A view from the exhibit floor… Science storytelling

David Pearson¹, Chantal Barriault² and Lowell Cochrane³

Transforming scientific information into accessible and easily understandable knowledge for the public has become important and often necessary for many scientists. Unfortunately we frequently draw our approach to communicating science from the impersonal, formal, method-results-conclusion structure and process detail of journal papers. However, we are a storytelling species and the journal format of communicating science does not engage or inspire the public. Effective science communication must use a variety of tools to engage people as active participants in the communication, not just passive recipients of information. Through a case study of a genomics-themed object theatre designed by Science North (a science centre in Sudbury, ON), we propose a new framework: the “Science Communication Pyramid”. This framework takes into consideration the way people learn and the principles of good design to deliver science to public audiences with impact, relevance and effectiveness. The engagement tools proposed in the framework include appealing to people’s personal interests, motivation, previous knowledge, familiarity and emotions. Metaphors and analogies are presented as powerful frames for understanding complex ideas and information. Counter-intuitive and surprising concepts will help pique interest while effective show design maintains an audience’s engagement throughout the presentation. We suggest that the same tools used to communicate challenging and difficult science in a multimedia theatre experience can help scientists effectively craft their communication to public audiences.

Introduction

The Nobel Prize winning nuclear physicist, Ernest Rutherford, is often quoted as having said “An alleged scientific discovery has no merit unless it can be explained to a barmaid.” (Quoted in Einstein: The Man and His Achievement (1973) by G. J. Whitrow, p. 42). Rutherford knew the test of whether he really understood what he was doing in his laboratory lay in whether he could put it into a story that made sense to someone with totally different interests. He knew that communicating science to people who are not scientists is best achieved by storytelling.

Unfortunately, many of us who are scientists often draw our approach to communicating science with public audiences from the impersonal, formal, method-results-conclusion structure and process detail of journal papers.

¹Laurentian University, Sudbury, Ontario, P3E 2C6, Canada
²Science North, Sudbury, Ontario, P3E 5S9, Canada
³Show Communications, Kingston, Ontario, K7K 4T8, Canada

Correspondence: lowell@showcommunications.com

Recieved: 2010/05/27; Accepted: 2010/09/18; Posted online: 2010/09/30

© 2010 D. Pearson, C. Barriault and L. Cochrane. This is an Open Access article distributed by Hypothesis under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/3.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.
tails of journal papers. We are concerned about presenting all the information we think people ought to know instead of designing our communication in ways that engage them. Our efforts often lack many of the elements of good storytelling and might have disappointed Lord Rutherford and the barmaids who enjoyed his stories of nuclear physics a hundred years ago.

Engagement and Learning
Effective science communication regards members of an audience as active participants in the process, not just passive receivers of information. Even though they may be silent, everyone is actively processing, interpreting and making meaning out of what they are hearing and seeing. Audience-oriented communication takes those processes into account whereas content-based communication does not. Communication that does no more than eliminate jargon and use plain language with the aim of “dumbing down” the science is still content-centred communication. Audience-centred communication or storytelling utilizes understanding and engaging the audience and therefore maximizing the likelihood of people making meaning of the experience; in other words, learning. There are effective engagement tools that one can use to increase the likelihood that a public audience attending a scientific talk or presentation will indeed become interested, engaged and even learn something new. The seven engagement tools we propose respond to the audience’s needs by considering:

1. Emotions
2. Previous Knowledge - Experience and Familiarity with concepts
3. Interest and Motivation
4. Personal identification.

In addition to these personal characteristics, effective science communication relies on:

5. Metaphors and analogies
6. Surprising and counter-intuitive facts
7. Show or presentation design

Influences on Engagement – Engagement Tools
Emotional factors have long been identified by psychologists and educators as important in engagement and learning (Falk & Dierking, 2000; Falk, 2001; Rennie, 2007) Our emotional state of mind, our feelings of well-being and overall comfort, as well as satisfaction in understanding new information and ideas are extremely important in enabling us to engage with and learn new things. In 1956, Benjamin Bloom identified three learning domains: the Cognitive, Affective and Psychomotor Domains. All three domains play an important role in enabling engagement and learning (Krathwohl, Bloom & Masia; 1999)

The Affective domain includes how we deal with things emotionally, using feelings, enthusiasm, values, and attitudes to make meaning of our experiences. In practice, as scientists, we tend to pay more attention to the cognitive domain, emphasizing facts, processes and results. But good storytelling is not just about presenting facts and information. Engaging an audience depends as much on the emotional quality of the communication as it does on the logical sequence of the story. The interpersonal cues communicated by the presenter can set an audience at ease and increase openness to the information content. The presenter or the narrator is the contact point with the audience and conveys much more than information.

Previous experience, knowledge, and familiar concepts are the foundation for any
learning experience. Engaging people with a science story is easier if the concepts and frameworks used allow them to build an understanding on the foundation of something that is already familiar. Constructivist learning theory and research argues that not only are we not passive recipients of information but that as active participants in making meaning we constantly refer to our past experiences to construct that meaning, and with it knowledge, from new information (Hein, 1998; Paris, 2000; Schunk, 2004). Consequently, a key ingredient in building understanding through a good science story is tapping into what people bring with them.

Interest and motivation stimulated by the presentation or show obviously plays a key role in engaging people, especially in settings where they make a choice on the spur of the moment about participating or not. Some audiences come with very high interest because of a concern and the engagement may take place in the context of communicating risk. Others are motivated by sheer curiosity. For others yet, the topic may have great relevance to their personal lives. In accentuating relevance to an audience it is important to avoid making the relevance seem token or trivial. The audience may well be just as intelligent as the presenter, but not specialized in that topic. The purpose of establishing relevance is to show why something matters and to draw the audience into the story through genuine interest and motivation.

Personal identification with people, their interests or concerns and things that matter to them can make a story more compelling. This effect can be extended by personally addressing people through the use of inclusive phrases in narration or presentations. It can also be combined with recognition of likely existing knowledge and experience in the audience. Acknowledging that the audience knows or has experience with some part of the content helps connect the presenter to the audience as one of them, as sharing something with them.

Metaphors and analogies provide powerful frames for understanding complex ideas and information. Metaphors are never exact (that is not their purpose) but it does mean that they have to be carefully chosen, especially in science where the limits of the analogue have to be obvious so that the audience is helped but not misled. Well-chosen metaphors enable people to think about something within a familiar framework that facilitates their thinking about something new, which may be invisible or abstract.

**Surprising and Counter-intuitive facts and observations are part of the currency of science and a strong asset in catching attention and stimulating the imagination of an audience**

They help to establish relationships between events or influences and can clarify cause and effect. For example, musical notation and repertoire as a genetic metaphor for DNA compares bases - genes – mRNA – ribosomes – proteins to musical notes – a song – musicians – music and orchestra. The idea is that the terms in each domain have a similar relationship. Metaphors from sport as another example, are commonplace and widely understood (although culturally and sometimes gender dependent).

Analogies that are more concrete and specific than metaphors are often used in communicating about objects or observa-
tions by comparing them to more recognizable everyday objects or experiences. In speaking of contaminants for example, saying that a concentration of 20 parts per billion is the same as 20 cents in 10 million dollars makes the number far more meaningful for a public audience.

Surprising and counter-intuitive facts and observations are part of the currency of science and are strong assets for catching attention and stimulating the imagination of an audience. Surprising elements that are counter-intuitive stimulate curiosity and encourage motivation to discover or find out more. Hearing that evaporation from the surface of one of the Great Lakes is measured in hundreds of cubic metres a second catches the imagination. The engagement effect can be multiplied if that is converted into an analogy, for instance comparing the evaporated volume to the size of a room in which a presentation is taking place. The effect can be emphasized if the audience is involved in the steps of the calculation.

To engage an audience about a topic is to ask them to critically think about what we are telling them – to construct a relational lattice between terms and facts and ideas. This demands from the audience a willing-

![Figure 1 | The Science Communication Pyramid](hypothesisjournal.com)
OPINION

Hypothesis

Vol. 8, No. 1

September 2010

hypothesisjournal.com

5

Animation, graphics and simulations that make it possible to imagine complex processes can produce moments of insight, understanding and interest. However, they quickly lose their impact if they are overloaded with unnecessary factual detail in the interest of conveying more content. It is important to set realistic goals for learning and engagement. Learning is largely a process of baby steps. Meaning is constructed by the audience and this takes time. In the design of a presentation one must choose those things that will be truly taught, and those that the audience will just be made aware of. A presentation must be realistic and honest about what it can accomplish.

Learning is largely a process of baby steps. Meaning is constructed by the audience and this takes time

Telling the Genomics story in the Club Genome Object Theatre at Science North

Object theatres at Science North are multimedia theatres for public audiences of about 25 to 30 people. Shows include narration over video on a main screen along with images and video on small secondary screens, with graphics and animation. Music, special effects (wind, mist and rain), and objects/models on the floor/ceiling (which are often animated and internally lit), complete the theatre. Objects play their role in supporting the story when they are selectively picked out by spot lighting at appropriate points in a 15 minute show (see Figure 2 and Figure 3).
Although the video on the main screen in the theatre carries the major part of the story, it does not play all the time during a show. The narrator or storyteller also speaks while the screen is dark and objects are lit or while some combination of secondary screen images and working models are active. The attention of the audience is therefore not limited to a single screen and the feeling of object theatre shows is very dynamic. A rich variety of engagement tools allows many combinations in support of complex science stories that have to be told in a short time of about 15 minutes. Every word and every image counts. Science North has used object theatres for telling the story of complex topics such as climate change, the brain, the science of neutrinos, and recently, genomics. We will use the genomics theatre, Club Genome, as an example of using engagement tools and the science communication pyramid to tell this science story.

Club Genome
Genomics is the study of genes and how they function. Research aims to decipher and understand the genome or all the genetic information encoded in the DNA of an organism, and how it functions in that particular organism. In contrast, investigating the activity of single genes or specific parts of an organism’s DNA, is the focus of genetics. Genomics is leading to new understanding of many genetically-based diseases and new ways to treat them.

The show in Club Genome is the story of “every living thing on the planet” (Table 1), the workings of DNA, and the great promise of genomics research. It was designed to convey an understanding of genomics and the function of genes in cells to a general public and family audience. Through the metaphor of music and a good deal of high quality animation, the show introduces the way DNA and genes work, the special properties of stem cells, and the very prom-

Figure 2 | A family audience inside the Club Genome Object Theatre at Science North. DNA bases are lit up in the curved “chromosome” benches. The main screen, showing images of twin girls, represents the nucleus of the cell.
is. All life on earth contains DNA and it is the differences in their DNA that accounts for the diversity of living things;
4. Genes are the specific sections of DNA code used, or expressed, by any given group of cells;
5. The genome of a species is its unique string of DNA;
6. The study of DNA is called genomics and has opened up new ways of treating many diseases.

Club Genome was designed to engage the general public in thinking about the amazingly complex chemical activity going on in their cells so that they can better understand the role played by DNA in this wonderful natural laboratory.

In addition, the show highlights that:

1. The trillions of cells in their own bodies are constantly using DNA every second of every day to carry on the activities of life;
2. DNA is a very long string of information used in cells to make the chemicals of living things;
3. All life on earth contains DNA and it is the differences in their DNA that accounts for the diversity of living things;
4. Genes are the specific sections of DNA code used, or expressed, by any given group of cells;
5. The genome of a species is its unique string of DNA;
6. The study of DNA is called genomics and has opened up new ways of treating many diseases.

The “skin” of the theatre or backdrop to the action simulates a cell membrane with several small ring screens for displaying backlit images. The cell nucleus is the main projection screen, and the audience sits on bar stools at curved translucent “chromosome” benches that are lit by periodically changing sequences of the bases in DNA (Figure 2). Part way through the show the
setting changes from the audience being inside a cell to inside a dance club, Club Genome. Jian Ghomeshi, the award winning Canadian broadcaster, narrates the show.

Use of Engagement Tools

After a short personal welcome and introduction from an exhibit floor “blue coat” (host), the show begins simply but powerfully as a glowing light illuminates a large beaker of DNA extracted from apples (Figure 3). It is real and looks disarmingly ordinary. The narrator describes it as “easily the most incredible substance on the face of the Earth” (Table 1), then profoundly as “well, .... life” (Table 1). It is said to be life in a way that is tentative and implies that there is more to it, but it is exactly the powerful, interest catching opening that a good story needs.

The analogy of DNA to a string of information, such as a musical score then introduces the music metaphor (Hellsten and

Table 1 | The action, narration and engagement tools explaining gene expression in Club Genome.

<table>
<thead>
<tr>
<th>ACTION</th>
<th>NARRATION</th>
<th>ENGAGEMENT TOOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>The theatre is dim as glowing light fades up inside a pedestal supporting a 5 litre glass jar containing white strands of extracted DNA suspended in water.</td>
<td>Look inside this beaker. Do you see the white stuff floating in there? That stuff is easily the most incredible substance on the face of the Earth.</td>
<td>* personal – involves audience * familiar - object (glass jar) is disarmingly ordinary * counter intuitive and motivating statement</td>
</tr>
<tr>
<td>Backlit image of an apple appears on one of the ring screens in the cell membrane. Soft images of an amoeba and a whale are on left and right sides of the cell membrane.</td>
<td>This particular sample was extracted from apples. But you can find it in every living thing on the planet, from the tiniest bacteria to the largest organisms. It's called nucleic acid and it’s .... well .... life.</td>
<td>* familiar apple * motivating statement * counter-intuitive and motivating statement</td>
</tr>
<tr>
<td>Main screen: a close-up image of strands of nucleic acid suspended in liquid. Images match actual strings — string, shoe laces</td>
<td>If you take a closer look, you notice that it is stringy. Lots of things around us are stringy - string for one thing... hair too...shoelaces...</td>
<td>* personal – involves audience * analogy to familiar material</td>
</tr>
<tr>
<td>Letter, binary and musical notes are animated on the main screen. Back to close up image of strands of DNA</td>
<td>But, there are other types of strings too. Like a string of letters that make up a sentence. Or a string of zeros and ones that a computer uses...or, even better, a string of notes that a musician performs. These strings contain information.</td>
<td>* extends analogy to familiar &quot;strings&quot; of information * introduces the music metaphor for the structure of DNA</td>
</tr>
</tbody>
</table>
Figure 4 | An image from the animations produced for Club Genome. The beautiful animations were stylized to match the color design of the theatre.

Nerlich, 2008) that is the main communication tool for the show (Table 1). It is used in two ways: first as a way of establishing the relationship between bases (musical notes), amino acids, and proteins (songs), and secondly as a way of situating the nucleus as the booth in the dance club, Club Genome, where all the information for the creation of proteins (playing of songs) is stored.

As the strings of DNA on the screen transform into animation of its molecular structure, the audience is brought into the story: “Now you recognize it” ... “the famous double helix” --addresses the audience as informed and intelligent observers of the action. That respectful relationship is reinforced throughout the show and the story is frequently made personal with phrases such as, “If you read a strand of your own DNA, it might read something like this: A-G-G-T-G-G-T-C ... and so on, and on and on, 3 billion letters long. But turn the bases into musical notes and play them ... and you start to hear the rhythm of life,” and, “Your DNA is about 99.5 % the same as the person beside you. That little difference, 0.5 % - is important. It is what makes your eyes their unique colour, or allows you to roll your tongue one way or another; or even determines how susceptible you are to certain diseases. Even a mouse has about 90% of the same DNA as a human...The counter-intuitive similarity of mouse and human DNA stimulates interest in learning more and epitomises the engaging value of such statements in shows as well as in live presentations. The opposite side of the same coin is the startling realization that just a 10% difference in DNA can have a profound result – a mouse instead of a human.

Inside the Dance Club
Activity inside the cell involving protein synthesis is portrayed first as a 40 second animated sequence accompanied by music but without narration (see Figure 4). It is a totally visual and emotional experience, amazing and even bewildering but accompanied by the realisation that this is some-
thing occurring inside everyone in the audience trillions of times a second.

From that state of wonder, the story for the audience becomes more concrete as the protein synthesis is replayed, step by step, with narration aided by a major shift in the music metaphor that gives its name to the show. The cell becomes a dance club, Club Genome with DNA isolated in a DJ booth, the nucleus, from which the instructions for “playing the hemoglobin song” and the “songs” for other proteins are carried by messenger RNA. Objects are also brought into the storytelling: the prominent model of RNA and its ribosome “music box”; a chain of amino acids, and a protein “disco” ball help break the process into steps. It is not expected that a first time visitor will remember those steps, but that they will at least appreciate that the processes have been recognized and understood by scientists.

Furthermore, while the details of the entire process may not stick with the audience, the explanation is accessible because it relies on familiarity with music to compare the relationship between DNA and proteins, to musical notes and a song. Having the audience understand DNA in this way is useful for what follows, in that the audience grasps the idea of the four bases of DNA holding a range of poten-

Table 2 | The action, narration and engagement tools explaining gene expression in Club Genome.

<table>
<thead>
<tr>
<th>ACTION</th>
<th>NARRATION</th>
<th>ENGAGEMENT TOOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main screen: more of genetics labs, medical footage, and computer output of genetic sequencing.</td>
<td>Genomics is maybe the greatest science endeavour of our time, because it is all about understanding ourselves from the inside out.</td>
<td>* personal</td>
</tr>
<tr>
<td>Picture of an apple illuminated in a ring screen in the cell wall (same as opening scene). The sound of biting into an apple. Main screen: an apple leaf and an apple. Animation of DNA appears in simulated microscopic views into leaf and fruit.</td>
<td>Here’s what I mean. Think about the apple and the apple leaf. They are very different: they look different, feel different, and taste different. Yet the cells in the leaf and the cells in the fruit have exactly the same DNA - apple DNA. The reason is that different genes are turned on, or expressed, in the leaf cells than in the fruit cells.</td>
<td>* familiar apple (and associated with extracted DNA in opening sequence). * counter-intuitive * motivates interest</td>
</tr>
<tr>
<td>Main screen: smiling young boy in a jaunty pose - photomicrographs of cells appear in succession adjacent to his heart, pancreas and brain</td>
<td>Your own cells work the same way - different cells express different genes. The cells in your heart only sing certain songs from your DNA songbook, different ones than your pancreas, or your brain cells.</td>
<td>* personal * recalls dance club metaphor</td>
</tr>
</tbody>
</table>
Table 3 | The action, narration and engagement tools explaining Stem cells in Club Genome.

<table>
<thead>
<tr>
<th>ACTION</th>
<th>NARRATION</th>
<th>ENGAGEMENT TOOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>The sound of the orchestra carries through into this scene. Lights illuminate instruments.</td>
<td>Most cells are like regular musical instruments - a tuba, a harmonica, a violin. And a tuba can't ever become a violin.</td>
<td>* analogy or extension of music metaphor to cells as instruments</td>
</tr>
<tr>
<td>Stem cells on screen</td>
<td>But there is one group of cells that doesn't play by the same rules: stem cells. You may have heard of them. A stem cell is more like an electronic synthesizer before any buttons have been pushed - it has options - it can still choose what type of instrument it will be.</td>
<td>* electronic synthesizer as an analogy for a stem cell</td>
</tr>
<tr>
<td>Main screen: fertilized egg to early stages of fetal development , ending with new born baby.</td>
<td>For instance, this single fertilized egg with a single copy of DNA, inherited from each parent, can develop into an entire human being with all its different parts. Each one of you developed from a few embryonic stem cells.</td>
<td>* personal</td>
</tr>
<tr>
<td>A Mexican salamander is illuminated in the cell membrane ring. On the screen, we see it regenerate a leg in time-lapse.</td>
<td>Here's another example. This is a Mexican Salamander. If a Mexican salamander looses a leg, this is what happens: it re-grows. It can do this thanks to special stem cells that collect at the wound.</td>
<td>* counter intuitive</td>
</tr>
<tr>
<td>Smiling young boy with cells visible in animated tissue samples linked to parts of the body</td>
<td>Your body also contains stem cells. They don't give you the ability to re-grow entire limbs, but stem cells are used throughout your body to heal different tissues.</td>
<td>* personal</td>
</tr>
<tr>
<td>Footage dissolves to a clump of embryonic stem cells. Repeat video of regeneration of salamander leg.</td>
<td>Imagine that you could turn on the same healing power in your stem cells as you see in this salamander. It is not as far-fetched as you might think</td>
<td>* motivating</td>
</tr>
<tr>
<td>Research laboratory footage. Light fades up on models of the spine and brain.</td>
<td>Stem cells are going to be a powerful tool for tackling many illnesses and injuries, from re-growing spinal cords in people who are paralyzed, to renewing brain cells in people affected by trauma.</td>
<td>* personal and high emotional impact</td>
</tr>
</tbody>
</table>
tials in the same way that the eight notes of music can create an infinite range of songs. So the design of the explanation is to give the audience an understanding they can apply in other places in the show. Moreover, walking through the steps and seeing them played out makes the process real and physical instead of just a nicely phrased description.

Apples
After the introduction of the ever-familiar apples in the opening sequence as the source of the extracted DNA in the glass jar, apples are recalled later in the show, this time to illustrate gene expression by pointing out that exactly the same DNA that creates the tasty apple also creates the less tasty apple leaf (Table 2). This sets up the question of how the same DNA can be the source of such different outcomes. Thus, the audience is led into the idea of gene expression and cell differentiation through their own familiarity with a very common lunch snack. It is then an easy step to ask them to think about their own bodies, and all the different tissues that their DNA has created.

This section is the first step in establishing the scope of genomics as being the understanding of the interplay of the many roles of all the genetic material in the nucleus of a cell.

Musical instruments and stem cells
The nature of stem cells is described using another variant of the music metaphor: musical instruments as analogues of different types of cells (Table 3). Very strik-

Table 4 | The action, narration and engagement tools in the concluding segment of Club Genome.

<table>
<thead>
<tr>
<th>ACTION</th>
<th>NARRATION</th>
<th>ENGAGEMENT TOOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>The music begins to build; the themes and rhythms heard throughout the show weave together to create an anthem of life. Images on the screen from throughout the show.</td>
<td>As each week passes, the music of DNA reveals more and more of its wonder. In science and medicine, this is the next big thing and it affects every one of us - because it is about every one of us.</td>
<td>* motivation</td>
</tr>
<tr>
<td>A glowing light on the beaker of extracted DNA that we opened the show with fades up. On the screen, a kaleidoscope of life - individuals, then groups - family, classroom, crowd ... and other species we share the planet with.</td>
<td>So this stuff - that looks so ordinary in this beaker - turns out to be pretty important.</td>
<td>* personal</td>
</tr>
<tr>
<td>Shadows of people on the cell wall dancing in time to the music. The entire theatre is pulsing to the beat. Big ending.</td>
<td>It allows us to be who we are: individual and unique living things that all dance to the beat of similar music.</td>
<td>* affective</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* affective  
* personal
ing and memorable time lapse footage of the re-growth of a salamander limb along with powerful images of a fetus from fertilization to birth establish the potential of stem cells dramatically, catch the audience’s attention and signal a new chapter in the story. Models of a human spine and brain are illuminated to point out possible applications of stem cells in treating injuries. Recognising that the show is too short to be able to explain stems cells explicitly, it offers instead a useful way to think about stem cells in contrast to regular differentiated cells: a tuba, and violin are lit up in the theatre and their sounds played. These represent differentiated cells – very specific expressions of DNA. These objects are followed by the analogue for a stem cell: a music synthesizer that has the capacity to be a variety of instruments. It is a strongly personalized and affective part of the story.

Researcher vignettes
At about the three quarter mark in the show, the audience has gained some familiarity with DNA, cell differentiation, gene expression and stem cells. These are essentially the core concepts on which modern research in genomics is conducted. However, it is important to show how this knowledge translates into useful medicine and technologies that have some bearing on the lives of those in the audience and society. Showcasing the work of two Canadian researchers in genomics shows that genomics is “maybe the greatest science endeavour of our time”: Dr. Amadeo Parisi from the North Eastern Ontario Regional Cancer Centre and his research on gene expression and chemotherapy responses give the audience a glimpse of the potential for personalized treatments. In addition, an interview with Dr. Stephen Scherer from the Hospital for Sick Children in Toronto describes how genomics is a “revolution in how researchers tackle diseases” and its application to his very powerful and emotional research into child autism.

These examples of current and ongoing research allow a final key point about genomics that sets it apart from traditional genetics: that genomics, its technologies and techniques, involves experiments that not only deal with complexity but also the sheer quantity of genetic activity in living cells. Once again, music allows for a useful analogy: “The power of genomics is its ability to listen in on the thousands of things that are happening inside a cell at any moment and make some sense of it. It’s like coming across an orchestra of a million musicians and being able to pick out a single French horn. Genomics takes a lot of time and patience but it’s going to mean a revolution in how researchers tackle disease.”

In September 2010, Dr. Scherer’s lab announced an important advance in genetic markers for autism. People who have seen the show might well have made the connection when this discovery was announced.

Full Circle
At the end of the show, Club Genome returns to the “this stuff that looks so ordinary in this beaker” that now “turns out to be pretty important” (Table 4). It brings the audience back to the ordinary looking, unremarkable white strands that were said, surprisingly at the beginning of the show, to be “easily the most incredible substance on the face of the Earth.” The audience now knows that DNA “allows us to be who we are: individual and unique living things that all dance to the beat of similar music.”

Like all good stories the show is a journey - an intimate, personal and emotional journey - as well as complex and scientific. As T.S Eliot wrote, “And the end of all our
exploring will be to arrive where we started and know the place for the first time.”

Conclusion
The basic principles of design and learning that engage an audience apply just as much to the creation of an effective speech or slide presentation as they do to a multi-media object theatre at Science North. The technology and special effects of a theatre are, of course, beyond those used in a Powerpoint presentation but the design principles embodied in the Science Communication Pyramid are just as appropriate. The same kinds of engagement tools can be used as successfully in a slide presentation as in a multimedia theatre: emotional factors, prior experience, knowledge and familiarity, metaphor and analogy, surprise and counter intuitiveness, interest and motivation. What is lost through simpler technology can be replaced by the body language and presence of the presenter. The screen should be rich in images that illustrate the story. They can, for example, portray metaphors and analogies, local context or microscopic detail to raise the interest and catalyze the imagination of the audience. The text of the story is for the voice of the presenter. The screen should not be used as a teleprompter but as an opportunity to create interest and engagement.

While emotion may be out of place in the doing of science, it is not misplaced in the communication of science. Engaging an audience in scientific discoveries, facts and theories requires a passionate presenter and an audience-centred presentation. Perhaps the most important aspect of the Science Communication Pyramid (Figure 1) is that it is not simply content driven. Communicating with public audiences depends more on storytelling and engagement tools than on the brilliance of the research and discoveries underlying the story.

Resources for further reading


Practice, Museum Education Roundtable, Washington, DC.


About the authors
David Pearson was the founding director of Science North. He is a Professor of Earth Sciences and Co-Director of the Laurentian University / Science North Graduate Program in Science Communication.

Chantal Barriault is Senior Scientist, Research and Evaluation at Science North as well as Co-Director of the Laurentian University / Science North Graduate Program in Science Communication.

Lowell Cochrane is the Chief Creative Officer at Show Communications and was the writer of the Club Genome Object Theatre show.