IT'S TIME TO ENGAGE!

A practical science communication guide developed for the Office of Astronomy for Development (OAD), International Astronomy Union (Cape Town, South Africa).

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2. It's time to engage!

Astronomy is in a golden age in Africa. The impressive Square Kilometre Array and several more astronomy projects are uniting countries across the continent in ambitious collaborations set to expand not only the frontiers of knowledge, but also broadly-relevant technologies and skills.

This new focus on astronomy presents Africa's young astronomers with many opportunities to engage public audiences across the continent. In fact, many are already demonstrating their willingness and passion for sharing their science by getting involved in science festivals, science cafés and media work, and by using social media to engage people.

To be able to engage public audiences effectively, scientists need to be able to write and speak in ways that "ordinary people" (those who are not scientists or who work in other disciplines) are able to understand and connect with. Scientists also need to master social, digital and other online media skills so that they can make the most of these exciting new communication platforms.

I hope that these practical "how-to" guides will equip you with new communication tools, sharpen your current skills and inspire you with fresh ideas. These communication skills can help you with funding proposals, engaging key audiences and becoming a recognised voice in your field.

Several people have helped me with content and editing, including Anina Mumm (ScienceLink/SciBraai, South Africa) and Ronel Steyn (Stellenbosch University, South Africa). A special thank you also to Jenni Metcalfe (Econnect, Australia) for generously sharing her content and science communication expertise.

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3. Why science communication matters

While the joy of sharing the fascination and wonders of the universe will always be an important reason for astronomy outreach, there are many more reasons to make time for targeted stakeholder communication and public science engagement.

Think of public science communication as making your science accessible, understandable, meaningful and relevant to diverse public audiences, including people (of all ages) who are not scientists. Remember that public engagement is a two-way street and must (whenever possible) include dialogue, interaction and listening to your audience! Lively debate around the role of astronomy in African societies is essential for building a trust relationship with society over the long term.

> *"Science communication is not about getting society to support science, but rather about embedding science in society and allowing people to participate in science."*
> – Prof Peter Weingart, DST-NRF Research Chair in Science Communication, Stellenbosch University

We often think of public communication as "telling people" about our work for their benefit, but many top astronomers have told me that they are the ones who benefit most from engaging the public. They get new inspiration and ideas from talking to young people about their science. Many astronomers find it especially rewarding to talk to young children, even though the often ask the hardest questions!

Facing questions from the media may not always be easy or comfortable, but it will force you to think about the societal benefits of your work. Also, when scientists don't speak out about their science, people will look for answers from other (possibly pseudoscientific) sources.

Successful media engagement requires the ability to distil key messages and answer questions such as "What are you doing?" and "Why does it matter?" in a way that journalists can use to write compelling stories.

Tip: Possibly one of the biggest reasons for public misunderstanding of science is that people generally don't understand the "nature" of science – the way that researchers work; the types of questions they ask and how they answer them; how research results generate new knowledge; how new knowledge is challenged and may change over time. It is therefore a good idea to have this at the back of your mind when you engage with the public, and use the opportunity to clarify how science works when relevant.

Here are some of the ways in which effective science communication can help to build an informed society that is more scientifically literate and engaged than before, specifically in the developing world:

- Science communication can help people understand the natural world in which we live, and can take away fears and misconceptions about natural phenomena.

- Science communication can empower people to make good decisions and use new scientific knowledge to improve their quality of life.
- Science communication can combat pseudoscience by helping people to grasp the difference between solid, evidence-based science and unfounded claims.
- Science communication can assist policy makers in making sense of scientific advances and to apply new knowledge strategically when they formulate new policies and legislation.
- Science communication can attract young people to exciting career opportunities in science and so ensure that a steady stream of motivated, talented new minds enter the research sector.
- Science communication can sustain political and public support for science.
- Science communication targeted at business and entrepreneurs opens their eyes to opportunities for bringing new products to market in collaboration with scientists.
- The knowledge economy requires objective, effective and timely science communication directed at policy-makers, government and the private sector

In 2013 David Eagleman published "Why Public Dissemination of Science Matters: A Manifesto" in the Journal of Neuroscience (http://www.jneurosci.org/content/33/30/12147.abstract). He acknowledges that moving science from the world of academia into public dialogue can be expensive, time-consuming and may even carry the risk of criticism from colleagues. Despite this, he offers the following six reasons why the public dissemination of science matters.

- **Thank your funders:** We owe it to the tax-paying public, or other donors, to report back to them, while also sustaining public/political support.
- **Inspire critical thinking:** Help people to distinguish between evidence-based claims versus speculation and misinformation.
- **Stem the flow of bad information:** Instead of just cringing about inaccuracies in the mass media and advertisements, scientists should make themselves heard.
- **Inform public policy:** Help to make sure that laws and policies are based on sound science.
- **Clarify the nature of science:** Help people to understand there is not necessarily only one true answer, because uncertainty is part of science and science changes over time.
- **Share the beauty of the scientific pursuit:** Help people to enjoy the wonder of science and experience the thrill of scientific discovery.

When we consider the importance of science communication from the perspective of individual scientists, there are many reasons for researchers themselves to get involved and collaborate with professional science communicators. Here are a few examples.

- **Impact:** Science can only improve people's lives if scientists are able to share its insights and outcomes at many different levels, ranging from small gatherings in rural villages to inter-governmental negotiating tables.
- **Democracy:** In a democratic society and knowledge-based economy people demand participation in science and want to have a say in its governance.
- **Informed citizenry:** Effective communication helps people make evidence-based decisions about matters affecting their lives, health and well-being, such as immunisation, nutrition and lifestyle.
- **Recognition and support:** Being able to present a compelling case for your science and having a public profile in the mass media will hugely increase a scientist's potential to attract funding, collaborators and students, and will benefit your personal and institutional profile.
- **Influence:** Scientists who can deliver information effectively and are willing to speak out are able to sway public opinion and change policy directions. In other words, their science matters and they make a difference in society.
- **Citations:** The mass media and other public platforms can also be an effective way to make other scientists aware of new findings. They may learn about a new peer-reviewed article in a newspaper, and then go back to the original scientific literature.

- **Inspiration:** Scientists who communicate well are valuable role models that help to stimulate curiosity about scientific research and attract young people to study science.
- **Meaning:** Scientists who have regular interactions with the general public often report that it provides them with new perspectives and raises relevant questions about their work. Such interactions also add meaning to their research.
- **Motivation:** Most scientists who regularly engage with the public really enjoy these interactions. The interactions provide the scientists with new enthusiasm for their own fields of research and new energy to tackle emerging research questions.
- **Career development:** Taking part in public science events is an effective way of building new networks and being noticed by other scientists, policy makers and funders.
- **Image:** By interacting with the public, scientists can change the public perception of scientists as people living "in ivory towers" or the stereotypical image of a lab coat-wearing introvert that does not live in the real world. Public engagement removes fears of and stereotypes about scientists.
- **Setting the record straight**: Scientists can help stop the spread of misinformation by speaking out when they notice the media reporting incorrectly on science; or when celebrities, advertisers and even other scientists spread misinformation about science.

Suggested reading: Article in Mail & Guardian (South Africa) about how young scientists benefited from participating in "Science Voices", a popular science writing competition - http://mg.co.za/article/2015-04-17-plebs-finally-get-to-understand-a-bit-of-lab-coat-lingo

Nancy Baron, a science communication advocate in the US, makes a particularly compelling argument for the importance of science communication in this extract from the article "Stand up for science" published in *Nature* in 2010 (http://www.nature.com/nature/journal/v468/n7327/full/4681032a.html).

She writes: "In my work with scientists, I often hear that they cannot afford the time to work on their communication skills, with their hectic research, publishing and teaching schedules. **I see it another way: they cannot afford not to.** Many of the most prolific and accomplished scientists have risen to the top of their field by conducting significant, relevant research and working out how to communicate it within their discipline and beyond. They know the value of being quizzed by Congress or the media, even if at times it can be uncomfortable. Going public forces them to distil the essence of their work and to think harder about the questions — what is known and what is left to discover. Worm's philosophy is that engaging with thoughtful criticism — even if it seems harsh in the media spotlight — makes everyone think more deeply and makes us push harder against the limits of the unknown. That's why sharpening communication skills has value beyond increasing public understanding. It can breach interdisciplinary boundaries within science and help colleagues with different viewpoints catch a glimpse of a bigger picture. Articulating vision and common goals has long been a cornerstone of leadership on the battlefield. Scientists would be wise to adopt a similar strategy. **Being a good communicator is not a trade-off. It makes you a better scientist.**"

In this 2012 blog post on "Why Scientists Should Publicize Their Findings – for Purely Selfish Reasons", Matt Shipman reminds scientists of the many ways that they can move their work forward by publicizing their research results beyond academic journals (http://blogs.scientificamerican.com/guest-blog/2012/06/18/why-scientists-should-publicize-their-findings-for-purely-selfish-reasons/).

Interesting evidence about the power of social media in science communication is now emerging, showing, for example, that scientists can enhance the impact and citation of their journal papers through effective use of social media. A 2014 paper in *Journalism & Mass Communication Quarterly*

looked at a number of public communications approaches (including working with reporters, blogging and talking to non-scientists) and found that Twitter amplifies the impact of those public communication efforts – see http://jmq.sagepub.com/content/early/2014/09/12/1077699014550092.abstract

Whatever your reason or motivation for getting involved in science communication, there will be challenges along the way, but also many rewards and rewarding moments. This guide will hopefully help you to overcome the challenges and multiply the rewards.

4. How to prepare and deliver effective presentations

Whether speaking at a scientific conference or at a primary school, your presentation can only be effective if your AUDIENCE benefits from listening to you. Therefore you must tailor the content, the structure and—most importantly—your delivery style to your audience. Your audience is the most important part of your presentation. You must think about them – and get to know them – first!

Before you start working on your presentation, ask yourself these questions:

1. Why am I doing this talk, and what do I want to get out of it? (Your objective)
2. Why are people coming to listen to me and what are they hoping to get out of it? (Their expectations and benefit)
3. Do I know my audience? Who will be there and how big is the audience (age, occupation, field, education, experiences, preconceptions, background, number of people)?
4. What do they already know about my subject? Are they likely to understand technical terms and expressions? What questions are they likely to ask?
5. What is on the programme before my presentation and at what time of the day am I speaking? (If you are the fourth talk in a session or the first talk after lunch, you have to think of an interesting and energising way to start!)?

Questions 1 and 2 are the most important. Both your objective in giving the presentation and the audience's benefit from listening need to be made clear to the audience in your introduction.

Have a clear objective

Why did you agree or decide to give this presentation? What key points do you want to get across to this audience? Examples of objectives:

- to present new information to research collaborators
- to inform potential partners about your research
- to update funders or policy makers on progress and make a case for more/new funding
- to enthuse educators about using astronomy as a tool in science education
- to interest young people in astronomy careers

What's in it for them? It is important to consider carefully why your audience members will decide to attend your presentation. What benefit are they hoping to get out of attending? Have they been told to attend, but would rather be somewhere else? Consider how you can bring these people on board; how can you make your talk relevant to them?

Even at research conferences, it is important to consider what your audience may want to get out of attending your presentation. Will your peers attend because they want to learn about your work, find new information, check out the possibilities of collaborating with you, or for some other reason?

Tailoring content, style and visuals

Different audiences will respond to different approaches. A scientific audience may be more interested in technical details and may appreciate graphs and diagrams. Business, management and policy audiences may want concise presentations that focus on the implications and the triple bottom line (economic, social and environmental costs/benefits). Industry audiences may prefer plenty of examples and opportunities to ask questions. A lay public audience or children may be interested in the story behind a discovery, illustrated with engaging visuals.

Decide in advance the content, style and visuals that will best connect with your audience.

Tip: You may not be able to answer all the questions, but be prepared to respond and explain what you do know. It is perfectly acceptable to say so when you are not sure of something. If possible, offer to find out and get back with the answer via a suitable platform (for example Twitter).

Have a clear message

This three-step message design process will help you add impact and relevance to your presentation, while also making sure that you think (beforehand) about what could go wrong:

Ask yourself and prepare answers for these questions:

1. What do you want to get across to this audience? Your answer should link to your objective in giving the talk.
2. What does this audience want to know about your topic? What is the benefit to them in listening?
3. What could this audience get wrong unless you stress the correct information? This will help you avoid misunderstanding.

We live in an age of style

Your style—the way you deliver your presentation—is more important to the audience than the content or visual aids. The audience is much more likely to listen to you if you first engage them.

When preparing your talk, think about what style will be appropriate to your audience. Prepare with the following questions in mind:

- What style of language will your audience relate best to (for example, colloquial, technical or business)?
- What degree of formality will connect you with your audience?
- Will your audience respond to a high level of interaction, or is the occasion best suited to limited or no interaction?
- What sort of humour will connect you with your audience without offending anyone?
- How should you dress? Consider what you'd like to convey about yourself.

Use visual aids for impact

Only use visual aids that add impact or help you to explain something. Consider visual aids other than PowerPoint slides, such as enlarged photos, sound, video, graphics, objects, examples, equipment and demonstrations. For example, do you have a scale model of a telescope or interesting piece of equipment that you could take with you to the lecture?

If you must use PowerPoint, it should be for the audience's benefit, rather than acting as your speech notes. As a general rule, keep text to concise main points only and rather liven up your presentation with good images and animations. Use compelling and interesting photos, and only one strong image per slide (not lots of small images or collages).

Checklist to make sure your talk matches your audience

When you are speaking to peers (other scientists)		
Content	**Style**	**Visuals**
New information Relevance to their work Opportunities for collaboration/linkages How it fits the 'big picture'	Formal in a conference; less so in a smaller meeting Some jargon ok, but avoid specialist jargon Rhetorical questions work well Appropriate humour	Some visuals e.g. graphs with error bars Diagrams, pictures Some text
Preparing a talk for senior managers/business executives/funders		
Content	**Style**	**Visuals**
The bottom line What you want them to do The decision you want them to make Benefits, costs Opportunities Fit with strategic directions Specific examples Clarify the nature of science where relevant	Formal Succinct Jargon-free Get the most important information out first	Graphs showing trends Clearly presented numbers Few or no text slides
When reaching out to rural communities		
Content	**Style**	**Visuals**
Benefits, especially in terms of jobs and economic opportunities Options Local relevance Details of how they can get involved Local examples Aim to build trust and clarify the nature of science	Casual, but professional Colloquial language Jargon-free Interactive	Actual objects Pictures, diagrams Limited text slides Handouts Clearly presented numbers
Engaging community group and broad public audiences		
Content	**Style**	**Visuals**
Big picture Local relevance Interesting facts/quirky details Personal stories Examples Explain how science works	Casual, but professional Appropriate humour Colloquial language Jargon-free Interactive, where possible	Pictures Objects Limited text slides Clearly presented numbers
When speaking to (potentially) hostile audience or about controversial topics		
Content	**Style**	**Visuals**
Set your context in the issue Acknowledge their concerns as valid Acknowledge divergent views Prepare key points	Avoid being defensive Be firm Plan the meeting carefully Stay calm, relaxed and polite	Clear facts Diagrams Clearly presented numbers

Anticipate the questions they are likely to raise Explain how science works		Handouts

Structure your presentation

Many speakers battle with clarity versus detail versus time. Often clarity or time loses out. Be strict with yourself; cut down on detail. Using Jenni Metcalfe's 5-box talk is a good way to do this:

1	Introduction • 'Shake hands' with your audience—use an anecdote, quote, strong statement or question. • Tell your audience why they will benefit from listening. • Give an outline of your presentation. • Use a linking phrase e.g. 'Let me turn to my first point…'
2	Body section 1 = heading 1 Organise your information within the middle three boxes of the body of your talk to: • Make a point • Give a reason for making that point • Back this up with an example Use a linking phrase before moving on to the next "box" Remember to do something different here—pause, turn off visual aids, move to another part of the room etc.
3	Body section 2 = heading 2 Use snappy headings for each section of your talk e.g. past, present, future; problem, research, solution. Use a linking phrase.
4	Body section 3 = heading 3 Use a linking phrase.
5	Conclusion - Summarise your talk. - Remind your audience of the relevance of the talk to them. - Use a strong exit line (it is very important to plan how you are going to end with impact!).

Remember this: Experienced science communicators tell us that …

- We read much faster than we talk (that is why people will read ahead if your slides are filled with text and will then lose interest while waiting for you to get to the next slide)
- most people will forget 90% of what you say within 24 hours – therefore it is really important to think of just one strong message that you would like your audience to remember (and emphasise that!)
- people rarely remember more than five things from a presentation, and are more likely to remember only three

This means you need to distil your content to key points you want to get across. Be disciplined and cut the details out; people can always refer to something you've written later.

Summary of key tips for delivering high-impact public talks

Use this checklist to guide you while preparing your talk:

- The best presenters are enthusiastic about their topic – they speak with passion.
- The most important element of your presentation is your audience—consider them first.
- Your style (the way you deliver your presentation) is more important to the audience than the content or visual aids—think about how you will engage the audience.
- To win the battle between clarity, detail and time, cut back on the detail and include time for pauses.
- 'Super-prepare' your introduction to give you a confident start.
- Prepare a strong exit line for your conclusion.
- Use keywords to signpost your presentation so your audience knows where you're taking them. (For example: I have told you about X, now I am going to move to my second point, Y.)
- Choose visual aids that add impact or help you to explain something.
- Prepare a single page of dot point notes or a series of palm cards to guide yourself during the talk – do not use your slides for this purpose.
- Memorise your opening and closing sentences.
- Rehearse and time your presentation. Make sure you're comfortable with the venue—do you know how to use the equipment? Find out who can help you with technical issues, sound, lighting, etc., and meet them beforehand to test that everything is working.

Remember this during your talk:

- Take deep breaths before getting up to speak; breathe from your abdomen.
- Breathe throughout your talk; take pauses; have a sip of water.
- Look at the audience and make eye contact with different people around the room.
- Smile. Relax.
- If you lose your way, pause, look at your notes, find a place to restart your talk (it doesn't matter if you miss a bit or repeat something), look at the audience and start from that point again.
- If you are asked a question that you don't know how to answer, that's fine. Respond that you don't have the answer at hand right now, but could look into it and let them know, or refer them to a person or a website where they might find the answer.
- Don't attempt to answer questions that scientists are not qualified to answer. Use such questions as an opportunity to explain how science benefits society and where it fits into knowledge- and decision-making processes in society.
- Don't exceed the time limit.

FameLab

Engaging public talks have become very popular via platforms such as TED talks, and you can get great ideas for engaging talks from watching these online. If you are interested in doing popular talks – especially also for younger audiences – you may be able to get new ideas and inspiration from FameLab.

FameLab is an international competition that has been dubbed the "Pop Idols of Science". Young scientists compete to impress the judges with the most engaging and captivating talk in just three minutes or less. The participants may use small props, but no PowerPoint! The aim of the competition is to engage diverse public audiences with accessible concepts in science, technology, engineering and maths, thus changing perceptions of science and inspiring a new generation of scientists.

FameLab began in 2005 at the Cheltenham Science Festival in the UK, as an initiative of the British Council. The competition has become extremely popular around the world and is now also running in some African countries.

The FameLab judges look for "content, clarity and charisma". They give the following advice to participants: The content should be a good mix of information and entertainment, but always scientifically accurate and compelling. The structure of the talk should help ensure that it is clear and easy to follow. To add the elusive element of charisma, make sure you let your own passion for the topic shine through. There are some more great tips at http://www.famelab.es/en/tips.

FameLab has its own YouTube channel at https://www.youtube.com/user/famelab where you can see how previous participants, and competition winners, presented their topics.

Watch a FameLab trailer here: https://www.youtube.com/watch?v=34pOz1moec8

And here is a great wrap-up of FameLab SA in 2013, with some useful advice from the participants, judges and experts: https://www.youtube.com/watch?v=sVL3_VP5gjE

The South African Agency for Science and Technology (SAASTA) produced this video to promote FameLab SA (2014): http://youtu.be/l4BSufg50NI

Tips on public talks from other astronomers

An earlier guide to astronomy communication – developed for the South African Agency for Science and Technology Advancement – collected communication tips and advice from leading astronomers around the world. Here are their tips on "speaking from the heart":
http://www.southernscience.co.za/astronomystars/speak.php

I also found this blog on delivering effective public talks useful (whether you consider yourself to be an introvert or not!):
http://www.duarte.com/blog/public-speaking-for-introverts-6-essential-tips/

An inspiring example: Wanda Diaz Merced is a blind astronomer. She turns data into sound, and this works really well as an aid during presentations to lay audiences. She demonstrated this at SciFest Africa 2015: http://scibraai.co.za/blind-astronomer-turns-data-into-beautiful-sounds-scifest-2015/
Watch her TED talk at https://www.youtube.com/watch?v=wbtLTCA1Qd4

5. How to write about your science for public audiences

By the time young scientists reach PhD studies, they've mastered an entirely new technical dialect often very specific to their discipline. They've also learnt to write in the impersonal and predictable style required by scientific journals. This may impress their peers, but most people will find it incomprehensible, indigestible and boring – a real turn-off!

Given the increasing demand on scientists to reach out to public audiences, the ability to communicate science in a way that the general public will understand and appreciate, is becoming a sought-after skill. Scientists who master popular science writing and explore diverse outlets for their articles will find that it offers many rewards.

Before you start to write, it is important to think about what motivates you to write for a general audience? Is it to educate, inform or entertain? Are you trying to impress potential funders or attract students? Perhaps public outreach is a requirement of your research grant? Or do you simply want to raise the public profile of your research group and get some media attention? Some reflection before you start will help to explore (and meet) your communication objectives.

Your conclusion will depend on your aim in writing—to inform or persuade. Many scientists think they should write only to inform. We encourage you to write to PERSUADE! (It is perfectly acceptable for scientists to have an opinion and to be an advocate for a certain position, as long as they have the evidence to back up their opinion.)

Writing to persuade

To write persuasively, apply one or more of three rhetorical devices that have been used for thousands of years:

- Project credibility—sound authoritative or have someone authoritative back up your claims (ethos).
- Make an emotional appeal to the reader's needs, desires or fears (pathos).
- Appeal to logical reasoning based on principles and evidence (logos).

It is a good idea to add a human touch (emotions, feelings) to persuasive writing, but when you present something as a fact, it must always be based on solid scientific evidence.

Tip: In popular writing you are not expected to provide scientific references as you would in a peer-reviewed article, but you can refer to studies and scientific consensus. If you do want to share a personal opinion not based on research finding/outcomes, make that clear.

To write science you have to read science

It's important to read popular science. You'll learn how others structure their stories, and immersing yourself in the language will show you what is and isn't appropriate. Reading will also familiarise you with outlets in your country (and beyond) that might welcome your stories.

Blogging is also a great way to find your own (writing) voice and hone your writing skills. There is an introduction to blogging in the section on "Making the most of social media".

Where can I get published?

Identify the target outlet for your story and familiarise yourself with its style. Different outlets will be interested in different topics and angles. Look at what they've already published to make sure your story will interest them. Learn from the way others have structured their popular science stories.

Writing for an internal university or corporate magazine (or website!) may be a good place to start.

Perhaps surprisingly, writing for a children's magazine is probably the hardest, but also extremely rewarding as you may help nurture budding scientists in your field.

Whether you approach a publication or vice versa, put some work in. Think carefully about the topics a publication covers and the target audience. What style does it use – relaxed or more formal language?

Pick the right publication and get in touch with the editor by phone or email. And find out about deadlines – how long in advance do you need to submit something for a monthly magazine versus a weekly or a daily?

Media outlets are often pleased to receive stories from scientists, particularly if they fit their format and interests. Pegging a piece to a particular event, such as World Space Week, can also increase its chances of publication. This is particularly important when it comes to reaching audiences on social media – if your posts are shared using hash tags that are trending, or that certain people are very interested in, there is a much higher chance that people will see your writing.

Blogging could be a natural place to start so that you can present evidence of your writing experience and ability.

Think audience (love your reader)

Think carefully about who might read your piece. How can you relate it to their personal experiences? What are they likely to know about this subject and why should they be interested in your story?

This imaginary reader is all-important. Do not think about other scientists. You are not writing to impress them. You also don't have to "dumb down" your science, but rather clear it up by explaining it well. Many science writers advice that they think of their mother (or another family member) and write a story that they would understand and enjoy.

Tip: Ask a friend to read your draft story and pick out one thing they found intriguing or interesting or would like to know more about.

Focus!

A story can only convey one big idea. Do not try to tell your reader everything you know about the chosen topic! You have to be able to pinpoint the central idea of your story in one short, sharp sentence – before you begin to write. There might be nothing more important than the care you give to crafting your message. It may help to test this "story idea" on a few people who represent your intended audience.

Choose an angle (and remember – everyone loves a good story)

You need to decide on the 'angle' or perspective you are going to take. Is it a news story about new advances in your field of science or are you attempting an in-depth feature? If you're going to

provide your opinion, present it as a commentary piece. It helps to find a published story with the kind of angle you want to take to help consolidate your ideas and choose your angle.

Nothing hooks people's interest more than when they sense a good story coming on – it is simply one of the most powerful communication tools. If you can, find a way of turning the facts into a narrative and weave some excitement and adventure into the storyline.

It may take some time to master the required writing skills, but fortunately help is freely available. For example, it helps to know what kind of introductions are used in a feature (the lede and nut graf), as well as how to set the scene and use anecdotes. These resources may be useful in this regard:

- http://www.poynter.org/news/media-innovation/11371/the-nut-graf-part-i/
- http://nestersteachingblog.com/2008/04/10/the-lede-intro-nut-graf-and-narrative-opening/

Give it structure

How you structure your article will depend on its type: Is it a news story about a scientific advance or are you attempting in-depth coverage? Or is it a commentary piece, i.e. your opinion? Each type has clear conventions.

For example, news stories begin with a short, sharp description of the main finding. A news story turns a scientific paper on its head, putting the conclusions first. Features draw the reader in, setting the scene with more creative, colourful prose.

A news story also requires interviews with people. The human element is very important. Research is almost always done by people/on people/for people, so it is usually possible to add human interest, and it allows people to relate so they will read on.

In all cases, turn your research, or a scientific development, into a story with a narrative. The opening paragraphs must entice the reader to carry on reading. If it's difficult to understand from the start, readers will give up right away.

The body contains the details and facts. These should follow a clear thread, making it obvious to the reader why one paragraph leads to the next in a logical sequence. When writing features, find a way of turning the facts into a narrative and weave some excitement and adventure into the storyline.

The closing paragraphs of feature or commentary articles should sum up the essence of the story or point to future developments. You might leave the reader with thoughts to ponder, or it could be a call to action. Give them something to think about before letting them go.

Focus on relevance and impact

People are generally not that interested in how you conducted your research, but rather want to know how the research may be useful to them. You have to answer the "so what?" question. Focus on what it could mean in people's daily lives or how it could influence society. If your research has the wow factor or is cool and cutting-edge, make that obvious! And remember, people respond to

things that are close to them, things they can relate to – so if there are local or regional hooks, use them.

Tip: Think about what is likely to be going through the minds of the people listening to you and use that as a hook (or opportunity) to engage them. Try to connect to people's everyday lives and concerns, but be honest about how much your science can be translated to decisions or advice in everyday life. Where relevant, explain that you are not able to give definitive answers or advice, but that you can help them understand the issue and what scientists are still trying to understand. – Ronel Steyn (Stellenbosch University)

Style - Keep it clear and simple

The tyranny of jargon is the single biggest barrier separating science from everyday life.

Firmly eliminate the jargon, acronyms, short cuts and formalities that you use when writing for scientists. What is common knowledge to them will be alien to most readers. Describe abstract ideas and complex numbers in everyday terms and relate them to everyday experiences.

Analogies and metaphors that your readers can relate to may help. Most people, for example, will be able to picture a meteor impact crater the size of ten soccer fields.

Keep sentences short and stick to the active voice wherever possible. Use quotes, case studies and real-life examples to add interest.

Tip: Interviewing your fellow scientists (or supervisor) could be a good place to start. Try to get the story behind their work, including interesting insights and anecdotes. If you are writing about a research paper from someone else, call the researcher and make sure you pin down the Who, What, Where, When, Why and How of the story.

Writing about science in everyday language gets easier with practice. For me, translating jargon-infested science-speak into plain language is like untangling matted fur on a dog. It is difficult at first and even painful. But patience and perseverance gets rid of all the knots and tangles (the jargon, acronyms, long sentences, big words and passive voice).

A useful practice is to actively scan each sentence you write for unnecessary phrases and words and cut them ruthlessly. See how short you can get your sentences.

I've found the Gunning-Fog index useful for measuring clarity. It calculates how many years of formal education a reader needs to understand your text easily with one reading. If the text has a fog index of 12, your reader would need 12 years of education. Most scientific writing scores 40 or more. You lower the fog index by making sentences shorter, writing in the active voice, and axing long words. Try out the fog index calculator at http://gunning-fog-index.com/.

Suggested online course: Writing in the Sciences is an online course from Stanford Lagunita (MOOC). It is lectured by Kristin Sainani, a scientist with many years of popular writing experience. You can see all the lectures on Youtube: https://www.youtube.com/watch?v=27iGZ3sOsHk or sign up for the course at https://lagunita.stanford.edu/courses/Medicine/Sci-Write/Fall2014/about.

Let your passion shine through (… or, "scientists are people too!")

When you are writing for a public audience, you don't have to be neutral or objective. It is even acceptable to give your own opinion and speculate a bit. If you are enthusiastic, excited or concerned, say so. There's no reason why science can't be fun and you may even want to bring a bit of humour into the story.

And while people are less interested in the daily research processes, they are interested in your human side what obstacles you've had to overcome. How did you feel? Portraying a real person breaks down barriers, bringing the reader closer to science. Convey your excitement and pride, but don't hype, rely on facts and never lie.

Spice it up!

Keep sentences short and stick to the active voice as far as possible. Use quotes, case studies, metaphors and analogies.

A picture is worth a thousand words

Pictures can glue eyeballs to a page, so submit images and captions with your story – if you can, it may make the difference between getting published or rejected (and it may guard against a picture editor choosing something completely inappropriate). But if you can't, don't be put off. Publications will find an accompanying image.

Tip: You can also suggest stock photos for the publication to purchase should you know what you have in mind as an appropriate accompanying picture. For social media, sharing images are also vital; it is unacceptable not to include an image with a post on Facebook – we've found on SciBraai that it makes a huge difference in terms of engagement and reach. For complex topics without clear images, graphics and infographics are a great alternative. – Anina Mumm (SciBraai)

Tip: Recent evidence also shows that people are even more entranced by graphs than by images. Use one powerful graph if it's available, but make sure it looks good (no excel graphs!). Captions also influence online search rankings, so it pays to always include an image with a relevant and informative caption for online publication. – Paul Kennedy (SciBraai)

As you write, think creatively about images and captions. Science offers beautiful and unusual images that can help readers visualise what you are writing about. Spend time on catchy and informative captions as they are indispensable entry points into your story.

No references

While you may want to credit other scientists and collaborators in your story, you do not have to cite their work or provide a list of references at the end as is customary in scientific writing. Rather, see if you can get a quote from a scientist, in which case you simply mention the person's name and affiliation along with the quote. However, you should keep a record of the resources you used to produce a piece of writing just in case someone (an editor, reader or a fellow scientist) has a query.

It pays to double-check the facts

It is a good idea to get someone else to double-check the facts in your story. Dr Claire Flanagan, a South African astronomer, tells the story of what happened to her when writing a story about the 40th anniversary of the Apollo landing. "I calculated, re-calculated, checked, cross-referenced and double-checked the actual time (4:56am) of the landing. In the end, I sent a note (to 7 000 people) that said 'On June 21st 1969, at 4:56am (South African Time), Neil Armstrong took his first step onto the Moon.' They landed in JULY!"

Here are some tried-and-tested proofreading and editing tips:

1. When proofreading final version of your text on screen, view the text at 300% of its size (or even more) – this helps to spot things that you may otherwise miss. (And – at a minimum, do a proper spell check in Word.)
2. Print the story and find a comfortable, well-lit spot away from your computer. Then read the story out loud to yourself (slowly).
3. Forget about the article for a day or two and then read it again. Looking at it with a 'fresh' mind allows you to spot remaining obstacles to understanding, and helps you find creative ways to add interest and relevance.
4. If you are writing about other people's science, send the article to them to check it first.

Pre-test your story

Once you have written your article, turn your imaginary reader into a real one. Ask a non-scientist friend to read the piece and to point out anything they don't understand or find uninteresting or irrelevant. You will soon begin to find the level you need to be writing at. And if you spot a yawn or they lose interest half-way, remember that nobody is obliged to read your story. If it is technical, dull and boring, not even your friends will want to read it. Don't be put off if your reader has a lot of criticism or appears bored. This is an opportunity for you to improve, so get as much feedback as possible and try again.

That is why the reader – a person you may never actually meet in person – is king!

A good story ….

- has an intriguing start, development in the middle and a strong ending.
- delivers at least one "oh wow" moment
- connects with the reader's emotions
- usually contains an element of drama, surprise, suspense, tension, conflict, mystery or urgency

(More) help is available:

You may enjoy reading about what other astronomers had to say about what makes "a great story" when I interviewed them some years ago – the material is still available at http://www.southernscience.co.za/astronomystars/story.php

Here are some more guidelines and tips from experienced science writers to get you started or to share with the researchers with whom you work:

- Science writing 101: Everything you need to know to get published, by Sarah Wild http://mg.co.za/article/2014-05-01-science-writing-101-everything-you-need-to-know-to-get-published
- "How to write a science news story based on a research paper", by Ian Sample (2014) http://www.theguardian.com/science/2014/mar/28/news-story-research-paper-wellcome-trust-science-writing-prize
- "How to write a science feature", by Nicola Davis (2014) http://www.theguardian.com/science/2014/apr/10/write-science-feature-wellcome-trust-writing-prize
- "How to create a successful science blog", by Kelly Oakes (2014) http://www.theguardian.com/science/2014/apr/17/science-blog-wellcome-trust-writing-prize
- "How to avoid common mistakes in science writing", by Akshat Rathi (2014) http://www.theguardian.com/science/2014/apr/24/how-to-avoid-common-mistakes-in-science-writing
- "You need to know how to tell a good story", by Penny Bailey (2013) http://www.theguardian.com/science/2013/mar/27/penny-bailey-science-writing-wellcome
- "Grab them with your first sentence", by Roger Highfeld (2013) http://www.theguardian.com/science/2013/mar/20/roger-highfield-science-writing
- Top science writers give advice in this video produced by The Guardian and The Wellcome Trust http://www.theguardian.com/science/video/2013/apr/01/wellcome-trust-science-writing-prize-2013-video
- Mentoring and advice from the National Association of Science Writers in the US http://www.nasw.org/writer-resources
- Tips to improve your science writing, from Gwen Pearson (2014): http://entomologytoday.org/2014/11/25/5-ways-to-improve-your-science-writing/

How to write for the web

Many websites do not work because they are written in the same style as print media. There is no point in publishing your standard print publications or articles as-is on your website. On the web, you are communicating with a completely different and unforgiving audience.

The key is to understand how a web reader reads and to adjust your writing accordingly.

Most web readers do not 'read'—they scan. They want information and they want it fast. Eye-tracking studies show that web readers generally read in an F-shaped pattern—two horizontal stripes followed by a vertical stripe. The reader's eye travels from headline to captions to introductory paragraphs—not to pictures or graphics (though these are important attention grabbers). So your content needs to be well structured, written in plain language, concise and to the point, with the most important information at the top.

Writing for "scan-ability"

- Write half the amount you would write for a printed publication (about 300 – 500 words).
- Put the most important information first (summary or conclusion – the "so what").
- Keep your paragraphs and sentences short.
- Write in plain language using everyday words.
- Use bulleted or numbered lists.

- Use paragraph headings or one-line summaries as teasers and make them bold to stand out. Don't use underlining—web readers expect underlined words to be hyperlinks.
- Avoid italics—they are hard to read on-screen.
- Use short, meaningful labels—headings, page titles, navigation terms. Avoid 'cute' headings and puns; they are not universally understood.
- To make it easier for people to find your article online, it is also important to mention a key word around the subject in the title, the teaser, the URL and the body text. This is also important because people tend to scan Google search results as well.

Tip: Wordpress is probably one of the best places to start with blogging. It is free, simple to use, with lots of community support, and will give new writers a feel for the online environment, where they need to keep social media, search engine optimisation and short attention spans in mind. It also introduces them to the possibilities of using multi-media embeds and html code. And they can track the popularity of their writing as well.

Online requires a different structure and style

To work online, content needs to be structure differently – broken up into small blocks. These blocks should be arranged hierarchically, with the most important information up the top. Take advantage of hyperlinks when structuring your content. Not everyone wants all the detail. Put more in-depth information on a separate page and link to it.

Unlike printed publications, the web reader can read your web pages in any order. So make sure that each page can stand alone—it may be the first page they read.

Limit each page to one concept. Web readers do not want to be confronted with huge wads of text. Keep paragraphs short and vary the length of your sentences. At the page level, use the journalistic 'inverted pyramid' structure—state the most important information in the first two sentences (or short paragraphs).

Try not to write in an overly promotional style – you will sound like a PR person and may lose credibility.

Web writing checklist

- Each web page can stand alone.
- Each page has one concept.
- Each sentence or short paragraph has one idea.
- At the page level, the most important information appears first.
- Writing style is consistent throughout the website (especially capitalisation, punctuation, tense, person, tone and navigation labels).
- All text has been edited and proofread.
- All hyperlinks work.
- All content is current (still valid) and all items have a date when it was written
- Underlining is limited to hyperlinks.
- No italics used.
- Page titles and headings are short and meaningful.
- Hyperlinks are descriptive (not 'click here' or 'http://www…)
- Multi-media content is a must – more on that below.

The importance of multi-media

Multi-media is crucial for online publishing. Many websites convey written content in the form of captions to eye-catching images, or as an introduction to an embedded YouTube video on the subject. Take Mashable for example – they have really optimised content for the short attention span online audience, and a South African example is EWN – these sites make use of video, sound, image and social media embeds to complement their stories. For news articles and features, many websites still use the same content in print as online, but they would, for example, add paragraph headings. Adapting writing for online platforms means shifting the focus to multi-media content, and this plays a further role in social media sharing where one can entice readers to watch or listen to your content. While it may be challenging to create original multi-media content, plenty of resources on public platforms like YouTube are available to embed. And free tools like Piktochart allow you to make simple infographics. But even if you are short on time and capacity and multi-media skills, original or sourced images are easy to include.

Use online images correctly

Interesting visual content (photos, graphics, charts etc.) help to make complex information more accessible, and helps to attract readers/followers. It is also much easier to read online text livened up with visuals, rather than slabs of grey copy.

Images should always be relevant and add value and information to your text. When you use images that you have sourced online, it is very important to make sure that they are of good quality and that you don't breach any copyright.

Simply taking an image from a website or blog, without the permission of the owner, means that you are copying another person's intellectual property without permission. If you are unable to take your own photograph or create an illustration, do not use images off the internet. Instead, consider purchasing an affordable image from a stock image library such as:

1. www.fotolia.com
2. www.istockphoto.com
3. www.corbisimages.com
4. www.fotosearch.com
5. www.gettyimages.com
6. www.shutterstock.com

Alternatively, you can source free images where permission to use has been provided to support the sharing and use of creativity and knowledge. A 'Creative Commons' licence means you must give credit to the original creator of the work – find out more at www.creativecommons.org and explore the free images available at http://commons.wikimedia.org and www.morguefile.com

It is easy to find images that may be shared for non-commercial use using the Google Image search function – there is a search tools button under which 'usage rights' gives you options for CC-licensed images.

When images are used in printed media (such as brochures), they must be in high resolution – at least 300 dots per inch (dpi). However, in the online environment such high-res images are not necessary and they can take too long to load – 72 dots per inch (dpi) is adequate. Most graphic

software packages (for example MS Paint) will allow you to resize your images so that they are 72 dots per inch and about 600 pixels x 400 pixels in length or height.

Always credit an image correctly if you don't own it (and even if you do, say so, and tell others whether or not they can use it freely).

6. How to get media attention for your work

Science communication takes many shapes and forms – ranging from popular talks at science festivals or an interactive display in a science centre, to taking part in a public science café or keeping up one's own science blog. But effective engagement with mass media (including social media and traditional mass media – newspapers and radio) is vital if you want to reach large audiences. Therefore, a media plan and media skills – for you and key partners in your research team – are not negotiable. This includes getting to know the media landscape, media platforms and tools, and developing good relationships with key journalists in your region. Radio remains a key communication channel to reach large audiences, especially in rural areas. For young audiences in Africa, platforms like MXIT, Whatsapp, Twitter and Instagram are becoming popular.

Practical training can help you get media savvy

Speaking in front of public audiences and doing media interviews does not necessarily come naturally to all scientists, and there are some pitfalls. But, with some training and practice, you will be better prepared and more confident. And, you will be able to take control of the interview and achieve a positive outcome that will boost your own profile and that of your research institution.

Targeted science communication and media training can go a long way towards equipping scientists with the confidence and skills they need to make the most of science communication opportunities. Attending a media training course tailor-made for research scientists will help you to understand how different media outlets work and what science reporters need in order to sell the story to their editors. It should provide you with a solid understanding of news values so that scientists will be able to recognise newsworthy developments in their own work and frame news stories appropriately for different news platforms and editorial spaces. It will teach you how to pitch a new science story to the media, but also how to respond when the media comes to you. Advice on how to prepare for different kinds and styles of interviews will make sure that you will be ready to make the most of media opportunities that may come their way, and also to pro-actively seek out media opportunities. This includes being willing and prepared to handle more difficult and possibly confrontational interviews.

Researchers must also learn how to package their research for maximum media appeal. A good science story sells even better if it comes with excellent visuals, high-quality video clips and easy-to-understand infographics. It is important to make these "extras" easily available to journalists in a media-friendly format. As an example, look at www.wits.ac.za/sediba to see how the University of the Witwatersrand packaged a science story that made headlines around the world.

Help is available!

1. "Science Media Savvy" is an Australian organisation that have created an extensive (free) online media training resource for traditional and print media. Visit

http://sciencemediasavvy.org/ and explore this useful web site, including the sample interviews for print, radio and television.

2. In 2011, the Wellcome Trust published "A Guide for African Science Media Officers" that provides practical advice to help media officers working in African institutions improve the communication of scientific research to the public, policymakers and funders. The tips and advice in this guide will also be relevant and useful to scientists who wish to engage the media. Download it here: http://indico.saip.org.za/getFile.py/access?resId=12&materialId=0&confId=14

7.How to write a media release

Most researchers will get help from their organisation's media office when compiling a press release, or the media people will do it for you. However, if you know what makes for a good press release, you can work more constructively with them.

The first thing to remember is that most journalists receive hundreds of press releases each day and most of them are deleted almost immediately. To give your media release every chance of being picked up by the media, you need to crystallise your main message, find an angle, structure the release in such a way that it immediately grabs attention, include all important details in plain language, and consider the timing and distribution method.

A second key point is to remember that press releases are written for the media (journalists) and not to please your research director or to impress your peers. It must therefore be designed according to the media's rules.

The advantages of a media release

Preparing a media release can be a lot of work and, if a number of partners are involved, can take time. But a good one has a lot of value:

- It saves time for you and the journalist
- You can reach a number of media outlets at the same time.
- It makes you think about how you will explain the work in simple terms – it is preparation for media follow-ups.
- It helps journalists get the details correct.
- It is a source of quotes and anecdotes, and might even be used word-for-word by smaller papers.
- It forces you, your colleagues, your collaborators, your supervisor and your media liaison officer to think through and clarify what you want to say, to condense it, and to check that you are all saying the same thing.
- You can clear it with your organisation and collaborating organisations.

Who should write the media release?

Writing a good media release is not easy and is best done by a communication professional skilled in writing for the media. They are not as close as you are to your work, and can more easily identify what the story is and what will appeal to different media outlets. A communication professional will also have

established networks with the media and will be able to personalise the delivery and follow up of your media release. If you can, work with a communication professional to write your media release.

Designing the main message

Think about your aims before you start.

1. Why are you issuing this release? What are the main points you want to get across? This is particularly important for sensitive issues.
2. Why should the media (and the public) care? What do they want to know—or need to know—about this work? They are much less interested in the clever science than the impact the science might have on the person in the street.
3. What could the media get wrong? List the most likely things they could misunderstand or get wrong unless you stress the correct information and explain any potential misunderstanding.

Finding the angle

Once you've designed your main message, the art of writing a good media release lies in finding the hook—the angle for your story. Usually, journalists will be interested if the work is going to affect the lives of their readers and viewers. A quirky story—for example, the greenhouse effect of methane emissions from cows—can also grab attention. Journalists like newness, action, change, conflict, local relevance, rarity and personal stories. To test whether your story will be of interest to the media, ask yourself the 'so what?' question.

The inverted pyramid

Media releases are written in the inverted pyramid style—the most important parts come first, followed by supporting information in descending order of importance. This point is important enough to repeat: a media release does not start with background, it starts with the "so what" and the main message, and background follows. In other words, it is the opposite of traditional academic writing.

The headline also needs to be catchy. Think of it as a red flag for waving down a train. Yours will be one of hundreds of media releases that newsrooms get every day and, often, all they read is the headline and the first sentence. Begin with an attention-grabbing 'lead' sentence that also covers the basic message. The entire release should be bright, direct and simple, but especially so in your first sentence.

Who, what, when, where, why and how

Journalists are trained to cover the six basic questions: who, what, when, where, why and how. You should answer all these questions in the first few sentences.

For a science story, What and Why are key (not so much How).

- **Who** said it? Who is this about? Who will this affect?
- **What** happened? What does this mean for people? What is so important? This paragraph could contain a quote from your spokesperson.
- **Where** did it happen? Where will this be applicable?
- **When** will it happen? When did it happen? When will it be available?
- **Why** is this so important? Why is this research being done?

- **How** was the research done? Is there anything unusual/quirky about this? And how does this make you feel?

10 tips for telling your story in a news release

1. Focus on what is "new" in your story.
2. Make it relevant – how does it benefit or affect people? How can they use the information?
3. Use simple and direct language – the challenge is to make it clear (not to dumb it down!)
4. Connect with everyday life – use anecdotes, analogies and metaphors that people can relate to.
5. Money matters – it always helps to include tangible information on costs, benefits, etc.
6. Make it real by including direct quotes and telling stories about real people – journalists want a human interest angle or a case study.
7. Make it personal – use "I" and "we" in the direct quotes.
8. Try the story (or press release) first on someone you know who is not in your field – find out what they understand and what take-home messages they remember.
9. Keep it short – short paragraphs, short sentences and ideally just one page.
10. Provide links to high-resolution visuals or online resources.
11. Invite the media to follow up with interviews and photo opportunities.
12. Provide contact details and be available for phone and in-person interviews!
13. Make sure you have a date and institutional affiliation on the press release for context and credibility.

Distributing the media release

You can distribute media releases to established commercial media contact lists or you can develop your own personal contact lists. You can send it to a wide range of journalists, or target a few, or even just one reporter. You may decide to issue a media release under embargo. The best strategy depends on the nature and timing of the story. Once again, it is advisable to get help and advice from a communication professional in your organisation.

If you are emailing the media release to journalists, include it in the body of your email as plain text and avoid document and jpeg attachments unless they have been specifically requested by the journalist. Sending the press release in a document from (such as .docx or .pdf) reduces the chance that it will be read – if the text is in the email body, the journalist merely has to open the email and read it, rather than having to download.

Print journalists may request photos, and usually prefer them emailed as .jpeg files with a resolution of at least 300 dpi.

How to give a media interview

When giving a media interview, you need to remain in control of the interview—if not, you may fail to get your message across or worse, you may the wrong message may come across.

Before you start:

1. **Objective** – Be clear about why what you want to achieve by using the media or why you have agreed to do the interview.

2. **Audience** – Who do you want to reach with your messages? Always know who the media audience is before the interview starts – consume media to familiarise yourself with the media landscape.
3. **Message** – What do you want to get across to the audience? Consider your objective, what the audience might want to know (which generally shapes an interviewer's questions) and what the audience (or interviewer) might get wrong unless you stress the correct information. Get you main points across first.
4. **Written** – Always give journalists something in writing before the interview; offer to email or fax it to them. The more background they have, the better informed they will be to ask questions.
5. **Preparation** – Think about money ($ figures), statistics and any background information that might be useful in your interview. Prepare for the interview by thinking of simple everyday explanations and/or examples and by focusing on the main points of your message. Case studies and anecdotes are powerful.
6. **Rehearsal** – Practice with someone who can play the role of the journalist—try your family or friends; colleagues know too much.
7. **Interview** – When you meet the journalist, walk them through the main 2-3 points of your story before they start the interview.

Control the agenda

1. **Try to ensure the FIRST answer you give to a question encapsulates your most important point.** For most interview situations, this will direct the sorts of questions journalists will ask you. If the first question was not appropriate, you can start your answer with, for example, "before we get to that, I first want to mention that…" – you can redirect the question to suite your prepared answers.
2. Stick to your 2 – 3 key points (which may mean turning questions around). Back up key points with examples or colourful analogies. Repeat your key points two or three times using different words.
3. Keep your answers short and interesting. Be enthusiastic and lively.
4. In pre-recorded interviews, the audience would rarely hear the question when it is played. So avoid yes/no answers and pronouns, and give an answer that is complete and can stand alone – speak in sound bites that are easy for journalists to edit without removing context.
5. See questions as opportunities to say what YOU want, rather than something you need to accurately answer in detail.
6. Check with the journalist at the end of the interview that they understood your key points.

Consider the different roles of researchers and journalists. Researchers work with accuracy, detail, incremental developments, robust methodologies and peer review. On the other side of the microphone, most journalists work with breaking news, quick grabs, key points and catchy and/or controversial comments—they work under constant time pressure and tight deadlines.

Be prepared to turn questions around

Most journalists are not out to trick you. They just haven't time to do a lot of research and so they don't know the right questions to ask you. And if you keep answering their questions, you'll both go merrily down the garden path and you may not get your message out.

Be prepared to turn the interview around and point it in the right direction. This does not mean you completely ignore the question. Rather, you see the question as an opportunity to convey your key points. Here are some phrases that might help:

- 'The point of the whole issue is simply this…'
- 'The really exciting thing about our work is…'
- 'Let me answer your question by simply pointing out that in the last...months we have...'
- 'I think that your question is best directed to...but what I can say is...'
- 'To appreciate our position on that issue it is important that you first realise…'
- 'Let's look at that issue from another viewpoint...'
- 'Well, that's an interesting point but the key thing I want to say is...'

Don't want to answer a particular question?

Never say 'No comment'. It makes you look guilty. Always give a reason why you can't answer a question. Be honest. Some examples are:

'It's too early to answer that question…' or 'I can't talk about … because I'm not the person working on it...' or '…because it's commercial in confidence…', or '...because the full results aren't in yet…'.

Then add, 'but what I can say is ...' and return to the main message you have prepared.

Dealing with difficult interviews

Most research stories are 'good news' stories—announcements or releases issued on behalf of researchers and accepted by an uncritical media. The agenda and timing is determined by the research organisation.

You should carefully plan and release 'bad news' stories about difficult or contentious subjects in the same way as 'good news' stories. Draft a media release, discuss it with the people concerned, nominate a spokesperson, work out the main message, put it in simple terms, anticipate the questions, rehearse and organise an interview or event. Take extra care with all of these steps. Respond to the issue quickly and credibly.

If a news event occurs during which your type of research comes under fire for whatever reason, or if you are called upon to comment on a contentious issue, prepare for controversial questions and be proactive in responding publically through media releases and other means.

This is a time when you have to be careful *what* you say, and how you say it. Learn to control the agenda so your message gets out, not the journalist's ideas or preconceptions. Work out what you want to say, and keep saying it—pleasantly, patiently and firmly.

10 tips for dealing with controversial interviews

1. Find out as much as you can about the agenda of the media. Why are they doing the interview? What are the related issues? Who else will they be talking to?
2. Find out who the audience will be; this will shape the interviewer's questions and agenda.

3. For TV: Where will the interview be held? How will the location affect your image and that of your organisation? Take control of this.
4. Do lots of preparation and work out what you want to talk about, and what you DO NOT want to talk about. Draw a very clear boundary around your story.
5. Prepare positive explanations of the research that will ensure you stay on the front foot during the interview. Never become defensive.
6. Be careful with analogies and explanation of risk—they can backfire. If you want to use analogies, make sure they make sense for the media audience you will be talking to.
7. Acknowledge the concerns of others as valid, even if they do not have a rational basis to them. Don't be arrogant – place yourself in the position of a lay person who may not understand all the facts or who may have other perceptions.
8. If appropriate, rehearse with a freelance or ex-journalist who can ask you difficult questions.
9. During the interview stick to the key points that you want to get across. **Remember, a question equals an opportunity to say what you want. It does not equal an answer.**
10. Remain cool, calm and polite during the interview. If the interviewer becomes aggressive, they are the ones to lose out, not you.

Following up on media interviews

Ideally your first media interview with a specific journalist will be the start of a trust relationship with that journalist. If you get to know the journalist (and specifically his/her work) you will know what they write about and will be able to identify stories and opportunities that he/she will be interested in. This will also mean that they will contact you if they are looking for expert comment on an issue relevant to your research.

Tip: Don't pester journalists if they do not use your press release, but do remember to thank them (via a quick email) if they visit to interview you or write up a story that you have issued.

8.How to make the most of social media

Social media is transforming and revolutionising (science) communication, particularly in terms of reaching new scientific and non-scientific audiences. To be effective and become a recognised voice in science, you have to embrace (and you will then enjoy!) social media.

Don't think of social media as something extra that you have to do. Rather see it as a way of adding momentum, value and visibility to what you are already doing. It is also a tool to network (directly) with top people and exciting new voices in your field of expertise.

Twitter, for example is great for networking and events (and #scicomm is big on Twitter!). Facebook helps to you share your work with your local or scientific community; social media helps to humanise scientists.

And the best part is that you can teach yourself – so much support is available online in the form of tutorials, courses and community forums.

Below follows some guidelines to get you started.

Create your profile

Your profile is the first point of contact between you and your followers. It should make it easy for people to find you and to see what your work and research interests are about. When you first register on a social media site, for example Twitter, you will be asked to set up a profile (and you can always update the profile later).

The three essential ingredients of a profile are: (1) a username; (2) an image and (3) a short biography.

Choose a unique username, ideally 15 characters or less, that is easy to type and remember. You can use your own name, or become creative with a username that says something about yourself.

The image (a graphic or a photo) that you add to your profile will be the image people will have in their minds when they interact with you on social media. Use this as an opportunity to say something about yourself or your work by, for example, using an "action photo" of you doing the work you love. Remember that this picture will often be displayed very small on the screens of readers, so make sure it is clear and bright, focused and not too busy.

A brief biography – the final part of your profile – should describe who you are, what you do and your interests—all of which should indicate what you intend to talk about. On Twitter you only have 160 characters to do this, so it's important to use key words that allow people to find you easily and decide if you're worth listening and/or interacting with.

Once you've set up this profile, use it consistently across all social media channels. This will help people recognise you wherever you are posting on the web. You may also want to set up a "gobally recognized avatar" (also known as a "gravatar") – find out more at www.gravatar.com.

Tip: For scientists I recommend creating a solid online profile via Twitter, Instagram, ResearchGate and Linkedin for personal yet public interaction, as well as a blog. On Facebook, many people have personal and private interactions with friends, so a page for a research group/lab may work best, one that is managed and contributed to by all in that group, and which is focussed on science communication for lay persons. A Facebook group is also useful for engaging with a particular community that has something in common, like having attended a conference or a course. – Anina Mumm (SciBraai)

Share science on Facebook

While many people use Facebook for personal networking, it can also be a very effective medium for engaging people in science. Instead of setting up a personal profile (that only friends can see), you would set up a public Facebook page typically used by organisations or public figures. Just as with personal pages, you can also post links, events, discussions etc. and your followers can respond.

The events and updates published by the page administrators will appear in the Facebook timelines of all the fans (people who have chosen to "follow" the page).

A page is basically a broadcasting platform that you can use as a continuously updated news feed on your research group to increase awareness of your work and attract funding. It also allows you to get feedback and input from others. These pages are public and are "searchable" (similar to web pages), allowing you to grow an audience more easily. Anyone can see these pages, but you can add 'administrators' or 'authors' who can post content. Facebook has useful integrated measuring tools that allow you to monitor how people are engaging with your content. For example, you can see who has clicked, liked, commented on or shared your posts.

Facebook Groups are useful for people who share a specific interest, for example science communication. While Facebook Pages are open for anyone to read and access content, Facebook Groups are private and have three access options: You can create a group that is either:

- Open – anyone can join and access content
- Close – anyone can ask to join, but administrator must approve first
- Secret – only invited users can join and access content

Groups have 'administrators' who manage the group, approve applicants or invite others to join. It is a good tool to connect and share with a more focused group of people. It can become a valuable networking space for scientists with common research interests.

If you already have a Facebook account, setting up a Facebook page or group is easy. The three most important things to ask before setting up either a page or group are:

1. do you need permission to set it up on behalf of your colleagues, organisation or institution?
2. who are you interested in having as page 'fans' or group 'members'?
3. what name will you use your page or group?

To set up a page, go to: facebook.com/pages/create
To set up a group, go to facebook.com/addgroup

It is important to post new (and interesting) materials regularly, as well as to act professionally in what you write and post and all times.

Tips: It is also important to include images with all posts, to customise the images/text of links being shared if they are unattractive, and to delete the link text itself from the post text once the link has loaded. Also, post texts that accompany shared links could be phrased as teasers, or a slightly opinionated comment that makes people want to click on the link. Convergence plays a role here too – share things from your related website or blog. You can also link your lab's own Twitter account to a Facebook page. If you mention people or groups you know are on Facebook, tag them as this increases reach. And interact with others and your audience by responding to comments, for example.

Some good, interesting or at least fun (science, nature and science communication-based) Facebook pages to explore:

- Animal Demography Unit (University of Cape Town)
  https://www.facebook.com/animal.demography.unit
- WWF South Africa
  https://www.facebook.com/WWFSA
- SciBraai.co.za
  https://www.facebook.com/scibraai
- Sciencedump (the lighter side of science)
  https://www.facebook.com/sciencedump
- I fucking love science
  https://www.facebook.com/IFeakingLoveScience
- BBC Earth
  https://www.facebook.com/bbcearth
- Africa Geographic
  https://www.facebook.com/Africa.Geographic

- Zooniverse (citizen science) https://www.facebook.com/therealzooniverse
- Science communication central https://www.facebook.com/scicommcentral
- ASAPscience (also check out their YouTube channel!) https://www.facebook.com/AsapSCIENCE
- Universe Awareness (project aimed at inspiring children) https://www.facebook.com/unawe

I administer a Facebook group for African science communicators – you are welcome to request to join us at https://www.facebook.com/groups/scicomafrica/

Using Twitter as a science communication tool

Twitter (the post are called "tweets") is a form of blogging, also known as a micro-blog. Tweets are limited to 140 characters and published in real time. It is a quick and easy tool to use, with the potential to engage with people that would otherwise be hard to reach.

Setting up a Twitter account is quick and easy. All you need to get started is an email address and then:

1. Visit www.twitter.com
2. Fill in the "New to Twitter? Sign Up" fields. Create a password.
3. Choose a username (on Twitter these are known as handles; they begin with the "@" sign and are not case-sensitive)
4. Twitter will guide you through finding a unique username.
5. Twitter requires new users to go through a set-up wizard. Begin by clicking "Next." The guide will prompt you to follow five people to "Build your timeline."

Because Twitter is all about keeping messages short, abbreviations and symbols are used to help achieve this.

Here are a few helpful explanations of the most common abbreviations and symbols.

- RT or R/T Stands for **retweet**, Twitter's equivalent of quoting. If you come across a tweet that you want to quote and share with your audience (followers), use the "Retweet" tool (two arrows). This will also give credit to the original user who tweeted.
- MT - If you change a retweet (for instance shortening it to add your own comment), it is a modified tweet.
- DMs = **Direct messages**, or private messages sent to specific Twitter users in your network.
- A Username or "**handle**" is preceded by the @ symbol. Use the @ symbol followed by their username when you want to talk to or about someone on Twitter. For example, when I include @scibraai in a message, this user (or person) will be notified about my tweet.
- HT stands for hat-tip – a way of recognising the original source of something (or where you found it e.g.: "Look at this cool link! HT @scibraai"
- The # symbol is also known as a **hashtag** on Twitter. Use it to highlight keywords, topics, events or even emotions in a tweet. Using a hashtag turns a word or phrase into a link that lets you filter tweets containing the same tag. In other words, the hashtag is like a search filter. Searching for #scicomm yields a list of all recent tweets where anyone on Twitter (whether you are following them or not) included that hashtag in a tweet. It is a great way to

find new people interested in the same things as you, or to join popular conversations. You can create your own hashtag or use other popular hashtags. If you're not sure if a hashtag already exists, simply search for it.

Start tweeting!

Once you have set up your Twitter account and feel comfortable with some of the Twitter jargon, you are ready to "join the conversation". Here are some suggested steps to follow:

1. If you are using Twitter for the very first time, it is a good idea to spend a bit of time searching for keywords that relate to your area of interest to discover what other people are already tweeting on these topics – who/where they are and what they are saying.
2. Follow some of these users and observe how they use it. Think about what they are saying and how they say it.
3. Retweet comments and links that you like, find interesting or agree with. You can also quote someone's tweet if you'd like to add your own comment to it.
4. Reply to people's questions and, if there's something relevant to you, comment on people's tweets.
5. Tweet your own views – remember to keep your tweets relevant to your Twitter biography where possible. In other words, if you tweet as a professional astronomer, don't include personal tweets. (I keep my personal and professional social media platforms completely separate.)
6. Share photos, videos and links to useful websites, and to your own content elsewhere on the web – tweeters love things to click and view.
7. Connect with scientists attending conferences that you plan to attend. You can search for the conference twitter hashtag and start a conversation with other people using that hashtag before or during the conference.

Tip: Who you follow hugely influences your experience on Twitter. As a scientist, you might like to follow top science communicators, researchers and institutions involved in your field to make sure you are getting the best info. When you come across someone interesting, follow them! If someone is posting irrelevant or annoying content, unfollow. It will vastly improve your twitter experience.

Twitter is also a really good way of keeping track of current events/new discoveries that are making waves/scandals – the hashtags are very useful in this regard. Remember there is no need to post anything if you have nothing to say. Plenty of people use Twitter purely as a way to curate the flood of information available online.

A few do's and don'ts of tweeting

Do

- ✓ Keep it short. This is the number one rule.
- ✓ Use hashtags. Especially when you are at a conference, or any event.
- ✓ Make it easy to read. Strive for perfect spelling and grammar, and correct punctuation—people notice errors. Start each sentence with a capital letter. Avoid ALL CAPS.
- ✓ Write as if you are writing a newspaper headline. You want to grab people's attention.
- ✓ Reuse what you've already written. Use the same principles for writing blog headlines for writing tweets; your blog headline can be your tweet.

- ✓ Check your tweets. Tweets cannot be edited once published, but they can be deleted and rewritten if you notice an error. However, it is possible for someone to take a screenshot of your tweet, or to copy your text in a RT or MT, so triple check your tweets!
- ✓ Keep it conversational. Social media is about real people communicating with each other. Be yourself, but most importantly be honest.
- ✓ Be interesting. Share your personality with your followers as well as your news, blogs and other information.
- ✓ Mention people if your tweet/content concerns them.

Don't

✗ Oversell or over-promote yourself. Tweeting about your work is great, but constantly selling yourself will turn people off, and you will become invisible to them.

✗ Sell a link. Sell the content instead. Don't just say 'Great article' or 'This is cool'. Tell them why it's cool. Give people a reason to click on a link.

✗ Retweet without careful consideration. What you retweet reflects on you.

✗ Tweet your every movement. That really is wasting people's time.

✗ Tweet when you are angry or drunk. Needs no explanation.

✗ Use punctuation marks in hashtags. This will break the link to the hashtag

✗ Use too many hashtags in a single tweet. Multiple hashtags can be used to credit a number of people/organisations, or when your tweet is related to a number of topics, but it is generally best to keep hashtags to one or two, otherwise it becomes very difficult to read.

✗ Mention people if your tweet/content is not relevant to them.

Consider blogging

A blog (or web-log) is basically a chronological online journal that interested people can subscribe to. Blog posts are usually between 500 – 1 000 words and should feature multi-media like images, graphics and videos. The same principles discussed in the previous chapter about writing for public audiences and writing for the web applies here.

Tip: You can embed or upload your own social media posts, images, videos, graphics, Storify, sound clips or almost any other multi-media object. Multi-media is important – it is the modern way to blog.

Creating (and sustaining!) your own blog can help you to connect with others in your field and build your own reputation and profile. Most blogs offer readers the opportunity to comment, and therefore provides a two-way channel where you can interact with your readers. Blogging helps you hone your writing ability, allows science to presented in an informal or conversational way, and it generates provides content for social media platforms like a Facebook page.

Reading other blogs will help you to decide whether blogging is right for you and how you can use blogging as a science communication tool. Here are some great astronomy blogs (or selections of blogs) that you may find interesting:

- http://www.skyandtelescope.com/astronomy-blogs/
- http://space.about.com/od/computerresources/tp/blogsastrospace.htm

- http://www.slate.com/blogs/bad_astronomy.html (One of the most-widely-read astronomy blogs)
- http://astrosibs.blogspot.com/ (This is the blog of Sibusio Biyela – a South African BSc student who used his blog to help launch a career in the media)
- http://www.urban-astronomer.com/ (Allen Versfeld writes for this blog – he is an amateur astronomer and winner of a 2014 Profile award for science writing)

Useful advice for (potential) science bloggers:

- http://blogs.plos.org/blog/2012/12/31/ten-essential-qualities-of-science-bloggers/
- http://www.scilogs.com/from_the_lab_bench/motivations-to-blog-about-science-mysciblog-data/
- http://blogs.scientificamerican.com/incubator/2013/04/02/how-to-break-into-science-writing-using-your-blog-and-social-media-sci4hels/ (This is a fantastic all-round resource for scientists who want to blog)

Here are some of the blogs I enjoy (and are great for networking and ideas in science communication):

- A selection of science blogs at www.scilogs.com
  I specifically follow Matt Shipman (Communication Breakdown) at http://www.scilogs.com/communication_breakdown/author/shipman/
  and Kirk Engelhardt (The Leap) at http://www.scilogs.com/the-leap/
- This is one of my favourites: Answering the "So What?" in science communication at http://compassblogs.org/
- "The Plainspoken Scientist" is an excellent science communication blog run by the American Geophysical Union - http://blogs.agu.org/sciencecommunication/
- I am also subscribed to this blog by "grrlscientist" - http://www.theguardian.com/science/grrlscientist

For a local (science communication) flavour, don't miss http://scibraai.co.za/ - they are always looking for contributions (your science stories!). Also have a look at www.dreamingthefuture.co.za and http://www.capetownbotanist.com/.

It is relatively quick and easy to start a blog via one of the many free online blogging platforms, but sustaining a blog requires passion, time and commitment. Before you launch a blog, think carefully about what you are hoping to achieve, what your blog will focus on and who you are aiming to engage.

There are many free blogging platforms online, each with their own personality, style and type of audience. Most of them offer advice on getting started. Some examples to start exploring:

- www.wordpress.com (As mentioned in the previous chapter, we recommend Wordpress above the others as it is easy to use, easy to learn and also easy to upgrade into a professional website)
- www.blogger.com
- www.tumblr.com
- www.livejournal.com
- www.weebly.com

More platforms to explore

Instagram: Astronomy often produces great visuals, and this is one platform where you can share those and daily activities as long as it is a pretty picture – scientists in the lab, a new computer-

generated image of the sky, getting dirty doing telescope maintenance, a mid-night snack during an optical observation, the Karoo on the way to the SKA site etc. You can link your Instagram account to Facebook, but rather not to Twitter as it only displays a link to the image, not the image itself.

ResearchGate is a professional network for scientists – you have to be with some kind of research institution to join, so it gives you credibility. It allows you to add topics that you are interested or experienced in, so an astronomer could add 'radio astronomy' and 'science communication'. You can also share your publications with other scientists (great to get around pay walls) and vice versa, and you can engage in discussions in your field and in cross-disciplinary fields with other scientists. ResearchGate also rates scientists based on interactions and publications shared.

Tip: I use ResearchGate to obtain articles from researchers, and to gain background information on those I need to interview. As a scientist-turned-communicator, it is one of the most valuable resources at my disposable. It gives me credibility when reaching out to other scientists, and I pose questions about science communication or about a field I am writing about to relevant groups. For example, I can ask a radio astronomy group if my simplified explanation of how KAT-7 works is accurate yet understandable. – Anina Mumm (SciBraai)

LinkedIn is a professional networking platform. You can follow news from industry and other professional related to your field, and participate in relevant discussion groups. You can also reach out to other professionals by exploring groups and the connections of your connections. LinkedIn allows you to create a public profile that is the equivalent of a CV, making it easy for you to point people to your CV using your other online platforms.

One more thing worth mentioning is that all social networks also allow you to follow projects, organisations and people you are interested in. This is a wonderful source of inspiration for content to share, new content and new contacts with whom to collaborate for content creation. When it comes to the online space, content is king (**currently multi-media content is king!**).

9.Planning for communication as part of your science

Communication does not happen without careful planning and resourcing. If you don't plan for it, it is likely to remain an afterthought or optional extra, or may even be totally ignored.

Ideally, you should plan and budget (time, expertise and money) for communication in much the same way you plan and budget for research. Remember, if you have a budget (or if you apply for a communication budget as part of a research grant) you can get help from professional editors, designers, photographers. This could take your science communication to a whole new level!

Professional communicators (or communication managers) will often draw up "broad" communication plans for a whole institution, division or department. But, you can use the same basic principles to draw up a communication plan for a specific research project that you are working on. And the best time to draw up this plan is right at the start of the project, while you are still in the planning (and budgeting) phase of the research.

A science communication plan in support of a specific research project will typically aim to:

- demonstrate the success and impact of the project
- sustain public, political and funding support for the project on a local, regional, national or even global level
- attract partners, collaborators, students and possibly further funding

- change behaviour and perceptions where necessary
- help mitigate risks to the project, for example risks that may result from funding cuts and negative public opinion
- engage specific stakeholders in constructive dialogue
- ensure co-ownership of research between relevant interest groups

Tip: You may find that there is help available with communication planning in your organisation. Make contact with the communication and media professionals where possible. They will be able to give you valuable support, advice and help, and can advise you on the communication policy, support mechanisms, role players and value chain in your organisation. – Ronelle Steyn (Stellenbosch University)

When drawing up a communication plan and budget, ask yourself the following questions:

1. Who do I want to reach (and identify the individuals and groups that are a high priority for you to engage with)?
2. What am I hoping to achieve with communication? (For example, I want to raise my own profile, or attract new collaborators)
3. How much do I know and understand about my key audiences? Is there something I can do to find out more about them?
4. What are my key messages? (There will be different key messages for each audience group. Think about benefits, impacts and opportunities when you work on your key messages.)
5. How will I engage with my key audiences? Which tools, tactics and activities will I use?
6. What are the roles, resources and timeframes? Do I have help available, or can I get some experts to help me? Who will do what, and when? What do I need to implement this plan in terms of skills, expertise and budgets?
7. How am I going to implement this, and how will I know whether I've been successful?

Message design

Here is a tried and tested method to develop key messages: Ask yourself the following three questions:

1. What are the three things that I would most like to get across to this specific audience.
2. If I put myself in the shoes of the audience, what are the three things that they are most likely to want to know about this topic? (consider asking someone who represents the audience)
3. What are they likely to misunderstand or get wrong unless I emphasise the correct information.

Take these answers into account when you go on to choose three key messages. Any more than three will cause you to lose focus, and won't be remembered.

Evaluation

Effective evaluation of your science communication or public engagement activities may turn out to be a tricky challenge. It is important to plan for evaluation from the start, since some vital aspects of evaluation can take place even before a project starts. In fact, many opportunities for evaluation (for example getting feedback from visitors during an event) cannot be re-created at a later stage.

Tip: In the online space, most social media networks have some kind of gauge – SciBraai uses Facebook page insights and WordPress site view statistics to gauge reach and engagement.

When developing science communication resources, such as exhibitions or posters, pre-testing is a crucial, value-adding evaluation tool. This involves setting up focus groups – which must represent the intended target audience – and testing the accessibility and relevance of the resource with that group beforehand. Based on the feedback from the focus groups, the resource can be improved before printing or final production, for example by getting rid of jargon or changing illustrations that the target group did not understand.

There is a wide range of evaluation guides publicly available, such as:

- Evaluation: Practical guidelines (Research Councils UK, 2011) – A practical guide specifically designed for researchers who are seeking to engage public audiences - http://www.rcuk.ac.uk/Publications/policy/Evaluation/
- The user friendly guide – An extensive handbook for project evaluation - http://informalscience.org/documents/TheUserFriendlyGuide.pdf
- Ingenious evaluation toolkit – A toolkit originally developed for the Royal Academy of Engineering's Ingenious awards – see resources, guides and sample questionnaires at http://www.raeng.org.uk/grants-and-prizes/ingenious-grant/evaluation

10.A few more resources

The internet is a great source of ideas, inspiration and guides on science communication, but it is also easy to get lost in this ocean of information. In addition to the online resources already listed in this guide, you may find the following useful and relevant:

1. www.capjournal.org
   A free peer-reviewed journal for astronomy communicators that has been going since 2007. This journal is supported by the International Astronomical Union. Download previous issues at http://www.capjournal.org/issues/index.php

2. www.sciencemediasavvy.org
   A set of practical guides and great videos to help scientists who want to make more of opportunities presented by mass media and social media

3. http://www.scidev.net/global/content/practical-guides.html
   A useful and well-written series of blogs and guides about science communication catering for the context of a developing country

4. http://ec.europa.eu/research/science-society/science-communication/index_en.htm
   Research communication guide developed for researchers participating in EU-supported projects

5. http://za.unawe.org/
   Explore "Universe Awareness" for some inspirational ideas on presenting astronomy to young children

6. Follow #scicomm and #scicomafrica on Twitter

7. http://pitchpublishprosper.com/science-writers-handbook/

A description of The Science Writer's Handbook, which can be purchased online