Introduction: About this Book

Question: There are many books on communicating clearly, so why is this one different?

Answer: It's aimed at doctors and scientists, and anyone else who has to present or talk about clinical trials, science or medicine to a range of audiences. Scientific researchers, physicians who conduct clinical trials, academics, executives in pharmaceutical companies and representatives of scientific will find it invaluable.

Scientific communication poses its own challenges. The subject matter is complex and often requires the audience to have a certain level of prior knowledge to understand it correctly. Describing hazard ratios, interpreting Kaplan Meier curves and explaining confounding factors is different from talking about a new car or clothing range. Processes, for example in clinical trials, are laborious and tedious. Knowing how much of the detail to include and exclude requires judgement. Conclusions are rarely clear cut, and are often a matter of interpretation rather than hard facts. Communicating statistical risk and probability is challenging, especially to non-statisticians and non-scientists such as journalists. This book will look at these and many more challenges, then introduce powerful techniques for overcoming them.

It focuses on three types of activities:

1. **Peer to peer communication**, where you are talking to (and answering questions from) informed or specialist audiences.
2. **Onward communication**, where you need to communicate complex matters to non-experts, for example funding bodies or the public.
3. **Media interviews**, where you are required to tell a complex scientific story in a range of media, including newspapers, magazines, specialist journals, TV, radio and online.

Imagine you are one of the leading researchers on a trial of a promising new treatment for one of the major killers which attracts worldwide attention, such as diabetes, cancer, dementia or HIV/AIDS. You and your team have received the data, and the preliminary results are striking. You have been invited to present them at a satellite meeting at the year's major conference in the US.

You expect there will be a few hundred physicians, scientists and researchers in the audience, as well as medical journalists from around the world. *The New England Journal of Medicine* will simultaneously publish the findings online. The presentation will be a high profile event which has handed you a professional responsibility (to get it right) and a personal opportunity (to raise your profile in the medical community).

The findings are unclear, despite the smallest hint of a potential minor safety concern. If they are confirmed by larger and longer trials, this treatment could be what physicians and patients around the world have been waiting for. You want to do justice to the data, and strike the right balance in communicating the potential risks and benefits of the new treatment. You need to convey the promise it offers, while avoiding the 'miracle cure' and 'medical breakthrough' headlines you know the journalists will demand.

After your presentation, you will have to answer questions from scientific colleagues (and rivals!). Immediately following that there will be a series of interviews with scientific and medical correspondents accredited to the conference. They will file their stories and you will then be contacted by non-specialist journalists from all over the world, whose understanding of the subject matter may be sketchy at best. When you return to your institute you will be besieged with requests to talk about your data.

All of these situations require sophisticated communication skills. In particular, you will be dealing with different levels of understanding and prior knowledge.

Before any of that, you have to write the presentation. Where do you start? Where do you end? The data set is large and complex ... how much should you include? How much emphasis should you give to that potential small safety concern? How will you illustrate the key points, ensuring that every slide enhances the audience's understanding? When you take the stage, how can you ensure you will deliver an assured, impactful and memorable performance? How confident will you feel handling questions from internationally-renowned

researchers with big reputations and even bigger egos? If that goes well, how can you handle the media interviews, balancing the hope and the hype? Then there will be countless other conversations about it, and your opinion will be sought regarding the larger trials.

This book is your starting point for success. It will teach you how to combine the accuracy of peer-reviewed science with the narrative skills of journalism.

It will help you develop and deliver impactful presentations on medical and scientific data. It will help you to move beyond PowerPoint and tell a clear, compelling story based on your data. It will show you how to develop clear messages and themes from complex data, while adhering to the advice attributed to Einstein: 'Make things as simple as possible ... but no simpler.'

It will also help you to plan for the media interviews, avoiding the traps which are waiting for unsuspecting scientists in the harsh glare of the media spotlight. It will use real-life examples of scientific media coverage to help you understand the media world, and to tailor your messages and activities to it. In addition, it will help you to handle all those other conversations you need to have, with colleagues, other triallists, pharmaceutical company executives, regulators and patient groups.

My Own Experience

I have spent nearly 20 years working with some of the world's leading medical and scientific thought leaders, helping them to prepare for crucial presentations at congresses, conferences and meetings. I have trained and coached thousands of physicians, scientists and pharmaceutical executives in presentation, communication and media skills in Europe, the US, South America, Russia and the Far East. This book is based on the accumulation of that expertise.

I understand the challenges of talking about science and medicine, and the responsibility of the task. I recognise the conflict between saying something new and exciting which will gather recognition, not to mention further research grants, and the need to avoid charges of bias by over-simplification or over-extrapolation of the findings.

I particularly enjoy coaching presenters and interviewees who have to present in English when it is not their first language, and the book includes much advice for you.

I use many real-life examples and illustrations throughout the book. Some are from very recent studies, while others are from landmark trials that changed medical practice. They all contain great lessons for anyone hoping to communicate science and medicine clearly.

In today's world, it is no longer sufficient to be a good doctor or scientist. You also need to be a skilled communicator. I hope this book gives you that opportunity.

1

Science Communication in the Twenty-First Century

The importance of the audience – suspicion about science – why talking to non-scientists is important – the overlapping rings of science communication – the convergence of communication channels – examples of great science communication.

Appreciate the Audience

If I had a magic wand and was able to wave it over every person in the world preparing a presentation, I would make them all do this: Think about the audience. Put yourself in their shoes and stand where they are standing. Only then can you see your situation from their point of view. From there you can develop a presentation or an informal talk that takes into account their level of knowledge, interest and expectations.

Let's do this now, and think of the audience in terms of the big picture. When we talk about science communication, we refer to a situation where an expert (you) communicates to non-experts (your audience). Their level of 'non-expertness' will vary hugely. Examples from opposite ends of the spectrum might be a presentation to fellow physicians and researchers at a medical congress, where you and they both understand the background, and where what you are telling them is the result of your latest specialist research, versus a television interview about your research on a show aimed at the general public.

In both instances, and every situation in between, our aim is clear spoken communication. The challenges, however, are very different. They start with the audience. Scientific colleagues start with a good level of understanding about your subject, and are ready to pick on the smallest details of inconsistency,

error or lack of rigour. On the other hand, the public start with a suspicion about science, a fear of its power and often a feeling that it is too difficult to understand.

Ben Goldacre, author of *Bad Science*, his best-selling book based on his weekly column in *The Guardian* newspaper, has a theory about why the public is suspicious of science. He says that until the 1960s, if you learned about science at school, you could broadly understand how things worked … engines, powered flight, TV sets, space rockets and other inventions which were regarded as 'cutting edge' at the time. Since then, however, science has become so complicated that only real specialists can understand it. If you stopped someone in the street, would they be able to explain how a mobile phone works? Or a computer? Or satellite navigation? 'Something to do with microwaves, and radiation … and satellites,' is as close as most people get. Can you explain how the human genome was cracked? How Tyrosine Kinase Inhibitors work? As a scientist you may know the answers, but the public doesn't. What we don't understand makes us fearful. On top of that there have been so many 'scares about science' in recent years including fears over the safety of genetically modified (GM) crops, mobile phones linked to brain cancer, leukemia clusters around power lines and many other issues. If you have the public as your audience, you need to take this into account when you start to plan your presentation. Hence my advice: put yourself in their shoes. We will explore this in detail later in the book.

Given the difficulties, you may ask why we should communicate about science at all to non-scientists. Why shouldn't we confine our discussion to scientific journals, and only present to specialist colleagues? For centuries, that's exactly what happened, in most cases. Scientific research was conducted in a metaphorical black box. Scientists beavered away in secret, and when they had invented something which they believed was worthwhile, or maybe just clever, they handed it over to a grateful public. The public, when it thought about science at all, assumed it was conducted by bald men in white coats ('eggheads') who would run down a corridor shouting 'Eureka!' when they discovered something. They accepted the fruits of the research unquestioningly, and the scientists went back to their work.

Eventually the recipients started to ask questions: Is this the kind of development we want? Who decided what the scientists should invent? Is the new technology safe, and for how long? What if it falls into the wrong hands? Is it a good financial investment? Over time, these questions became

criticisms, some justified, some not. The scientists began to discover the truth of C. Northcote Parkinson's quote about the consequences of failing to communicate: 'The void created by the failure to communicate is soon filled with poison, drivel and misrepresentation.'

The next step was that the public – and governments – demanded a stake in the planning of research, and a say in deciding what was ethically acceptable and financially justifiable. 'We're paying for this research out of public funds, so we want to know what's going on.' Nowadays, not communicating with non-scientists is not an option. Doctors and scientists are regularly called upon to explain and justify their work. Scientific topics such as climate change, energy use, cloning, stem cell research, the perceived risk of dangerous emissions from electricity pylons and mobile phones, risk of deep vein thrombosis (DVTs) on long haul flights and cancer risks from almost anything as well as the risks and benefits of vaccines and medications are high on the list of people's concerns. The way to allay those concerns is by communicating clearly about science.

The Overlapping Rings

Science communication takes place in a number of ways. The three most important are:

1. publication in peer-reviewed journals
2. presentations
3. media interviews

Within these, we can identify sub-sections:

1. Publication in peer-reviewed journals
   - often involves editorial comment in the journal
   - includes online publication on journal website

2. Presentations
   - to colleagues
   - to public

3. Media interviews
   - to specialist media
   - to general media
   - one-to-one interviews or press conferences

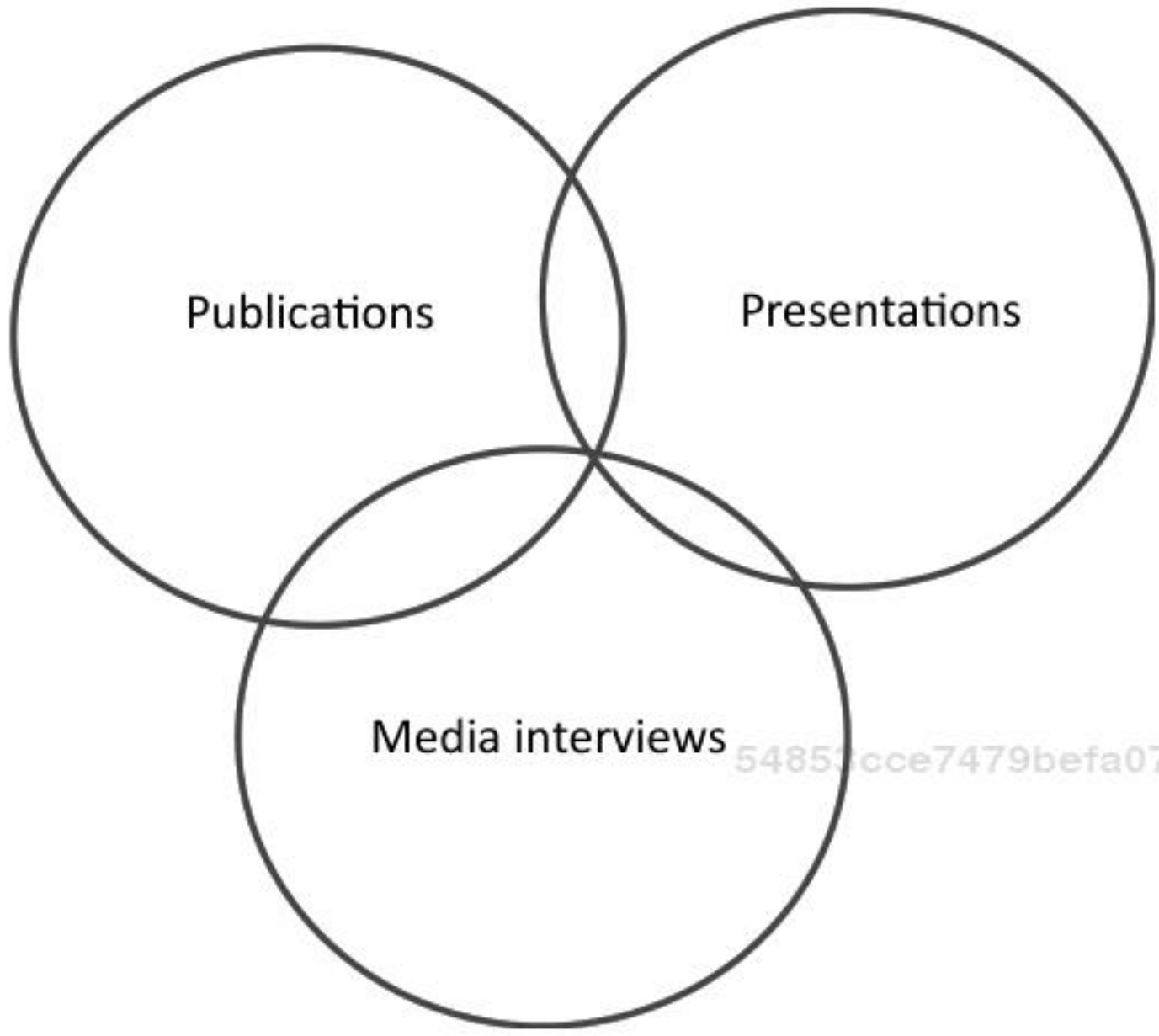

Figure 1.1 The overlapping rings of science communication

This book is concerned with the last two, which demand skills in spoken communication. However, presenting this as a list gives an inaccurate impression, as it suggests three discrete activities taking place sequentially on a continuum. In reality, they overlap. In the process, the audience changes too, from specialists to the general public. Today, I think of most science communication as three overlapping rings:

Presenting all three rings as the same size suggests that they are all equally important. In my view, this is increasingly the case, although without the peer-reviewed publication ring there would be nothing happening in the other two. Once you have achieved the publication, however, the other two take on equal significance with it among different but equally important audiences.

THE RINGS IN PRACTICE

As an example, consider a large study presented at the annual congress of the European Society of Cardiology (ESC). This is the largest medical meeting in Europe, and the largest cardiology meeting in the world. It is attended by approximately 25,000 physicians, 750 journalists and 5,000 others, including specialist nurses, scientific researchers, pharmaceutical executives, investors,

equipment suppliers and exhibition staff. In 2009, it was held in Barcelona, Spain. On 29 August the results of a major study were presented. The PLATO trial was an investigation of a new anti-platelet agent aimed at preventing dangerous blood clots and reducing stroke, heart attacks and cardiovascular deaths in people with Acute Coronary Syndrome. It compared a new experimental drug, ticagrelor, with clopidogrel, a well-established medication.

The study was presented in the plenary session by Professor Lars Wallentin, Director of the Uppsala Clinical Research Centre, Sweden, and co-chair of the PLATO executive committee. It was standing room only in the packed plenary hall as more than a thousand physicians, researchers, pharmaceutical executives, investors and journalists crowded in to see the long-awaited results unveiled. Many attendees, including me, were forced to sit on the floor in the aisles. The presentation was broadcast live on the internet and immediately made available around the world. There were many more in the overspill hall and others watching on Congress TV around the conference centre.

The results were simultaneously published online in the *New England Journal of Medicine*. This allowed fellow specialists to delve into the details and comment on the study. Traditionally, when the scientific journals were print-only publications, comments took weeks or months to emerge. Now it happens online within minutes of the paper appearing on the journal's website.

As is usually the case, Professor Wallentin was allowed only five minutes to present the findings. This in itself posed a major challenge with a study which included more than 18,500 patients treated for up to 12 months. Deciding what to include and omit was a crucial decision. As I said in the introduction to this book, he needed to combine 'the accuracy of peer-reviewed science with the narrative skills of journalism'. He did an exemplary job. His presentation was followed by a five-minute commentary from 'The Discussant', another expert who gave his view of the study's strengths, weaknesses and relevance.

Journalists following the presentation in the hall were also following the online comments from specialists, and noting the comments from The Discussant. They were writing their stories based on a combination of the sources. The first headlines appeared on major medical news sites before Professor Wallentin had finished speaking.

After the plenary presentation, the professor and colleagues were interviewed about the study on Congress TV. You can find the interviews on the ESC's *YouTube* channel.

The next step was the press conference, attended by many of the 745 journalists accredited to the congress. They included news agency reporters, and correspondents from a wide range of publications from specialist to general, for example, *Cardiology Today* and *Heart.org* to *The New York Times*, *El Pais* or *The South China Morning Post*. The language at the press conference was less technical than that used in the plenary presentation. The key points needed to be clear, and relevance to the journalists' audience had to be explained.

This prompted follow-up calls from journalists all over the world. It is impossible to check how many stories appeared as a result, but a Google search for 'PLATO ticagrelor publication' produces 44,000 results.

This is a perfect illustration of the three overlapping rings, and how new science is communicated to scientists and non-scientists early in the twenty-first century.

Great Communicators

I have hosted many of these press conferences, and have experienced some outstanding examples of clear communication. One came from Professor Salim Yusuf, an internationally renowned professor of cardiology from McMaster University in Ontario, Canada. He was expected to speak for 15 minutes on the programme to make a presentation about a major new study at the American College of Cardiology (ACC) in Chicago. The ACC rules prevent anybody from holding an event at a time which may conflict with the ACC meeting. As a result, the press conference was held at 6.30 a.m. The results were so significant that more than a hundred journalists turned up.

Never a man to waste time or words, the professor said, 'I'm not going to bore you with a presentation. This was a big study, and it involved two drugs which can both reduce your blood pressure. The main question was: 'Is an Angiotensin Receptor Blocker (ARB), a newer drug, just as effective as a proven ACE (Angiotensin-Converting Enzyme) inhibitor, an older drug that is known to save lives, at preventing heart attacks and strokes? The answer is "Yes". We've proven it with a very high degree of confidence. The good news is that the ARB is slightly better tolerated so if you can't tolerate an ACE inhibitor, then we now know we can use the ARB with confidence. This gives doctors and patients an important choice. Now … questions?'

When faced with such a clear example of communication, there was little chance that the journalists could misunderstand the result or its significance, and the story made headlines around the world.

The two stories above demonstrate another fact about the overlapping rings: They are converging. The area of overlap in the diagram I used above was quite small. Thanks to the dominance of the internet and the ubiquitous nature of instant communication, the boundaries between the publication, presentation and media elements are becoming increasingly indistinct. The following diagram is probably a more accurate representation:

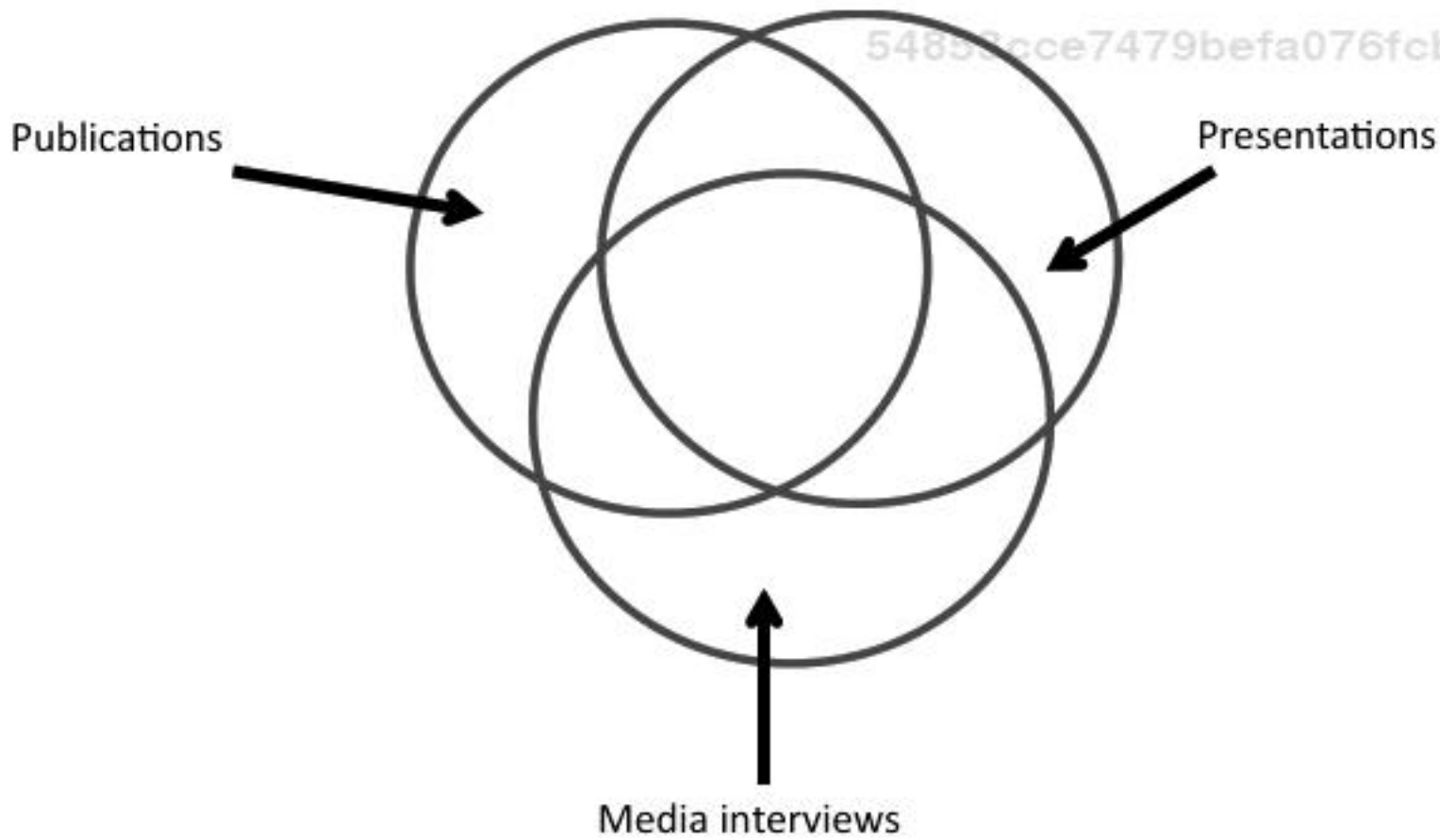

Figure 1.2 Converging overlapping rings

Mastering the overlapping rings has a number of benefits: Public, professional and personal.

PUBLIC

The public gets to know about the latest developments in science and medicine. This may be relevant to their own lives, diseases and problems. Being informed about the latest scientific developments is a crucial part of public debate.

PROFESSIONAL

Exposure of this type raises the profile of the institution to which the presenter is affiliated. Universities and institutions are ranked according to the amount

and calibre of their research, and successful researchers attract more funding for further work. Presenting and publicising their research, in addition to having it published in respected scientific journals, is a crucial element of this process.

PERSONAL

Achieving recognition as a communicator is increasingly important for the career progression of physicians and scientists. Spoken communication skills are the new cornerstone for success in science and medicine. It is no longer sufficient to be a good physician or scientist. Anyone who aspires to be a key player in their field must also be an excellent communicator. In particular, they must be able to present, explain and be interviewed about their research, confidently and memorably.

This is not just the case for young professionals starting out on their career. Once seasoned professionals have achieved Key Opinion Leader status, they need advanced spoken communication skills to maintain it.

Nobel Prize Standard Communication

I started this chapter by urging you to consider the audience. To see world class examples of an organisation which does exactly that, look up the announcements of the Nobel Prizes for science. Given the complexity of the science involved, the subject matter is necessarily complicated. However, the Nobel Prize organisation does a fabulous job of making it understandable.

The press releases announcing the prizes are a model of clarity. The Nobel organisation issues different versions of background reading to explain the research which has been honoured. It supplies background material aimed at scientists, which it calls *advanced information* and non-scientists, known as *public information*.

In the words of the opening chapter of this book, the Nobel Prize organisation really does aim to follow the advice attributed to Einstein to 'Make things as simple as possible, but no simpler.' They also achieve what I am aiming to do with this book, and combine the accuracy of peer-reviewed science with the narrative skills of journalism.

Here is an extract from the general press release announcing the 2010 Nobel Prize for Physics:

> *A thin flake of ordinary carbon, just one atom thick, lies behind this year's Nobel Prize in Physics. Andre Geim and Konstantin Novoselov have shown that carbon in such a flat form has exceptional properties that originate from the remarkable world of quantum physics.*
>
> *Graphene is a form of carbon. As a material it is completely new – not only the thinnest ever but also the strongest. As a conductor of electricity it performs as well as copper. As a conductor of heat it outperforms all other known materials. It is almost completely transparent, yet so dense that not even helium, the smallest gas atom, can pass through it. Carbon, the basis of all known life on earth, has surprised us once again.*
>
> *Geim and Novoselov extracted the graphene from a piece of graphite such as is found in ordinary pencils. Using regular adhesive tape they managed to obtain a flake of carbon with a thickness of just one atom. This at a time when many believed it was impossible for such thin crystalline materials to be stable.*
>
> *However, with graphene, physicists can now study a new class of two-dimensional materials with unique properties. Graphene makes experiments possible that give new twists to the phenomena in quantum physics. Also a vast variety of practical applications now appear possible including the creation of new materials and the manufacture of innovative electronics. Graphene transistors are predicted to be substantially faster than today's silicon transistors and result in more efficient computers.*
>
> *Since it is practically transparent and a good conductor, graphene is suitable for producing transparent touch screens, light panels, and maybe even solar cells.*[1]

Here are excerpts from two documents explaining the background to the 2010 Nobel Prize for Chemistry, awarded to three scientists for the development of palladium-catalyzed cross coupling. Notice the difference in language and complexity of ideas:

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1 'The 2010 Nobel Prize in Physics – Press Release.' Nobelprize.org. 18 Jun 2011 http://nobelprize.org/nobel_prizes/physics/laureates/2010/press.html

General Press Release

GREAT ART IN A TEST TUBE

Organic chemistry has developed into an art form where scientists produce marvellous chemical creations in their test tubes. Mankind benefits from this in the form of medicines, ever-more precise electronics and advanced technological materials. The Nobel Prize in Chemistry 2010 awards one of the most sophisticated tools available to chemists today.

This year's Nobel Prize in Chemistry is awarded to Richard F. Heck, Ei-ichi Negishi and Akira Suzuki for the development of palladium-catalyzed cross coupling. This chemical tool has vastly improved the possibilities for chemists to create sophisticated chemicals, for example carbon-based molecules as complex as those created by nature itself.

Carbon-based (organic) chemistry is the basis of life and is responsible for numerous fascinating natural phenomena: colour in flowers, snake poison and bacteria-killing substances such as penicillin. Organic chemistry has allowed man to build on nature's chemistry; making use of carbon's ability to provide a stable skeleton for functional molecules. This has given mankind new medicines and revolutionary materials such as plastics.

In order to create these complex chemicals, chemists need to be able to join carbon atoms together…[2] Here is the introduction to the 'public information' section:

A Powerful Tool for Chemists

There is an increasing need for complex chemicals. Humanity wants new medicines that can cure cancer or halt the devastating effects of deadly viruses in the human body. The electronics industry is searching for substances that can emit light, and the agricultural industry wants substances that can protect crops. The Nobel Prize in Chemistry 2010 rewards a tool that has improved the ability of chemists to satisfy all of these wishes very efficiently: palladium-catalyzed cross coupling.

2 'The Nobel Prize in Chemistry 2010 – Press Release.' Nobelprize.org. 18 Jun 2011 http://nobelprize.org/nobel_prizes/chemistry/laureates/2010/press.html

By contrast, here is an excerpt from the 'scientific background':

> *There are two types of cross-coupling reactions according to this principle that have become important in organic synthesis. These two types of reactions are shown in equations 1 and 2.*
>
> *Both reactions are catalyzed by zerovalent palladium and both reactions employ an organohalide RX (or analogous compound) as the electrophilic coupling partner. However, the nucleophilic coupling partner differs in the two reactions. In the first type (eq. 1) it is an olefin whereas in the second type (eq. 2) it is an organometallic compound R''M.*

I hope you can see from these examples how targeting different audiences is so important for clear scientific communication.

OTHER EXAMPLES OF GREAT COMMUNICATION

Whatever audience you have, you can find great examples of excellent communication on the internet. I recommend you take a look at what's available on your own specialist subject, and see if you can do better. Patient websites or sites like http://Webmd.com are an excellent place to start. As an example of communication at both ends of the expert–non-expert spectrum, here are two descriptions of how abiraterone, a treatment in development for castration-resistant prostate cancer, works:

Scientific Version from Wikipedia:

> *Abiraterone inhibits 17 α-hydroxylase/C17,20 lyase (CYP17A1), an enzyme which is expressed in testicular, adrenal, and prostatic tumor tissues. CYP17 catalyzes two sequential reactions: (a) the conversion of pregnenolone and progesterone to their 17-α-hydroxy derivatives by its 17 α-hydroxylase activity, and (b) the subsequent formation of dehydroepiandrosterone (DHEA) and androstenedione, respectively, by its C17,20 lyase activity. DHEA and androstenedione are androgens and precursors of testosterone. Inhibition of CYP17 activity by abiraterone thus decreases circulating levels of testosterone.*

Patient Version from Cancer Research UK:

Abiraterone is a new hormone therapy drug that researchers are looking into for prostate cancer. It is also called CB7630 or abiraterone acetate. It works in a different way to other hormone treatments for prostate cancer.

The male hormone testosterone stimulates prostate cancers to grow. Stopping the body making testosterone can slow the growth of the cancer, or even shrink it. Most testosterone is made by the testes but a small amount is made by other tissue in the body including the cancer itself. To make testosterone the body needs an enzyme called cytochrome P17 (CYP17). Abiraterone acetate blocks this enzyme, which stops both the testes and other tissues in the body making testosterone.

Researchers are looking at using abiraterone treatment for men with prostate cancer that has spread to another part of the body, and who have had hormone therapy that is no longer working.

Chapter Summary

Plan your presentation with the audience in mind. For decades, scientists primarily communicated only with each other. Today, explaining science to non-scientists is crucial for their support and understanding.

Science communication takes place in three situations:

1. publications
2. presentations
3. media

They all overlap, producing the three overlapping rings.

Read, watch and listen to great science communicators, and aim to emulate them. Make things as simple as possible, but no simpler.

2

The Seven Challenges of Communicating Science

Conveying the risks and benefits – the problem of information overload – the importance of telling a story – less is more – not seeing the wood for the trees – don't ignore the obvious – a tragic misuse of PowerPoint – the difficulty with jargon – clarifying your objective – attitude softening – explaining the benefits – the power of appropriate simplicity – what to include – what to exclude – examples of excellence.

Defining the Difficulties

In the previous chapter I examined why it is important for experts to communicate about science, and gave some examples of where it has been done well. When you see it done well, it seems so easy, like watching a great tennis player or golfer. You think 'Why can't I do that?' or 'How hard can that be?' In reality, we all face many obstacles to communicating clearly. Scientists in particular face specific challenges. Einstein said, 'A problem correctly described is 90 per cent solved.' With that in mind, in this chapter I want to describe the major problems faced by scientists when they aim to communicate clearly.

Balancing the Risks and Benefits

The former US President Harry Truman was so frustrated at the advice he received from his economics advisers ('On the one hand, Mr President … but on the other …') he once said, 'Give me a one-handed economist!' Scientists are notorious for behaving in the same way. Their training encourages them to view any problem from all possible angles, and they are reluctant to come down on one side of an argument until they have all the facts.

In reality, we rarely have the luxury of 'all the facts'. What we have at best is 'all the facts we have been able to establish so far based on the limitations of the trial design'. So we have to make a judgement on an incomplete data set. Even a huge clinical trial of 15,000 patients may not spot an adverse event that occurs once in 20,000. This is where your experience and intuition come in. As the presenter you have a responsibility to make a judgement, based on the data, about whether the overall risk/benefit profile of a new treatment is favourable or not. Your job is not just to *report* the data, but also to *interpret* it for the audience. This task of balancing the positive and negative underpins every example of science communication.

It is hugely important to you at both a personal and professional level. Your personal credibility is at stake if you appear to overstep the mark and sound too positive. You then run the risk of being accused of hyping the data and possibly being in the pocket of the sponsors, usually a large, rich pharmaceutical company. At the same time you want to be as positive as the data allows. You don't want the audience to be put off unnecessarily or prematurely from continuing with what could be an important new medication for patients. Finding the right balance of just the right amount of positivity and concern can be difficult. There is hardly a new drug approved by regulators anywhere in the world where somebody has not put a different interpretation on the trial data.

So how do you find 'The Goldilocks Option' of just the right amount of risks and benefits in your talk? You do this in a number of ways. Primarily by deciding what to include and exclude. My advice here is to follow the process adopted by publicly-quoted companies when deciding whether to inform the stock markets about an important development: if it can be deemed material, you should disclose it. If you have a reservation about a finding, or a concern about a potential problem, it is your responsibility to include it in your talk. That's why you are on the podium and they are in the audience.

The other way you convey the risk/benefit equation is by using the right language to describe a finding. You need to convey the extent to which you find the data convincing. On a scale of robustness, you might say the data:

Appears to suggest … suggests … supports the idea that … shows a trend towards … demonstrates … proves …

By combining these two techniques you can accurately convey your own interpretation of the data. That is your starting point. I now want to turn to the seven challenges of communicating science. There are seven challenges:

1. Information is not communication.
2. 'I know so much, I don't know where to begin'.
3. It's not about the PowerPoint.
4. Great communication means saying something in a way which cannot be misunderstood.
5. Start with the end in mind.
6. Don't confuse features and benefits.
7. Make everything as simple as possible, but no simpler.

Let's look at them in more detail.

Challenge 1: Information is Not Communication

On 30 September 1950 the *British Medical Journal* (*BMJ*) published the first instalment of what would become a lifetime's work for a British epidemiologist called Richard Doll and his colleague Austin Bradford Hill, a statistician. The title was 'Smoking and carcinoma of the lung. Preliminary report'. In it, the pair of researchers highlighted a 'phenomenal increase in the number of deaths attributable to cancer of the lung'.

They quoted a compelling statistic to support their claim: In the quarter century between 1922 and 1947 the annual number of deaths recorded [from lung cancer in the UK] increased from 612 to 9,287, or roughly fifteen-fold. They said, 'This remarkable increase is, of course, out of all proportion to the increase of the population – both in total and in particular in its older age groups.' They discussed how a number of possible causes had been considered and explained how they had set about investigating a link with cigarette smoking. After outlining their research methods, presenting their findings of the incidence of different cancers in smokers and non-smokers, they reached a conclusion of stunning simplicity:

> *To summarise, it is not reasonable in our view, to attribute the results to any special selection of cases or bias in the recording. In other words it must be concluded that there is a real association between carcinoma of the lung and cigarette smoking. We therefore conclude that smoking*

> *is a factor, and an important factor, in the production of carcinoma of the lung.*

Over the next 50 years, Doll and Bradford Hill published many more papers on the health consequences of smoking. Much of their research involved the smoking habits of male British doctors … an impressive 34,439 took part over the 50 years from 1951 to 2001. The *BMJ* published an update in 2004 under the title: 'Mortality in Relation to Smoking: 50 years' observations on male British doctors'.[1]

Doll and Bradford Hill, supported by other colleagues including Richard Peto, conducted ground-breaking research which was soon complemented and supported by many other researchers around the world. It quickly became apparent that smoking caused not only lung cancer, but could exacerbate many other diseases too.

In 1954 Doll and Bradford Hill published a paper confirming the link between smoking and lung cancer, and three years later the British Medical Research Council announced there was 'a direct causal connection'. In 1962 the Royal College of Physicians concluded that smoking is a cause of lung cancer and bronchitis, and said it probably contributes to heart disease. Three years later, cigarette advertising was banned on British TV, and health warnings on cigarette packets were introduced in 1971.

From 1950 the evidence that smoking is bad for your health began to accumulate, and received large amounts of publicity. During that time, people were still smoking in the face of clear evidence of the harm it could cause. One of them was my father. Like many people of his generation he started smoking when he was about 13 years old. Coincidentally, this was about 1950, the time that Doll's first smoking research was published. As Doll and colleagues continued to publish, and the evidence mounted, my father, and millions like him, continued to smoke.

I have always been an anti-smoker, from the days when, as a small child, I was forced to sit in smoke-filled rooms with my parents. I have lost count of the times I told my father to quit. I quoted the research, told him it was worth quitting however old you are, and banned him from smoking in the house.

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1 You can read the original 1950 paper here: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2038856/?page=12004; or the 2004 paper here: http://www.bmj.com/content/328/7455/1519.full.pdf+html)

Nothing worked. Then one day, when I was a TV journalist, I interviewed clinical pharmacologist Professor Peter Sever at St Mary's Hospital in London. He had been conducting research into the effects of smoking on cardiovascular risk, in particular on the speed at which cardiovascular (CV) risk is reduced when you quit.

In my TV interview he said this:

> *We know that smokers have sticky blood. The viscosity, or stickiness, of a smoker's blood is thicker than a non-smoker's. That's one factor that puts them at risk of a heart attack or stroke. What we've done in our research is to measure the viscosity of the blood in people who are on stop-smoking courses. We've measured it up to their quit day, and continued to measure it afterwards. We've discovered that their blood is measurably thinner within 48 to 72 hours of their last cigarette. To put it another way, if you stop smoking on a Tuesday, you start to cut your risk of a heart attack or stroke by Thursday or Friday.*

As soon as Professor Sever said this, I knew this would make a great piece for the evening news. When I next saw my father I showed him a video of the interview and an amazing thing happened: He stopped smoking after nearly 50 years. All the research conducted by Doll then by Richard Peto and others meant nothing to him. A single television interview convinced him. There was no lack of information that smoking is bad for you. As far as my father was concerned, it hadn't been communicated in the right way.

The story nicely sums up the first challenge of communicating science:

Information is not communication.

I was recently engaged by a large pharmaceutical company to help them prepare for a regulatory hearing for a new drug. Their submission contained 802 PowerPoint slides! Of course, they were not planning to present them all, and most were in the back-up set. However, it was obvious that their case was completely unclear and unfocused. In a recent US lawsuit involving another large pharmaceutical company, it emerged the company had provided 14 million pages of documents to plaintiffs' counsel! This of course may have been a case of deliberate obfuscation, but if so it still illustrates the point.

This is a classic problem for scientists. In their desire to appear thorough, they equate information overload with communication effectiveness. This leads to a belief that 'More is better.' In reality, the opposite is true.

In the scientific world, information is valued higher than almost any other property. In the world of research, data is prized above all else. It is understandable that the inhabitants of that world, having collected data or gathered information, regard their work as done. However, if you regard the onward communication of that information as a key part of your role, you have more work to do.

Here are some ways to ensure you focus on communication, not just information:

- 'just the facts' is not enough
- in science, information is the platform for your talk, interview or presentation. Without it, you would have nothing to say. But information alone is not enough.
- tell a story and build a compelling case
- establish relevance
- stress benefits
- make emotional connection
- anticipate questions

Challenge 2: 'I know so much, I don't know where to begin'

I regularly use this cartoon when I make presentations about the challenges of communicating about science:

It always receives a wry smile, because many of the people in the room know it applies to them. At the same time, being accused of knowing too much is flattering … it takes a really clever person to know *too* much about something, right? That's far better than not knowing enough, surely? Oh how superior it makes us feel!

The cartoon neatly summarises a key challenge for academics and scientists. In your world, knowledge is the basis of your success, and it is impossible to know too much. Part of the reason the cartoon gets a laugh is that the very idea of 'knowing too much' is itself laughable. How can anyone know too much?

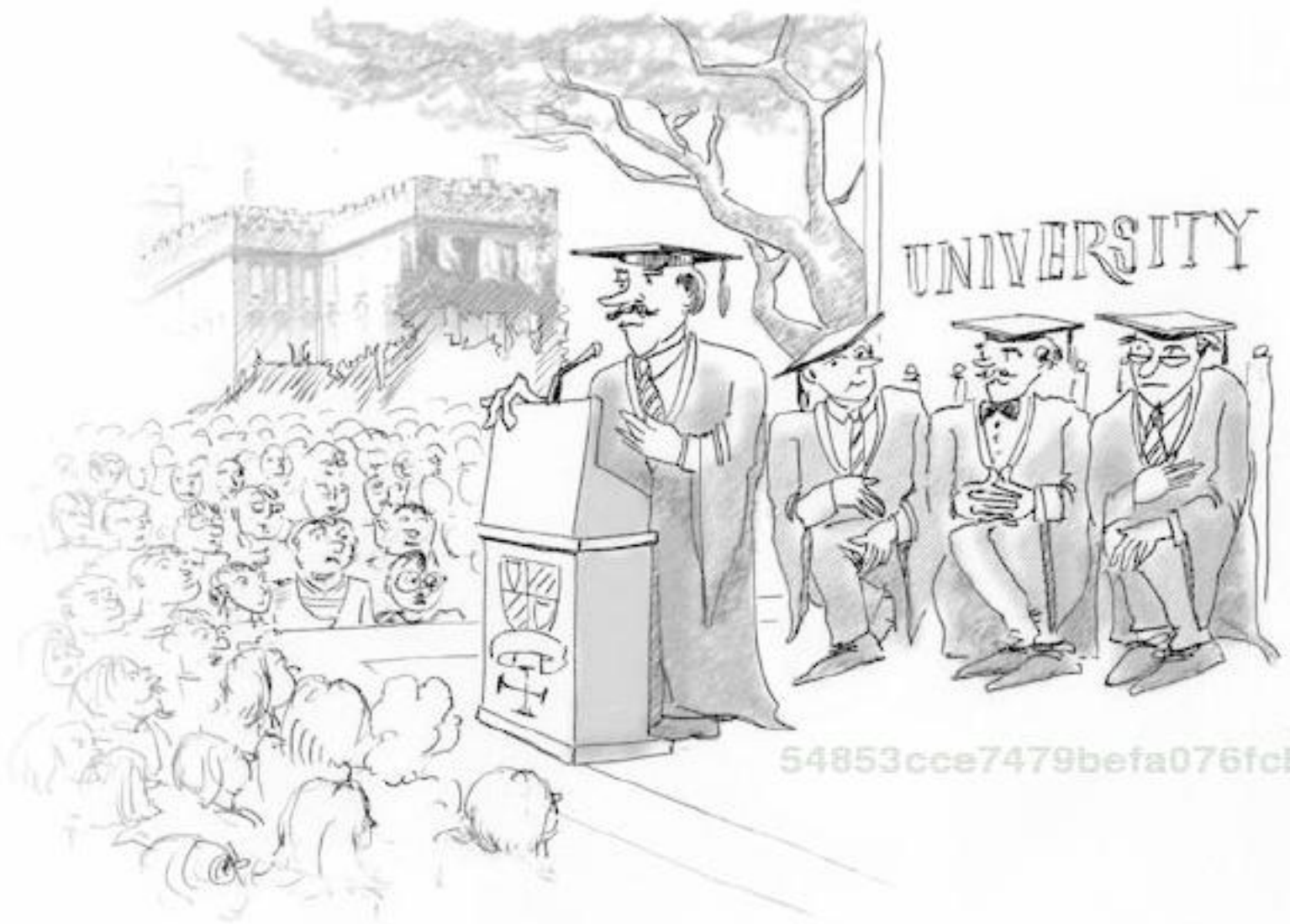

Figure 2.1 'I know so much I don't know where to begin!'
Raymond Patmore

The problem of knowing too much is that it's difficult to stand back and decide what is important. Many languages have their own version of the English idiom, 'You can't see the wood for the trees', or as Americans and Australians say 'You can't see the forest for the trees.' It refers to someone who is unable to understand what is important in a situation because they are paying too much attention to details. This is a classic problem: After you've spent years researching a single topic you get to a point where you can't see the wood for the trees.

Some years ago I was working with a pharmaceutical company whose best-selling drug for many years had been a beta blocker, a type of drug known as an anti-hypertensive, used for reducing blood pressure. A rival company had included a similar drug, another beta blocker, as the comparator arm in a study of their own new and exciting drug, which had a different mechanism of action. The rival company hoped that the trial would demonstrate that their exciting new kid on the block drug would be safer, more effective or both. They would then say there was no longer any need for beta blockers, as they had been superseded. My clients expected the beta blocker would come off second best against the newcomer, but felt there was still a need for it in specific patient groups. They asked me to help them craft a story which explained this,

and helped to defend their product's position after years of success and millions of patients successfully treated.

I ran several meetings with senior people in the company, trying to help them tell the story clearly and fairly, without making any claims that could not be substantiated. As usual, I was aiming for the combination of the accuracy of peer-reviewed science and the narrative skills of journalism. At the end of every meeting, we all felt we had made progress. First we developed a story line, then key factual statements, then different versions for scientific and non-scientific audiences, from journalists to payers and patient groups. Finally we agreed the question and answer documents (general and scientific), about the meaning of the trial and future prospects for our beta blocker.

Any statements a pharmaceutical company makes about its medicines need to comply with strict, legally binding codes. So all our statements need to be approved internally by a number of people with different responsibilities, including legal, regulatory, medical and investor relations. On this occasion everyone was happy except for the person who had to sign off statements regarding the mechanism of action of this and similar types of drugs. He was an associate professor at one of the world's oldest universities, and was renowned as one of the world's leading experts on beta blockers. He was also very busy, and never had time to meet us personally. We sent him our ideas, and he sent back comments, which were usually negative and technical.

On several occasions, he crossed out key sections of our argumentation, with no explanation, just the comment, 'You can't say that' or 'This is incorrect.' Nobody in the team I was working with understood exactly what was wrong with our explanation, or why we couldn't say it. Increasingly frustrated, and with time running out before the major conference at where the trial results were due to be announced, we finally sat down with the professor, face to face.

He had worked on beta blockers for 28 years. He was a charming man, and his knowledge was truly impressive. He had so much gravitas and obvious learning in the way he explained things, and such a specific way of speaking that nobody would disbelieve a word he said. Unfortunately he suffered from a serious case of knowing too much.

A side effect of knowing too much is often that you don't realise how little others do know. This is often because something is so obvious to you that you wouldn't think of stating it any more than you would say, 'The sun will rise

in the East tomorrow.' It would be a statement of the obvious. This was the case here. The problem often manifests itself to the audience when something doesn't make sense. You feel there's a missing piece of the puzzle which nobody has given to you. You go round it again and again, and keep feeling something is not right. One problem is that many people are afraid to ask the questions that might provide the missing piece, in case it makes them look foolish. As a journalist, I have years of experience of asking questions that might make me look foolish, so it doesn't worry me. I questioned him closely, asking what he regarded as more and more inane questions, and quite quickly we got to the bottom of it.

The missing piece of the puzzle was that not all beta blockers are alike. In particular, some are hydrophilic, while others are lipophilic, and lipophilic ones tend to cause more side effects. All our statements about beta blockers were only true for some of them. We needed to divide the type of drug into two, right at the start of our explanation. When I said to the expert, 'So our drug is different from the drug in the study because ours is hydrophilic, while theirs is lipophilic?', he laughed and said, 'Yes, of course. Maybe you should brush up on your pharmacology, John!' Laughter broke out around the room and I sensed most of the tension draining away. Now we had a story we could tell!

Contrast that story with another one where I was again involved. The leading expert here was an eminent British cardiologist, Professor Peter Sleight. At the time of writing (2011) he is Emeritus Professor of Cardiovascular Medicine at the University of Oxford. He was responsible for setting up the first ever large-scale, multi-centre trials on cardiovascular drugs, which led to radical changes in the way drug trials are conducted in all areas of medicine around the world. In 2010 he received the Gold Medal of the European Society of Cardiology (ESC) at the congress in Stockholm. In addition to his superstar status, he is a wonderfully clear communicator. Unlike many, knowing so much never means he doesn't know where to begin.

I hosted a press conference at the ESC in Munich where Professor Sleight was the main speaker. The subject was a follow-up of the trial I mentioned in the previous chapter, comparing two different types of cardiovascular drugs, an older one called an angiotensin converting enzyme (ACE) inhibitor with a newer one called an angiotensin receptor blocker, known as an ARB. The audience were medical journalists, and after a few introductory remarks from me, I gave the floor to Professor Sleight. His opening was a model of scene-setting which I encourage you to follow when you present medical data:

> *When I have finished a trial I have often forgotten what we were studying at the beginning, so for journalists who don't do this kind of thing every day it must be worse. So I will first remind everyone what it was about. It was a straight comparison between the 'new kid on the block' an ARB, in this case what looks like the best of the ARBs in many ways, longest acting, fewer side effects and so forth, and a very good ACE inhibitor, at full dose, versus the combination, ie the two drugs together, again at full dose.*
>
> *On this slide you can see the three arms … ARB v ACE v combination. In particular, notice that the ACE inhibitor was used at full dose, both on its own, and as part of the combination. That's different from other trials where you've had a combination of ACE and ARB, because very often the ACE dose has been reduced, which of course makes the ARB look a little better. Here, though, we had a full dose of the ACE so that's a hard test. What we wanted to find out was whether one drug is a better choice than the other, and whether the two together would be even better….*

What's so good about this is that the professor sets out his stall right at the start of the presentation, demonstrating that however much he knows about his subject, he certainly knows where to begin.

Where to End?

The professor in my cartoon says he doesn't know where to start. He has another problem: He doesn't know where to stop. We have a phrase in English, 'A little knowledge is a dangerous thing.' As another professor said to me, 'But sometimes a little knowledge is all you need.' Einstein (again) put it better: 'A little knowledge is a dangerous thing. So is a lot.'

Knowing where to stop is as important as deciding where to start. When people ask me 'How long should a presentation be?' I usually reply, 'As short as possible, but as long as necessary.' The key is to prioritise what information you want to communicate:

- What is essential for the audience to know?
- What would be helpful for them to know, to help their understanding?
- What else could you tell them if you had enough time and they had enough interest?

Start with the essentials. Then if your allotted time slot is long enough, go down the list. You are searching for what we call The Goldilocks Option ... not too much information, not too little information, but just the right amount of information. We will explore this in detail later in the book, and look at some techniques for achieving it.

Challenge 3: It's Not About the PowerPoint

When I make this point in my own talks about effective presenting, almost everybody nods and smiles. Occasionally, somebody cheers (or whoops, if we're in the US). The problem is that in many presentations, PowerPoint becomes a replacement for the speaker, instead of a re-enforcement. When this happens the speaker is just supplying the audio track for the slides, which takes away many of the presenter's strengths. In particular, it strips them of their ethos, their reputation and standing with the audience. (See Chapter 5 and Aristotle's methods of persuasion for more on this.)

Considering it's just a piece of software, the hatred that PowerPoint engenders is truly remarkable. You would be forgiven for thinking that using it is compulsory. Look it up on the internet and you will find articles with titles like 'PowerPoint is evil' and 'Is PowerPoint the devil?' The Dilbert cartoons about office life regularly parody the use of it, and Dilbert himself has referred to his audience falling into 'A PowerPoint coma'. The phrase 'Death by PowerPoint' is widely used in the business and academic worlds.

In Switzerland a man set up the Anti-PowerPoint party and expected to win enough votes in the election to win a seat in Parliament. PowerPoint was even blamed for the Columbia Space Shuttle disaster in 2003, when the spacecraft disintegrated over Texas while re-entering the earth's atmosphere. The tragic sequence of events began when a piece of foam insulation broke off on take-off. Engineers urgently attempted to predict whether the missing piece might cause a serious problem on re-entry. They made their report to senior managers, while Columbia was still in space, in a PowerPoint presentation of 28 slides, rather than in a detailed engineering report. As the two inquiry reports said:

> *Many of the engineering packages brought before formal control boards were documented only in PowerPoint presentations. It appears that many young engineers do not understand the need for, or know how to*

> *prepare, formal engineering documents such as reports, white papers or analyses.*[2]

Criticism focused on one complicated slide in particular:

> *As information gets passed up an organization hierarchy, from people who do analysis to mid-level managers to high-level leadership, key explanations and supporting information is filtered out. In this context, it is easy to understand how a senior manager might read this PowerPoint slide and not realize that it addresses a life-threatening situation.*[3]

Medical analogies abound among the anti-PowerPoint forces:

> *Imagine a widely used and expensive prescription drug that promised to make us beautiful but didn't. Instead the drug had frequent, serious side effects: It induced stupidity, turned everyone into bores, wasted time, and degraded the quality and credibility of communication. These side effects would rightly lead to a worldwide product recall.*

In my view, blaming PowerPoint for long, boring presentations with no clear focus and small, unreadable text is like blaming cars for drunken drivers. It's shooting the messenger. PowerPoint is innocent! It's the users who are guilty! PowerPoint is merely a tool. What you do with it is a matter for you. To turn to one more medical analogy, I agree with another writer who compared the abuse of PowerPoint to the abuse of antibiotics. When penicillin was invented it was regarded as a silver bullet for a wide range of illnesses affecting humans and, later, animals. It was used with such enthusiasm that its original purpose was lost. Over time the use became so prevalent that resistance developed and the antibiotics became less and less effective. So it is with PowerPoint, but that's not the fault of the people who developed it.

What this discussion illustrates nicely is that your presentation is not about the PowerPoint. If all you want to do is to read the slides, just send the slides, and don't bother to turn up yourself. When I'm invited to speak at a big meeting or conference, the client often asks to see my slides in advance. Usually they

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2 From the Return to Flight Task Group, set up after the disaster.

3 From the report of the Columbia Accident Investigation Board.

need to go through legal and regulatory approval. I have no objection to that. However, if they ask to see my 'presentation' I tell them that the presentation is the combination of me and the slides. I am an important part of it! You should do the same … it's as much about you, and what you say, as it is about the slides. The data, or the information, is the bedrock of your presentation, but it really is 'not about the PowerPoint'. We will look in detail at designing and using PowerPoint slides in a later chapter. I will also ask you to consider whether you always need PowerPoint (or any other presentation software) at all. So if your presentation is not about the PowerPoint, what is it about? Here are some suggestions:

- telling a story
- explaining the data
- building on the information you have
- putting the findings into perspective
- explaining the relevance to the audience
- generating enthusiasm for your story
- adding to what is on the slides
- producing a memorable experience

Challenge 4: Great Communication Means Saying Something in a Way Which Cannot Be Misunderstood

This is my mantra, and is printed on much of the material my company produces. The full quote is:

Good communication starts with saying something in a way which can be understood.

Great communication starts with saying something in a way which cannot be misunderstood.

As I travel around the scientific, medical and pharmaceutical worlds, I meet a lot of good communicators who meet the first challenge here, that is, what they say can be understood. However, the really good ones also meet the second challenge, and cannot be misunderstood. The first point to notice here is the phrase 'begins with …' This is because successful communication involves taking into account the way the audience is receiving what you are telling them, then adapting as necessary. For example, if they don't appear to

understand the technicalities, make it simpler; if they don't get the significance of the data to their work, explain it differently; if they're not convinced about the 'big picture' of your hypothesis, give them a real-life illustration.

Communication didn't always include a feedback loop. It was only when Shannon and Weaver published a book titled *The Mathematical Theory of Communication* in 1949 that feedback was generally recognised as an important element of communication. See Chapter 3 for more on this.

Here is another cartoon I use in presentations, to illustrate the importance of using language which cannot be misunderstood:

Figure 2.2 Example of miscommunication

Oliver Preston

So how do we ensure we cannot be misunderstood? By presenting understandable concepts, expressed in the right language.

An understandable concept is one which the audience can grasp. If you want to introduce a non-medically qualified patient to anti-clotting medication you would not talk about the coagulation cascade and whether it was more effective to block it by inhibiting Factor Xa or thrombin, and the importance of the von Willebrand factor. The concept would be meaningless, and the patient likely to end up more confused than when they started. You would be better advised to keep it simple.

The right language is a key element of successful communication, and causes a real problem for medics and scientists. Medical students learn a new language of 6,000 words at medical school. Non-medics don't speak that language, so you need to translate it for them.

The problem is actually more complicated than that, as there are in fact two types of jargon:

1. Words and phrases which have different meanings to specialists and non-specialists.
2. Words and phrases which non-specialists do not understand.

An example of the first type is the word 'censored' as used by statisticians. Critics of the way clinical trials are conducted say 'they even admit themselves that they censored the data', suggesting the data has been twisted in some way, to fit the conclusion the sponsors wanted (usually about a new drug). In reality, 'censored data' in this sense means data which is incomplete.

A medical example is the word sinus. To lay people, your sinuses are in your nose. To a cardiologist, sinus rhythm is a term used to describe the normal beating of the heart, as measured by an electrocardiogram (ECG). Classic cases are the words 'chronic', which to lay people means 'bad' or 'serious'.

Acronyms and abbreviations can also cause confusion, and I am not always innocent in this. I recently tweeted that I was on my way to Lugano, Switzerland, to host a conference on NHL, meaning Non-Hodgkins Lymphoma. 'I didn't know you were working with the National Hockey League', a friend replied. NHL is a good example of what we call TLAs … Three Letter Acronyms. Avoid them. A more serious example is the word 'progression' when used by oncologists.

If your oncologist tells you that your cancer is progressing or 'has progressed' you would be forgiven for thinking that this is good news. 'The recovery is progressing well', is good news. 'The cancer has progressed' is not, as seen in the popular endpoint in trials of cancer drugs, Time To Progression.

Doctors and scientists are traditionally major culprits of the second type of jargon, using words and phrases that mean nothing to anyone else. It is understandable because at medical school and with colleagues you are expected to use the medical and technical terminology. When I give talks I introduce this section with an old photograph of a distinguished-looking, grey haired male doctor and a British schoolboy, in the consulting room. The doctor is saying, 'You've got a bad case of acute diverticulitis' and the schoolboy says, 'but what about my dodgy tummy?'

In recent times I have seen two examples of communication which went wrong for very different reasons. The first was at an oncology conference in Switzerland. I was working with the Principal Investigator (PI) of a major trial of a new type of drug used to treat breast cancer. The trial's finding was very important, and has been one of a number of studies which have now changed clinical practice. The professor was due to present the findings to the conference the following day, and be interviewed by a medical journalist from The Wall Street Journal, the distinguished and very reputable US newspaper renowned for checking every detail of its stories. I could see that although the PI was a leading scientific researcher, communication was not his strong suit. He was the walking, breathing example of the professor who knows so much he doesn't know where to begin. He was also doing the presentation and interview in English, his third language.

I stressed the importance of using the right kind of language, told him it was vital to keep it simple and be very clear about the findings. I advised him to listen carefully to the journalist's questions, as they would give us a pointer regarding her level of understanding. When the journalist came on the phone, the professor ignored all that and went straight into a jargon-filled monologue which anyone but an experienced cancer researcher would have had difficulty following. The journalist did her best to keep up, but it was a losing battle. When it was over, I said, 'Well, professor. How did you feel that went?'

He replied, 'It was just ridiculous. She didn't understand any of it. She wasn't even a biologist!' Leaving aside the scandalous implication that biologists are the lowest form of scientific life, the professor had completely

missed the point, which was that his responsibility was to communicate the findings of the trial, and their implications. Fortunately someone else on the team with better communication skills was able to call the journalist back, and explain it more clearly.

The other example was completely different, but by coincidence it was at another oncology conference. I was speaking at a satellite meeting with a British oncologist, a specialist in kidney cancer, a disease for which at the time of writing there is no cure. I do sometimes have the privilege of meeting excellent communicators, who have a natural talent for explaining complex things very clearly, and have worked hard at it. I find them a joy to listen to. This doctor was one of them. He told a story of how he had recently explained to a patient that he had early stage cancer, and explained the treatment options. Having met the oncologist, and seen how clearly he communicates, I am sure he explained it all very clearly. At the end of it he asked the patient 'Is there anything that is not clear, or anything you want to ask me?'

The patient replied, 'Well I'm just glad I haven't got a tumour, doctor, because my mother died of a tumour.' The doctor had avoided using the word 'tumour' because it risked confusing the patient. (Some tumours are cancer, some are not.) However, in doing so, he had inadvertently made the patient's condition seem less serious than it was, and hadn't communicated clearly at all. I thought it was interesting that the doctor chose to tell me this, and tell the story against himself. It showed how keen he was to be seen as a clear communicator. Of course there are many other factors involved in dictating what patients hear when their doctor gives them a diagnosis, but the first step is to use the right language. This story shows how careful you have to be.

It may be that everybody in every audience to whom you present medical or scientific data knows the difference between a tumour and cancer. However, the lesson is clear: It is your responsibility to ensure that what you say cannot be misunderstood.

Here are some words which can cause confusion to non-specialists, so should be used with care:

incidence	prevalence
benign	malignant
morbidity	mortality
chronic	acute

The presentation of scientific data is an area which is ripe for confusion and misunderstanding. I have lost count of the number of physicians who have said to me, 'I hated statistics at college, and I've never got over that feeling. I get the general idea, but I can't get to grips with the detail. I just accept what the statisticians tell me.' I can understand that, and within large pharmaceutical companies it often occurs to me that the only two types of specialists whose views cannot be challenged are statisticians and lawyers. However, to present data effectively, you need a grasp of statistics, and an understanding of basic statistical terms. Then, and only then, can you start to explain them, and their importance, to your audience. They don't need to know the details, just the significance (itself a specific statistical term!). I once hosted a seminar for journalists about clinical trial design and statistics in medicine. To understand their knowledge level at the start, I asked them a number of questions. One of them was, 'What do you understand by the expression, "p-value"?'

One senior journalist answered, 'I don't understand how it's calculated, but I look for lots of zeros after the decimal point. The more zeros, the more reliable it is.' I thought that showed a good understanding overall, even though it ignored an important fact. This is that a p-value of 0.05 or less means that the finding is statistically significant. That means the likelihood of the result being down to chance is less than 5 per cent, which is the arbitrary level at which we say we're confident it's true. However, she had grasped the overall importance.

We will address this question in more detail in a later chapter, about interacting with your slides.

Challenge 5: Start With the End in Mind

I sit through hundreds of scientific presentations a year, all over the world. Occasionally, somebody I know slips into the seat next to me, just as the talk is ending. Sometimes they say, 'What was the point of that?' Sadly, I often have difficulty answering the question. Random thoughts run through my mind: 'That was a big study' … 'It had a long follow up' … 'He said it was important' … 'I wasn't sure what was new and what was already known …' 'I'm not sure what it means to clinical practice …' 'I didn't feel the conclusion was sufficiently supported by the evidence, but maybe I was confused …'

This can be avoided by adopting the 'Start with the end in mind' approach. It's one of 'The 7 Habits of Highly Effective People', an international best-

selling book written by American lifestyle and management guru Stephen R. Covey. (His phrase is actually 'Begin with the end in mind.') The book has sold 15 million copies in 38 languages since it was first issued in 1989. The tip has particular relevance for scientific presentations and conversations.

When I work with presenters on important presentations, I ask them to ask themselves two key questions before we start work on the talk:

What do I want to achieve by this talk?

What do I want the audience to do, think or feel after they have heard me?

Of course the answers are a matter for you … it's your data, your story, and you have the clearest idea of what you want to achieve. Here are some possibilities:

- I want the audience to realise that there is new treatment option in X disease which is safer and more tolerable than the older drugs for many patients, without paying the price of reduced efficacy.
- I want them to invest in my idea.
- I want them to realise that this could be really important, and we need to fund bigger studies in a specific patient population.
- I want them to employ me.
- I want them to understand why the newer drugs should be used on top of the old ones, not instead of them.
- I want them to realise the significance of early diagnosis of condition X.
- I want them to understand what side effects to expect in a small number of patients, how to recognise them and what to do about it.
- I want them to be aware of the prognostic/diagnostic indicators which we can now use.
- I want them to be aware that a genetic test can identify likely responders with 95 per cent accuracy.

The key point about all these objectives is that they are very clear. The next time you plan a talk, I urge you to produce equally clear objectives. Once you have answered the questions about your aims and what you want them to do, you need to move on to the next list of questions:

- I know what I want them to do … now what do I need to do to achieve that?

- What do I need to tell them?
- How much context do I need to include?
- What will prevent me achieving my aims?
- What is the strongest data I have that will convince them?
- What objections will the audience have, and how can I overcome them?
- How can I best illustrate my talk?

Having done that, you can now start to sketch out your talk. I will outline some techniques for doing this in the next chapter.

Overcoming Objections

One key question you need to address concerns potential obstacles to you achieving your aims. In particular, you need to address concerns and objections which the audience have. A useful technique here is known as *attitude softening*. It's based on a psychological concept called reciprocity. This means that people are socially programmed to behave in the same way towards you as you do towards them. If you smile at someone they almost always smile back. If you are objectionable, the temptation is to do the same. An attitude softener works the same way and is widely used in selling: You give credit for their wise thoughts, then express their objection as a need, which you can then meet. In presentations we use it less to get what we want, but more to defuse a potential objection before it is expressed.

Let's look at an example. I was working with a physician who had been involved in a big trial on the first oral medication for Relapsing Remitting Multiple Sclerosis (RRMS). One of the key treatment aims in this area is to reduce the number of relapses experienced by the patient in a year. The most common treatments for RRMS are a group of drugs known as the beta-interferons. He was presenting the key data at an international conference.

When he reached the section about reducing relapses, he put up the data, comparing the new drug with the beta-interferons, and said, 'You can see here that the new medication was more successful at reducing relapses than the beta-interferons. When I've shown this to people they have sometimes said the difference is not very big. However, what is important to realise here is that these patients in the control group are on beta-interferons, which themselves are very good drugs, so any improvement on that is really worthwhile.

That's what we saw here … and improvement on something that's already regarded as being pretty good. The difference is statistically significant, but also clinically important to patients.'

There are several benefits to the attitude softening technique. One is based on a concept called *primary definers*. They are the people who define an issue first, in a particular way. Pressure groups and lobbyists are often very successful at this. For example, anti-vaccine campaigners who were against the combined Measles, Mumps, Rubella (MMR) vaccine claimed that giving the three vaccines at the same time was unsafe. They claimed it could cause autism and Crohn's Disease in young children. In communication terms, they were the primary definers, and defined MMR vaccination as a safety issue. In contrast, governments defined it as a public health issue. They claimed that if parents had to bring their babies to the surgery two or three times for separate injections, many of them would not do so, vaccination rates would drop, herd immunity would not be achieved, and there would be outbreaks of the three illnesses. To achieve the public health objectives, the governments needed to first overcome the safety concerns expressed by the primary definers. In some countries, notably the UK, this took a lot of time and money.

The cost of new medications is frequently a difficult issue, but in my view one which needs addressing head-on. In your talk about a new drug, you can define the cost as a moral issue, that is. 'How much is better quality of life worth for our patients?' Or you can accept that the cost is an economic issue, but define it more broadly. Here you might say, 'It is true that the new drug is more expensive than the older ones. However, with the better safety and tolerability profile, we expect better compliance. With the old drugs, 30 per cent of patients stop taking them within six weeks because of the side effects. As a consequence, they need more consultations with the physician and nurse, are tried on other drugs which often have different side effects, and they end up in spiral. Every twist of that spiral costs money. Our view is that with the better compliance we expect, most of these extra costs can be avoided.' Of course, you have to have the data to back up the claims!

Another benefit of the attitude softening technique is that you are preparing the ground for a discussion about the objection. You are signalling to the audience that you understand their concerns, have thought about them and have a solution to propose. As with any communication exercise, seek first to understand, then to be understood. Attitude softeners help you achieve this. I will return to this topic later, in the section on handling Q&A sessions.

Challenge 6: Don't Confuse Features and Benefits

One of the first things anyone asks themselves when attending any kind of talk is the question, 'What's In It For Me?' (Often abbreviated by Americans to WIFFM?). You need to answer this question clearly. If this was a marketing book I would say the answer to WIIFM is your value proposition. It's whatever you are selling that's worth something to your potential customers. In the scientific world we are not selling anything, at least not in the sense of a commercial transaction where money changes hands. However, please don't think that just because your audience are not paying hard cash there is no exchange involved. You are selling them an intangible. It may be your idea, concept, data, experience or expertise. They are paying for it with their time and attention. And they expect value for this just as they expect value for money in a commercial transaction.

So how do we deliver value to an audience? First, by understanding what they are looking for, as spelt out in the discussion of the earlier challenges. Then we come to the crux of challenge number six: Don't confuse features and benefits. This is another well-known sales or marketing technique which you need to adapt for the scientific arena. To answer the question, 'What's in it for me?' You need to spell out the benefits. The problem is that a lot of scientific research starts with the features. As an example, the way a drug works, or interacts with other drugs, is its feature. The benefit is what that means.

The relationship between the two is based on this idea:

Feature … which means that … Benefit

It's the phase *which means that* which translates the feature into the benefit. To grasp the concept before we apply it to scientific talks, here are some examples:

Feature: My phone has a 50 number speed dial facility.

Which means that …

Benefit: I can call colleagues and friends really quickly.

Feature: My car has a driver's airbag.

Which means that …

Benefit: If I'm in a crash I'm less likely to be injured by my head crashing into the windscreen.

Feature: My computer has a remote mouse and slide advancer.

Which means that …

Benefit: I can move around the room during presentations, and really engage with the audience rather than being stuck behind a podium.

Now let's translate the concept into medical and scientific presentations:

Feature: This new drug is more specific to X receptor.

Which means that …

Benefit: It has fewer side effects than the old drugs.

To a different audience, you might take the story one step further:

Feature: This new drug has fewer side effects than the old ones.

Which means that …

Benefit: Patients continue to take their medication, so compliance is improved.

Feature: This new anti-platelet agent prevents platelets clumping together, but without increasing the risk of internal bleeding.

Which means that …

Benefit: Your risk of a stroke or heart attack caused by a blood clot is reduced, without dangerous side effects.

Challenge 7: Make Everything as Simple as Possible, but no Simpler

This is one of many quotes attributed to Einstein. It now appears that he didn't actually write this exact phrase in any traceable document, though he certainly agreed with the concept and of course he could have said it verbally. Reducing complex matters to the simplest level possible was constant theme of his writings. He did say:

> *If you can't explain it simply, you don't understand it well enough.*

He also apparently said:

> *It should be possible to explain the laws of physics to a barmaid.*

The quote which comes closest to the one which concerns us here is:

> *It can scarcely be denied that the supreme goal of all theory is to make the irreducible basic elements as simple and as few as possible without having to surrender the adequate representation of a single datum of experience.*

So whatever he actually said, his point was the same: Make everything as simple as possible, but no simpler. This is our final challenge, and it is crucial to recognise that both parts of the advice are equally important. If you don't make it as simple as possible it's still too complicated and you leave yourself open to the problem of Challenge 4, that is, you can be misunderstood. If you stretch the simplicity too far, you may lose the scientific validity of whatever it is you are explaining. However, including everything can make things more complicated, rather than simpler. You need to strike the right balance. Once again we are trying to establish 'The Goldilocks Option' of just the right amount of simplicity.

So where is The Goldilocks Option? That depends on the subject matter and the audience. Let's consider the presentation of the results of a clinical trial comparing Drug X with Drug Y for the reduction of risk of event A in patients with condition B. The trial will reach a result with a specific patient population at a specific time. Based on a number of factors, including the trial design, relevance of the patient population to clinical practice, the dosing regimens used and statistical methods, it is reasonable to extrapolate that result to similar

populations. However, both the trial result and the extrapolation are full of caveats, qualifying factors and nuances.

> *Not making it simple enough would mean leaving them all in. Making it too simple would mean taking them all out.*

It's your job to decide where the balance lies.

Let's start with the trial design, the first crucial aspect of any study. When doctors and researchers present the design, they usually begin with the inclusion and exclusion criteria. This often involves reading a list of gender, age, duration of disease, previous treatment, blood counts, tumour grades or liver function test (LFT) results where appropriate and other factors such as comorbidities, weight and smoking history. You would then describe the methodology, including how patients were recruited, randomised and treated. This would include detail of the drug regimens in each arm of the study. This is generally too much detail for you to enumerate in a presentation, though it needs to be in the written publication. (There are rare exceptions, which I will discuss later in this section.) You may even feel that you need to include it all on a slide for the sake of completeness, but you don't usually need to read it all out. Tell us what's important, and point out what we should take from the criteria presented. There are two important questions here:

- How well-matched are the groups on Drugs X and Y?
- How relevant is this patient population to those seen in clinical practice?

These are the two factors you need to focus on. You might say, 'As you see, the two groups were well-matched in terms of all the important criteria. There were slightly more women than men, but that reflects the incidence of this disease. You'll also notice that the American patients were on average 5kg heavier than the Europeans … again, that reflects what tends to happen in practice.'

Then you may highlight the key exclusion criteria. 'Patients who'd previously been treated with XXX class of drug were excluded because there is some evidence or cross-resistance, which might reduce the efficacy of drugs X and Y.'

Now let's turn to the other end of the presentation: The results.

The main finding might be that drug X reduced the risk of event A by 14 per cent more than drug Y, with a p-value of 0.003 and a 95 per cent confidence interval (CI) of 12.92 to 16.24. Based on the p-value and the confidence interval, it's fair to say that this is a robust result. In this case we would be justified in including the p-value and CI values in our presentation, but only making a passing reference to them. Assuming you were talking to an informed audience, you might say, 'As you see here, based on the p-value and the confidence interval, this result is pretty robust.'

If you were talking to a less informed audience but still wanted to make the point that these results are robust, you might say, 'These numbers here are calculated using statistical tools which tell us how confident we can be that these results are real, and didn't just happen by chance. The numbers themselves in this instance … 0.0003 and this range here, from 12.92 to 16.24, tell us these results are very likely indeed to be genuine findings.'

But what if the p-value was 0.05, and the CI was 7.9 to 19.7? That's a far less robust result. Then you would want to draw attention to it, and explain why this is on the edge of what we call statistical significance. You would then have to include more caveats and nuances. If you didn't you would have simplified it too much, and no longer be within range of The Goldilocks Option.

Returning to the subject of how much detail to give regarding the trial design: If the design is in any way unusual (positively or negatively), or is deficient in some other way, you would want to spend more time on it. I worked with one client recently whose major trial, on which they were to base their regulatory submission, included a broad range of patients admitted to cardiac Emergency Rooms (ERs) in the US, whereas the competitor trial had excluded a major sub-set of patients. The details of the trial designs were important, and formed a small but crucial element of the submission.

I worked with another pharmaceutical company whose main competitor had conducted a trial of the competitor's drug versus my clients' drug. The results apparently showed that the competitor drug was better. It was only when you looked closely that it became apparent that the loading dose of my clients'drug used in the trial was lower than that generally used in practice. The discrepancy, in my clients' view, could account for the difference in results. On this occasion, my clients' version of the presentation of the results highlighted this key difference. To return to the point of this section, the competitor's version had over-simplified the situation by ignoring the loading dose question, where my clients felt that this was key.

When I am working with medics and scientists, they often criticise the way journalists summarise the results of clinical trials. I will discuss this more in the chapters on the media, but the main problem is that journalism reduces most things to a binary level of stop/go, black/white, yes/no. In effect, the nuances and caveats are lost in this process and the results or design are oversimplified. So although journalists are excellent communicators, they don't always meet the demands of Challenge 7. That's why journalism and peer-reviewed science don't always go well together.

However, my aim with this book is to make them go together where appropriate, and to encourage you to combine the accuracy of peer-reviewed science with the narrative skills of the journalist. Following Challenge 7 will help you do that. If you are planning a presentation or interview to a non-scientific audience, take a look at some news stories online to get a flavour of how journalists describe your own topic. Look at the language they use, and the level of simplicity versus complexity. Then ask yourself if the journalist concerned has made it as simple as possible, but no simpler. See the later chapters on using the media to communicate science for good and bad examples.

There are many other places on the web to find excellent examples where scientists and medics have met Challenge 7. I mentioned patient websites earlier in this chapter, and will return to them now for more examples. Here is a section from http://www.WebMD.com, a website written by doctors aimed at patients with no medical knowledge:

Leukemia – Topic Overview

WHAT IS LEUKEMIA?

Leukemia is cancer of the blood cells. It starts in the bone marrow, the soft tissue inside most bones. Bone marrow is where blood cells are made.

When you are healthy, your bone marrow makes:

- **White blood cells**, which help your body fight infection.
- **Red blood cells**, which carry oxygen to all parts of your body.
- **Platelets**, which help your **blood clot**.

When you have **leukemia**, the bone marrow starts to make a lot of abnormal white **blood** cells, called leukemia cells. They don't do the work of

normal white blood cells, they grow faster than normal cells, and they don't stop growing when they should.

Over time, leukemia cells can crowd out the normal blood cells. This can lead to serious problems such as **anemia**, bleeding, and infections. Leukemia cells can also spread to **the lymph nodes** or other organs and cause swelling or pain.[4]

Macmillan Cancer Support is one of the leading cancer charities in the UK. Their slogan is 'We make things clearer.' Their website is a shining example of The Goldilocks Option of information. Here is an excerpt from their website, explaining how hormonal therapies for breast cancer work.

Hormonal therapies for breast cancer

Hormonal therapies are treatments to reduce the levels of hormones in the body or block their effects on cancer cells. They are often given after **surgery**, **radiotherapy** and **chemotherapy** for breast cancer to reduce the chance of the cancer coming back.

Hormones exist naturally in the body. They help to control how cells grow and what they do in the body. Hormones, particularly oestrogen, can encourage some breast cancer cells to grow.

Hormonal therapies work by lowering the level of oestrogen in the body, or by preventing oestrogen from attaching to the cancer cells. They only work for women who have **oestrogen-receptor positive cancers**.

Hormonal therapies are given to reduce the chance of breast cancer coming back and to protect the other breast. They can work in different ways and are usually given for a number of years. You'll start hormonal therapy after you have finished **chemotherapy** (if you're having it). Hormonal therapies can also be used before surgery to shrink a large cancer to avoid the need for a **mastectomy**.

Hormonal therapies are usually well-tolerated. Sometimes side effects are more troublesome in the first few months but get better over time. If you

4 http://www.webmd.com/cancer/tc/leukemia-topic-overview. Accessed 31.12.12

continue to have problems, talk them over with your specialist nurse or doctor, as there are ways of reducing some of the effects.[5]

Chapter Summary

The need to balance the risks and benefits, and convey them accurately, underpins every example of science communication.

As the presenter you have a responsibility to your audience to *interpret* the data as well as *report* it.

- Don't confuse information and communication.
- Think about where to start your talk to make it meaningful to the audience.
- PowerPoint is supporting you in your talk, not vice versa.
- Use the most appropriate language, and avoid inappropriate jargon.
- Be clear about what you want the audience to do, think, feel or say.
- Stress the benefits, not just the features.
- Aim for 'The Goldilocks Option' with just the right balance between complexity and simplicity.

5 http://www.macmillan.org.uk/Cancerinformation/Cancertypes/Breast/Treatingbreastcancer/Hormonaltherapies/Hormonaltherapies.aspx. Accessed 31.12.11.

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3

Preparing Your Talk

The importance of preparation – the difference between a paper and a presentation – the five elements of communication planning – preparation techniques – using Twitter to clarify your messages – emotional versus intellectual audiences – an academic model of communication – the grid system of presentation planning.

Preparation: The Key to Success

The previous chapter looked at the traps which lie in wait for anyone who aims to communicate science clearly, and gave advice on how to overcome them. It was a general discussion with, I hope, clear and relevant examples. I was encouraging you to think about the point of communication, the way you do it and ask yourself whether you could do it more effectively. When I make presentations about communicating, I usually preface the material from the previous chapter by urging the audience to 'raise your head up above the daily routine and consider the point of communication', The next three chapters are a practical guide to preparing, illustrating and delivering your talk.

Let's start with:

Preparing Your Talk

All three words are crucial if you aim to be successful.

PREPARING

There are many pre-requisites for success, whether in life, in business or in specific activities like presenting or communicating. Many great men and women put preparation and hard work at the top of the list.

If people knew how hard I had to work to gain my mastery,
it wouldn't seem wonderful at all.

Michelangelo

By failing to prepare you are preparing to fail.

Benjamin Franklin

It usually takes more than three weeks
to prepare a good impromptu speech.

Mark Twain

YOUR

Notice the title of this chapter ... it's about *your* talk. Whenever you take to the stage, stand up to address an informal group or give a media interview, you are responsible for the content and its delivery. You need to own it. The timing, staging, length and topic may be in the gift of the organisers, but the time in the spotlight is your own. Turning this thought into reality can be challenging, as all kinds of obstacles appear. They include:

- It may be your talk, but it may be someone else's data or trial design.
- In corporate life you often have to pull together a talk from a range of material produced by others. You may be short of time to pull this together coherently, and make it your own.
- You may have been given the topic by a manager, and don't feel confident to deliver it to the audience in mind.
- The audience may include experts who know more about the subject than you.
- The audience may be sceptical or even hostile.

All of these problems can be overcome by the techniques outlined in these three chapters. The starting point is to prepare a talk that only you can deliver. Put some of your personality into it, and make sure you tell a story in your own way.

TALK

Many presenters have spent huge amounts of time on the data, the trial design and interpreting the results, but invest very little time in preparing the talk which will deliver it. This is understandable, as the peer-reviewed paper,

published in a prestigious journal, is the cornerstone of academic research so it seems right that this should gain the lion's share of attention to detail. However, as discussed earlier, the talk is growing quickly in importance, and is your opportunity to widen your audience beyond the narrow group of academic scientists who read the journals.

A good talk and a good academic paper are like (need analogy) … they are different products of a common thread. The thread is the research and the results. The output, however, is quite different. One designed to be read, the other to be spoken.

The paper is a document of record. It will be there for all to see in decades to come, maybe for longer. For example, Edward Jenner's original paper which led to the vaccination against smallpox, and ultimately other fatal viruses, is still available:

> *Edward Jenner: An inquiry into the causes and effects of the Variolae Vaccinae, a disease discovered in some of the western counties of England, particularly Gloucestershire, and known by the name of the cow-pox.*[1]

I was able to quote from Sir Richard Doll's 1950 *British Medical Journal* (*BMJ*) paper earlier in this book, but could find no reference to the talks he gave about it. It has a permanence which talks did not have in the past, though this is now changing with so much digital storage space available. The paper is the basis for further research, and scientists today or in the future need to know all the details necessary to be able to understand, challenge or build on your work. Within reason its length is a matter for you and the journal editor.

The talk is distillation of the key information from the paper. It should establish the hypothesis clearly, outline the methods used to test it and communicate the results. It should also explain the relevance of the results to the audience. It will be limited by the time allowed by the meeting organisers, and if you go over-length you face being cut off and embarrassed. The websites of the major congresses are already archiving the main presentations, so maybe in 200 years a researcher will be able to access your presentations in the way we can still read Jenner's work … if so, I hope your descendants will feel proud of it!

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1 Third edition. London: printed for the author by D.N. Shury, 1801. Available at: http://www.sc.edu/library/spcoll/nathist/jenner2.html. Accessed 31.12.11

Where the paper and the talk are similar is when you are asked to submit a poster to a conference. This is a slightly different situation from the one discussed her. Because a poster is a summary of (usually preliminary) research, what you say will necessarily mirror what is in it. Even here, however, you have the opportunity to add to what's on the poster, in the same way that you should add to what's on the slides in a main presentation.

So you've done your research, which has reached an interesting conclusion, and are ready to start writing the talk. This chapter will introduce you to a number of techniques to help you prepare effectively. I suggested in the previous chapter that you should develop a talk by asking yourself what you want to say, and what you want the audience to do, think or say after they have heard you. Notice that this is an entirely different approach from 'I'll start with the slides and talk through them.' Remember that your objective is to tell a story which will engage, educate and inform your audience.

MESSAGE MAPPING

This technique is well known so I won't spend much time on it here. It's a great way of capturing all your thoughts on a subject, then ordering them into a flow. I find it both simple and powerful. There are mind-mapping software packages available, but I prefer the simplicity of using a pen and paper. It's great for planning speeches, talks, and even books. The book you are holding in your hands now began life as a mind map.

To draw a mind map, turn the page through 90 degrees, so it is now in landscape format, and put the main subject in the centre of page. Then you surround it with the main topics, for example, safety, tolerability, efficacy, mechanism of action, properties of an ideal treatment for condition X, limitations of current treatments, key results from previous trials and so on.

I then draw arrows, or write numbers, around the sub-topics, which produces a linear flow, or a rough order. Then I take each sub-topic separately, and start a new page with that in the centre, and sub-sub- topics around it, and so on. Once I have drawn the mind map, and produced a liner flow, I turn my attention to the slides I will need to illustrate the points. There is more on the effective production and use of slides in later chapters. At this stage, I hope you can see that this technique is almost the opposite of the approach of so many presenters, who start with the slides then add the commentary to them.

MALES

This is an acronym which illustrates the five elements you need to consider:

M	Message
A	Audience
L	Language
E	Examples
S	Summary

MESSAGE

The problem with many scientific presentations is that they don't have a clear message. They have lots of data, information and so on. But as we know, information is not communication. As I was writing this I received an email from the European Respiratory Society (ERS), asking for abstracts for presentation at the annual conference. The focus of the email is not on information, but communication:

> *An unrivalled opportunity to communicate: submit your abstract today! Communicate your research, communicate your clinical experience, communicate with your peers.*

There's no doubt what the ERS thinks is important … communication! Clear communication starts with a clear message, or a small number of messages. When I lead seminars on communicating, I write this on a flipchart:

$9 \times 1 = 0$

$3 \times 3 = 1$

This usually produces puzzled looks, and occasionally a comment such as 'I know that many journalists are humanities graduates who can't do maths, but this is ridiculous!' When the laughter subsides, I explain what it means. It's an eye-catching way of expressing a simple but crucial thought: If you have too many messages, the audience will be confused. Or to paraphrase my faux equation: If you have nine messages and say them all once, the audience don't remember any. If you have three messages and communicate them three times, the audience will remember one. In reality, they may remember all three. Some years ago I was the executive producer of a TV documentary series about xenotransplantation. At the time there was exciting research being conducted in the possibility of genetically modifying pigs to enable their organs to be

transplanted into humans without being rejected by the human immune system.

The series, called *Organ Farm*, was broadcast in many countries around the world, and generated considerable publicity. I was interviewed by a number of TV and radio programmes about it. Following my own advice, I developed three key messages, which I still remember, over ten years later:

- There's a major shortage of organs available for transplant. Every seven minutes, somebody dies because they can't receive one.
- You could solve that situation if you could use genetically modified pig organs, and grow them on demand in a series of organ farms.
- However, if you do that, you may be introducing dangerous pig viruses into the human race, which could cause a new epidemic against which we have no defence.

These messages were very clear, and a summary of a hugely complicated research programme. Professor David White, the scientist who led the research in the UK, and whose team bred a herd of transgenic pigs, is another great communicator. He has spent most of his working life trying to solve the problems of transplanted organs being rejected by human immune system. He summed up the challenge like this:

There is a component of our immune system called complement. The question is, 'How does this complement identify only the foreign enemy and not destroy our own cells?' The answer is that every cell in our bodies has on its surface a set of proteins which act like flags saying to the complement, 'I am a human – don't shoot!' So these flags protect our bodies from destruction by friendly fire from complement.

Unfortunately if you transplant a pig organ into a human the pig cells have flags which say 'I'm a pig' so human complement promptly destroys the transplant. What we have done is made a tiny genetic modification to the pig, which has in essence changed the flags. So instead of saying 'I'm pig' the flag says 'I'm human. Don't shoot.' False flagging has been used by war ships for centuries but it has still taken us many years to adapt the idea for pig-to-human transplants.[2]

2 Interview with author, clarified 14.07.11.

To reach that level of simplicity of explanation of such a complex subject requires a great clarity of thought and an understanding of the needs of the audience. It is also a great demonstration of the advice in the previous chapter, 'Make things as simple as possible, but no simpler.' Note that when I refer to something I have previously mentioned in this book, I used the phrase 'previous chapter' rather than 'last chapter' which could have you turning to the end of the book pointlessly. This is another example of 'Great communication means saying something in a way which cannot be misunderstood.'

MESSAGE CLARIFICATION TECHNIQUES

There are a number of techniques which can help you to clarify your message. Most people find they prefer one or two over the others, so I will list the main ideas here.

Technique 1: assertion – evidence – support

This is a great way to start your messaging process, and is well-suited to medical and scientific subjects. You make an assertion, back it up with the key evidence then bring in some extra supporting information. The three elements together produce a very robust message, which can then be expanded into a story flow as required.

Assertion

Before I turn to some specific examples, I would like to ensure that we all understand the same thing by the word 'assertion'.

An assertion is defined in dictionaries in a number of ways. They include 'a positive statement, usually made without an attempt at furnishing evidence', and 'confidently stated to be so but without proof; alleged'. These definitions offer a good starting point for this exercise: It's a clear, positive statement which would require evidence to prove or support it. In argumentation and rhetorical studies, it's what is called a claim (not to be confused with a 'claim' used in a legal or regulatory sense by a pharmaceutical company talking about one of its products.) Here are some examples of assertions:

- London/Tokyo is the most expensive city in the world.
- In 2010 and 2011, Lionel Messi was the world's greatest soccer player.
- A recession is when the gross domestic product of a country falls for three quarters in a row.

- Smoking causes lung cancer.
- Lowering low density lipoprotein (LDL) cholesterol reduces your risk of a heart attack or stroke.
- Cross-resistance is a major problem with HIV/AIDS medication.

The work of great scientists often results in an assertion. Newton's laws of motion are good examples:

1. An object at rest will remain at rest unless acted on by an unbalanced force. An object in motion continues in motion with the same speed and in the same direction unless acted upon by an unbalanced force.
2. Acceleration is produced when a force acts on a mass. The greater the mass (of the object being accelerated) the greater the amount of force needed (to accelerate the object).
3. For every action there is an equal and opposite re-action.

One of the most controversial topics of the 1990s and early 2000s began with an assertion. It came from Dr Andrew Wakefield, a British gastroenterologist who conducted research on children who had received a triple vaccination against measles, mumps and rubella that's known as the MMR jab. His assertion that the triple jab could overload the immune system and cause the development of Chron's Disease and autism. He claimed he had evidence that children's behaviour changed drastically shortly after they received the MMR jab. 'This is a genuinely new syndrome and urgent further research is needed to determine whether MMR may give rise to this complication in a small number of people,' he told a news conference.

The MMR case is a good example to discuss, because it demonstrates that an assertion alone can be very powerful. It is designed to be an accurate, memorable summary of the main point of your argument. It is designed to attract attention, provoke discussion, maybe to promote a particular view. However, to have any scientific validity, it must be backed up by the other two components of this technique, the evidence and support. Dr Wakefield's assertion that the combined MMR vaccination could cause autism and Chron's, was not backed up by sufficiently robust evidence, and consequently lacked support in the medical and scientific community. (This is not the place to discuss its value in other communities which place a higher value on emotion and coincidence than on scientific rigour.)

An assertion alone, unsupported by evidence, is like an advertisement. There's nothing wrong with that, as far as it goes. However, if you want to

persuade your fellow medics and scientists of the value of your research, you are unlikely to do it with an advertisement. You need data to back it up. Here are some assertions taken from clinical trials published in peer-reviewed journals in 2011.

- Reduction of LDL cholesterol with simvastatin 20 mg plus ezetimibe 10 mg daily safely reduced the incidence of major atherosclerotic events in a wide range of patients with advanced chronic kidney disease.
- Some of the widely practicable adjuvant drug treatments that were being tested in the 1980s, which substantially reduced 5-year recurrence rates (but had somewhat less effect on 5-year mortality rates), also substantially reduce 15-year mortality rates.
- Screening for latent infection can be implemented cost-effectively at a level of incidence that identifies most immigrants with latent tuberculosis, thereby preventing substantial numbers of future cases of active tuberculosis.
- Results of a new Cochrane Systematic Review reveal the drugs [statins] that are widely used to lower cholesterol may be of no benefit for those with no history of cardiovascular disease and may even cause more harm than good for some patients.

Evidence

The evidence that you supply to back up your assertion needs to be credible for the audience. In the medical and scientific community, this usually involves robust research which has been published in a peer-reviewed journal. Documenting the evidence in a paper usually follows the accepted Introduction, Methods, Results and Discussion (IMRAD) method. Your talk will include the key parts (but only the key parts) of the evidence.

Support

This is the final piece of the jigsaw, and ideally provides independent verification of the value of the evidence. In the case of a pivotal trial for a new drug, it may involve:

- Supporting comments from an eminent scientist, academic or physician.
- Inclusion in guidelines published by an acknowledged expert body, such as the American Heart Association, or the World Health Association, or the British Thoracic Society
- Approval from a regulatory authority demonstrating unmet need.

Technique 2: elevator speeches

The idea behind an elevator speech, or elevator pitch, is this: Imagine that you have been invited to present your research at a satellite meeting at a major congress or some other important event. After the presentation, you step into the elevator and just as the doors close, another person jumps in. This happens to be a VIP, in fact the most important person in the world, professionally, to you. They may be the chair of the world congress of your therapy area, a leading professor at an institution where you dream of working, or the head of the grant-giving institution which can fund your pet project. This person turns to you and says, 'Hi. I'm sorry I missed your talk today. What was the summary?'

The VIP is only travelling up one floor in the elevator. This means you have about 20 seconds to summarise the key points of your presentation. It's a great discipline to practise doing this. Your objective is not to explain the whole data set, but to persuade the VIP to press the 'stop' button and say, 'I'd like to hear more about that.'

Technique 3: point – evidence – point

This technique offers a number of benefits which are integral to clear communication: it puts the message up front, and involves repetition.

It works like this:

- Make your point.
- Give evidence to support it.
- Repeat your point.

As an example, assume you are about to present results of an early study of an oral treatment for Multiple Sclerosis (MS). Your introduction might talk about the need for oral treatments rather than intravenous (IV) formulations. Having established the need for an oral treatment, you will then go on to present the results. Using the Point – Evidence – Point (PEP) technique you might say this:

> **(Point)** *A diagnosis of MS as we know can be devastating for the person concerned In addition, they then find that the treatments, beta interferons, delivered by IV or infusion, involve a trip to hospital so are*

inconvenient, can be unpleasant and can have troublesome side effects. So there is a clear need for safe, effective, oral therapies which patients could just take at home.

(Evidence) *A recent study suggested that up to 44 per cent of patients stop taking the beta interferons, even though these drugs can be really effective.*

(Point) *So it's clear, then, that there is a need to develop oral treatments for MS which would be more likely to be accepted by patients. Now I'd like to turn to Drug X, one potential treatment which looks promising.*

Technique 4: Tweet my story

Earlier I talked about an elevator speech. Tweet my story is an even more rigorous stripping down of your argumentation to its bare essentials. The task is to summarise your story in a maximum of 140 characters, including spaces, as permitted by the social networking site Twitter. I am not suggesting for a moment that this technique would ever catch on in medical and scientific circles, but doing it successfully does impose a degree of clarity on your thinking. I have run this as an exercise many times, with groups including scientific researchers, with great success. The story about the need for new MS treatments would be summarised:

Up to 44% MS pts stop meds cos sfx + othr prbs. Need new oral meds. X lks prmising. Rlpses down 60%, compliance high 90% in p2 stdy.

There you have it, the key point summarised in 132 characters.

Audience

If scientific presenters could make just one change, it should be this: Put yourself in their shoes. When I present this, I illustrate it with a slide showing many photographs of many different types of shoes: high heels, pumps, workmen's boots, trainers, shiny city shoes, canvas shoes, flip flops, soccer boots and others. I also use a photo of Prince Charming trying to fit the wrong size shoe onto Cinderella. The point is well made: There is no 'one style and size fits all' for scientific presentations.

I regularly see big name, well-respected scientists deliver their standard talk on their specialist topic without any thought for the specific needs of different audiences. This is wrong, and in my view disrespectful to the audience. I recently sat in a presentation about the biology on protease inhibition where the presenter lost the audience in the detail within two minutes of a 20 minute talk which would have been more accurately aimed at post-doctoral researchers rather than HIV physicians.

This is section explores in more detail what 'their shoes' might look or feel like.

As with any population, you can divide an audience in many ways: Gender, age, language, educational attainment, wealth, geographic location, profession and religion are common ones. Before you plan your talk, ask yourself these questions about the audience:

- What does the topic mean to them?
- How much do they know about this topic?
- What preconceptions do they have about it?
- What are the barriers to them understanding your point of view?
- How much do they want to know?
- What do you want them to do after they have heard you?
- What do you need to tell them to get them to do that?

Once you have answered these questions you'll have a good impression of the audience. Then look at your data and divide it into different groups:

- essential
- nice to know
- could be included if we had more time

For example if you are talking to a conference of infectious disease experts you don't need to tell them that pneumococcal disease includes sepsis, otitis media and pneumonia, or that it is the biggest killer of children under five years of age in the developed world. However, you probably do need to update them on the changing resistance profile of different strains of pneumococcus, and where those strains have appeared in different parts of the world. The other essential information might be that details of the 13-valent vaccine being trialled, and which serotypes included in it.

Emotional and Intellectual Approaches

Apart from their scientific knowledge, there are other considerations. In particular, I would like you to consider the emotional v intellectual attributes of audiences, and also of a presentation. Some people I meet believe there is no place for emotion in a scientific presentation. However, I was in the audience at the American Society of Haematology (ASH) when the Principal Investigator received a standing ovation after he presented the results of his trial. The data set was very robust, the trial was well-designed and conducted, and the results were stunningly clear.

What feelings were evoked? Pleasure at the elegance of the trial design and clarity of results. Relief that an important medical question (could a novel drug have the same impact on overall survival in myeloma patients as an autologous stem cell transplant?) had been answered. Excitement on behalf of their patients, that there was now evidence that their lives could be extended. Yet deeper than that, was an empathy with the patients, who the physicians understand have to go through the trauma of treatment as well as suffering the painful symptoms of the disease.

The professor also exuded another emotion: passion. This is one of his defining personal characteristics, but here, presenting the results of a landmark study, his passion was even more evident.

The point about the intellectual versus emotional criteria of the audience is a partial, simplified modern version of Aristotle's ideas from 3,500 years ago. I will discuss this in more detail in Chapter 5. He believed that to communicate successfully, you need to appeal to both the intellectual and emotional sides of your audience. There has been much discussion in recent years of intelligence quotient (IQ) versus educational quotient (EQ). There is no doubt that everybody who is invited to make a scientific presentation has a high IQ. The great presenters also have a high EQ.

So how do you ensure you make both an intellectual and emotional connection? Consider a continuum from emotional to intellectual. For a moment, imagine that every audience is at one end or the other. Figure 3.1 illustrates how you would appeal to the opposite ends of the scale.

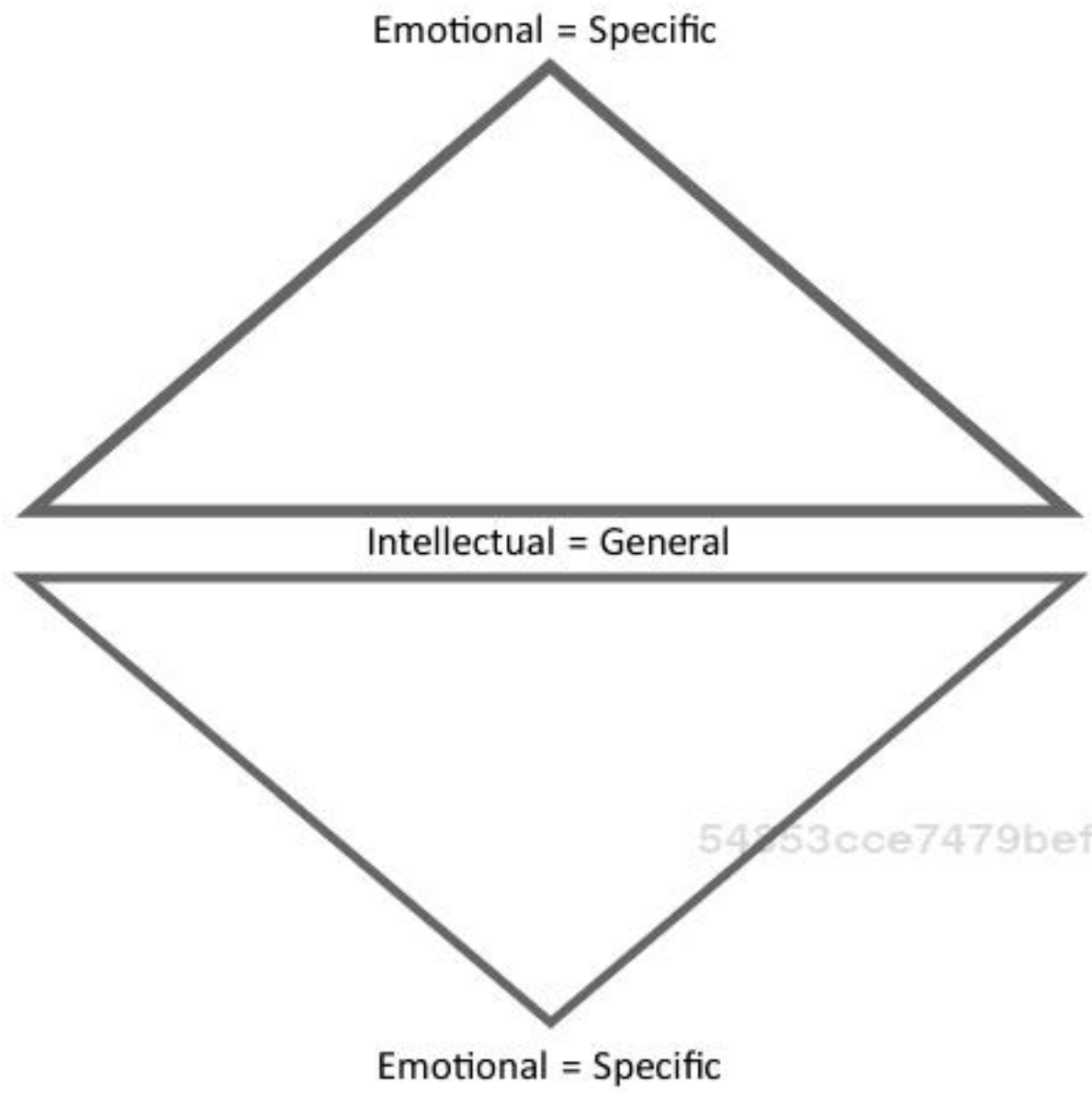

Figure 3.1 Appealing to emotional and intellectual audiences

To appeal to the emotions, start with a specific example then widen out to the general picture.

To appeal to the intellectual, start with the general picture, then narrow it down to a specific example.

Looking at this in terms of medical presentations, you might say that the bases of the triangles (intellectual) represent Evidence Based Medicine, while the apexes (emotional) are composed of anecdote and case study. In my experience, the case studies often provoke as much discussion at some medical congresses as the data.

In reality, of course, very few audiences are completely emotional, or completely intellectual (even juries in serious criminal trials have been known to be influenced by passionate pleas from skilled orators, in the face of strong evidence to the contrary). Most audiences are composed of a mixture of knowledge, experience and feelings. In other words, they are somewhere on the emotional–intellectual continuum. An additional challenge is that an audience is composed of individuals, each of whom sits somewhere on the same continuum. The challenge for you as the presenter is to gauge accurately where they sit.

An example of where this went wrong was at the opening session of the Climate Change Conference in Copenhagen in December 2009. The conference opened with an apocalyptic video, showing a young girl going to sleep peacefully but waking up to find herself in a desert wasteland. As she sets out to explore, the land on which she was standing appears to crack open and she runs away. She then faced a tornado and a flood, at which point she leapt into a tree and screamed.

The video was produced to provoke an emotional reaction, and ended with the caption, 'Please help the world'. In fact, the main reaction to the video was criticism. Many scientists and scientific commentators claimed it played on emotion, was inaccurate anyway, and ignored the factual basis of climate change. Coming as it did in the wake of the climate change email revelations from the UK, some said it was the kind of unsubstantiated rear-mongering so often quoted by climate change deniers. For our purposes, the incident offers a salutary lesson: Be sure you get the emotional/intellectual balance of your audience correct. Otherwise you harm your credibility.

Anticipating Objections

Another key part of preparing your talk is to anticipate what obstacles you will face in getting the audience to agree with you. The challenge is a classic one in communication studies. It was first exemplified by two researchers called Shannon and Weaver in 1942. They later amended it, separately and together but I now use a modified version of their original model. It looks like this:

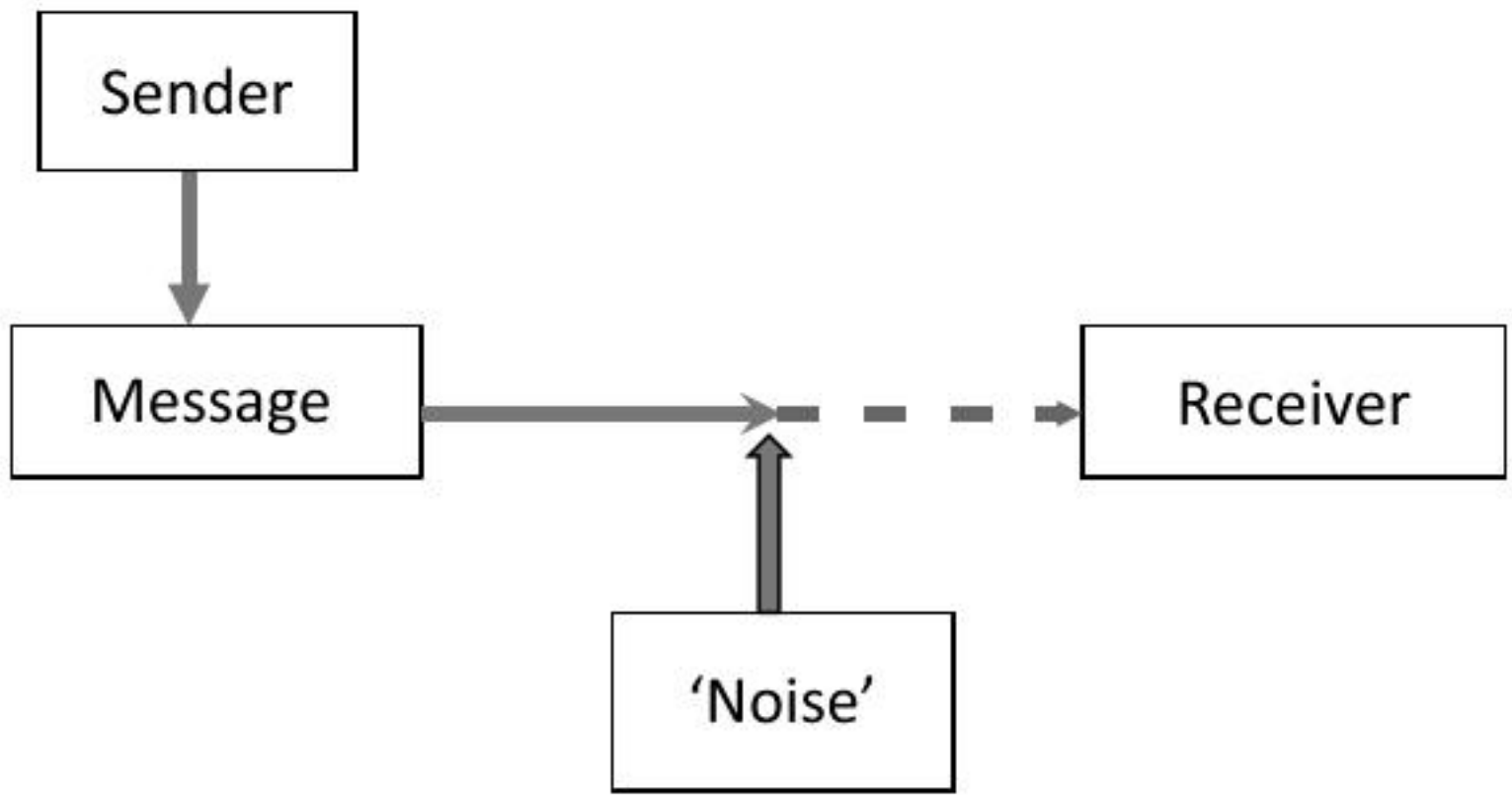

Figure 3.2 An academic model of communication