Phytotitre projects - Information for educators

Background to *Phytotitre* projects

The *Phytotitre* library is a collection of 800 natural extracts that has been used to support drug discovery projects in academia and industry for many years. We now offer a smaller, 400 extract version of the *Phytotitre* library specifically for use in Life Science student research projects at BSc and MSc level.

To support the use of our product in such projects, we offer comprehensive project guides and method sheets, giving step-by-step instructions for the completion of 4 different laboratory projects, or 2 different data analysis projects. All project guides, sample datasets and method sheets are free to download without requirement for purchase or registration.

Designed for ease of project set-up and supervision

We recognise that academics at UK universities are under great pressure to allocate time to many different tasks, yet would like to provide their students with high quality training in key skills relevant to diverse Life Science career paths. The *Phytotitre* projects were developed to help supervisors achieve these aims, while also requiring minimal setup, facillitating ease of supervision and covering key Learning Objectives expected from projects at levels 6 and 7. Our projects are supported by comprehensive online support for both supervisors and students, particularly with respect to the setup, running and assessment of the different *Phytotitre* project options.

Developed by an established academic with over 20 years experience of supervising student research projects at UK universities, the projects can be run as stand-alone, turn-key options, or as the basis for projects addressing your own research interests at BSc or MSc level. Whether you aim to supervise experimental (“wet-lab”) or computational data analysis (“dry”) projects, our ready-to-use kits and supporting resources make the projects easy to run for both students and educators alike.

Phytotitre projects at a glance

- Excellent training in early stage drug discovery
- 4x lab projects & 2x data analysis projects available
- Comprehensive guides and methods for students
- Extensive support for supervisors, freeing up time
- Each kit can support 1 to 5 student projects
- Easily modified to fit your specific research aims

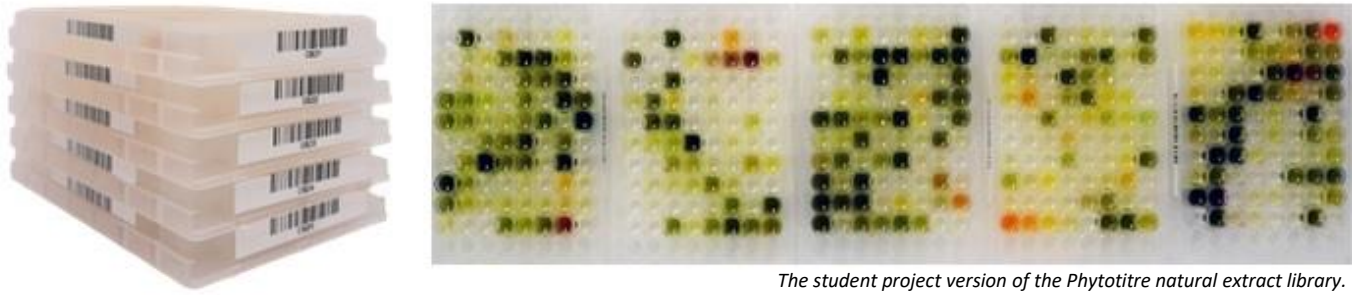

A cost-effective solution

In addition to saving supervisors time, the *Phytotitre* projects are a cost-effective solution to the provision of BSc and MSc research projects. Each kit can support 1 to 5 student projects, thus fitting well within the budget typically available for running a BSc or MSc research project. There is also potential to use screens of the library to address your own, specific research questions and generate novel IP.

About the *Phytotitre* library

The *Phytotitre* library is a collection of 800 natural extracts that has been used by researchers in academia and industry for drug discovery projects targeting diverse therapeutic areas in over a dozen countries since 2015. The full-size kit comprises both polar and non-polar extracts of 400 plants, for a total of 800 extracts.

We now provide a half-size version of the larger collection to support student research projects (see image below). The student project version of the *Phytotitre* library comprises only the non-polar extracts of the same 400 plants present in the larger collection. This carefully curated collection is conveniently arranged in five re-sealable 96-well microplates for ease of use.



The student project version of the Phytotitre natural extract library.

A unique focus of the collection is that it comprises almost entirely of traditional herbs or medicines with a history of safe oral use in humans. By focussing on such plants, the aim is increase the likelihood of identifying leads with both a high hit rate for biomedical targets, and a favourable safety profile. The inherently low toxicity of the extracts is a further advantage for use in student projects. To learn more about the background to the *Phytotitre* library, please read **Method sheet 100**.

Key properties of the student project *Phytotitre* collection
• Well-characterised and annotated collection of 400 natural extracts
• Supplied in a convenient and easy to use, resealable 96-well format
• Low toxicity suitable for use in student projects
• Published resource with a proven hit rate in drug discovery against diverse targets
• Backed by clear, practical method sheets, free to download from our website
• An excellent introduction to modern drug discovery techniques

Support available for supervisors

Project guides and method sheets

A key aim of the new *Phytotitre* collection is to save time and effort for supervisors in the provisioning of student projects. To help achieve this, we offer full turn-key **project guides** for 4 different laboratory-based projects, and 2 different data analysis projects. All six project guides are further supported by comprehensive, step-by-step method sheets. These resources are free to view and download without registration from the downloads page on our website.

Support for risk assessments and COSHH forms

We also offer ready-filled templates for **risk assessments** and **COSHH forms** specific for each project, with the aim of assisting supervisors in the completion of these documents. As we recognise that students may be asked to prepare such documents as part of their assignment, these templates are not available to download from the website. They are, however, available on request from supervisors by email from a verifiable UK academic email address. In the student-facing area of the website, the necessary safety data sheets are available to download, along with explanations of what to include in such risk assessments, COSHH forms and, where necessary, ethics applications.

Support for project assessment

The assessment criteria for student projects will differ between institutions. However, there are several key milestones and markers that high scoring students should have achieved through completion of a *Phytotitre* project. Supervisors can request a crib sheet that reveals how every chart and table should look if the students have completed the analyses as explained in the project guides and method sheets. Students have no access to these resources as they are not available to download from our website, but they are available on request if received from an email address of a verifiable UK academic (e.g. via presence on a department web page).

Project costing and logistics

Cost estimates for *Phytotitre* projects

The following cost estimates for running a *Phytotitre* project are based on pricing as at March 2026. Please visit our website for current pricing information.

Item	Cost
1x *Phytotitre* kit (5x plates, 50 µl/well)	£495
3x hit extract resupplies (*optional*) *	£90
Shipping	£0
Plastics and general chemicals **	£30 - £120
Cost per 1 student	£615 - £705
Cost per student (2 sharing)	£308 - £353
Cost per student (3 sharing)	£205 - £235
Cost per student (4 sharing)	£154 - £176
Cost per student (5 sharing)	£123 - £141

* *Optional*: Students can attempt relication experiments to further explore the properties of their hit extracts by purchasing larger quantites of those extracts. We recommend purchase of 1-3 of the top hits to complete the basic project.
** In addition to the *Phytotitre* collection, students will require access to general consumables such as: pipette tips, plastic tubes, sterile 96-well plates and sterile tissue culture plastics, depending on which project is chosen. Project-specific chemicals, such as DMSO for vehicle controls, an antibiotic for the microbiology projects, culture media and crystal violet for the cell-culture projects, will also be necessary. Apart from the anti-inflammatory drug discovery project, which requires use of actinomycin-D, it is anticipated that all necessary supporting chemicals will almost certainly be available in existing stocks of typical university Life Science laboratories. A more comprehensive list of the additional supporting reagents be necessary to run each project is given below.

How to order

The kits are easy to order, with only a PO number and delivery name / address necessary. We are registered suppliers to many UK universities and will be happy to register with any new customers. We can zero rate VAT if the order is accompanied by a statement that the products will be used for medical research. Invoices are sent after delivery and all products come with a 30 day money back guarantee.

Shipping and delivery

Shipping is free to UK academic customers. The products are shipped frozen with gel packs for temperature control. We typically ship kits on the Monday following receipt of an order, with delivery expected within 1-2 days.

Summaries of projects available

List of available laboratory projects

We offer four laboratory project outlines for use in BSc or MSc research projects. These can be easily modifed or extended to meet your specific research aims.

Project title	Summary of main activities
1) Antibiotic drug discovery	Screen for inhibitors of growth of *E. coli* or *M. luteus*, analyse HTS data, identify top hits, attempt replication of individual hits, prepare dose curve, calculate IC50
2) Cancer drug discovery	Screen for inhibitors of growth of a tumour cell-line of interest, analyse HTS data, identify top hits, attempt replication of individual hits, prepare dose curve, calculate IC50
3) Enzyme inhibitor drug discovery	Screen for inhibitors of the enzyme β-galactosidase, analyse HTS data, identify top hits, attempt replication of individual hits, prepare dose curve, calculate IC50
4) Anti-inflammatory drug discovery	Screen for inhibitors of production of TNF-α by a macrophage cell-line using the L929 bioassay, analyse HTS data, identify top hits, attempt replication of individual hits, prepare dose curve, calculate IC50

List of available data-analysis (“dry”) projects

Project title	Summary of main activities
1) Antibiotic drug discovery (data analysis)	Screen for inhibitors of growth of *E. coli* or *M. luteus*, analyse HTS data, identify top hits, attempt replication of individual hits, prepare dose curve, calculate IC50
2) Cancer drug discovery (data analysis)	Screen for inhibitors of growth of a tumour cell-line of interest, analyse HTS data, identify top hits, attempt replication of individual hits, prepare dose curve, calculate IC50

Typical project work-flow

Students screen our *Phytotitre* natural extract collection to identify those extracts which modify a biological phenotype of interest (e.g. bacterial growth, tumour cell-line growth, etc.). They then perform follow-on experiments using one or more of the hit extracts (e.g. dose response assays, *in vitro* toxicity testing, investigation of potential mechanisms of action, etc.).

Students can either follow our ready-made, turn-key project outlines and method sheets, requiring minimal additional input for project design and planning, or use the outlines as a starting point for your own target-based discovery projects using your own methods.

Comprehensive online support is available in the form of FAQs, trouble shooting guides and tips for data analysis.

Typical project duration

The basic project outlines can be achieved typically within an **8-10 week** period of lab time (not including time for writing up).

Extending projects to 'Level 7' (MSc) work

Engaged undergraduate students should be capable of complete the experiments suggested in the basic project outlines within about **8-10 weeks** of lab time. However, if students are very keen and/or efficient, or want to progress beyond the basic project, this can be extended to up to **30 weeks** by following the suggestions for further experiments and follow-on investigations given in the ‘Additional experiments’ section of each project outline.

For those students completing a project at Masters level, where more time is typically available in the laboratory, it is expected that they should complete at least two of the additional ‘project extension’ experiments given in the project guide. These additional experiments do not require purchase of an additional kit, but will incur additional costs in plastics and basic chemicals.

Assigning projects to different levels of experience and ability

For those students who are likely to be less engaged, or who perform poorly in a laboratory setting, we recommend allocation to one of the data analysis projects.

Of the laboratory projects, the easiest to set up and run for both supervisors and students is the microbiology-based antibiotic discovery option. The anti-cancer and enzyme inhibition projects are of intermediate difficulty, but the anti-inflammatory drug discovery project is significantly more challenging. We would advise offering this project only to students with proven cell culture skills, ideally at level 7, as the techniques required can be quite challenging and will require some time and practice to master.

Mapping to RSB and Biochemical Society competencies

Phytotitre projects directly address the Royal Society of Biology (RSB) criteria for 'Technical Proficiency,' 'Quantitative Skills,' and 'Data Handling', making them ideal for accredited degree programs.

Skills students will gain through the projects

The *Phytotitre* projects have been designed to offer students experience in key practical and analytical skills in current demand from Life Science employers. The following tables map these core employability skills to the respective project options:

Practical / laboratory skills practised in each project

	1) Antibiotic drug discovery	2) Anti-cancer drug discovery	3) Enzyme inhibitor drug disvovery	4) Anti-inflammatory drug discovery	5) Antibiotic screen data analysis	6) Anti-cancer screen data analysis
Requirement for Risk Assessments	✓	✓	✓	✓	✓	✓
Examining ethical implications	✓	✓	✓	✓	✓	✓
General laboratory safety	✓	✓	✓	✓	-	-
Aseptic technique	✓	✓	✓	✓	-	-
High throughput screening methods	✓	✓	✓	✓	-	-
Multichannel pipetting	✓	✓	✓	✓	-	-
Microplate absorbance measurements	✓	✓	✓	✓	-	-
Preparation of dose response curves	✓	✓	✓	✓	-	-
Kinetic assay of phenotype	✓	✓	✓	-	-	-
Standard microbiology methods	✓	-	-	-	-	-
Disk diffusion assays	✓	-	-	-	-	-
Standard cell culture methods	-	✓	-	✓	-	-
Cell viability assays	-	✓	-	✓	-	-
Enzyme activity assays	-	-	✓	-	-	-
Bioassays for cytokine measurement	-	-	-	✓	-	-

Data analysis and statistical skills practised in each project

	1) Antibiotic drug discovery	2) Anti-cancer drug discovery	3) Enzyme inhibitor drug disvovery	4) Anti-inflammatory drug discovery	5) Antibiotic screen data analysis	6) Anti-cancer screen data analysis
Standard Microsoft Excel techniques	✓	✓	✓	✓	✓	✓
Data Management and Integrity	✓	✓	✓	✓	✓	✓
Background correction	✓	✓	✓	✓	✓	✓
Normalisatiion to control conditions	✓	✓	✓	✓	✓	✓
Calculation of assay Z' factor	✓	✓	✓	✓	✓	✓
Mapping assay values to plate maps	✓	✓	✓	✓	✓	✓
Identifying hits from HTS data	✓	✓	✓	✓	✓	✓
Creation of bar charts	✓	✓	✓	✓	✓	✓
Creation of scatter plots	✓	✓	✓	✓	✓	✓
4-parameter logistic curve fitting	✓	✓	✓	✓	✓	✓
Calculation of IC_{50} values	✓	✓	✓	✓	✓	✓
One way ANOVA with Tukey's post-test	✓	✓	✓	✓	✓	✓
Two way ANOVA for dose curve analysis	✓	✓	✓	✓	✓	✓
Linear regression for correlation analyses	✓	✓	✓	✓	✓	✓
Correction for multiple testing	✓	✓	✓	✓	✓	✓

Support available for students

Project guides and method sheets

Students receive online access to comprehensive project guides and method sheets, which describe how to set up and complete each experiment. These are free to download without registration from the downloads page on our website. Troubleshooting advice to help solve common problems that may arise during the project is also given in each project guide. The university supervisor is responsible for day-to-day supervision and will be the primary point of contact for students.

Support for Ethics applications, Risk Assessment, Health and Safety

In addition to training in the above techniques, we advise that students should follow the guidance of their host institution with respect to project ethics applications, risk assessments and local health and safety procedures. However, we also offer basic guidance on all of these elements as part of the preparatory phase of each project. Specifically, students receive advice on the roles of Safety Data Sheet (**SDS**) and Control of Substances Hazardous to Health (**COSHH**) documents in the preparation of project-specific **Risk Assessments**. They are also advised of the main ethical risks associated with each of the projects options, and the requirement to submit a Research Ethics application if it is necessary to do so within their instution. As the projects involve the screening of natural products, there is also explanation of how and why the projects are compliant with the **Nagoya Protocol**, as discussed in more depth on our website.

Support for data analysis

Students receive Method sheets explainig how to perform each step of the data analysis pathway relevant to each project. These functions include: background correction, normalisation, Z' factor calculation, one way ANOVA, two way ANOVA, 4 parameter logistic curve fitting, calculation of IC_{50} and how to plot appropriate charts for each type of experiment.

Support for report preparation

We do not provide suggested text for students to avoid potential for "copy and paste" plagiarism. However, we do offer advice on how best to structure their report in terms of what major sections they should include, and how best to present the results of these projects. These can be viewed in Method Sheets 33 - 36.

Necessary equipment

Project-specific equipment requirements

The following items of equipment are the minimum necessary to run each project option. Note that the data analysis projects require access to a PC / laptop and Microsoft Excel (or equivalent spreadsheet software) only.

	1) Antibiotic drug discovery	2) Anti-cancer drug discovery	3) Enzyme inhibitor drug disvovery	4) Anti-inflammatory drug discovery
Access to a containment level 1 microbiology laboratory	✓	-	-	-
Access to a containment level 2 microbiology laboratory	-	✓	-	✓
Access to standard laboratory space	-	-	✓	-
A microplate reader capable of measuring absorbance *	✓	✓	✓	✓
Access to a -20°C freezer for storage of *Phytotitre* kit	✓	✓	✓	✓
General pipette set, capable of dispensing 1 µl to 1,000 µl	✓	✓	✓	✓
Multichannel pipette capable of dispensing 1 µl	✓	✓	✓	✓
Multichannel pipette capable of dispensing 50 - 200 µl	✓	✓	✓	✓
Autoclave for sterilisation of tips and/or media	✓	✓	-	✓
A microcentrifuge	✓	✓	✓	✓
Static 37°C incubator	✓	✓	✓	✓
37°C incubator with a shaking platform	✓	-	-	-
Class II containment safety cabinet for cell culture	-	✓	-	✓
37°C incubator with a 5% CO_2 atmosphere	-	✓	-	✓
Bench-top swing out rotor centrifuge	✓	✓	-	✓
Squeezable wash bottle for dispensing distilled water	-	✓	-	✓
A large plastic tray to collect runoff from plate washing	-	✓	-	✓
Waste stream for used crystal violet dye	-	✓	-	✓
An inverting microscope	-	✓	-	✓
Appropriate waste stream for biological waste	✓	✓	✓	✓

* The wavelengths of filter to be used for each of the projects are shown in the table below. If filters matching the most appropriate wavelegth is not available, a range is given within which good results can still typically be obtained from the respective assays.

Project	Optimum wavelength	Suitable range
1) Antibiotic drug discovery	600 nm	570 - 630 nm
2) Chemotherapy drug discovery	600 nm	570 - 630 nm
3) Enzyme inhibitor drug discovery	420 nm	405 - 450 nm
4) Anti-inflammatory drug discovery	570 nm	540 - 600 nm

Necessary reagents and consumables

In addition to the *Phytotitre* kit, the following items (not provided) will be required for successful completion of the respective projects. It is expected that most of these supporting reagents will be present in UK university Life Science laboratories. If any are absent, these should be purchased from other suppliers before initiation of projects.

1) Antibiotic drug discovery projects

Reagents	Consumables
Autoclaved Luria broth (LB) or another, appropriate bacterial growth medium	Clear plastic sterile 96-well microplates (at least 30 per student)
Dimethyl sulphoxide (as vehicle control, about 10 ml)	Autoclaved plastic tips compatible with available pipettes
Any positive control antibiotic (e.g. ampicillin or tetracycline)	Plastic reagent reservoirs (sterile, for loading plates with stock solutions)
	15 ml or 50 ml sterile plastic tubes (for preparation of master-mixes)
	Nitrile gloves

2) Anti-cancer drug discovery projects

Reagents	Consumables
Growing culture of an adherent tumour cell-line of interest (e.g. MCF-7, PC3)	Clear plastic sterile 96-well microplates (at least 30 per student)
Tissue culture medium (e.g. DMEM), foetal calf serum (FCS/FBS) and antibiotics	Autoclaved plastic tips compatible with available pipettes
Standard tissue culture reagents (sterile PBS, trypsin/EDTA)	13 ml or 30 ml pipettes for use with a motorized pipette filler
Dimethyl sulphoxide (as vehicle control, about 10 ml)	Plastic reagent reservoirs (sterile, for loading plates)
Crystal violet powder (~2 g, for cell staining)	15 ml or 50 ml sterile plastic tubes (for preparation of cell suspensions)
Methanol (~200 ml, for fixing cells)	Nitrile gloves
Acetic acid (~200 ml, for solubilising the crystal violet stain)	*Optional*: Benchkote laboratory surface protector for working with crystal violet dye
MTT (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) powder (~100 mg) - instructions are given on how to prepare working reagent for use in viability assays	
Sodium dodecyl sulphate (SDS, 10% solution in H_2O)	
Optional: A positive control chemotherapy drug, can use 0.1% SDS as alternative	

3) Enzyme inhibitor drug discovery projects

Reagents	Consumables
Recombinant beta-galactosidase enzyme (1 mg/ml, frozen aliquot)	Clear plastic sterile 96-well microplates (at least 30 per student)
Ortho-nitrophenyl-β-D-galactopyranoside (ONPG, at least 60 mg, the substrate)	Plastic tips compatible with available pipettes
Galactose (as a positive control for enzyme inhibition)	Plastic reagent reservoirs (sterile, for loading plates)
Phosphate buffer (for constitutents see Method sheet 15)	Nitrile gloves

4) Anti-inflammatory drug discovery projects

Reagents	Consumables
Growing culture of the J774, RAW or THP-1 macrophage cell-line (only one necessary)	Clear plastic sterile 96-well microplates (at least 60)
Growing culture of the L929 mouse fibroblast cell-line (the indicator cell-line)	Autoclaved plastic tips compatible with available pipettes
Cell culture medium (RPMI with L-glutamine and 10% FCS or 5% FCS)	Plastic reagent reservoirs (sterile, for loading plates)
Dimethyl sulphoxide (~10 ml, as vehicle control)	15 ml or 50 ml sterile plastic tubes (for preparation of master-mixes)
Actinomycin-D (~100 µl of 1 mg/ml in DMSO)	Nitrile gloves
Bacterial endotoxin (~100 µl of 1 mg/ml lipopolysaccharide, LPS)	*Optional*: Benchkote laboratory surface protector for working with crystal violet dye
Crystal violet powder (~2 g, for cell staining)	
Methanol (~200 ml, for fixing cells)	
Acetic acid (~200 ml, for solubilising the crystal violet stain)	
The antibiotic polymyxin-B (~100 µl of 10 mg/ml in water, positive control for inhibition of LPS-signalling)	

Supervisor FAQ

1) Do we require a Material Transfer Agreement (MTA) to purchase and use the collection?

No. There is no requirement for MTA - you can simply order the kit by placing a purchase order.

2) Who keeps the intellectual property arising from screening the collection?

You keep all intellectual property you generate from your own screens of the collection.

3) Is it possible to publish the results of screens of the collections?

Yes. Please visit this page to see recent examples of publications reporting the results of screening our *Phytotitre* and *Puretitre* collections.

4) Can the projects accommodate students with a wide range of aptitudes?

Yes. Some projects are more straightforward than others. We would advise that weaker or less engaged students should be assigned to data analysis projects. Of the laboratory projects, the easiest to set up and run for both supervisors and students is the microbiology-based antibiotic discovery option. The anti-cancer and enzyme inhibition projects are of intermediate difficulty, but the anti-inflammatory drug discovery project is significantly more challenging. We would advise offering this project only to students with proven cell culture skills, ideally at level 7, as the techniques required can be quite challenging and will require some time and practise to master.

5) Is there a backup strategy for less engaged or less capable students?

Yes. A convenient approach to dealing with students who begin a laboratory project but fail to engage sufficiently with the project or make progress in data collection, is to transfer them to the corresponding data-analysis (dry) version of the project using our in-house data. These projects are based on the same background reading as the laboratory projects, and receive the same level of support in the form of online method sheets explaining how to perform each stage of the necessary data analysis.

6) Can we modify the projects to better fit our specific research aims?

Of course! The project guides can be used as a turn-key solution to yield projects that are easy for supervisors to organise and run. However, they can also be adapted in any way you see fit to address your own, specific research questions.

7) We would prefer to screen a collection of pure compounds with established structures - is this possible?

Yes, all of the laboratory projects are easily modified to utilise our *Puretitre* collection of 200 natural compounds, which ships in 3x 96-well plates and is fully curated with SMILES structural data, SDF file and physicochemical data. Please visit our website for further information.

8) We would like to purchase herb extracts without purchasing a complete library first - is this possible?

Yes. Please email to request a quotation.

9) Do you offer any support for educators in terms of what to expect from dissertations following successful completion of one of your projects?

Yes. Although the assessment criteria for student projects will differ between institutions, there are several key milestones and markers that high scoring students should have achieved through completion of a *Phytotitre* project. Supervisors can request a crib sheet that reveals how every chart and table should look if the students have completed the analyses as explained in the project guides and method sheets. Students have no access to these resources as they are not available to download from our website, but they are available on request if received from an email address of a verifiable UK academic (e.g. via presence on a department web page).

10) Can students complete the project using artificial intelligence (AI)?

No, at least not for the timebeing. The diverse files and documents containing data and instructions are too complex for existing AI models to process correctly. We recommend that students are asked to submit their working Excel file along with their report to evidence that they have completed the analysis themselves. For example, it is very easy to check if cells contain - equations / cell references where expected instead of absolute values. Further advice on how to monitor for academic misconduct is given in our ‘Spotting Academic Misconduct’ guide for supervisors, which is available on request by email.

11) Do you have any advice on how to detect and prevent poor academic practise in students completing wet or dry *Phytotitre* projects?

Yes. We offer advice on key areas of resilience, such as how to prevent collusion between students on similar projects and how to spot signs of attempted short-cuts in our ‘Spotting Academic Misconduct’ guide for supervisors, which is available on request by email.