Peter Agger · Robert S. Stephenson
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A Practical Guide to Biomedical Research for the Aspiring Scientist

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Preface

So you are intrigued by scientific research and what it has to offer, but you do not know where to start? This book will help aspirational inexperienced researchers turn their intentions into actions, providing crucial guidance for successful entry into the field of biomedical research.

The world of science is exciting, and in contrast to what many people think, it is not confined to the intellectual elite, extraordinary genius minds or someone with a special gift. Science is something everyone can do. Like any other craft you just need the right tools, the right guidance and the right motivation.

Aimed at future researchers within the biomedical professions, be it undergraduate students, young doctors, nurses, physiotherapists or engineers, this book advises and supports novice researchers taking their first steps into the world of scientific research. Through practical tips and tricks we describe the entire research process from idea to publication, while also providing insight into the vast opportunities a research career can provide.

We hope that this book will help you make a smooth start in research, and aid and inspire you to create your own little piece of history in contributing something truly novel to the world of science. Who knows, you might make a career out of it!

Please help us improve this book for the benefit of future researchers. If you have any comments, questions or feedback, we would be happy to hear from you via guide.to.biomedical.research@gmail.com.

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Contents

Part I

Before You Start

The first part of this book will take you through all you need to know in order to prepare a scientific project. It will guide you through the different available research approaches and the process of finding a supervisor. You will subsequently find advise on how to define and describe your project.

1

The First Steps into Research

Throughout the history of mankind, curiosity and an open mind have been the driving force behind discovery. What is over that hill? What is across that body of water? What can be found in the dark depths of space? It was probably also curiosity that made you open this book. Essentially, research is about pursuing curiosity. Leaving no stone unturned, in an eternal search for new discoveries that will improve the understanding of ourselves, and the world around us. Imagine being the first person to describe a phenomenon that will forever change the way we look at ourselves. You could be just months away from producing something that lasts forever; a piece of science that will inspire and stimulate the curiosity of future researchers.

1.1 Why Do Research?

Grandiose introduction aside, there are countless reasons to get involved in research. On a personal level, maybe you wish to attain an academic degree or qualification, maybe you would like to boost your CV, or perhaps you just want to see what all the fuss is about? At this point you probably already know why you would like to get involved in research, that is the easy part, but what are the first steps you should take? Who should you talk to? Where do you go? How do you start?

Before you can answer these questions there are a couple of things you need to consider. First of all, which topic or field of research interests you the most? Genuine interest is arguably the most important driver for sustained engagement in research. A research project will take you through an entire

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spectrum of emotions, from extreme happiness to deep frustration, and everywhere in between. An existing interest in your research field is not a prerequisite for success, but in times of trouble your passion for the subject is sometimes what gets you out of bed in the morning.

Second, you need to decide which type of research you would like to do. An important aim during your initial steps is to determine who you are as a researcher. How do you like to work?

Which approach is likely to suit you best? Are you a "lab rat" who likes vials and Petri dishes? Do you get your kicks from working with experimental animals? Are you intrigued by technical inventions and applications? Or would you prefer a quiet day at the office working with databases or questionnaires? Maybe you can only see yourself in the clinical setting, investigating fellow human beings? Obviously, no choice is scientifically better than the other, but some may be a better match with your personality and temperament. Just to make this decision a bit more complex, it is not uncommon to combine multiple approaches of research into a single project. It is important to consider all possibilities in the early phase, prior to choosing your supervisor and designing your study. In Chapter 2 we provide a thorough walkthrough of the different approaches to research.

"Anything that can go wrong will go wrong". In spite of the fairly negative connotations of Murphy's Law, it is indicative of one of the main challenges in research: the art of preventing things from going wrong. A skilled researcher is able to anticipate the obstacles and unexpected turns that are inevitably going to occur, and is able to navigate their project elegantly past them. This skill is based on one thing and one thing only: **preparation**.

Preparation is essential from the very first moment you consider starting a research career. The more you know about your preferences, as outlined above, the higher the likelihood of finding the right project, the right supervisor, and the right research group.

Source: Shutterstock

1.2 Initial Contact

There are many ways of establishing contact with a research environment. You may already know someone who works in a group you would like to join, or maybe you know a professor who is conducting research you are particularly interested in. Face-to-face contact is always the most effective way of instigating collaboration, but it is not always possible. An email to a potential supervisor may do the trick, but it might also be lost in the hundreds of other emails academics receive on a weekly basis. There are no golden rules to follow in this matter, except that the lack of a response is not the same as rejection. Sometimes, establishing initial contact requires equal measures of perseverance and patience. In Chapter 3 we elaborate further on what you need to consider when looking for a supervisor.

1.3 The Project Life Cycle

Your first project will allow you to journey through the entire life cycle of a project. In the remainder of this book we will often refer back to the concept of the "Project Life Cycle" when describing the time line from your initial research ideas to the publication of your study. The Project Life Cycle is outlined in Figure 1.1. In the following section you will be introduced to some of the vocabulary used to describe the different stages of the cycle—yes,

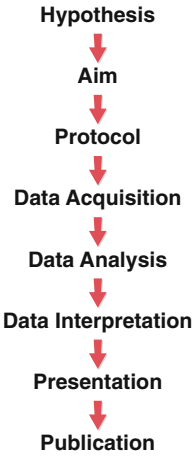

Fig. 1.1 Outline of the Project Life Cycle

scientists have their own special language—and it can even differ from one research area to another.

To enter the cycle you must first have a solid **hypothesis**. This is a kind of basic question or speculative statement specifically related to your research, it may be something like "I anticipate this new drug can cure cancer". Based on this hypothesis you formulate an **aim** for your study, e.g. "the aim of this study is to investigate whether drug X has a curative effect on cancer". Despite seeming to address the same issue, note the important linguistic transformation from the hypothesis to the aim. These and the other aspects of the Project Life Cycle are all put into context in your **protocol**, the description of your planned scientific project, which will be outlined in more detail in Chapter 8. The protocol is the cornerstone for planning and conducting your research project. It is used to convey to others what, why and how you will investigate your hypothesis, it is also the basis for applying for funding and the relevant approvals to conduct the study.

Once the protocol is ready and approved by all collaborators, including your supervisor, you are basically ready to go. Once all methods have been established, equipment is working, etc., you start **data acquisition**. At this point is it important to adhere strictly to the protocol. Do not make any changes once the protocol is closed and data collection has been initiated! This is one of the fundamental rules in science. If you change your procedure for data collection, you have effectively started a new project. Therefore, preparation at the protocol stage is extremely important—and pays off in the long run.