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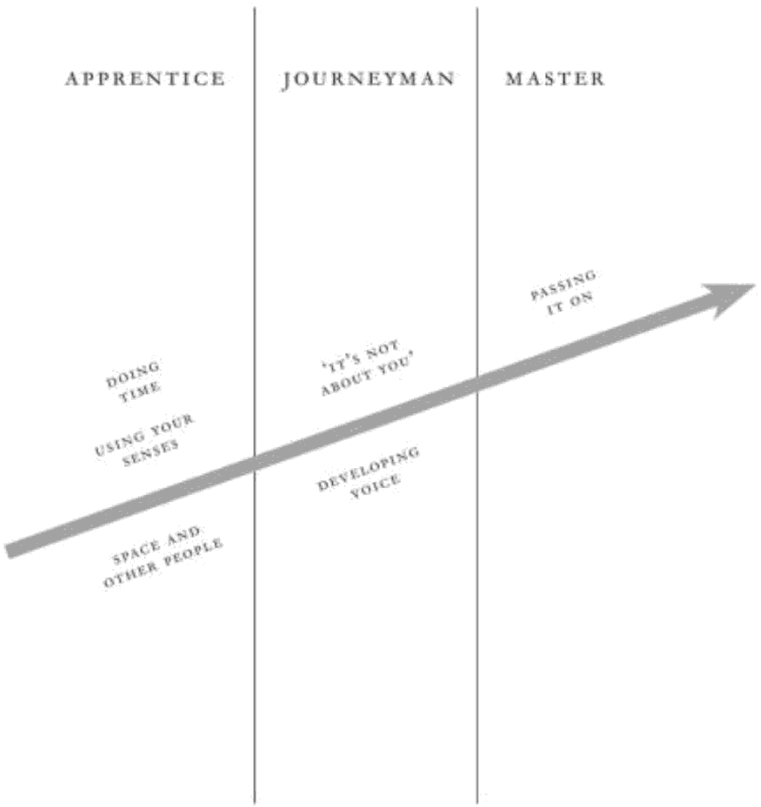
About the Author

Professor Roger Kneebone directs the Imperial College Centre for Engagement and Simulation Science and the Royal College of Music–Imperial College Centre for Performance Science. His first career was as a surgeon, operating on trauma patients in southern Africa. He then changed direction, becoming a general practitioner in south-west England. Now, as an academic at Imperial College London, he researches what experts from different fields can learn from one another. His unorthodox and creative team includes clinicians, computer scientists, musicians, magicians, potters, puppeteers, tailors and fighter pilots. This is his first book for a general readership.

To Dusia



1. Experts and invisible fish

When I visited Derek Frampton, he was posing a clouded leopard. I'd never seen a clouded leopard before. She was sitting like a cat, her tail curled round her, gazing at a tiny cub which looked as if it was about to run away and play. They were so realistic I could hardly believe they were stuffed.

Derek is a taxidermist, one of the best there is. He'd invited me to his house to see how he works. We were in his 'display room', full to bursting with animals of every kind. Glass cases of birds and reptiles, every surface covered with creatures. On one table was a parakeet nearing completion, its wings held in position by threads; on another was an alligator with its jaws about to snap shut, next to a tree frog glowing like a jewel in the sunlight. Apart from the eerie stillness, it was like being in a menagerie.

I'd arranged to visit Derek because he's one of the country's leading experts in his field. I'm interested in experts and I wanted to find out more. Moving a half-finished skink from a chair so I could sit down, Derek explained what taxidermy involves.

He made the process sound pretty straightforward. You remove the animal's skin, recreate its body shape with a plaster model and place the skin over the model. He showed me a zebra's hide, shapeless and slumped in a corner. When I asked how he would create the plaster shape for those final stages, he said, 'Well, you just sculpt a zebra that size and put the skin back on.'

It's that 'just' that's key. If you want a zebra, you *just* sculpt one that size. It's obvious. But to me it isn't obvious, it's unimaginable. It's what makes Derek an expert.

Taxidermy is not a science, a craft or an art, Derek told me. It's a practice which combines all three. The science is in the precision,

close observation and accuracy which allow his work to be a reference point for scientific research. Zoologists may refer to Derek's specimens for years to come, so the precise details of a mammal's colouring, a fish's scales or a reptile's teeth might be crucial in identifying new species or tracking the decline of animal populations. The craft is in the skills Derek has built up throughout his career: his ability to take the skin off an animal, then recreate that specimen's unique shape in plaster or wax. And the art is what brings it all together, making that clouded leopard look as if she's about to stoop down and lick her little cub. It's because he's an expert that Derek can combine these strands, applying them with wisdom and care to each new situation. Becoming expert is what this book is about.

Becoming expert

I'm a doctor. Medicine, too, is not a science, a craft or an art, but a practice which combines all three. Of course it is founded on science, that factual knowledge I spent so long studying as a student. The craft is how I worked as a practitioner, examining patients, operating on them or talking with them in my consulting room. The art is how I made sense of each patient and the problems they brought to me. The connection between Derek and me might not seem obvious at first, since surely taxidermy and medicine are completely different worlds. But that's not the case at all.

After explaining the basics, Derek took me into his workshop, which was like an alchemist's laboratory. The room was full of works in progress and there were all sorts of animals – birds and mammals, fish and reptiles. Creatures large and small, at every stage of preparation. An edible dormouse was on his workbench, a gorilla's head hung on the wall, and an antelope's torso stood in a corner. The air smelled of glue and plaster, and gurgling noises came from the next room.

In the centre of the room was the wooden cabinet where Derek keeps his most precious tools, the ones he inherited from his master. He only has a few and he's been using them for decades. The cabinet is the size of a wind-up gramophone and has two

brass-handled drawers. On top is a turntable, where a tiny clay frog lay next to some of Derek's sculpting instruments. Rotating the turntable slowly by hand, Derek can work on specimens like that frog without damaging them. All around are the materials he needs. His workshop is where the science, craft and art come together.

Derek has been a taxidermist for forty-five years, mounting ('setting up', he calls it) everything from giraffes to shrews, from Komodo dragons to fish. He's in high demand by museums, zoos and private collectors. Though much of his work is with new specimens, he also conserves examples from scientific collections of animals and birds that are now disappearing or even extinct. Expert taxidermists, like many of the animals they work with, are rare creatures indeed.

I asked Derek how he started his career. At school, he told me, he loved art. He was good with his hands but he's dyslexic and he found studying difficult. When he was twelve he came across a dead blackbird on the road, took it home and started to draw it. He was fascinated by the bird's anatomy, by the delicate mechanism of its wings. From then on, he collected as many dead animals as his mother would let him get away with, drawing and painting them as accurately as he could. His epiphany, as he described it, came when he was sixteen. One day he realized that he didn't have to draw these animals as he found them; instead, he could pose them. He never looked back. He joined the Natural History Museum in London as an apprentice taxidermist, working there for many years before striking out on his own.

Not everyone can become an expert taxidermist like Derek. Not everyone would want to. Yet finding out how Derek and others like him in different fields have become so expert is relevant to all of us. What does it mean to *be* an expert? How do you become one? What makes Derek an *expert*, rather than just someone who is very good at what he does?

We can all become expert at something, though we probably can't become really expert in more than one or two areas. To become an expert you have to concentrate on your selected field, pushing distractions aside and focusing intently for year after year. It's a long, demanding process that takes great effort, and there's a lot of frustration along the way. This sounds obvious, but

it's something people often overlook. We live in a world that demands immediate results. We are also taught to believe that talent is innate, and that if you don't show flair for something, it isn't worth pursuing. I don't think either of those things is true. Moving along the path towards becoming expert brings its own rewards: the slow march towards mastery is deeply satisfying – and, as we'll discover, it meets a fundamental human need. Besides which, you won't find out how talented you are until you try.

This book

This book is about experts and what it is to become one. I've been fascinated by experts for as long as I can remember. I've spent years watching them, talking to them, working with them, thinking about them, learning from them and marvelling at them. In the last few years I've made this a focus of my university teaching and research. I've read what others have written and I've explored theories of how people become expert, whether as an individual or in a group. I've spent countless hours with some of the world's leading experts in many different fields. I've tried to fathom what makes them what they are. Throughout all of this, it's the people who have caught my imagination – not 'expertise' in an abstracted sense, but the experts themselves.

Having expertise is one thing. *Being expert* is another. Am I an expert? It probably looks that way from the outside. It's over forty years since I qualified as a doctor. As I'll explain in the next chapter, since then I trained as a consultant surgeon and spent years operating on patients in the UK and South Africa. Then for nearly two decades I was a family doctor in a country town in the south-west of England. Now I'm a professor at Imperial College London, where I divide my time between teaching and research, much of it about experts. But I don't *feel* expert. To me it seems as if I'm just beginning to make sense of all that experience. Having said that, many experts I've spoken to describe a similar feeling.

Much of what experts do is invisible, even to themselves. Being expert is about how you think and see things. It's the result of an internal process that establishes who you are; it's not simply defined by what you create. We seldom see *how* experts become

expert. We might experience what they make or do, but we don't see how they got there. We watch someone perform a trumpet solo in a concert hall, but we don't see the lifetime of practice behind their flawless execution. When we look at a painting in a gallery, we're not seeing the thousands of studies that led to it. But if you want to be an expert, you have to go through a long process. This book describes that process.

I've tried to work out what makes experts expert. I've tried to put into words their apparent ease, their mastery of materials, their instinctive judgement, their ways of knowing and doing, and their ability to respond to the unexpected. I've tried to capture their commitment to something beyond themselves. This is a tall order. Being expert is something you do, not something you describe. Much of it is impossible to put into words. It's only when you've tried to do their work yourself that you get a sense of how skilled such experts really are. Theirs is the art that conceals art.

It's like the apocryphal story of the elderly boilermaker who is hired to fix a heating system that has stopped working. He arrives at the site, asks a few questions, listens to the system, takes out a hammer from his overalls and gives a sharp tap to one of the pipes. The system starts working and he goes home. The whole thing has taken a few minutes. Then he sends a bill for £500. The client is outraged at being charged so much for just using a hammer and asks him to itemize the bill. He replies: 'For use of hammer: £5. For knowing where to hit: £495.'

Invisible fish

So how can you tell if someone is an expert? Sometimes we recognize experts immediately. We experience their work and can judge it for ourselves – in concert halls or theatres or exhibitions, or in work by people like Derek the taxidermist. Sometimes we trust in their expertise without seeing how they do it, as with surgeons, chefs or architects. Such experts seem mysterious, and most of us know we could never do their work ourselves.

Other experts are all around us, though we often fail to notice them. When we have our car fixed by a skilled mechanic, or a new bathroom installed by a master plumber, it's easy to miss how

expert these people really are. Because cars and bathrooms are so familiar, we overlook the skill required to do a good job. We take this expertise for granted and hardly register it. Yet work of this kind is the fruit of decades of experience.

The perceived value of an expert's work has a lot to do with how we judge it, and this can be misleading. For many people, surgeons, airline pilots and concert pianists come fairly near the top, while garage mechanics, plasterers and plumbers come further down. Yet the essence of being expert – that wisdom that allows you to get to the heart of a problem and fix it with skill, judgement and care – cuts across these unhelpful hierarchies.

Part of the undervaluing of experts is because of familiarity – or its opposite. Taxidermy is so far outside most people's experience that Derek's expertise is plain to see. A plasterer skimming a ceiling or a carpenter making window frames may require an equal amount of artistry, craft and science to do a good job, yet because ceilings and window frames seem so ordinary we fail to recognize how expert these craftsmen are. In fact, the dexterity and precision of a surgeon and a joiner are surprisingly similar. They will both have walked a gruelling path. Yet the hierarchies that place surgery above joinery hide the common ground they share. The point about being expert is not the field you are in but what you have to do to get there.

Becoming expert, therefore, applies to us all. We each have our own interests and skills, whether driving or playing tennis, publishing or accountancy, using a computer keyboard or playing a musical instrument. But being expert is easier to recognize in others than in ourselves, whether you are composing emails or composing symphonies. Yet although experts often go unnoticed, we can spot them if we think to look.

It's like observing the natural world. One day I was walking along a riverbank with an old friend. He's a keen angler, and he was trying to explain his passion. 'It's not really about catching the fish,' he told me, 'it's about looking.' I didn't understand what he meant. When we reached a bend in the river, he pointed and said, 'There, do you see them?' I couldn't see anything special, just the water with a few leaves bobbing up and down and some flies swarming in the sunshine. 'Look, loads of them,' he said, and he

told me the type of fish he'd spotted. I couldn't see a single one. 'Just relax and look a while, and you'll see them too,' he explained.

As I stood on the bank, I let my gaze soften. Gradually I realized that what I'd thought were surface shadows were in fact fish flitting underneath. I couldn't identify what kind, but I became aware that they were there. My friend had been fishing since he was a child. He could put together the tiny clues that told him what was happening. They formed a language that he could understand but I couldn't. Ripples in the water, fleeting shadows, the glint of the sun, the pattern of the flies darting above the surface. He knew how to interpret all of this and make sense of it, even telling one species of fish from another.

Experts are like these invisible fish – all around us but hiding in plain sight. Often they are so modest about their accomplishments that they hardly acknowledge them. In this book I will be like my friend was that day, pointing out the invisible fish that surround us and live within us. I'll describe how to recognize experts, explore the characteristics they share, and ask what we can learn for our own lives.

Researching experts is a challenge. They often struggle to explain what they do. Their work has become unconscious – inaccessible even to them, and almost impossible to put into words. But they can usually show you. When you visit them in their studio, workshop, performance space, clinic or operating theatre, you can watch them at work. Even then, it's difficult to grasp the subtlety of what they do, to understand the judgements they make and the wisdom they bring to their work.

You might wonder how to find experts whose work resonates with your own and whose experience can shed light on yours. If experts are invisible fish, how can you see them? One approach is to go where you know fish will be, to find a bend in the river where they congregate. One such place in the United Kingdom is the Art Workers' Guild.

I found the Guild quite by chance. I was wandering through Bloomsbury in central London some years ago and ended up in Queen Square. This site is well known in medical circles because of some famous hospitals, including Great Ormond Street Hospital for Children and the National Hospital for Neurology and Neurosurgery. My eye was caught by a beautifully painted sign

over the door of No. 6 saying 'Art Workers' Guild'. It happened to be Open Garden Squares Weekend in London, when hundreds of organizations throw open their doors to passers-by. No. 6 Queen Square's was ajar. I stepped in and found myself in another world.

I discovered that the Art Workers' Guild was started in 1884 by young designers and architects who wanted to bring the fine and applied arts together on equal terms. This was the time of the Arts and Crafts movement, and William Morris – the artist, textile designer, writer and social activist who was one of its leading figures – was an early Master of the Guild. Now the Guild includes experts in over sixty fields, from pottery to botanical illustration, portrait sculpture to architectural drawing, ornamental plasterwork to jewellery-making. In most groups of experts – a society of silversmiths, say, or glass blowers, or printers, or doctors – all members are from the same profession. The Art Workers' Guild is quite the opposite. Its membership is very broad, and many of the experts I'll introduce in this book are among them.

I became fascinated by these Art Workers. As individuals, they are all highly skilled – only those at the top of their field are invited to join the Guild. As a group, they share a belief in the importance of doing good work and also a quiet pride in having spent years mastering a difficult craft. All of them are unusual; many are downright eccentric. In the years that followed my first visit, I spent more and more time with them, and eventually I was invited to join the Guild myself.

Spending time with them and other experts – including the ones you'll meet in this book – gave me an insight into their work. I began to see parallels between their experiences and mine, even though none of them do anything connected with medicine. I was able to test out ideas about the path to becoming expert – ideas which evolved into the ones you'll encounter in this book. I've had the experience of walking down a path towards becoming expert in my life as a doctor, and I found this image resonated with others too.

The apprenticeship model

At the heart of this book is the apprenticeship model. This has been widespread throughout Europe for centuries and has counterparts all around the world. Many people associate it with the medieval guild system for becoming a craftsman (a long-established term, which now of course applies equally to men and women, and which for convenience I will use throughout this book). Although many apprenticeship systems in the UK are being eradicated by social, political and industrial change, the model remains useful for our thinking. Historically it has referred to learning a craft or a trade, but for me it applies to experts of every kind – from taxidermists to teachers, plumbers to pilots. It's a model that most people understand intuitively, even if they haven't thought about it in detail. Crucially, it captures the idea of progression. I'll use this model as a framework throughout this book.

Traditionally there are three phases – Apprentice, Journeyman and Master.[fn1] Of course, social conditions nowadays are radically different from those of medieval Europe. Apprentices no longer sleep behind the stove in their master's house or work for years without pay. But these stages provide a road map for anyone who wants to become expert.

1. **Apprentice.** You start by knowing nothing. You watch and copy others, learning to do things as they are already done in your master's workshop. Responsibility for your work and any mistakes you make lies with your master, and so does any credit for the work you do.
2. **Journeyman.** You launch your career as an independent expert. You leave your master's workshop and move around the country. Now you take responsibility for your own work, and you have to deal with the consequences of error. You continue to gain experience, refining and extending your skills and developing your individuality.
3. **Master.** Finally you set up a workshop of your own and teach others. You pass on your knowledge and expertise to future generations. You do what you can to look after the individuals who are learning from you; you have a sense of

stewardship towards your field more widely; sometimes you even take the field itself in new directions.

These three phases are a useful way to think about the acquisition of skill. But they are descriptive, not explanatory. They identify points on a path, but they don't show you how to reach those points or how to know when you've got there. They divide the process into segments and treat these as if they were static. They measure what can be measured. But much that is important can't be measured. There are changes in who you are, not just what you can do. This process may be invisible from the outside. It's difficult to quantify, and may even go unnoticed from within.

Much research has focused on 'expertise', framing it in terms of impersonal attributes and capacities. Expertise is seen as separate from the person who acquires it. Expertise is being able to make a dovetail joint or put a basketball into the net. But I'm interested in what happens internally, in what it means to *become* expert, then become *an* expert, recognized by peers, the public and the outside world. I'm interested in what happens to that person when they learn to make a dovetail joint, rather than how they make the joint itself.

Descriptions seldom give an insider's point of view. They don't tell you what to expect if you want to become expert yourself, or where to place your effort. And they don't tell you how long it's likely to take, or the problems you'll encounter on the way. So I've broken down the Apprentice–Journeyman–Master model into smaller steps – the inside story of becoming expert. These steps form the chapters of the book. In the diagram on page 13 I've mapped them onto the Apprentice–Journeyman–Master framework. Of course, the steps don't always follow in an orderly sequence, and the stages often overlap. But they provide a sense of the terrain.

1. Apprentice

When you start out, your role is to learn. You're in someone else's world, learning to do things their way, and they take responsibility for what you do. I've called this step **Doing time**. Your focus is on yourself – on the knowledge and skills you are acquiring. You are shielded from the impact of the mistakes you will inevitably make,

both on the work itself and on you as a person. You become part of a community of practice, a group of people already doing what you aspire to learn. This community is usually supportive, though you may not experience it like that at the time. You are not expected, or even permitted, to depart from the established ways or try new things out. Your job is to conform, not to innovate. Your work involves repetition, boredom, trudging through menial tasks, and having to do things even when you don't understand why.

The next step – **Using your senses** – is about the fruits of doing time: the understanding you gradually develop of the work you are learning to do. You become familiar with the world you are starting to inhabit. You learn how it functions. You experience your work with your senses and your mind, as well as with your hands and your body. This applies whether you are becoming a stonemason or a doctor, attending evening classes in hat-making, learning the oboe as an adult beginner, or studying to become a lawyer, a film-maker, an accountant or anything else.

The third step, **Space and other people**, is about being systematic with the materials and tools you work with – 'mise en place', as the chefs call it. At the same time, you develop sensitivity to the people you are working with: your colleagues or patients, customers or clients. You learn how to enter and work within other people's personal space.

By now you are getting ready to leave the Apprentice phase. Along with this comes **Getting it wrong and putting it right**. Mistakes happen, but so far you've been cushioned by being a novice. People expect you to get things wrong. Your environment is arranged so that you, your colleagues and your workplace are protected from the consequences of your errors. You start by working on material that doesn't matter, that can be replaced. You have people who will tell you when you're going off course and how to put things right. You're in a safe space. But in the next phase, that starts to change.

2. Journeyman

Now you're becoming independent – responsible for your work and how it's received. This transition from Apprentice to Journeyman entails two pivotal shifts. The first I've called '**It's not**

about you', borrowing a phrase from magicians I've worked with. This requires a radical change in your focus of attention, shifting it away from yourself. Expert work involves doing something *for* someone else. Somewhere, there's an audience – a person or people who experience what you do – though you don't always see them directly. That audience may be obvious, as at a concert, a football match or a play. Here, expert and audience share space and time, and the work is synchronous. But in other fields, the audience is not there with you, and your work is asynchronous. When a potter makes a vase in a studio, there may be nobody else watching. But still the potter intends their work to be seen, whether in a shop, an exhibition or a display. Although the making takes place out of view, there is always an audience, even if theoretical, distant or completely unknown.

Whether you're an artist, a scientist, a clinician or a mechanic, this stage involves moving attention away from yourself. It's the shift 'from you to them'. 'Them' refers to the people who experience your work – your audience, patients or customers. This is a crucial transition, though it doesn't always happen at the same point on the path to becoming expert. Sometimes it doesn't happen at all. It's possible to be technically brilliant but remain focused on yourself; to miss or corrupt the heart of what you are doing. In my profession, the occasional rogue surgeons who carry out unnecessary operations, or experiment without their patients' consent, are often highly skilled. But they distort their work's purpose, coming to think it is more about them than their patients.

The second shift is **Developing voice**. I've taken this term from the world of jazz, where musicians will create a personalized musical fingerprint. As a performer, you reach a point where you are no longer a cog in someone else's machine, but a creator of expert work in your own right. As you establish your style, you develop your individuality. Now, you are shaping your work and giving it your signature. You are taking responsibility for being yourself and establishing your own identity. That requires confidence and self-belief. It's a subtle process, as it needs to develop in parallel with the transition to 'it's not about you' without making you arrogant or self-centred. You need to balance your emerging identity as an expert with a constant awareness of

who your work is for. When this succeeds, you establish yourself as an individual, recognizable to those who experience your work.

Alongside these two shifts runs **Learning to improvise**. By now, you are taking responsibility for the successes and failures of your work, and you're responding to what life throws at you. You may be leading a surgical team, as I was. You may be developing your own research as a scientist, or setting up in business. You may be performing in public, writing a novel or heading up your department. Whatever your field, you'll be faced with the unexpected, and you'll have to improvise. When things go wrong, it's up to you to fix them. At the same time, as a Journeyman, you have freedom. You can develop new ideas, challenge existing methods, put your own stamp on the things you make or do. As we'll see, some of the most creative leaps come from serendipitous insights that nobody anticipated or planned. Improvisation is a hallmark of becoming expert.

3. Master

By this time you have become expert in the field you've spent so long studying. A few people go further, reimagining their field and taking it to a different place. In **Changing direction**, I examine what it means to reshape your field and take it in a new direction. Many of the experts in this book have done exactly that. One of these was John Wickham, a pivotal figure in the development of keyhole surgery.

In the final step, **Passing it on**, you are sharing your expertise with others and helping them grow. This requires another switch 'from you to them', but this time 'them' refers to people in your field: students, apprentices, and colleagues in your group or community of practice. Passing it on forces you to think about your own thinking. It makes you clarify what you do, distilling years of expertise into something you can share with others. Not all experts do this formally, establishing their own teaching practice or workshop. Not all experts do this at all.

This is when you take responsibility for supporting other people as they learn and for the errors they will inevitably make. You take the rap if things go wrong. You may 'pass it on' in other ways too. You might write a book or a blog, or share your work through

Instead I lay down a challenge to move beyond the discipline-based thinking that keeps plumbers, neuroscientists, potters, magicians and heart surgeons in separate compartments. I highlight similarities and differences between experts, and I map a path from raw novice to wise mentor.

This book is about real people.

One of the strands running through the chapters that follow is my insider's perspective. That gives me access to things other people can't or won't say. I've drawn on my own experiences: the mistakes I've made, the thoughts I've had, and the ideas I've developed over the years. In my case, many of these are medical. That's inevitable, because I'm a doctor. My emphasis on clinical experiences is not because the world of medicine is unusually expert, but because that happens to be my story. If you were writing it, the central thread would be different. In that case you'd be drawing on other examples, making other connections. But the stages and themes would be similar.

In my professional career, I've changed direction several times and I'm still doing that now. I've been a surgeon, a family doctor, an academic and a university teacher, and in those areas I've become proficient. I have other interests too. As an amateur musician I'm still at the shallow end – nowhere near being an expert. And as a harpsichord-maker and a light-aircraft pilot I've had an initial taste, but never progressed beyond being a beginner. All of us do different things with our lives, and we're always at different staging posts along the path towards becoming expert. I've simply drawn on the parallels that are closest to hand for me, so I can draw comparisons.

At various points in the story, however, I'll bring in other strands and other experts. One of these is Joshua Byrne, a bespoke tailor I've been working with for over a decade. At first glance, Joshua's world and mine could hardly be further apart. After all, medicine is a science and tailoring is a craft – or so it seems. Yet our experiences have been surprisingly similar. We've been through the same stages, struggled with similar challenges. By comparing our experiences, our difficulties, and our ways of looking at the world, I will trace the shape of the path from Apprentice to Master.

I'll also bring in more people at the top of their game. I've already introduced Derek the taxidermist. Over the years I've had the privilege of meeting many others. Some are colleagues in medicine and science. Some are experts in the visual and performing arts. And there are pilots, magicians and craftspeople, too. I've watched them in their studios, workshops and laboratories, and I've spent hours talking to them. Those insights form the backbone of my research.

Though my own career has been medical, I'm not practising as a doctor now. If I'm expert in anything, it's education. When I work with students and trainee surgeons I see them struggling with the steps I've outlined. I see them coping with boring repetitive work, developing skill in their hands and bodies, dealing with error, working with people, and going on to teach. I've also read what others have written about expertise, and tried to understand their theories and their ideas.

As you read this book another strand will emerge – your own. Everyone has their own experience of becoming expert, to a greater or lesser degree. Whether you're dedicating your life to a single focused aim or simply trying to get better at something you enjoy, the urge to become expert lies in each of us. It is difficult but not impossible. It's like running a marathon: anyone can do it if they train for long enough and persevere. Few of us will become world champions, but we can all try.

Experts under threat

So why is becoming expert important? In the book's final chapter I'll try to explain. For centuries, the apprenticeship system expected people to go through the lengthy process that leads in the end to mastery. Though becoming expert brings rewards, these rewards don't come instantly. There are no shortcuts, and immediate gratification is not on offer. This is increasingly at odds with our social world and its intolerance of doing things slowly. People are impatient, and they want to see results. They don't want to spend years in someone else's workshop before becoming independent.

In some ways, the work of individual experts is highly prized, especially in a world of uniformity and mass production. At the same time, experts as a group are being devalued and their skills dismissed. This is partly because the end result – a suit, a vase, a successful operation – conceals the work that has gone into it. The greater the expertise, the less you notice it. So it's often easy to imagine that you or anyone else could do the same.

But there's also a devaluing of expertise in society. Experts are seen as elite, unnecessary and dispensable, because information that was once their exclusive province can now be accessed at the click of a mouse. But this is a dangerous misconception. Information is not wisdom. And wisdom is what experts provide.

We have always needed experts, and I believe we always will. Partly that's because of what they can do for us: the services they provide, and the objects and experiences they create. But just as importantly, they give us inspiration. They show us what we can do if we really want to. At the end of this book I'll return to why experts are essential to us all and address questions I often hear, such as: Why should we seek to become expert in some areas of our life? Why are experts under threat? And what can we do about it?

I started this book with Derek the taxidermist posing his clouded leopard. But for now we'll leave Derek and go back several decades, to a hospital on the outskirts of Johannesburg in South Africa. I'm in the operating theatre with Simon, who has been disembowelled.

2. The surgeon and the tailor

It's 1981. I'm in Emergency Theatre B at Baragwanath Hospital and I'm about to start a trauma case. Baragwanath is in Soweto in South Africa – at that time one of the most violent places in the world. It's 4 a.m. on a Saturday night and Simon, a young Zulu man in his early twenties, has been stabbed. He's on a stretcher when I first meet him, coils of intestine spilling out of a wound in his abdomen onto the sheet that covers him. Night after night, patients like Simon are rushed into the 'surgical pit' for emergency treatment.

I've only been at Baragwanath for a short time, but already I'm used to seeing patients with their guts hanging out – evisceration, as the textbooks call it. I've learned that the dramatic-looking ones aren't always the most dangerous. But Simon[fn1] is really sick. He's not responding, he's slipping into unconsciousness and his blood pressure is dropping. He must be bleeding internally, and he needs immediate surgery.

We've rushed him to theatre. It's a busy intake, with several surgeons on duty. They are all in other theatres, dealing with their own cases. I'm in my twenties, eager to operate but still wet behind the ears. I've been a surgical registrar at Baragwanath for a year or so, and I've reached the stage where I should be able to do an operation like this on my own.

With elective (planned) surgery, you can start with 'easy' cases and build up. But with trauma surgery, you never know what you're going to find. Blades and bullets don't respect anatomy, and what starts off as a straightforward case can quickly turn into a nightmare. As I scrub up, I go through in my mind what I might encounter. I'm excited and terrified at the same time.

As soon as Simon is anaesthetized, I clean his skin, cover him with sterile drapes, then make an incision in his abdominal wall. I deepen it until I'm into the peritoneal cavity. Dark blood wells up and I can't see a thing. Lumps of maize floating on the blood and a sudden sour whiff of beer show there's contamination – the stab wound has gone into the stomach, at least. But my first priority is to stop the bleeding.

There's so much blood that at first I can't find where it's coming from. The temptation is to grab the first bleeding point I can see, but I force myself to slow down and be systematic, examining each of the organs in turn before deciding what to deal with first. Liver, stomach, small bowel, large bowel, spleen, pelvic organs. One by one I check them, sometimes by eye, sometimes reaching around corners to feel the parts I can't see.

I realize with a lurch that the stab wound is deeper than I thought. It's gone down towards the head of the pancreas – tiger country for any surgeon, but especially one as inexperienced as I am. Blood keeps obliterating my field of view and I feel a rising panic. What if I can't cope, and my patient bleeds out on the table?

Becoming a surgeon

That night in the operating theatre with Simon I was certainly no expert, though I'd done a fair amount of surgery under supervision. I had started to do things on my own, to take responsibility for the decisions I made, but I hadn't had much experience in leading major operations. In terms of the path I outlined in the previous chapter, I was well into the Apprentice phase, and starting to become a Journeyman.

Fast-forward almost four decades. My career since then has taken me in unexpected directions. I'm not a trauma surgeon now. I'm not even seeing patients. Instead I've become a professor at a large London university, and I've specialized in surgical education. I spend a lot of my time exploring what it is to become an expert, and now I'm writing this book. It's a long way from where I began, and now I'll explain how I got here.

When I was starting that operation on Simon in Soweto in 1981, I'd been studying medicine for over ten years and was well into my

Repairing an injury here would take me way beyond my comfort zone. I look carefully, exploring millimetre by millimetre. Although there's bruising, none of the vital structures have been seriously damaged. It's a huge relief.

The next hour is filled with cutting and stitching: removing a section of small intestine, sewing the ends together again, closing the wound in the stomach. All things I'd read about in textbooks and seen a hundred times before but seldom done on my own. After a final check, I'm satisfied that I've repaired all the damage. I close Simon's abdomen with sutures, put on a dressing and take off the green drapes, now soaked with blood. My gown, too, is soaked, and I have to go and change before I can start the next operation.

Opening someone's abdominal cavity to see what's wrong inside is called a laparotomy. I'd learned the steps from my textbooks. But books don't tell you what it feels like to operate, or how to cope when you realize you're getting out of your depth. The people who write the books have experienced that, but when you're starting out, you haven't. You don't yet share a language with them. Even the sensation of cutting into a living human body is hard to describe. The slitheriness of living flesh, the feel of organs pulsating under your fingers, the click of the instruments as they lock into place – not to mention the hammering of your heart as you start a major operation, or the sick feeling in your stomach when things start to go wrong. Nothing you read in books or see on television can prepare you for the real thing.

And none of those textbooks ever described the physical pleasure of operating when it goes well or the fear when things go wrong. None of them mentioned the satisfaction of seeing a seriously ill patient that you've operated on walking out of hospital once they've recovered. Looking back, I can still feel that mixture of excitement and apprehension when I opened Simon's abdomen. I didn't know what I'd find. I didn't know whether I could cope. But once I'd started, I forgot my anxiety. It wasn't about me any longer; it was about Simon. I had to work out what his injuries were and do my best to fix them. I narrowed my focus and concentrated on each part of the procedure, as I'd been taught. Luckily things turned out well, but afterwards I'd replay it in my head, wondering if I could have done things better.

After that operation I realized I'd reached a watershed. I wasn't an expert by any means – far from it. I was still in the Apprentice phase. But I had managed to subdue my anxiety and perform a difficult operation that ended well. For the first time, I felt I was becoming *a surgeon*, rather than just somebody who was able to do a surgical procedure.

Later I discovered that this happens to experts in many fields. Of course, when I was starting that operation I wasn't thinking of those other fields. I was a trainee surgeon, applying my scientific knowledge and physical skills to make an injured person better. It never occurred to me that I could learn from tailors, musicians, hairstylists or fighter pilots. Now, decades later, I wish I had.

Becoming a general practitioner

In the years that followed, operating on patients like Simon became routine. Some of the most urgent had been stabbed in the heart. We usually had several of these over a weekend, sometimes more. In the end, I became used to running at full tilt down the corridor to the operating theatre with a patient whose heart was on the verge of stopping. A few moments to transfer the patient onto the table, then making a skin incision, splitting the breastbone with a hammer and chisel, slitting open the pericardial sac and putting a stitch in a spurting ventricle. Once things were under control we could all take a breather while the patient's blood pressure came up and ours went down, before we started closing the chest.

After almost three years at Bara, I felt I was getting the hang of trauma surgery. I wanted to broaden my experience, so I moved to Cape Town. I'd decided to continue my training at Groote Schuur, the university hospital famous for the world's first heart transplant, performed by Christiaan Barnard in 1967. At Groote Schuur I was still treating a lot of trauma patients, but I also worked for some of the world's leading experts in liver disease, intestinal surgery, neurosurgery, paediatric surgery and intensive care. By rotating through these specialities I gained a broad experience which later proved invaluable. I took my FRCS exams, became a consultant, and for a few months headed up the