Teaching Science Using Stories: The Storyline Approach

by Aaron D. Isabelle

A story provides the missing link that makes learning meaningful.—Kieran Egan

Storytelling is an age-old and powerful means of communication that can be used as an effective teaching strategy in the science classroom. Listening to a story involves imagination, activation of prior experiences, knowledge, and imagery. A community of learners, characterized by inquiry and discovery, can be initiated through the process of storytelling.

The Storyline Approach is an inquiry-based teaching method based upon a strategy first introduced by Kieran Egan (1986). The story structure can provide students with a framework for concept formation and for the retention of the concept. The main characters of these stories are not fictitious; rather, the history of science is overflowing with scientists, philosophers, math-
ematically, and inventors from diverse backgrounds who each have their own story to tell. In this article, I describe my experiences implementing the Storyline Approach in the context of teaching the concept of air pressure to seventh- and eighth-grade students. I also offer story-shaping strategies and history-of-science resources to assist in the creation of your own story.

Narrative and the history of science
The use of narrative in science education has been the focus of increasing attention in recent years (Egan 2003; Groce 2004; Hadzigeorgiou 2006; Wieder 2006). Although researchers view narrative and its structure from different perspectives, there is agreement that narrative reflects a very basic, yet powerful, form of communication. For example, oral cultures have exploited, and continue to exploit, the sequential structure of narrative to aid memory; narrative plays a critical role in teaching children and in maintaining culture.

A historical presentation of science provides opportunities for students to "appreciate that scientific and mathematical progress does not amount simply to a series of incidental discoveries, but that the growth of science and math is characterized by feats of imagination and creativity" (Irwin 2000, p. 5). The history of science is "full of accidents and conjunctures and curious juxtapositions of events, and it demonstrates to us the complexity of human change and the unpredictable character of the ultimate consequences of any given act or decision" (Feyerabend 1988, p. 9). The aim of the Storyline Approach is to draw upon these dramatic episodes, amazing discoveries, and intriguing characters in the history of science as the basis for interesting storylines. This approach can motivate students and give them immediate access to the science topic by humanizing the subject matter (Egan 1997, p. 51).

Implementing the Storyline Approach
By employing the Launch, Explore, Summarize (LES) instructional model, the Storyline Approach takes on an inquiry-based structure for the exploration of a science concept (Burns 2000). (Note: The LES methodology is an analogous, condensed version of the Five Es instructional model.)

In the Launch phase of the LES method, the teacher typically uses probing questions to activate and elicit students' prior knowledge about the concept under investigation. This can also be done by stimulating students' thinking by offering physical objects to manipulate or a visual display to capture their attention. In the context of the Storyline Approach, this initial stimulus should be directly related to the concept that will be explored in the story and should be something that students are familiar with. For example, as part of a preactivity reflection for learning about the concept of air pressure, I give each student a set of suction cups in a cooperative group setting and offer the following directions:

Push the suction cups tightly together. In your cooperative group, discuss what is going on. Write your explanation in two or three sentences, or draw a picture to help convey your ideas.

After a brief discussion fueled by students' thinking, I transition to the Explore phase by stating, "Before we continue our discussion about why the suction cups stay tightly together, I'd first like to read you a story that may help you in your thinking." I read the story that I created, "Under Pressure" (see Figure 1). (Note: I distribute a copy of the story to each student, which is especially helpful for visual learners.) While reading about Otto von Guericke's experiment, I use an overhead projector to display the well-known drawing of the Magdeburg hemispheres experiment (see www.scienceandsociety.co.uk; search under "Magdeburg"). I find that showing this image not only helps to give students a much better impression of this historical event, but it is also an appropriate context to integrate a historical document. The drawing is used to help create a visual context for the story itself, rather than a way to compare the hemispheres and the suction cups. The teacher guides students in making a direct comparison between the hemispheres and the suction cups during the Summarize phase, after the story is read.

After reading the story, I discuss with students what is factual and what is not. As it is not my intention to distort students' views of history or any of the figures in the history of science, I place a special emphasis on the historically accurate components of the story.

I then transition to the Summarize phase by revisiting the stimulus provided during the Launch phase and make explicit connections to the ideas presented in the story. I ask students, "What is the connection between the suction cups and the Magdeburg hemispheres? How are they different? How are they similar?" To make this comparison more concrete, I introduce a smaller model of the Magdeberg hemispheres that is approximately 6 inches (15 cm) in diameter. (Note: Magdeberg hemispheres can be obtained from most science supply companies for approximately $30.) The science content conveyed through the story assists students in formulat-
There were only a couple days left until election day and the two candidates for mayor were preparing for the last big debate. The people of the town of Magdeburg, a small town in Germany, were all taking this election very seriously. There were a lot of serious issues at hand, like job opportunities and health care. But above all of the problems to be discussed, the people of Magdeburg wanted one problem solved more than any other: They wanted their mayor to put their town on the map: they wanted their town to be heard of and admired across the country! Berlin and Munich were cities in Germany that people spoke about all the time. But no one knew anything about Magdeburg; most people had never heard of such a town, never mind where it was in Germany.

"But what could the town of Magdeburg ever be famous for?" the people asked. It was not as large as Berlin or Munich. No one famous had ever been born there. Magdeburg didn't manufacture or produce anything important. Basically, Magdeburg was an average-sized town, with an average population; it had an average location; the lives of its citizens could even be considered to be quite average. Everything about the town of Magdeburg was average and the people were sick and tired of being just average. They wanted to be known as "The Great Town of Magdeburg" or "The Incredible Town of Magdeburg," or at the very least, "The Above Average Town of Magdeburg." The only problem was that they didn't know how to achieve this. That was why this election was so important to them. They wanted their new mayor to have an answer to their problem.

Well, the day of the big debate finally arrived. Excitement was in the air and the people were hopeful that their city would soon make a name for itself. All were attentive as the first of the two candidates stepped onto the stage. The first candidate for mayor, Hans, was the more experienced of the two. Hans had invested a lot of time and money into the town of Magdeburg and he was pretty confident that he would be the next mayor of Magdeburg. And, if this had been a normal election, Hans probably would've won. But, this was by no means a normal election. As experienced in politics as he was, he was also a very quiet, soft-spoken person. The crowd was so excited that Hans' soft-spoken nature was, unfortunately, not a good thing at that moment.

The people wanted someone on the platform as fired up and loud as they were. Hans quietly and calmly said, "I want to give this town a good name as much as you do. So, I have a plan to clean up this town. Magdeburg will be known as "The Cleanest Town in Germany..."

Someone at the back of the crowd interrupted Hans and shouted, "Speak up, Hans! We can't hear a word you're saying!"

Hans started to repeat his idea when another person yelled back, "He's talking about cleaning up the town or something like that..." Once the people heard what Hans had been saying, the whole crowd began to boo him and his idea. Granted, it was a good idea to clean up the town, but the people of Magdeburg were aiming a little higher than "Welcome to Magdeburg: The Cleanest Town in Germany."

As Hans walked off the stage, the crowd continued to grumble. In the midst of all the emotion, no one had even noticed that the next candidate for mayor, a person by the name of Otto, had walked onto the stage and was standing in front of them. Although Otto did not have the same political experience that Hans did, he not only had a bellowing voice, but he also had a way with crowds; he was quite an entertainer and a showman.

Otto suddenly spoke clearly and loudly: "My good people of Magdeburg. There is no reason for such anger. If you will all just calm down and gather around me, you will be able to witness my plan for making this town known to all of Germany."

Otto's calming, commanding presence affected the crowd and they began to settle down and walk closer to him to see what he had to say.

"My name is Otto—Otto Guericke [GAY-rih-kuh] [Hakim 2005, p. 218]. Most of you do not know me, but if you will lend me your eyes and your ears, I believe I will be able to help you. Now, what I have next to me might look strange to you, but it is simply a hollow bronze globe that I made with my own hands."

The crowd stared in surprise at the shiny metal globe that was about two feet wide (about 60 cm). They did not know what to make of this spectacle.

Otto continued speaking in the face of their amazement,
"As you can see, the bronze globe is cut in half so that the two halves of the globe can easily come apart."

He showed the crowd that the bronze globe could easily be separated in two and that the inside was completely hollow. When separated, it was like the two halves of an orange with the inside taken out. He then put the globe back together and showed the people that both halves fit tightly together.

Otto went on to say, "When I put the two halves of the globe together, the globe is airtight! That means that when the globe is together, nothing, not even air or water, can pass in or out."

To show them this, Otto forced the globe underwater for a few minutes. After he took the globe out of the water, he separated the two halves, showing that the inside of the globe was completely dry. Clearly, the two halves of the globe fit very tightly together.

Someone in the crowd then yelled out, "So what's the point, Otto? How is this globe going to make us famous?"

"Well," said Otto, "I want to make you all a proposition. I bet that once I put the two halves of this globe together that two teams of eight horses pulling on both sides of the globe will not be able to pull the globe apart."

"Another person in the crowd shouted, "This must be a joke... You just showed us how easily the globe can be pulled apart!"

"This is no joke!" said Otto authoritatively. "I'm very serious. So serious that if I'm right, word will spread all around Germany about this fantastic event in Magdeburg. You will be known as "The Great City of Magdeburg Where Anything is Possible," and I, Otto Guericke, will be your mayor."

At this point, as ridiculous as the idea sounded, the citizens of Magdeburg were willing to try anything. So, without hesitation, they cleared an area in the center of town and prepared two teams of eight horses to pull apart the bronze globe. On each side of the globe, Otto had attached solid brass rings. The horses were tied with ropes onto these rings so that there were eight horses on each side of the globe, ready to pull in opposite directions. Everything was ready to go.

Otto walked to the center of the crowd where the bronze globe and the horses were and said to the people, "What you are about to see is real. This is not some sort of magic show intended to fool you. Rather, what is going to happen here can be explained by science."

Otto then placed before the people an interesting-looking device. "What I have in my hands is a tool I constructed a few years ago. It is a type of air pump, but instead of pumping air into something (like a bicycle pump), this device pumps air out."

Otto attached the air pump to a small valve on the bronze globe and began to pump the air out of the globe. After a couple of minutes, he was finished and he said to the people, "All I did was take out most of the air that was inside the globe. Let the horses try to pull the globe apart now!"

At Otto's command, the horses were released. Most of the people in the crowd thought that the globe would immediately come apart, but it did not. One person in the crowd said, "This won't last. I'll give it a minute at the most." Surprisingly, more than a minute went by. At least five minutes went by and the horses were still pulling at hard as they could. Their hooves were even digging far into the dirt. They eventually had to stop the horses because they were tiring.

Otto then went over and opened the air valve in the globe, letting all of the air back in. As soon as he did this, the two halves of the globe fell right apart onto the ground.

Everyone in the crowd was in awe. One person remarked, "How is this possible? Anything else would've been torn apart in seconds by the power of those horses."

"Two words," said Otto. "Air pressure! You see, the air around us actually pushes upon us in all directions with great force. If you were under water, the pressure of the water would be pushing inward on every part of your body. Well, the same thing is happening right now with the air around us. Basically, we all live at the bottom of an ocean of air. In fact, the force of the air on our bodies is extremely large. There is close to 30,000 pounds of force (133,440 newtons) pushing upon our bodies, from all directions, right now!"

A person nearby said, "30,000 pounds? If 30,000 pounds were placed on one of us right now, that person would be crushed in a second. If what you say is true, why isn't the air pressure crushing us right now?"

Otto said, "That's a very good point. But remember, as we breathe, air enters our body, our bloodstream,
and our cells. Air exists in all of our tissues and body cavities. So, even though the air is pushing upon us with about 30,000 pounds, the air in our bodies is pushing out with the same force. So, we’re okay because the forces are balanced. If you could somehow take the air out of our bodies, then the air pressure around us would certainly crush us because there would be no air to exert an outward force from inside our bodies. The force of air pressure inside our bodies and outside our bodies would no longer be balanced.”

Otto went on to say, “That is exactly what I did in this demonstration. As long as there was air inside the globe, the two halves came apart quite easily. But, when I took most of the air out of the globe, there was hardly any air pressure left inside. I made a partial vacuum, or a space with hardly any air inside. When I did this, the air outside the globe was still pushing with 30,000 pounds, but there was very little air inside the globe to push back. In essence, the forces of air pressure were unbalanced. So, you have all that air on the outside pressing upon the globe from all directions, keeping it together. The only reason the globe wasn’t crushed by all that force was because it is made out of a strong metal. We saw the horses working against air pressure. Believe it or not, those horses were no match for 30,000 pounds of force exerted by the air on the globe.

One of the leaders of the town spoke up and said, “This is truly amazing. But I wouldn’t have believed it if I hadn’t seen it with my own eyes. I don’t think other people will believe us when we tell them. They’ll just say, ‘It’s just those average people from Magdeburg desperately trying to be famous again.’”

“Well,” said Otto, “if you elect me to be the new mayor of Magdeburg, I will call the bronze globe the Magdeburg hemispheres and I will tour the countryside to carry out this experiment. Everyone in Germany will be shocked and delighted. People will come from miles away to see the indestructible Magdeburg hemispheres and every one will say, ‘Magdeburg is truly an amazing town where anything is possible!’”

All the townspeople cheered with happiness for they knew their town would finally go down into history as great. They all carried Otto Guericke to the town hall and swore him in as their mayor. From that moment on, he became Otto “von” Guericke in respect for his new position.

It was quite a day in Magdeburg’s history. It was also quite a day for Otto von Guericke. Just like his globe, he was under a lot of pressure in front of all those angry people. He knew that if his experiment hadn’t worked, he would’ve faced a rioting crowd. But Otto seemed so confident about the demonstration that there didn’t appear to be a doubt in his mind. “Never let them see you sweat,” the expression goes. But, if everyone could’ve only heard what was going on in Otto’s mind:

Is the bronze strong enough to withstand the air pressure?
Are the halves fitting tightly together so no air will leak in?
Does the air pump work correctly?
Did I pump out enough air?
Are the horses stronger than I calculated?
Do I really want to be mayor?

In any case, putting all doubts aside, the day was a success for all. And even though most people have never heard of the town Magdeburg, Germany, today, I’m sure it was a pretty popular place 350 years ago.

THE END

Fact:
- Otto was the Burgomeister (or Burgomaster, similar to a mayor) in Magdeburg, Germany, in the 17th century. He lived from 1602–1686.
- Otto was a scientist and inventor, but preferred conducting experiments on a large scale.
- He was a showman; the bigger the spectacle the better!
- His Magdeburg hemisphere experiment did actually occur in 1654 and did bring fame to Magdeburg.

Fiction:
- Otto did not conduct his experiment for the purpose of becoming mayor.
- Hans is a fictitious character.
- Otto did not actually tour the countryside with his globe; however, word did spread about this amazing display of air pressure and became a popular teaching device.
TEACHING SCIENCE USING STORIES

ing scientifically appropriate ideas. The following explanation represents a target student response: “Although the Magdeburg hemispheres are rigid and the suction cups are flexible, both objects stay tightly together because a partial vacuum is formed inside; the air on the outside pushes the parts together. An air pump removes most of the air from inside the hemispheres; however, most of the air is pushed out between the suction cups when they are forced together.” I also reinforce the learning of the concept by introducing other real-world experiences that exhibit the same underlying science principle, such as why your ears pop when you fly in an airplane and why the liquid in a barometer rises and falls. Thinking about the same concept in various familiar settings not only helps students to make more meaningful connections, but also assists them in developing a deeper understanding of the concept.

As a postactivity reflection, I ask students to write down what they learned: “Now that you have listened to the story ‘Under Pressure,’ and we have discussed how the suction cups are staying together, in two or three sentences explain what you have learned, or draw a picture to help convey your understanding. If what you learned is different from your initial ideas, explain how your knowledge has changed.” (Note: Pre- and postactivity reflection directions have been included as part of a student task sheet in Figure 2. A comparison of students’ pre- and postresponses can serve as a formative assessment instrument to monitor student learning.)

As part of our final discussion, students often ask, “Why 30,000 pounds? Where does this number come from?” I explain that air pressure is defined as the force per area exerted on a surface by air molecules. The fundamental unit for air pressure in the SI system is the pascal, which is equivalent to a newton per square meter; standard atmospheric pressure is 101,325 pascals (Pa) or 101.325 kilopascals (kPa) (Serway and Faughn 2003, p. 265–66). Standard atmospheric pressure, as defined in the United States, is 1 atmosphere or 14.7 pounds per square inch (psi) at sea level. This leads to a discussion about the surface area of the original Magdeberg hemispheres, which were approximately 1 square meter or 2,000 square inches. Because standard atmospheric pressure is 14.7 psi, there was a net force of 29,400 (or approximately 30,000) pounds pushing on 2,000 square inches of surface area of the hemispheres. (Note: In the SI system, 1 pound of force is equal to a 4.448 newton-force; therefore, 30,000 pounds of force

FIGURE 2 Student task sheet

Preactivity reflection

Directions—Push the suction cups tightly together. In your cooperative group, discuss what is happening. Write your explanation in two or three sentences, or draw a picture to help convey your ideas.

Postactivity reflection

Directions—Now that you have listened to the story “Under Pressure,” and we have discussed how the suction cups are staying together, explain in two or three sentences what you have learned, or draw a picture to help convey your understanding. If what you learned is different from your initial ideas, explain how your knowledge has changed.
FIGURE 3

Ten steps for story shaping

1. What science concept will my story teach?
   - Choose a science concept that will be the topic of your story (e.g., air pressure).
   - Decide exactly what you want your students to learn about that concept (e.g., hurricanes are living in a sea of air and that air exerts a tremendous amount of force on us, pushing on our bodies and on all objects from all directions).

2. Become an expert on your science topic.
   - You should be able to explain your science concept both clearly and accurately in the story.
   - Know the developmental level of your audience. Your explanation should not be too complex, confusing, or so simple that it could be misleading.

3. Research the history of the particular science concept that you chose.
   - What scientists or inventors were involved in a particular discovery, theory, or invention?
   - What obstacles were encountered, if any?
   - Is there something interesting about the main characters' personalities?
   - Is there something dramatic or emotional that is inherent in the stones of their lives?

4. Find something interesting or dramatic in the history of science.
   - It is very important to locate some dramatic incident, character, or idea that will provide immediate access to the topic and excite students' curiosity and interest.
   - Develop your central character and storyline so that students can become emotionally invested in the story; they need to find the story both meaningful and interesting. Strong, interesting characters are essential to good stories.

5. Relate the story to your target audience.
   - Develop a storyline that is affectively charged and that students can relate to. Use your creativity in combination with ideas and events from the history of science. Try not to stray too far from historical facts.

6. Set up a sense of tension or conflict in your story.
   - Any good story has some sort of problem to be solved or question to be answered.
   - By planting an element in the story that will come to fruition later, you create a sense of expectation and anticipation for your students. Develop the plot of the story.

7. Use dialogue between the characters.
   - Dialogue is a very useful tool, not only to help infuse a scientific explanation into your story, but also to help bring your characters to life.
   - Using dialogue, one character can explain a scientific idea or theory to another character. The characters engage in discourse about the concept until it is understood; this strategy attempts to mirror your students' own learning process and difficulties that they may face in understanding the concept.

8. Your science concept will solve the problem: science to the rescue!
   - Your science concept should be used as a means of solving the problem or answering the question that you have set up in the story.
   - The entire story has been building up to this point when the sense of expectation or anticipation is finally satisfied.
   - Your science idea, explained through dialogue, should offer a reasonable solution to the problem.
9. Create a title for your story.

- Now that you have written your story, you will be in a better position to create a catchy title. The title could be funny, witty, or simply appropriate for the science content being taught.
- Story titles that I created include "Under Pressure" (air pressure), "All Fired Up" (the nature of heat), "Newton’s Apple Cider" (gravity), "Archimedes Needs a Bath" (density), and "Chasing Rainbows" (refraction of light).

10. Fact vs. fiction.

- It is very important to list at the end of your story the ideas that are historically accurate and the ideas that were fabricated for the purpose of making an interesting and engaging story.
- The goal is not to distort your students’ views of history or of the characters in the history of science. You are simply attempting to make the content more meaningful and accessible to them.

is equivalent to 133,440 newtons.) I emphasize the fact that an average-sized human being has a body surface area of approximately 2,000 sq. inches (1 sq. meter). Therefore, similar to the Magdeberg hemispheres, an average-sized person also experiences a net force of approximately 30,000 pounds pushing from all directions by the air molecules (Glashow 1994, p. 164-65).

Extensions

The next logical step in learning about air pressure is gaining an understanding about how air pressure can change. The reference to the real-world example of "liquid in a barometer rises and falls" could lead to an extension activity about the relationship between air pressure and weather; students could create their own barometers and use them to track changes in weather conditions. The reference to why your ears pop when you fly in an airplane could lead to an extension activity about the relationship between air pressure and sea level; the classic collapsing-soda-bottle experiment could be used to demonstrate this idea.

Story shaping

Because the story itself is a major component of the Storyline Approach, it is important for students to get to know the central characters in the story and for the story to contain a plot that highlights something interesting or dramatic in the history of science (see Figure 3 for Ten Steps for Story Shaping). Students need to become invested in the story, the characters, and the action. In doing so, students become part of the story; in other words, they enter into it. The teacher and students become an integral part of the inquiry process as the story unfolds and the concept is explored: mental images are formed, emotional states are highlighted, prior knowledge and experiences are activated, questions are raised, and meaning is negotiated (Lipke 1996, p. 8).

When constructing a story, Egan (2003) states, “We must start with what is most profoundly known by the student and build new knowledge on that basis” (p. 444). This not only includes activating students’ prior conceptual knowledge, but it also entails highlighting what is affectively or emotionally important to students in their everyday lives. Therefore, according to Egan, when constructing a story, it is essential to identify what is most “affectively charged for your audience” (Egan 1997, p. 248). From my experiences, I have found that the most affectively laden topics for middle school students pertain to friends and social interactions, the demarcation between male and female groups, as well as identity formation. In the construction of my story, “Under Pressure,” I specifically focused on two particular themes: identity lost vs. identity found (i.e., the citizens of the town of Magdeburg wanted to be recognized as important) and stressed vs. relaxed (i.e., Otto von Guericke had to prove himself; he was under a lot of pressure to succeed). By connecting a dramatic episode in the history of science with a topic that is affectively charged, the science content can become more accessible and meaningful for students (see History of Science Resources for websites to assist in story shaping). Effective story shaping therefore requires (1) identifying and using episodes of the history of science to provide an interesting story line; (2) highlighting and developing affectively charged topics to orient students to the new information and to help make the new sci-
### FIGURE 4
Sample science topics, history of science connections, and resources

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<td>Incandescent light</td>
<td>Thomas Edison, Joseph Swan</td>
<td><a href="http://www.thefrontpage.net/the-history-of-the-light-bulb.html">www.thefrontpage.net/the-history-of-the-light-bulb.html</a></td>
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<td><a href="http://americanhistory.si.edu/lighting/bios/swan.htm">http://americanhistory.si.edu/lighting/bios/swan.htm</a></td>
</tr>
</tbody>
</table>

Science content easier to grasp; and (3) infusing science content into the story at various points and explaining the concept through dialogue among the characters.

Having successfully utilized the Storyline Approach with middle school students, as well as with preservice and in-service teachers, I invite you to implement this teaching strategy in your own classroom and to develop your own story (see Figure 4 for a sample listing of science topics along with connections to the history of science and applicable informational websites). You might also consider a collaborative story lesson construction project as part of a district curriculum initiative. Although story shaping can prove to be a challenging and time-consuming task, the positive outcomes with regard to both student learning and motivation are well worth the effort.

### References


Clary, R.M., and J.H. Wandersee. 2006. Mary Anning:
She's more than "seller of sea shells at the seashore." American Biology Teacher 68 (3): 153–57.


History of Science Resources
Accomplishments and profiles of Chicano/Latino and Native American scientists—www2.sacnas.org/biography/default.asp

African American scientists and inventors—www.infoplease.com/spot/bhmscientists1.html#scientists

Eric Weisstein's world of scientific biography—http://scienceworld.wolfram.com/biography

Use the "search site" feature by typing in a science concept; the results should give you one or more links to scientists related to your concept.

Famous Hispanic scientists—http://coloquio.com/famosos/science.html


History of science—www.ou.edu/cas/hsci/rel-site.htm

HyperHistory online—www.hyperhistory.com/online_n2/History_n2/a.html

Click on "people" and then click on the "alphabetical index."


Click on "biographies."

Internet history of science sourcebook—www.fordham.edu/halsall/science/sciencesbook.html

History of science content is organized by specific cultures and by particular periods of thought.


Scientists and inventors with special needs—www.reddisability.org.uk/famous/DisFamScience.htm

Timelinescience—www.timelinescience.org/index.php

Click on the dates on the timeline or use the search feature.

Twentieth-century women in physics—http://owp.library.ucla.edu/dev/photopage1.1.html

Search the archive or browse the annotated photo gallery.

Visionlearning library—www.visionlearning.com/library

Find a science concept in the interest categories or use the search feature. Biographies are offered both in the learning modules and as links.

Women in science—www.astr.ua.edu/4000WS/discipline.shtml

Women in science are listed by discipline.

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