
SECTION 1: MODULE SPECIFICATIONS

1. Title of the module: **PHAM 1087: ASc1 - Advanced Science Elective 1: Advanced Neuroscience**
2. School which will be responsible for management of the module: **Medway School of Pharmacy**
3. **Start date of the module:** Autumn 2011
4. **The cohort of students (onwards) to which the module will be applicable:** September 2008
5. **The number of students expected to take the module:** maximum 45
6. **Modules to be withdrawn on the introduction of this proposed module and consultation with other relevant Schools and Faculties regarding the withdrawal:**
7. **Level of the module:** Master
8. **The number of credits which the module represents:** 20 credits
9. **Which term(s) the module is to be taught in (or other teaching pattern):** Term 2
10. **Prerequisite and co-requisite modules:** Successful completion of stage 1, 2 and 3 of MPharm program
11. **The programme(s) of study to which the module contributes:** Master of Pharmacy (MPharm)
12. **The intended subject specific learning outcomes and, as appropriate, their relationship to programme learning outcomes**

SSLO1. A critical evaluation of current research and advanced scholarship in key areas of neuroscience

SSLO2. A critical awareness and understanding of current problems and/or new insights associated with recent advances in neuroscience research.

Related to programme learning outcomes:

Substances used in Medicines (SB)

PO4. The properties of medicinal substances, and their relationship to molecular structure.

PO5. The design of medicinal agents and approaches to their discovery.

The Actions and Uses of Medicines and Other Agents (SB)

PO16. Normal and abnormal bodily function: physiology; biochemistry; genetics; microbiology; nutrition; immunology; infective processes; pathology and pathophysiology.

PO17. The actions of medicines within living systems: molecular; cellular; biological and physical aspects

PO20. The therapeutic uses of medicines in man, including adverse reactions to, and interactions of medicines, and their significance in treatment.

PO21. The recognition of disease states and the management of symptoms

13. **The intended generic learning outcomes and, as appropriate, their relationship to programme learning outcomes**

SSLO3. An ability to identify and resolve complex issues in the topics covered both systematically and creatively.

SSLO4. An ability to critically assess relevant scientific publications and communicate their conclusions clearly to specialist and non-specialist audiences.

Related to programme learning outcomes:

Cognitive Abilities and Skills: (SB)

PO38. Demonstration of knowledge and critical understanding of essential facts, concepts, principles and theories relating to the subject areas identified above.

PO40. Recognition and analysis of problems and planning of strategies for their solution.

PO41. Critical evaluation, interpretation and synthesis of pharmaceutical information and data.

Pharmacy-related Practical Skills (SB)

PO51. The planning, design and execution of self-directed and original research investigations, from the problem-recognition stage through to the evaluation and appraisal of results and findings; this to include the ability to select appropriate techniques and procedures.

PO52. The operation of standard pharmaceutical instrumentation.

PO53. The ability to evaluate critically and to interpret purposively data derived from laboratory and clinical observations and measurements, in terms of their significance and the theory underlying them.

Transferable Skills (SB)

PO57. Interpersonal skills: the ability to interact effectively with patients; the public and health care professionals, including communication, both written and oral.

PO59. Problem-solving, relating to qualitative and quantitative information, extending to situations where evaluations have to be made on the basis of limited information.

PO60. Numeracy and computation, including such aspects as error analysis, order-of-magnitude estimations, correct use of units and modes of data presentation.

PO61. Acquisition, transformation, interpretation and critical evaluation of data.

PO62. Information retrieval in relation to primary and secondary information sources, including information retrieval through online computer searches.

PO63. Information technology skills, including word processing, spreadsheet use, database use, archiving data and information, and internet communication.

PO64. Time-management and organisation, as evidenced by the ability to plan and implement efficient and effective modes of working.

PO65. Independent study skills as preparation for continuing professional development.

PO67. Analysis and critical appraisal of published literature.

PO68. Application of general, biological and medical statistics.

PO70. Recognition of the need to work within personal limitations.

14. A synopsis of the curriculum

Molecular Pharmacology: Ion Channels as Drug Targets

- Review of the structure and function of ion channels
- Mutagenesis, molecular modelling and electrophysiology: Methods to study ligand-gated ion channels
- Biophysical studies of 5-hydroxytryptamine-3 and nicotinic acetylcholine receptors: The impact of Cys-loop receptor structure on function
- Neurosteroid action at GABA_A receptors: *In vitro* and *in vivo* studies

Cellular Neuroscience: Neuronal Excitability

- The diversity and importance of ion channels in the nervous system
- Voltage-gated ion channels - structure and function

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- Ion channels in health and disease
- Excitatory and inhibitory synaptic transmission
- Quantal transmission at synapses
- Regulation of intracellular calcium concentration
- Synaptic plasticity, long term potentiation (LTP) and memory

Cellular Physiology: Neurons to Behaviour (Biological rhythms)

- Introduction to the mammalian circadian rhythm
- Anatomy and neurochemical regulation found within the mammalian biological clock
- The role of melanopsin, a novel photopigment, in mediating photic information to the circadian clock
- An understanding of advanced molecular mechanisms essential for circadian clock function
- New insights in the recent discovery of peripheral clocks and the mechanisms involved in their synchronisation with the master pacemaker
- Current advances in the discovery and treatment of circadian related disorders; focusing on chrono-therapy and pharmaceutical interventions

Modern Medicine: Drug Therapy in Psychiatry

- Drug Therapy in Psychiatry
- Present an overview of the criteria employed by the pharmaceutical industry in selecting, testing and exploiting suitable novel drug targets
- Detail the integral stages involved in the flow-chart approach necessary in developing any new drug; i.e.: proof of concept work, application of appropriate disease models, drug screening, lead optimisation and final drug development
- Give an overview of which novel drugs are currently emerging in the sub-categories of antidepressants, antipsychotics and drugs for the treatment of Alzheimer's disease and age associated cognitive decline. Drugs which are currently undergoing clinical trials, and which are likely to emerge into the clinic

15. Indicative Reading List

Students will be directed as appropriate to primary literature and reviews available from journal collections in Kent or Greenwich and from performing online literature searches using PubMed.

Examples include:

General Reading:

Kandel, E.R., Schwartz, J.H. & Jessell, T.M. (2000) *Principles of neural science*. McGraw-Hill., New York; London.

Nicholls, J.G., Martin, A.R., Wallace, B.G. & Fuchs A. (2001) *From neuron to brain*. Sinauer Assoc., Sunderland Mass.

Squire, L.R., Bloom, F.E., McConnell, S.K , Roberts, J.L & Spitzer, N.C. & Zigmond, M.J. (2002) *Fundamental neuroscience*. (Second Edition) Academic Press, San Diego.

Aidley, D.J. & Stanfield, P.R (1996) *Ion channels, molecules in action*. Cambridge University Press.

Ashcroft, F. M. (2000) *Ion channels and disease*. Academic Press, London.

Hille, B. (2001) *Ion channels of excitable membranes*. Sinauer Assoc., Sunderland Mass.

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Johnston, D. & Miao-Sin Wu, S. (1995) *Foundations of cellular neurophysiology*. MIT Press, Cambridge MA.

Specific Papers and Reviews:

Alexander, SP, Mathie, A, Peters, JA (2011) Guide to Receptors and Channels (GRAC), 5th edition. *Br J Pharmacol* **164 Suppl 1**: S1-324.

Lall GS, Revell VL, Momiji H, Al Enezi J, Altimus CM, Guler AD, Aguilar C, Cameron MA, Allender S, Hankins MW, Lucas RJ (2010) Distinct contributions of rod, cone, and melanopsin photoreceptors to encoding irradiance. *Neuron* 66:417-428.

Morin LP, Allen CN (2006) The circadian visual system, 2005. *Brain Res Rev* 51:1-60.

Macdonald, RL, Kang, JQ, Gallagher, MJ (2010) Mutations in GABAA receptor subunits associated with genetic epilepsies. *J Physiol* **588**(Pt 11): 1861-1869.

Machu, TK (2011) Therapeutics of 5-HT3 receptor antagonists: current uses and future directions. *Pharmacol Ther* **130**(3): 338-347.

Reddy, DS (2010) Neurosteroids: endogenous role in the human brain and therapeutic potentials. *Prog Brain Res* **186**: 113-137.

Uusi-Oukari, M, Korpi, ER (2010) Regulation of GABA(A) receptor subunit expression by pharmacological agents. *Pharmacol Rev* **62**(1): 97-135.

Yevenes, GE, Zeilhofer, HU (2011) Allosteric modulation of glycine receptors. *Br J Pharmacol* **164**(2): 224-236.

16. Learning and Teaching Methods, including the nature and number of contact hours and the total study hours which will be expected of students, and how these relate to achievement of the intended learning outcomes

Acquisition of outcomes is through a combination of lectures, workshops and MSCL. They are given by specialists from within the School.

Summary of Learning and Teaching Activities

Lecture/seminars	Practical/workshops	MSCL/CAL	Private Study	Formal assessment	Total hours
32	6	100	59	1 x 3 hour	200

Directed Learning and Teaching Activities

Activity	Lecture / seminars	Practical/ Workshops	MSCL/ CAL	Total hours
Molecular Pharmacology	8	0.5x 3 h	25	34.5
Cellular Neuroscience	8	0.5x 3 h	25	34.5
Cellular Physiology	8	0.5x 3 h	25	34.5
Modern Medicine	8	0.5x 3 h	25	34.5
Total hours core elements + either A or B	32	6	100	138

17. **Assessment methods and how these relate to testing achievement of the intended learning outcomes**

Method of Assessment	Learning Outcomes Assessed	Weighting %	Outline Details
Continuous assessment	SSLO3 & SSLO4	40% PASS required	1 interim assessment Satisfactory attendance and performance at workshops *
Examination	All learning outcomes	60%	3 hour examination

18. **Coursework (40%)**

SSLO 3 and SSLO 4 will be assessed through writing a short essay (1000 -1500 words). At the beginning of term 2, students will be given the choice of four recent research papers relevant to the course. Students will have to critically discuss and reflect on one research paper.

Examination (60%)

SSLO 1, SSLO 2, SSLO 3 and SSLO 4 will be assessed by written examination.

19. **Implications for learning resources, including staff, library, IT and space**

Lecture notes will be given to the students and made available via Moodle. All publications in the reading list are available on line via the UoK or UoG library portal.

Teaching Staff	Subject Area
Professor A Mathie	Cellular Neuroscience
Dr S. Kelley	Molecular Pharmacology
Dr G. Lall	Cellular Physiology
Dr A. Bratt	Modern Medicine

20. **The School recognises and has embedded the expectations of current disability equality legislation, and supports students with a declared disability or special educational need in its teaching. Within this module we will make reasonable adjustments wherever necessary, including additional or substitute materials, teaching modes or assessment methods for students who have declared and discussed their learning support needs. Arrangements for students with declared disabilities will be made on an individual basis, in consultation with the University's disability/dyslexia support service, and specialist support will be provided where needed.**

SECTION 2: MODULE IS PART OF A PROGRAMME OF STUDY IN A UNIVERSITY SCHOOL

Statement by the School Director of Learning and Teaching/School Director of Graduate Studies (as appropriate): "I confirm I have been consulted on the above module proposal and have given advice on the correct procedures and required content of module proposals"

.....
Director of Learning and Teaching

.....
Date

.....Dr Buge Apampa.....
Print Name

Statement by the Head of School: "I confirm that the School has approved the introduction of the module and, where the module is proposed by School staff, will be responsible for its resourcing"

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Head of School

.....
Date

.....Professor Iain Cumming.
Print Name
