BRITISH PHARMACOLOGICAL SOCIETY

TODAY'S SCIENCE TOMORROW'S MEDICINES

Principles for inclusive implementation of the undergraduate pharmacology core curriculum

Through our vision for inclusive pharmacology, the Society commits to placing equity, diversity and inclusion at the heart of pharmacology, whether in terms of the opportunity for a successful career, or in benefitting from pharmacology research. How pharmacology is taught, and to whom, is at the heart of achieving this. Therefore, we have developed the following principles for inclusive implementation of the undergraduate pharmacology curriculum as part of a holistic review to help ensure that the curriculum continues to meet the needs of students, responds to an evolving discipline – and ultimately reflects the real-world settings that require pharmacology education and training.

These principles were developed by an expert steering group and capture the cross-cutting themes that emerged from a wider review of the Society's undergraduate core curriculum. We hope that using them will support the development and delivery of pharmacology programmes that:

- Positively impact research and health across global communities.
- Acknowledge cultural and historical influences on the discipline.
- Value the individuality of all who benefit from and contribute to pharmacology.
- Operate within inclusive educational environments, including collaboration & setting expectations with students.
- Inspire knowledge sharing and discussion within and between educator and student communities.

The Society acknowlegdes that progress in inclusive pharmacology education will emerge as part of a relfective, collaborative and community-drive approach. These principles are intended to spark discussion and to help continue to build such a community. We know that there will be gaps in knowledge or confidence, and welcome discussion about the use of language. We believe that being honest and curious about where we are now as a collective will help focus progressive discussions and support shared learning. To this end, the Society has named inclusive pharmacology as a priotity education area, committing funding and staff time to support the development and dissemination of resources, good practice and continued learning. This will be an evolving process and our intention is to progress it in partnership with the global pharmacology community.

The Society thanks IUPHAR for endorsing these principles.

To enable inclusive delivery:

Pharmacokinetics and pharmacodynamics

- Explore genetic and epigenetic influences on drug action and how these lead to interindividual differences in response to drugs.
- Consider how drug effects can be significantly impacted by dietary and environmental variation.
- Consider how drug effects can be significantly impacted by physiological variables, such as age, sex, and pregnancy.

Pharmacological research

- Examine the need for research to include a diverse and representative pool of subjects.
- Consider drugs in a variety of contexts e.g. as the focal point of clinical trials, as active ingredients in medicines/remedies, as positive controls, as tools in mechanistic studies.
- The global pharmacology community
- Provide examples of drugs to treat a broader range of diseases from across the world.
- Recognise global inequities (e.g. health inequalities, data gaps) and the impact of dominant power structures (e.g. patriarchy, colonialism, capitalism) and biases in generating and perpetuating them.
- Explore the historical and geographical origin of drugs and therapeutic interventions, and recognise contributions to our understanding from all individuals, environments and cultures.
- Acknowledge regional variations in local rules, regulations, resources, technology and approaches to discovery, development, and administration of drugs.

The global pharmacology community

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Accessible pharmacology

- Ensure learning environments and materials are fully accessible by accounting for differences in educational skills, background and learning needs, taking care to not assume expertise or cultural norms.
- Provide support and additional opportunities for learning in critical areas, particularly mathematics, where considerable variation in educational background is recognised.
- Minimise the use of extraneous technology or software where possible, or provide alternative means to access them.

We have chosen to include some explanatory notes alongside these principles regarding our use of language. Language is meaningful and can be subject to interpretation. Our intention is to be explicit about our choice of language, and how we hope it will support inclusive implementation – and to invite comment and update as we learn.

[a]**Inclusive pharmacology:** The Society acknowledges that the term 'inclusive' has been used in some education settings to solely meane 'accissible'. Our intention is that these principles capture accessibility - but we use the word 'inclusive' here as an umbrella term in its broadest sense. Our aim is to enhance connectivity and intersectionality in the component parts of this work, whilst still commitiing to the focused difficult discussions that must happen - particularly in the conexts of decolonisation, democratisation and diversification. We recognise that as written, the curriculum hides biases and assumptions that reflect the impact of dominant power structures (e.g. patriarchy, colonialism, capitalism) that must be named if they are not to be perpetuated through implementation. For example, the curriculum is Euro-centric - it is currently framed through a Western lens, valuing Western approaches to drug discovery and development, to terminology, and to Western educational norms. It also hides divides (e.g. between Global North and Global South) and other biases and assumptions prevalent in research, development and health care, such as data gaps that perpetuate health inequalities. Naming inclusivity as a priority for implementation is intended to help acknowledge and redress such biases.

[b]**Drug:** We recognise that across different cultures and geographical regions, the term 'drug' has a variety of meanings and connotations often referring to Western therapeutic approaches or even abuse of illicit substances. In our documentation, the term 'drug' refers to a chemical or biological entity that induces physiological changes as a result of interactions with a target within the organism. The term is intended as a catch all for entities that might be active ingredients e.g. within experimental tools, prescribed medicines, plant or herbal preparations, natural products or traditional remedies. In clarifying this, it is hoped that we open up the pharmacology curriculum to recognise diverse cultural contributions to therapeutic approaches and practice.

[c]**Genetic and epigenetic influences:** We talk about inter-individual genetic variation in the context of contribution to scientific and clinically meaningful difference in drug responses. We have chosen not to use the term 'ethnicity' in the context of genetics because there are more similarities than differences between ethnic groups. Relying on ethnicity as a proxy for genetics is problematic and risks perpetuating genetic determinism, the tendency for people to ascribe differences in behaviours or traits to genetics alone. To understand differences in individual drug responses, researchers should directly measure the presence of implicated alleles alongside other factors such as diet, age and sex.

[1]The Society would like to thank members of the expert steering group: Professor Emma Taylor, Dr Nelson Chong, Dr Aidan Seeley, Dr Stephen Alexander, Professor Anja Mueller, Anna Wallis, Professor Catriona Waitt, Professor Clare Guilding, Dr Nicholas Freestone, Dr Jennifer Koenig, Dr Lauren Walker, Dr Manasi Nandi, Dr Shola Olafuyi, Professor Steve Tucker (VP Academic Development). The group was chaired by Dr Anna Zecharia, the Society's Director, Policy & Public Affairs

Contents

Core Knowledge Statements

Below we provide broad learning outcomes for each of the BPS core knowledge statements, together with resources which support attainment of these outcomes. It is important that these outcomes are not delivered in isolation and that the links and connections between these aspects of pharmacology are integrated within the design and delivery of teaching approaches.

Theoretical principles of drug action

Drugs that can be used in health and disease, giving examples from body systems

Broad Learning Outcome: Describe the mechanism of action, clinically relevant pharmacokinetics and major adverse side effects of drugs that are commonly used in the therapeutic strategies, giving examples from the body systems for example statins and beta blockers

How drugs interact with their targets, including drug-receptor theory

Broad learning outcome: Describe the molecular targets for drug action within the body including receptors, ion channels, enzymes and transporters, and outline the principles of how drugs interact with their targets

Pharmacodynamics (molecule to whole organism)

Broad Learning outcome: Explain drug and chemical post-target effects on cellular signalling and how these integrate into responses. Describe how pharmacological concepts (e.g. Emax, EC50, Kd, receptor occupancy), along with the mechanisms of action relate to dosing regime and whole organism effect

Pharmacokinetics (absorption, distribution, metabolism and excretion)

Broad Learning Outcome: Use pharmacokinetic principles relating to ADME to discuss and analyse drugs and their administration using specific examples

How physiological and pathophysiological processes are affected by drug action

Broad Learning Outcome: Describe the ways in which drugs interacting with their targets influence specific downstream events that lead to changes in cell, tissue, organ and / or whole organism performance, explaining the relevance of this in health and disease

Pharmacogenomics

Broad Learning Outcome: Explain (with examples) how individual and population genetics can influence pharmacokinetic and pharmacodynamic responses to drugs, relating this to personalised medicine and drug discovery

Principles of toxicology and their application in safety pharmacology

Broad Learning Outcome: Describe the relationship between dose, exposure and adverse effects of a substance, relating this to its safe and effective use in an organism

Principles of translational research and experimental medicine

Broad learning outcome: Define translational research and describe the stages from foundational and pre-clinical research through to application of new therapies and diagnostics in individuals and populations

Methodological principles

Qualitative and quantitative statistical tools and analytical methods used to interpret pharmacological data

Broad Learning Outcome: Apply knowledge of maths and statistics to summarise and visualise data, using appropriate models and inferential tests to interpret results and make inferences in relation to the study design

The scientific method (hypothesis formulation, hypothesis testing, experimental design, experimental analysis)

Broad Learning Outcome: Use the research literature to identify an appropriate research question and develop a testable hypothesis to answer it. Design a suitable series of experiments to test a hypothesis and understand principles of good experimental design. Critically appraise the design and analysis of an experiment to test a hypothesis

Appropriate and emerging methods for interrogating the pharmacodynamic effects of drugs

Broad Learning Outcome: Explore different methods for interrogating the pharmacodynamic effects of drugs, for example, fluorescent techniques or molecular dynamic approaches. Explain which methods are appropriate for measurement of different parameters

Appropriate and emerging methods for interrogating the pharmacokinetic effects of drugs

Broad Learning Outcome: Explore different methods for interrogating the pharmacokinetic effects of drugs, for example, labelling or mass spectroscopy of plasma or urine samples. Explain that total plasma or tissues concentrations can be predicted by incorporating key pharmacokinetic parameters into mathematical models.

There are three broad areas within this:

1. Measuring drug concentrations
2. Using drug concentrations to predict dose regimens using models
3. The relationship (or lack of) with a drug action

Drugs as pharmacological tools in scientific research

Broad Learning Outcome: Explore the use of drugs as tools for scientific research and evaluate the impact of these on the scientific knowledge gained using specific examples

The principles of reduction, refinement and replacement in the use of animals in research

Broad Learning Outcome: Explain the use of animals in research with accurate reference to the 3Rs and their use in practice

Drug discovery and development

The principles of reduction, refinement and replacement in the use of animals in research

Broad Learning Outcome: Describe the role of multiple disciplines in drug discovery and development e.g. chemistry, physiology, pathology. Describe how the integration of knowledge from these disciplines with pharmacology is critical for the drug discovery and development process

The stages of drug discovery and development

Broad Learning Outcome: Describe the stages of drug discovery and development including the purpose, importance, design and limitations of each stage

Principles of clinical trial design

Broad Learning Outcome: Describe the key principles underpinning the design of a clinical trial for a new therapeutic entity

How knowledge of pathophysiology can yield insights into drug targets and new therapeutic avenues

Broad learning outcome: Identify suitable targets for possible pharmacological intervention by understanding the mechanisms underlying the pathophysiology of a disease and limitations of current therapies. Explain how knowledge of disease mechanisms lead to the development of named drugs (rational drug design)

Emerging therapeutic avenues

Broad learning outcome: Describe emerging therapeutic avenues for example biologics, nanotechnology, cell and gene therapy, immunological therapies and other medicine modalities

The use of gene modification techniques in drug discovery and development

Broad learning Outcome: Explain the fundamentals of why different gene modification techniques are used to modify receptors or proteins within the drug discovery process using examples such as fluorescent/bioluminescent tags, genomic modification with siRNA or CRISPR, and tagged receptors in vivo

Commercial drug discovery techniques

Broad learning outcome: Describe the key techniques used in successful industrial drug discovery, from target selection, hit discovery, PK/PD and toxicology to commercial impact

How medicine formulation impacts drug action

Broad Learning Outcome: Explain how different components of medicine formulation (e.g. solvents, stabilisers, buffers, excipients) alter the route of administration, ADME characteristics and the dose profile (e.g. depot, slow release) to achieve a desired clinical effect

Regulatory processes to include medicine quality, safety and effectiveness

Broad Learning Outcome: Explain the purpose and importance of the international medicines regulatory process and list the requirements for making an application to a regulatory body

The challenges associated with developing and assessing the efficacy and safety of new therapeutic approaches

Broad Learning Outcome: Describe the challenges associated with developing and assessing the efficacy and safety of new therapeutic approaches, including the testing strategies and legal requirements involved

The society impacts of the discipline

The ethical principles of research, including clinical trials and animal research (design, implementation and reporting)

Broad Learning Outcome: Discuss the ethical issues surrounding scientific and medical research including the use of animals, principles of Humane Experimental Technique (3Rs) and the involvement of human participants in clinical trials, describing the associated legal and regulatory requirements

How pharmacology relates to social challenges and public health

Broad Learning Outcome: Examine how pharmacology can inform and advance understanding of social challenges and public health issues, for example risk/benefit analysis of drugs, social determinants of disease (progression, outcomes and response to treatment), and policy related to public health

The impacts of pharmacology on patient care with respect to the safe and effective use of medicines

Broad Learning Outcome: Appraise the importance of pharmacology in the discovery and development of drugs used to prevent and treat disease, and the impact of clinical pharmacologists on patient care with respect to ensuring the safe and effective use of medications

The various career paths and opportunities afforded by a pharmacology degree

Broad Learning Outcome: Identify the various career paths and professional opportunities afforded by a pharmacology degree including academic, industrial and clinical opportunities

LINK Link to Knowledge Statements Resources

Core Skills Statements

Experimental techniques

Core Skill Statement: Be able to formulate a scientific hypothesis

Assessment:

- Provide a redacted research article and get students to piece together the information provided to suggest a testable hypothesis
- Present a scientific problem and its context and get students to design and present a hypothesis explaining ways in which it might be tested
- Assess student abilities to write, explore and explain a scientific hypothesis within a research project
- Participation in group exercises where students are provided with information about a scientific problem and question and have to determine a hypothesis and explore it

Core Skill Statement: Implement principles of good experimental planning and design.

Assessments:

- Preparation of mock grant proposals based on preliminary data from research groups
- Participation in workshop/journal club focusing on the design of the experiments presented within a published study. Including analysis of whether conclusions match the data, additional experiments needed and validity of conclusions
- Construction of an experimental plan including timeline
- Critique of pharmacology research articles to assess whether studies meet the principles of good experimental design
- Reflection on experimental design following attendance at a research presentation

Core Skill Statement: Identify the most appropriate statistical approach.

Assessments:

- Provide simulated data and ask students to do an appropriate statistical analysis
- Provide data for example from a drug trial in wildtype and knock out animals. Assess student's ability identify the statistical approach, apply this and present the data graphically.

Core Skill Statement: Be able to make appropriate decisions about methodology when designing a study

Assessments:

- Assess methodological approaches in student grant and project proposals
- Participation in a groupwork exercise where students identify a drug to repurpose, and design a study with appropriate controls and data analysis
- Critique of real/hypothetical research studies to identify issues in methodology and experimental design

Core Skill Statement: Be precise and accurate when performing core laboratory skills

Assessments:

- Completion of a laboratory task with a quantifiable output e.g. determining an unknown concentration from a standard curve
- Observation of students completing and discussing laboratory tasks
- Completion of a series of OSPE stations assessing various aspects of laboratory work

Core Skill Statement: Carry out experiments with awareness of Good Laboratory Practice (GLP)

Assessment:

- Assess laboratory skills in a wet-lab practical write up / laboratory notebook recording
- Assess students' ability to annotate/appropriately identify examples of good and poor practice from examples of laboratory work

Core Skill Statement: Be able to use quantitative methods to collect, process and present data

Assessment:

- Participation in a workshop where students analyse data then present it using a traditional lab report, poster or oral presentation
- Completion of capstone project in the final year
- Writing of a research proposal including for example, research problem, proposed methodology and data analysis

Core Skill Statement: Be able to use in vitro techniques in pharmacology

Assessment:

- Assess lab practical reports which use in vitro techniques
- Student participation in data analysis workshops on in vitro techniques
- Oral presentation / Q&A sessions to test students' knowledge and understanding of in vitro techniques

Core Skill Statement: Have the necessary theoretical and/or practical training to be able to use in vivo techniques in pharmacology

Assessment:

- Student participation in scenario / experimental technique workshops
- Student completion of the NC3Rs Experimental Design Tool training and assessment
- Objective structured practical examination (OSPE) to assess legal, ethical and practical elements of in vivo techniques in pharmacology
- Students select and explore a disease, then present an appropriate in vivo model to study the disease, e.g. using Jackson Lab - knockout animal database
- Critique a project licence application

Data handling and analysis

Core Skill Statement: Identify and use information from appropriate and reliable sources

Assessment:

- Participation in workshops where students are given experimental questions to answer, then must find resources as a group, discuss the information, then present with Q&As
- Assess understanding of appropriate resources to use in the writing of a scientific article (primary research papers; peer-reviewed websites; science versus lay websites/blogs)
- Create an infographic integrating information from appropriate and reliable sources

Core Skill Statement: Integrate information from a range of sources and critically evaluate it

Assessment:

- Assess student ability to critically evaluate published work on a given topic in a journal club
- Assess students written work (e.g. dissertation) which critically appraises literature
- Provide students with information about chemical compounds and associated data and ask them to evaluate their potential as therapeutic agents

Core Skill Statement: Apply and interpret appropriate statistical tests correctly

Assessment:

- Assess student analysis of final year project data
- Provide students with a range of published papers and assess their ability to critically evaluate the statistical approaches used

Core Skill Statement: Use a common statistical software package

Assessment:

- Computer-based exercises where students are provided with a specific statistical software package and have to analyse given data
- Assess student preparation of laboratory reports where data is presented and analysed using a defined statistical software package
- Preparation of a dissertation with data analysed using one or more statistical software packages.

Core Skill Statement: Accurately record and reference source material

Assessment:

- Assessment of any written piece of work (e.g. dissertation) that requires cited references
- Student participation in workshops around citing and referencing appropriately
- Preparation of "mock" manuscripts for certain publications strictly adhering to authors guidelines
- Provide students with examples of poorly cited work and get them to identify the errors

Core Skill Statement: Analyse and interrogate large data sets

Assessment:

- Assess a journal club presentation that requires understanding of big data for example a Cochrane review
- Student participation in an assessed workshop where large data sets are analysed
- Provide a figure to students and ask them to analyse and write a figure legend

Working practices:

Core Skill Statement: Keep up to date with relevant literature and developments in pharmacology

Assessment:

- Assess student contributions to a blog/discussion board of "breaking news" style short articles
- Student creation of an e-portfolio of new findings and techniques gained throughout the year for presentation and discussion
- Student participation in a journal club presentation of a recent research paper

Core Skill Statement: Perform research efficiently through good planning and management

Assessment:

- Assess student literature reviews
- Assess student experimental design plans for projects
- Students develop research proposals / mock grant applications
- Students demonstrate use of GANNT charts for projects / research strategies

Core Skill Statement: Organise and accurately record information, for example, in a laboratory book

Assessment:

- Assess student preparation of a formal laboratory report
- Student completion of best practice laboratory record templates
- Assess student record keeping during practicals and projects using a laboratory notebook and discussing the importance of this as a competency exercise
- Students complete and record a practical exercise at beginning of year and are assessed repeating the exercise at the end of the year supported only by their notes.

Core Skill Statement: Work independently

Assessment:

Many examples of assessments of individual work throughout the programme years. These include assessment of:

- independent work in the laboratory to set up tissue, dilute drugs, generate standard curve
- preparation of scientific essays, laboratory reports, final year projects and literature reviews

Core Skill Statement: Work constructively in small groups or teams

Assessment:

- Completion of group work to investigate repurposed drugs relating to a condition
- Preparation of a patient information leaflet as part of a group
- Participation in team based learning with in depth peer assessment
- Development of a website about a specific pharmacology area as part of a group
- Assessing experimental design approaches in groups / teams

Core Skill Statement: Communicate effectively to scientific and non-scientific audiences (including written and oral forms)

Assessment:

- Completion of a drug design task where patient information leaflet created (for non-scientific audience) and new drug is designed and presented (scientific audience)
- Creation of posters for scientific or non-scientific audiences
- Delivery of seminar presentations to scientific audience
- Delivery of a research talk to a non-scientific audience
- Preparation of a research project thesis and presentation to scientific and public audiences

The Society also has a curriculum for the use of research animals which is intended to support undergraduate and taught masters programmes. The curriculum covers the knowledge, skills and attitudes that should be acquired by students specifically with respect to research animals.

LINK Link to Skills Statements and Assessments and Resources

Core attitude statements - Introduction

The BPS Education and Training Committee aims to better support educators to teach using the Society's Core Curriculum. Consequently, we have:

- Developed broad learning outcomes for each of the Core Curriculum Knowledge Statements
- Identified assessment examples which align well with each Core Curriculum Skills Statement
- Linked to relevant resources against each statement to help deliver them

For the Core Curriculum Attitude Statements, we have created a downloadable/editable proforma. This would act as a portfolio record for students to complete and reflect on alone or with their lecturers towards the end of their undergraduate courses.

To support completion of the proforma we supplied a list of typical undergraduate activities that would support each of the attitude statements.

For example, final year projects, placements, outreach contributions, conference contributions, research, or lab practicals.

The completion of this proforma helps demonstrate attainment of these attitudes when applying for jobs, preparing personal statements or reflecting on professional development (including inclusive approaches to working practices and relationships) and links directly to employability. This portfolio can therefore be used as a useful resource when preparing for future career steps.

Core Curriculum Attitude Statements

The Core Curriculum Attitude Statements represent key aspects of awareness, scientific maturity and responsibility that develop in undergraduate students through activities linked to their degree programme. These can be used flexibly by educators and students to reflect on teaching and learning activities and what attitudes these specifically instil or evidence, respectively.

For example, educators could use this list to assess what specific attitudes key learning experiences or entire programmes develop, whereas students could reflect on the list and consider learning experiences that evidence they have achieved each specific attitude. This could be done before and after a specific learning activity to assess learning gain or perhaps used at key stages throughout the entire programme to chart the progressive development of these attitudes. Such practice would provide an interesting and useful record for incorporation into placement or job applications.

The proforma below lists the Core Attitudes and offers an adaptable column for educators or students to use as a means of "checking off" attitudes covered by learning activities. The final column provides example tasks that might be used to evidence the specific attainment of the attitudes.

Useful resources

DOWNLOAD The BPS Core Curriculum Attitude Statements Proforma (blank and downloadable)

LINK The Society's Core Curriculum

LINK List of Resources to Support Inclusive Delivery

No	Having successfully completed an undergraduate degree in Pharmacology, graduates will have:	Achieved? (Y/N)	What tasks have been completed that evidence the attitudes listed?
1	A concern for detail and quality		• Data capture during practicals and subsequent analysis • Proof reading work • High quality academic writing
2	A curious attitude and openness when interpreting data		• Discussion of hypotheses which may fit data acquired in the discussion section of lab reports • Appraisal of scientific literature • Participation in peer review tasks
3	A confident and adaptable working attitude		• Adapting approaches to cope when outcome is not as predicted • Hybrid learning / working • Competency in the laboratory demonstrating Good Laboratory Practice
4	A willingness to accept a challenge		• Public engagement/ public speaking/ conference presentations • Participation in debates • Open day participation • Participation in co-curricular activities • Chairing teaching/ seminar sessions
5	The courage to stand up for their principles under pressure		• Asking questions on presentations • Participation in debates/ world cafe e.g., 3Rs, animal experimentation • Completion of resources such as mock legal trial for statins (Derek Lang, Pharmacology matters article)
6	A resilient attitude in the face of failure or unexpected outcomes		• Analysis and critique of why an experiment did not work • Self-assessment of assignments to identify how to improve • Effective use of feedback
7	The ability to work to the highest principles of scientific integrity, following ethical working practices		• Demonstration of scientific integrity • Consideration of ethics • Avoiding plagiarism • Completion of training programmes/lectures on ethics and integrity

No	Having successfully completed an undergraduate degree in Pharmacology, graduates will have:	Achieved? (Y/N)	What tasks have been completed that evidence the attitudes listed?
8	The ability to apply creative/ innovative approaches to addressing complex problems		• Design of experimental study • Preparation of mock grant proposals • Completion of research projects
9	The ability to maintain effective working relationships and collaborations		• Effective participation in any group work activity, recognising that people have different approaches to working and learning • Engagement in a collaborative working environment e.g. laboratory placements/final year projects • Peer review processes as a means of assessing group working skills • Participation in student-led societies, conference attendance/organisation • Use of LinkedIn or Alumni groups
10	The ability to work to fixed deadlines and manage pressure		• Completion of coursework assignments which may sometimes compete/ overlap • Effective management of pressure in the lead up to summative assessments
11	A willingness to engage with developments across science and healthcare		• Engagement with public science event • Applying for studentships/ internships/ placements and volunteering roles. • Engaging with student initiatives (such as UG journals/ journal clubs) • Engagement with learned societies
12	The ability to identify employment opportunities and independently pursue personal career goals		• Application for placements, summer internships and careers • Engagement with talks and online support from placements team and career service • Engagement with learned society careers resources • Use of LinkedIn e.g. as Alumni groups
13	The confidence and ability to apply their skills in a real-world setting		• Engagement with work or laboratory placements/ internships • Identification of skills that can be applied across many different project types e.g. laboratory research, systematic reviewing
14	The skills for lifelong learn-ing e.g., independence, time management, organ-isation and planning, initia-tive, knowledge transfer		• Developed throughout the programme for example through adherence to deadlines, engagement with taught activities, self-directed learning, creation of ideas, and independent development of research topics

No	Having successfully completed an undergraduate degree in Pharmacology, graduates will have:	Achieved? (Y/N)	What tasks have been completed that evidence the attitudes listed?
15	An appreciation of the societal relevance and impact of pharmacology		• A group-work task or presentation considering the role of pharmacolo-gists in society • Historical case studies of pharmaco-logical discoveries and their impact on society • Lessons learned from mistakes (e.g. MMR, thalidomide) • Examination of the role of pharma-cology in the COVID pandemic
16	An appreciation of the value of public engagement and outreach		• Participation in public engagement activities • Open day involvement
17	The ability to self-assess performance		• Reflection on contribution to group work • Self and peer assessment • SMART analysis of personal / professional development
18	An understanding of how to evaluate risk		• Involvement in completing risk assessments (COSHH), genetic modification risk and ethics forms for projects or laboratory/mock laboratory activities