be granted. You cannot assume you will be granted supplementary assessment. The deferred exam may include a significant oral element.

Special consideration in the event of illness or misadventure. Please note the following Statement regarding Special Consideration.

If you believe that your performance in a course, either during session or in an examination, has been adversely affected by sickness, misadventure, or other circumstances beyond your control, you should notify the Registrar and ask for special consideration in the determination of your results. Such requests should be made as soon as practicable after the problem occurs. **Applications made more than three working days after the relevant assessment will not be accepted except in TRULY exceptional circumstances.**

When submitting a request for special consideration you should provide all possible supporting evidence (eg medical certificates) together with your student number and enrolment details. Consideration request forms are available from Student Central in the Chancellery or can be downloaded from the web page linked below.

Note that normally, if you miss an exam (without medical reasons) you will be given an absent fail. If you arrive late for an exam no time extension will be granted. It is your responsibility to check timetables and ensure that you arrive on time.

Students who apply for consideration to Student Central must also contact the Course Convenor immediately. All applications for Special Consideration will be processed in accordance with UNSW policy (see: http://my.unsw.edu.au/student/atoz/SpecialConsideration.html). If you miss an assessment and have applied for Special Consideration, this will be taken into account when your final grade is determined. You should note that marks derived from completed assessment tasks may be used as the primary basis for determining an overall mark. Where appropriate, supplementary examination may be offered, but only when warranted by the circumstances.

Student equity and diversity issues

Information for students with disabilities is available at
http://www.studentequity.unsw.edu.au/content/Services/Disabilityservices.cfm?ss=2