

## Formulating a research plan

### 5.1. What is a research plan?

A research plan is a short document, which sets out initial thoughts on a research project in a logical and concise manner. It is a concept paper, which may be shared, in confidence, with peers and potential collaborators. Several iterations of a research plan may be necessary before it may be considered as complete.

A research plan in laboratory medicine includes the considered opinion of its author in a research area of his/her choice. It is supported by evidence from the scientific and/or medical literature. It may be constructed in the following format:

- The research question
- The hypotheses
- Aims and objectives
- Research design

A research plan is not a formal research proposal, although it may well be the foundation document from which a detailed research proposal may be developed. Having a coherent research plan may help to make the process of writing a research proposal easier and quicker.

### 5.2. The research question

All research should start with one or more research questions. The research question seeks to address the general point of 'What am I proposing to do?' It sets out a problem that can be challenged, examined and analysed in a logical and systematic manner. Superficially this may seem like a simple task but the construction of a well-defined

research question can have a big impact on the design of a research proposal, its chances of securing funding, and the likelihood of a successful outcome.

The research question needs to be focussed, relating to a specific study in a defined situation. In laboratory medicine the research question should have a clinical context. The starting point for the research question comes from a detailed knowledge of the researcher; what he/she has learned from studying the literature; and what gaps or problems have been identified that may be solved by the research to be undertaken. As explained in Chapter 3 the chosen research project should be both important and practicable. One question that the researcher should ask him/herself is 'will my research question' avoid the response of 'so what?'

There are a number of criteria that may be used to help in formulating a research question in laboratory medicine. Of these the PICOT approach is one of the most widely used. Using this approach the research question should be formulated in terms of:

- P**opulation to be studied
- I**ntervention of interest
- C**omparator for the intervention
- O**utcome that will be assessed
- T**ime frame over which outcomes will be assessed

Not all research involves intervention and so the abbreviations **I**ndicator and **C**ontrol may be more appropriate in these circumstances.

Once the research question has been framed in line with the PICOT approach the next stage is to ask whether the research question can be translated into a proposal that meets the FINER criteria. This means assessing whether the resulting project will be:

- F**easible to perform
- I**nteresting for the researcher and the user
- N**ovel in the local or wider context
- E**thical to undertake
- R**elevant to clinical practice

Having satisfied him/herself that the research question accords with PICOT and FINER criteria the researcher would be well advised to seek the opinion of peers before deciding on the final version.

An illustration of a 'good' and a 'poor' research question are included in Table 5.1.

**Table 5.1. | An example of a 'good' and 'poor' research question**

'Good' research question	'Poor' research question
Is it possible within one year to develop a mass spectrometric method to improve the specificity of measuring serum 'rhubarb' in order to better understand its significance as a biomarker of the risk of developing pre-eclampsia?	Does the measurement of serum 'rhubarb' have any relevance in the investigation of pre-eclampsia?

### 5.3. The hypotheses

A well-thought-out and focused research question leads directly into one or more hypotheses. What predictions can the researcher anticipate will arise as a consequence of answering the research question? Testing the hypotheses (predictions) becomes the justification for the research.

Hypotheses are much more than hunches or guesses. They have their foundation in scientific knowledge and principles backed up by the experience and vision of the researcher. Strong hypotheses:

- Provide insight into the research question
- Are testable and measurable by the proposed experiments
- Are capable of being challenged and addressed by others using a different approach

Normally, no more than three primary hypotheses should be proposed for a research study. A proposal that is hypothesis-driven is more likely to be supported than a "fishing expedition" or a primarily descriptive study.

An illustration of a 'good' and a 'poor' hypothesis are included in Table 5.2.

**Table 5.2. | An example of a 'good' and a 'poor' hypothesis**

'Good' hypothesis	'Poor' hypothesis
A reverse phase packing bed can be used to extract 'rhubarb' from serum using a 96 well format and small volumes of eluant that are capable of automated injection into the liquid chromatography system	A method can be designed to isolate 'rhubarb' from serum

### 5.4. Aims and objectives

In simple terms the aims of the research proposal are to test the hypotheses that have been developed. Therefore, there should be one aim for each hypothesis. The aims are short, broad statements of the outcomes desired from testing each hypothesis. Aims should emphasise what is to be accomplished and not how it is to be accomplished. If the research question and the hypotheses are well constructed then the aims will be relatively simple to compose.

An illustration of a 'good' and a 'poor' aim are included in Table 5.3.

**Table 5.3. | An example of a 'good' and a 'poor' aim**

'Good' aim	'Poor' aim
To devise and evaluate a reverse phase method for the extraction of 'rhubarb' from serum using a 96 well format and small volumes of eluant that are capable of automated injection into the liquid chromatography system	To explore a variety of methods to extract 'rhubarb' from serum prior to liquid chromatography.

Each aim should be broken down into one or more objectives. These are the specific tasks that you are going to undertake in order to meet the aim. Deciding on objectives for the research plan can be difficult because of the unpredictable nature of research. However, it is worth investing time into establishing relevant objectives because

these will determine the methodology that will be employed once the research plan is implemented.

There is a useful mnemonic to help construct appropriate objectives. They should be SMART:

- S**pecific – target a specific area for improvement
- M**easurable – as an indicator of progress
- A**chievable – within the local research environment
- R**elevant – to the aim that it qualifies
- T**ime-related – specify when the result(s) can be achieved.

An illustration of a 'good' and 'poor' objective are included in Table 5.4.

**Table 5.4. | An example of a 'good' and a 'poor' objective.**

'Good' objective	'Poor' objective
Within three months to determine the percentage and precision of recovery of 'rhubarb' from human pregnancy serum using micro-columns of OASIS HPL solid phase and a methanol /water based eluant	To explore a range of solid phase extraction systems to see which of them can extract 'rhubarb' from serum

## 5.5. Research design

In a short research plan it is not necessary to detail all the investigations that will be performed. The research design is the framework created to enable the researcher to map out the logical sequence of investigations to be performed to achieve each of the objectives. As part of this process the researcher should list all the equipment and consumables that will be required and to identify any items that will need to be obtained in order for the research to proceed. This process will enable the researcher to reassure him/herself that all the investigations are practicable within the research environment and the timescale allowed for the research. It will also provide sufficient information for collaborators and peers to understand the plan of investigation.

There are many ways to classify research design. However, such theory can be

confusing and the researcher will do well to focus on the particular framework of investigations needed for his/her study.

A flowchart diagram is a useful way to set out the research design.

## 5.6. References

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