

## Charles Hirshberg, “My Mother, the Scientist” – Grade 7

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**Learning Objective:** The goal of this three day exemplar is to give students the opportunity to use the reading and writing habits they’ve been practicing on a regular basis to absorb deep lessons from Charles Hirshberg’s recollections of his mother. By reading and rereading the passage closely and focusing their reading through a series of questions and discussion about the text, students will identify how much his mother’s struggles and accomplishments meant to both him and the wider world. When combined with writing about the passage—and possibly pairing this exemplar study with Richard Feynman’s memoir “The Making of a Scientist”—students will discover how much they can learn from this mixed genre memoir/biography about what inspires life choices.

**Reading Task:** *Students will silently read the passage in question on a given day—first independently and then following along with the text as the teacher and/or skillful students read aloud. Depending on the difficulties of a given text and the teacher’s knowledge of the fluency abilities of students, the order of the student silent read and the teacher reading aloud with students following might be reversed. With this piece, given its length, the students will read the first day’s selection, and then the teacher will read aloud the entire piece during the first day of instruction. What is important is to allow all students to interact with challenging text on their own as frequently and independently as possible. Students will then reread specific passages in response to a set of concise, text-dependent questions that compel them to examine the meaning and structure of Hirshberg’s prose. Therefore, rereading is deliberately built into the instructional unit.*

**Vocabulary Task:** *Most of the meanings of words in the exemplar text can be discovered by students from careful reading of the context in which they appear. Teachers can use discussions to model and reinforce how to learn vocabulary from contextual clues, and students must be held accountable for engaging in this practice. Where it is judged this is not possible, underlined words are defined briefly for students to the right of the text in a separate column whenever the original text is reproduced. At times, this is all the support these defined words need. At other times, particularly with abstract words, teachers will need to spend more time explaining and discussing them. In addition, in subsequent close readings of passages of the text, high value academic (‘Tier Two’) words have been **bolded** to draw attention to them. Given how crucial vocabulary knowledge is for academic and career success, it is essential that these high value words be discussed and lingered over during the instructional sequence.*

**Sentence Syntax Task:** *On occasion, students will encounter particularly difficult sentences to decode. Teachers should engage in a close examination of such sentences to help students discover how they are built and how they convey meaning. While many questions addressing important aspects of the text double as questions about syntax, students should receive regular supported practice in deciphering complex sentences. It is crucial that the help they receive in unpacking text complexity focuses both on the precise meaning of what the author is saying and why the author might have constructed the sentence in this particular fashion. That practice will in turn support students’ ability to unpack meaning from syntactically complex sentences they encounter in future reading.*



**Discussion Task:** *Students will discuss the exemplar text in depth with their teacher and their classmates, performing activities that result in a close reading of Hirshberg's piece. The goal is to foster student confidence when encountering complex text and to reinforce the skills they have acquired regarding how to build and extend their understanding of a text. A general principle is to always reread the passage that provides evidence for the question under discussion. This gives students another encounter with the text, helping them develop fluency and reinforcing their use of text evidence.*

**Writing Task:** *Students will paraphrase different sentences and paragraphs of Hirshberg's memoir and then write an informal explanatory essay detailing how one of the interactions between him and his father illustrates a deeper lesson. Teachers might afford students the opportunity to revise their in-class paraphrases after participating in classroom discussion or even rewrite their explanation after receiving teacher feedback, allowing them to refashion both their understanding of the text and their expression of that understanding.*

**Text Selection:** This exemplar text was written by the subject's son, who is a writer. He wrote this for *Popular Science* magazine for a Mother's Day edition in 2002. He writes with deep appreciation of his mother's determination to be a scientist in the face of adversity. The compelling stories offer vivid and concrete avenues for exploration and close reading.

**Outline of Lesson Plan:** This lesson can be delivered in three or four days of instruction and reflection on the part of students and their teacher. Reasons for extending the discussion regarding "My Mother, the Scientist" to four periods of instruction include taking more time to unpack the rich array of ideas explored in this piece, taking more time to look closely at academic vocabulary, or working with the writing prompt under direct teacher supervision.

**Standards Addressed:** The following Common Core State Standards are the focus of this exemplar: RI.7.1, RI.7.2, RI.7.3, RI.7.5, RI.7.6; W.7.1, W.7.2, W.7.4, W.7.9; SL.7.1.

**The Text: Hirshberg, Charles. “My Mother, the Scientist”**

Exemplar Text	Vocabulary

In 1966, Mrs. Weddle's first grade class at Las Lomas Elementary School got its first homework assignment: We were to find out what our fathers did for a living, then come back and tell the class. The next day, as my well-scrubbed classmates boasted about their fathers, I was nervous. For one thing, I was afraid of Mrs. Weddle: I realize now that she was probably harmless, but to a shy, elf-size, nervous little guy she looked like a monstrous, talking baked potato. On top of that, I had a surprise in store, and I wasn't sure how it would be received. "My daddy is a scientist," I said, and Mrs. Weddle turned to write this information on the blackboard. Then I dropped the bomb: "And my mommy is a scientist!" Twenty-five pairs of first-grade eyes drew a bead on me, wondering what the hell I was talking about. It was then that I began to understand how unusual my mother was.

*clean and shiny*

Today, after more than four decades of geophysical research, my mother, Joan Feynman, is getting ready to retire as a senior scientist at NASA's Jet Propulsion Laboratory. She is probably best known for developing a statistical model to calculate the number of high-energy particles likely to hit a spacecraft over its lifetime, and for her method of predicting sun spot cycles. Both are used by scientists worldwide. Beyond this, however, my mother's career illustrates the enormous change in how America regards what was, only a few decades ago, extremely rare: a scientist who's a woman and also a mother.

*ten years; the study of the earth and its relationship to the rest of the universe; a model that uses numbers to show an idea*

To become a scientist is hard enough. But to become one while running a gauntlet of lies, insults, mockeries, and disapproval-this was what my mother had to do. If such treatment is unthinkable (or, at least, unusual) today, it is largely because my mother and other female scientists of her generation proved equal to every obstacle thrown in their way.

My introduction to chemistry came in 1970, on a day when my mom was baking challah bread for the Jewish New Year. I was about 10, and though I felt cooking was unmanly for a guy who played shortstop for Village Host Pizza in the Menlo Park, California, Little League, she had persuaded me to help. When the bread was in the oven, she gave me a plastic pill bottle and a cork. She told me to sprinkle a little baking soda into the bottle, then a little vinegar, and cork the bottle as fast as I could. There followed a violent and completely unexpected pop as the cork flew off and walloped me in the forehead. Exploding food: I was ecstatic! "That's called a chemical reaction," she said, rubbing my shirt clean. "The vinegar is an acid and the soda is a base, and that's what happens when you mix the two."

*fluffy bread made with eggs*

After that, I never understood what other kids meant when they said that science was boring.

One of my mother's earliest memories is of standing in her crib at the age of about 2, yanking on her 11-year-old brother's hair. This brother, her only sibling, was none other than Richard Feynman, destined to become one of the greatest theoretical physicists of his generation: enfant terrible of the Manhattan Project, pioneer of quantum electrodynamics, father of nanotechnology, winner of the Nobel Prize, and so on. At the time, he was training his sister to solve simple math problems and rewarding each correct answer by letting her tug on his hair while he made faces. When he wasn't doing that, he was often seen wandering around Far Rockaway, New York, with a screwdriver in his pocket, repairing radios-at age 11, mind you.

*Scientist who studies concepts of the physical world; someone who says and does whatever he wants even if it is embarrassing or shocking*

My mother worshipped her brother, and there was never any doubt about what he would become. By the time she was 5, Richard had hired her for 2 cents a week to assist him in the electronics lab he'd built in his room. "My job was to throw certain switches on command," she recalls. "I had to climb up on a box to reach them. Also, sometimes I'd stick my finger in a spark gap for the edification of his friends." At night, when she called out for a glass of water, Riddy, as he was called, would demonstrate centrifugal force by whirling it around in the air so that the glass was upside down during part of the arc. "Until, one night," my mother recalls, "the glass slipped out of his hand and flew across the room."

*education*

Richard explained the miraculous fact that the family dog, the waffle iron, and Joan herself were all made out of atoms. He would run her hand over the corner of a picture frame, describe a right triangle and make her repeat that the sum of the square of the sides was equal to the square of the hypotenuse. "I had no idea what it meant," she says, "but he recited it like a poem, so I loved to recite it too." One night, he roused her from her bed and led her outside, down the street, and onto a nearby golf course. He pointed out washes of magnificent light that were streaking across the sky. It was the aurora borealis. My mother had discovered her destiny.

That is when the trouble started. Her mother, Lucille Feynman, was a sophisticated and compassionate woman who had marched for women's suffrage in her youth. Nonetheless, when 8-year-old Joanie announced that she intended to be a scientist, Grandma explained that it was impossible. "Women can't do science," she said, "because their brains can't understand enough of it." My mother climbed into a living room chair and sobbed into the cushion. "I know she thought she was telling me the inescapable truth. But it was devastating for a little girl to be told that all of her dreams were impossible. And I've doubted my abilities ever since."

*the fight for women's right to vote*

The fact that the greatest chemist of the age, Marie Curie, was a woman gave no comfort. "To me, Madame Curie was a mythological character," my mother says, "not a real person whom you could strive to emulate." It wasn't until her 14th birthday-March 31, 1942-that her notion of becoming a scientist was revived. Richard presented her with a book called Astronomy. "It was a college textbook. I'd start reading it, get stuck, and then start over again."

*imitate or try to be like*

This went on for months, but I kept at it. When I reached page 407, I came across a graph that changed my life." My mother shuts her eyes and recites from memory: "'Relative strengths of the Mg+ absorption line at 4,481 angstroms . . . from Stellar Atmospheres by Cecilia Payne.' Cecilia Payne! It was scientific proof that a woman was capable of writing a book that, in turn, was quoted in a text. The secret was out, you see."

*My mother taught me about resonances when I was about 12. We were on a camping trip and needed wood for a fire. My brother and sister and I looked everywhere, without luck. Mom spotted a dead branch up in a tree. She walked up to the trunk and gave it a shake. "Look closely," she told us, pointing up at the branches. "Each branch waves at a different frequency." We could see that she was right. So what? "Watch the dead branch," she went on. "If we shake the tree trunk in just the right rhythm, we can match its frequency and it'll drop off." Soon we were roasting marshmallows.*

The catalog of abuse to which my mother was subjected, beginning in 1944 when she entered Oberlin College, is too long and relentless to fully record. At Oberlin, her lab partner was ill-prepared for the advanced-level physics course in which they were enrolled, so my mother did all the experiments herself. The partner took copious notes and received an A. My mother got a D. "He understands what he's doing," the lab instructor explained, "and you don't." In graduate school, a professor of solid state physics advised her to do her Ph.D. dissertation on cobwebs, because she would encounter them while cleaning. She did not take the advice; her thesis was titled "Absorption of infrared radiation in crystals of diamond-type lattice structure." After graduation, she found that the "Situations Wanted" section of The New York Times was divided between Men and Women, and she could not place an ad among the men, the only place anyone needing a research scientist would bother to look.

*a book-length essay  
or report written to  
achieve a specialized  
degree*

At that time, even the dean of women at Columbia University argued that "sensible motherhood" was "the most useful and satisfying of the jobs that women can do." My mother tried to be a sensible mother and it damn near killed her. For three years, she cooked, cleaned, and looked after my brother and me, two stubborn and voluble babies.

*noisy, talkative*

One day in 1964 she found herself preparing to hurl the dish drain through the kitchen window and decided to get professional help. "I was incredibly lucky," she remembers, "to find a shrink who was enlightened enough to urge me to try to get a job. I didn't think anyone would hire me, but I did what he told me to do." She applied to Lamont-Doherty Observatory and, to her astonishment, received three offers. She chose to work part-time, studying the relationship between the solar wind and the magnetosphere. Soon she would be among the first to announce that the magnetosphere-the part of space in which Earth's magnetic field dominates and the solar wind doesn't enter-was open-ended, with a tail on one side, rather than having a closed-teardrop shape, as had been widely believed. She was off and running.

*educated, open-minded*

*My mother introduced me to physics when I was about 14. I was crazy about bluegrass music, and learned that Ralph Stanley was coming to town with his Clinch Mountain Boys. Although Mom did not share my taste for hillbilly music, she agreed to take me. The highlight turned out to be fiddler Curly Ray Cline's version of "Orange Blossom Special," a barn burner in which the fiddle imitates the sound of an approaching and departing train. My mother stood and danced a buck-and-wing and when, to my great relief, she sat down, she said, "Great tune, huh? It's based on the Doppler effect." This is not the sort of thing one expects to hear in reference to Curly Ray Cline's repertoire. Later, over onion rings at the Rockybilt Cafe, she explained: "When the train is coming, its sound is shifting to higher frequencies. And when the train is leaving, its sound is shifting to lower frequencies. That's called the Doppler shift. You can see the same thing when you look at a star: if the light source is moving toward you, it shifts toward blue; if it's moving away, it shifts toward red. Most stars shift toward red because the universe is expanding."*

I cannot pretend that, as a boy, I liked everything about having a scientist for a mother. When I saw the likes of Mrs. Brady on TV, I sometimes wished I had what I thought of as a mom with an apron. And then, abruptly, I got one.

It was 1971 and my mother was working for NASA at Ames Research Center in California. She had just made an important discovery concerning the solar wind, which has two states, steady and transient. The latter consists of puffs of material, also known as coronal mass ejections, which, though long known about, were notoriously hard to find. My mother showed they could be recognized by the large amount of helium in the solar wind. Her career was flourishing. But the economy was in recession and NASA's budget was slashed. My mother was a housewife again. For months, as she looked for work, the severe depression that had haunted her years before began to return.

*changing,  
moving  
frequently;  
having a bad  
reputation for  
something*

Mom had been taught to turn to the synagogue in times of trouble, and it seemed to make especially good sense in this case, because our synagogue had more scientists in it than most Ivy League universities. Our rabbi, a celebrated civil rights activist, was arranging networking parties for unemployed eggheads. But when my mother asked for an invitation to one of these affairs, he accused her of being selfish. "After all-there are men out of work just now."

*Jewish house of*

*worship slang for highly  
educated people*

"But Rabbi," she said, "it's my life."

I remember her coming home that night, stuffing food into the refrigerator, then pulling out the vacuum cleaner. She switched it on, pushed it back and forth across the floor a few times, then switched it off and burst into tears. In a moment, I was crying too and my mother was comforting me. We sat there a long time.

"I know you want me here," she told me. "But I can either be a part-time mama, or a full-time madwoman."

A few months later, Mom was hired as a research scientist at the National Center for Atmospheric Research, and we moved to Boulder, Colorado. From then on, she decided to "follow research funding around the country, like



Laplanders follow the reindeer herds." She followed it to Washington, D.C., to work for the National Science Foundation, then to the Boston College Department of Physics, and finally, in 1985, to JPL, where she's been ever since. Along the way, she unlocked some of the mysteries of the aurora. Using data from Explorer 33, she showed that auroras occur when the magnetic field of the solar wind interacts with the magnetic field of the Earth.

*each affects (acts upon) the other*

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her professional association, the American Geophysical Union, and spearheaded a committee to ensure that women in her field would be treated fairly. She was named one of JPL's elite senior scientists in 1999 and the following year was awarded NASA's Exceptional Scientific Achievement Medal.

Soon she'll retire, except that retirement as my mother the scientist envisions it means embarking on a new project: comparing recent changes in Earth's climate with historic ones. "It's a pretty important subject when you consider that even a small change in the solar output could conceivably turn Long Island into a skating rink-just like it was some 10,000 years ago."

*The first thing I did when I came home from Mrs. Weddle's class that day in 1966 was to ask my mother what my father did. She told me that he was a scientist, and that she was a scientist too. I asked what a scientist was, and she handed me a spoon. "Drop it on the table," she said. I let it fall to the floor. "Why did it fall?" she asked. "Why didn't it float up to the ceiling?" It had never occurred to me that there was a "why" involved. "Because of gravity," she said. "A spoon will always fall, a hot-air balloon will always rise." I dropped the spoon again and again until she made me stop. I had no idea what gravity was, but the idea of "Why?" kept rattling around in my head. That's when I made the decision: the next day, in school, I wouldn't just tell them what my father did. I'd tell them about my mother too.*

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**Day One: Instructional Exemplar for Hirshberg’s “My Mother, the Scientist”**

**Summary of Activities**

- 1. Teacher introduces the day’s passage with minimal commentary and students read it independently (5 minutes)
- 2. Teacher or a skillful reader then reads the passage out loud to the class as students follow along in the text (5 minutes)
- 3. Teacher asks the class to discuss the first set of text-dependent questions and perform targeted tasks about the passage, with answers in the form of notes, annotations to the text, or more formal responses as appropriate (40 minutes)
- 4. For homework, teacher asks students to answer a question on their own

<div>T e x t</div> <div>U n d e r</div> <div>D i s c u s s i o n</div>	<div>Directions for Teachers/Guiding Questions For Students</div>
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<p>In 1966, Mrs. Weddle's first grade class at Las Lomas Elementary School got its first homework assignment: We were to find out what our fathers did for a living, then come back and tell the class. The next day, as my well-scrubbed classmates boasted about their fathers, I was nervous. For one thing, I was afraid of Mrs. Weddle: I realize now that she was probably harmless, but to a shy, elf-size, nervous little guy she looked like a monstrous, talking baked potato. On top of that, I had a surprise in store, and I wasn't sure how it would be received.</p> <p>[read the intervening paragraphs]</p> <p>After that, I never understood what other kids meant when they said that science was boring.</p>	<p><i>clean and shiny</i></p>	<p><b>1. Introduce the passage and students read independently.</b></p> <p>Other than giving the brief definitions offered to words students would likely not be able to define from context (underlined in the text), avoid giving any background context or instructional guidance at the outset of the lesson while students are reading the text silently. This close reading approach forces students to rely exclusively on the text instead of privileging background knowledge and levels the playing field for all students as they seek to comprehend Hirshberg's prose. It is critical to cultivating independence and creating a culture of close reading that students initially grapple with rich texts like Hirshberg's piece without the aid of prefatory material, extensive notes, or even teacher explanations.</p> <p><b>2. Read the passage out loud to the class as students follow along in the text.</b></p> <p>Asking students to listen to Hirshberg's piece exposes students a second time to the rhythms and meaning of Hirshberg's language before they begin their own close reading of the passage. Speaking clearly and carefully will allow students to follow Hirshberg's narrative, and reading out loud with students following along improves fluency while offering all students access to this complex text. Accurate and skillful modeling of the reading provides students who may be dysfluent with accurate pronunciations and syntactic patterns of English.</p>
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**Directions for Teachers/Guiding Questions For Students**

In 1966, Mrs. Weddle's first grade class at Las Lomas Elementary School got its first homework assignment: We were to find out what our fathers did for a living, then come back and tell the class. The next day, as my well-scrubbed classmates boasted about their fathers, I was nervous. For one thing, I was afraid of Mrs. Weddle: I realize now that she was probably harmless, but to a shy, elf-size, nervous little guy she looked like a monstrous, talking baked potato. On top of that, I had a surprise in store, and I wasn't sure how it would be received.

"My daddy is a scientist," I said, and Mrs. Weddle turned to write this information on the blackboard. Then I dropped the bomb: "And my mommy is a scientist!"

Twenty-five pairs of first-grade eyes drew a bead on me, wondering what the hell I was talking about. It was then that I began to understand how unusual my mother was.

*clean and shiny*

**3. Ask the class to answer a small set of text-dependent guided questions and perform targeted tasks about the passage, with answers in the form of notes, annotations to the text, or more formal responses as appropriate.**

As students move through these questions and reread Hirshberg's memoir, be sure to check for and reinforce their understanding of academic vocabulary in the corresponding text (which will be **boldfaced** the first time it appears in the text). At times, the questions themselves may focus on academic vocabulary.

**(Q1) Why was the narrator nervous in class? Cite specific evidence.**

This question will enable teachers to assess students' literal understanding of the text. Likely answers from students:

- Mrs. Weddle seemed big and scary ("I was afraid of..." "looked ....monstrous...") while he is "shy...elf-like."
  - The entire class is watching ("...eyes **drew a bead**..."). Students should be able to ascertain the meaning of "drew a bead" from context (to look at, or stare), but teachers should explain that to draw a bead is to take aim through the sight of a gun, suggesting intensity and emphasizing his fright, as if facing a firing squad.
  - He is nervous because he "has a surprise in store." Mrs. Weddle expects him to report on his father's profession, but instead he is going to tell them about his mother. His mother doesn't do what other mothers do ("unusual" "extremely rare: a scientist who's a woman and also a mother").

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**Directions for Teachers/Guiding Questions For Students**

<p>Today, after more than four <u>decades</u> of <u>geophysical research</u>, my mother, Joan Feynman, is getting ready to retire as a senior scientist at NASA's Jet <b>Propulsion</b> Laboratory. She is probably best known for developing a statistical model to calculate the number of high-energy particles likely to hit a spacecraft over its lifetime, and for her method of predicting sun spot cycles. Both are used by scientists worldwide. Beyond this, however, my mother's career illustrates the enormous change in how America regards what was, only a few decades ago, extremely rare: a scientist who's a woman and also a mother.</p>	<p><i>ten years</i></p> <p><i>the study of the earth, and its relationship to the rest of the universe</i></p> <p><i>a model that uses numbers to show an idea</i></p>	<p><b>(Q2) Writers have many different ways of offering information and experiences to their readers. How are the sentences and the writing style in the fourth paragraph different than the first three?</b></p> <p>Students may give a variety of answers, including that the first three seem to be more about the son and the fourth about the mother or that the first three are humorous, while the fourth is not. Teachers should encourage students to focus on the different structure and style of the writing: The first three paragraphs tell a story (<b>narrative</b>) and the fourth explains (<b>expository</b>).</p> <p><b>(Q3) What is the central idea of the fourth paragraph? How does the narrative of the first three paragraphs support the central idea?</b></p> <p>Students should be able to articulate that there has been an “enormous change” in the way women who chose to be both mothers and scientists have been regarded. Such women faced many obstacles and “proved themselves equal.”</p> <p>Narrative can rarely be reduced to a single idea, but certainly one focus of the narrative here is that it serves as an illustration of how “unusual” it was for mothers to be scientists. (For example, the young Hirshberg is nervous because it will be a surprise; Mrs. Weddle only asks about fathers; the students don’t know “what the hell” he is talking about.)</p>
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**Directions for Teachers/Guiding Questions For Students**

To become a scientist is hard enough. But to become one while running a **gauntlet** of lies, insults, mockeries, and disapproval-this was what my mother had to do. If such treatment is unthinkable (or, at least, unusual) today, it is largely because my mother and other female scientists of her generation proved equal to every obstacle thrown in their way.

My introduction to chemistry came in 1970, on a day when my mom was baking challah bread for the Jewish New Year. I was about 10, and though I felt cooking was unmanly for a guy who played shortstop for Village Host Pizza in the Menlo Park, California, Little League, she had persuaded me to help. When the bread was in the oven, she gave me a plastic pill bottle and a cork. She told me to sprinkle a little baking soda into the bottle, then a little vinegar, and cork the bottle as fast as I could. There followed a violent and completely unexpected pop as the cork flew off and walloped me in the forehead. Exploding food: I was **ecstatic!** "That's called a chemical reaction," she said, rubbing my shirt clean. "The vinegar is an acid and the soda is a base, and that's what happens when you mix the two."

After that, I never understood what other kids meant when they said that science was

*fluffy bread made with eggs*

**(Q4) According to the fifth paragraph, how did American society treat the narrator's mother and "other female scientists of her generation" as they worked to become scientists?**

Students should be able to infer that these female scientists were treated badly. (They were met with "mockery," "insults," and "disapproval.") They should also be able to use context clues to determine the meaning of **running the gauntlet** (face an obstacle, go through something difficult), but the teacher should explain the original meaning: Soldiers who broke the rules used to be punished by being forced to walk slowly through a row of fellow soldiers who would whip or beat them.

This is a good moment to be sure students have the appropriate historical time frame. One way to do this is to draw their attention to the word **generation** and offer a simple definition (people living about the same age living during the same time period). The incident in Mrs. Weddle's class takes place in 1966 according to the opening sentence of the essay.

**(Q5) Read paragraphs 6 and 7 out loud again. Is this section narrative or expository? What sentences in particular offer clues that help you answer this question?**

This question gives students a brief opportunity to apply a concept they had discussed earlier in the lesson. Hirshberg has returned to narration, similar to paragraphs 1-3. However, the scene has shifted to home, and it is four years later. (Hirshberg is now 10.)

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**Directions for Teachers/Guiding Questions For Students**

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*fluffy bread made with eggs*

**(Q6) We know that Joan is both a mother and a scientist. How does Hirshberg develop both of these facts in this narrative section?**

- Joan is in the kitchen "baking challah bread" (like an old-fashioned mom).
- She is performing a science experiment and doing it as a mother to teach her son.
- She is doing the science experiment with things primarily associated more with mothers, not scientists.
- While the mother is "rubbing my shirt clean," the scientist is busy explaining the chemical reaction. (Teachers can recall how students were described as well-scrubbed earlier in the text, implying the presence of a "full-time" mother.)

**For homework, ask students to explain why the episode baking bread led the narrator to say he "never understood what other kids meant when they said science was boring." What evidence does he present to illustrate his fascination with science?**

Students will likely point to Hirshberg's language when describing his enthusiasm for science: "completely unexpected," "pop," "walloped," and "Exploding food: I was ecstatic!"

**Day Two: Instructional Exemplar for Hirshberg’s “My Mother, the Scientist”**

**Summary of Activities**

- 1. Teacher introduces the day’s passage with minimal commentary and students read it independently (5 minutes)
- 2. Teacher or a skillful reader then reads the passage out loud to the class as students follow along in the text (5 minutes)
- 3. Teacher asks the class to discuss the first set of text-dependent questions and perform targeted tasks about the passage, with answers in the form of notes, annotations to the text, or more formal responses as appropriate (40 minutes)
- 4. For homework, teacher asks students to answer a question on their own for homework

<div>T e x t  U n d e r  D i s c u s s i o n</div>	<div>Directions for Teachers/Guiding Questions For Students</div>
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<p>One of my mother's earliest memories is of standing in her crib at the age of about 2, yanking on her 11-year-old brother's hair. This brother, her only sibling, was none other than Richard Feynman, <b>destined</b> to become one of the greatest theoretical physicists of his generation: enfant terrible of the Manhattan Project, pioneer of quantum electrodynamics, father of nanotechnology, winner of the Nobel Prize, and so on. At the time, he was training his sister to solve simple math problems and rewarding each correct answer by letting her tug on his hair while he made faces. When he wasn't doing that, he was often seen wandering around Far Rockaway, New York, with a screwdriver in his pocket, repairing radios-at age 11, mind you.</p> <p>[read the intervening paragraphs]</p> <p>After that, I never understood what other kids meant when they said that science was boring.</p>	<p><i>studies concepts of the physical world; someone who says and does whatever he wants even if it is embarrassing or shocking</i></p>	<p><b>1. Introduce the passage and students read independently.</b></p> <p>Other than giving the brief definitions offered to words students would likely not be able to define from context (underlined in the text), avoid giving any background context or instructional guidance at the outset of the lesson while students are reading the text silently. This close reading approach forces students to rely exclusively on the text instead of privileging background knowledge and levels the playing field for all students as they seek to comprehend Hirshberg's prose. It is critical to cultivating independence and creating a culture of close reading that students initially grapple with rich texts like Hirshberg's piece without the aid of prefatory material, extensive notes, or even teacher explanations.</p> <p><b>2. Read the passage out loud to the class as students follow along in the text.</b></p> <p>Asking students to listen to Hirshberg's piece exposes students a second time to the rhythms and meaning of Hirshberg's language before they begin their own close reading of the passage. Speaking clearly and carefully will allow students to follow Hirshberg's narrative, and reading out loud with students following along improves fluency while offering all students access to this complex text. Accurate and skillful modeling of the reading provides students who may be dysfluent with accurate pronunciations and syntactic patterns of English.</p>
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**Text Under Discussion**

**Directions for Teachers/Guiding Questions For  
Students**

One of my mother's earliest memories is of standing in her crib at the age of about 2, yanking on her 11-year-old brother's hair. This brother, her only sibling, was none other than Richard Feynman, **destined** to become one of the greatest theoretical physicists of his generation: enfant terrible of the Manhattan Project, pioneer of quantum electrodynamics, father of nanotechnology, winner of the Nobel Prize, and so on. At the time, he was training his sister to solve simple math problems and rewarding each correct answer by letting her tug on his hair while he made faces. When he wasn't doing that, he was often seen wandering around Far Rockaway, New York, with a screwdriver in his pocket, repairing radios-at age 11, mind you.

My mother worshipped her brother, and there was never any doubt about what he would become. By the time she was 5, Richard had hired her for 2 cents a week to assist him in the electronics lab he'd built in his room. "My job was to throw certain switches on command," she recalls. "I had to climb up on a box to reach them. Also, sometimes I'd stick my finger in a spark gap for the edification of his friends." At night, when she called out for a glass of water, Riddy, as he was called, would demonstrate centrifugal force by whirling it around in the air so that the glass was upside down during part of the arc. "Until, one night," my mother recalls, "the glass slipped out of his hand and flew across the room."

Richard explained the miraculous fact that the family dog, the waffle iron, and Joan herself were all made out of atoms. He would run her hand over the corner of a picture frame, describe a right triangle and make her repeat that **the sum of the square of the sides was equal to the square of the hypotenuse**. "I had no idea what it meant," she says, "but he recited it like a poem, so I loved to recite it too." One night, he roused her from her bed and led her outside, down the street, and onto a nearby golf course. He pointed out washes of magnificent light that were streaking across the sky. It was the aurora borealis. My mother had discovered her destiny.

*studies  
concepts of the  
physical world;  
someone who  
says and does  
whatever he  
wants even if it  
is  
embarrassing  
or shocking*

*education*

**3. Ask the class to answer a small set of text-dependent guided questions and perform targeted tasks about the passage, with answers in the form of notes, annotations to the text, or more formal responses as appropriate.**

As students move through these questions and reread Hirshberg's memoir, be sure to check for and reinforce their understanding of academic vocabulary in the corresponding text (which will be **boldfaced** the first time it appears in the text). At times, the questions themselves may focus on academic vocabulary.

**(Q7) Why did Joan want to become a scientist?**

- Her brother loved science and she "worshipped" him. ("He recited it like a poem, so I loved to recite it too.")
- He showed her how science was in the ordinary, everyday things around her: "centrifugal force" in the glass of water, "atoms" in the waffle iron, "right triangles" in a picture frame; this seems "miraculous" to her.
- She saw the aurora borealis ("washes of magnificent light streaking...").



**Text Under Discussion**

**Directions for Teachers/Guiding Questions For Students**

My mother worshipped her brother, and there was never any doubt about what he would become. By the time she was 5, Richard had hired her for 2 cents a week to assist him in the electronics lab he'd built in his room. "My job was to throw certain switches on command," she recalls. "I had to climb up on a box to reach them. Also, sometimes I'd stick my finger in a spark gap for the edification of his friends." At night, when she called out for a glass of water, Riddy, as he was called, would demonstrate centrifugal force by whirling it around in the air so that the glass was upside down during part of the arc. "Until, one night," my mother recalls, "the glass slipped out of his hand and flew across the room."

Richard explained the miraculous fact that the family dog, the waffle iron, and Joan herself were all made out of atoms. He would run her hand over the corner of a picture frame, describe a right triangle and make her repeat that **the sum of the square of the sides was equal to the square of the hypotenuse**. "I had no idea what it meant," she says, "but he recited it like a poem, so I loved to recite it too." One night, he roused her from her bed and led her outside, down the street, and onto a nearby golf course. He pointed out washes of magnificent light that were streaking across the sky. It was the aurora borealis. My mother had discovered her destiny.

education

**(Q8) Find the ways the description of the Aurora Borealis, as well as the sentences in that paragraph, are different from the other examples in the paragraph. Why are those differences important to this account?**

- Unlike the others (a dog, a picture frame, a glass of water), this is not ordinary. It is extraordinary and has nothing to do with everyday life. It is extraordinary.
- The tone moves from the ridiculous (the flying glass, the waffle iron, the finger in the socket) to the sublime ("washes of magnificent light that were streaking across the sky").
- In the other examples, her brother is central, but, here, he merely takes her to the golf course; she makes the discovery on her own.

Without the Aurora Borealis example, the reader would have been left with the impression that she only became a scientist because she "worshipped" her brother. Now, we see that it is an internal desire—that she herself is interested in science—that it is her "destiny."

#### **Sidebar: Website on Aurora Borealis**

If students are intrigued to see what the Aurora Borealis look like, teachers can direct them to the following webpage with professional photography of the phenomenon:

<http://www.sciencemaster.com/monkeytime/sciencemaster/galleries/aurora/gallery.php>

**Text Under Discussion**

**Directions for Teachers/Guiding Questions For Students**

That is when the trouble started. Her mother, Lucille Feynman, was a **sophisticated** and compassionate woman who had marched for women's suffrage in her youth. Nonetheless, when 8-year-old Joanie announced that she intended to be a scientist, Grandma explained that it was impossible. "Women can't do science," she said, "because their brains can't understand enough of it." My mother climbed into a living room chair and sobbed into the cushion. "I know she thought she was telling me the **inescapable** truth. But it was **devastating** for a little girl to be told that all of her dreams were impossible. And I've doubted my abilities ever since."

The fact that the greatest chemist of the age, Marie Curie, was a woman gave no comfort. "To me, Madame Curie was a mythological character," my mother says, "not a real person whom you could strive to emulate." It wasn't until her 14th birthday-March 31, 1942-that her notion of becoming a scientist was **revived**. Richard presented her with a book called *Astronomy*. "It was a college textbook. I'd start reading it, get stuck, and then start over again. This went on for months, but I kept at it. When I reached page 407, I came across a graph that changed my life." My mother shuts her eyes and recites from memory: "'Relative strengths of the Mg+ absorption line at 4,481 angstroms . . . from *Stellar Atmospheres* by Cecilia Payne.' Cecilia Payne! It was scientific proof that a woman was capable of writing a book that, in turn, was quoted in a text. The secret was out, you see."

*the fight for  
women's right to  
vote*

*imitate or try to  
be like*

**(Q9) What obstacles does Hirshberg's mother initially encounter?**

Joan's own mother ("Grandma" to Hirshberg) told her—"it was impossible"—that "Women can't do science. Their brains can't understand..." The teacher should have the class consider the impact of Hirshberg's inclusion of certain details about the mother—that even a "compassionate" mother who fought for women's rights doesn't think a woman can be a scientist.

**(Q10) Why does the example of Marie Curie offer "no comfort" to Hirshberg's mother?**

Despite being a great scientist in her own right and therefore a potential model to emulate, Curie seemed unreal to Joan—a "Madame" who was practically a myth.

**Both Joan and her brother are described as "destined" to be scientists. For homework, review the text to this point and write down evidence that could be included in an essay that would discuss whether or not their experiences as they travelled to their destiny were similar or different?**

For Richard, there was "never any doubt what he would become," followed by a list of accomplishments (written in a parallel rhythmic structure). Richard appears to have lived without bumps, as if it were written in the stars and he had never encountered any trouble. Hirshberg accomplishes this by using a parallel rhythmic structure in the list. Teachers might want to give several students an opportunity to read the list out loud with a dramatic emphasis.

Teachers could add an extra day of instruction at this point to review the evidence that students found in groups or as a whole class and then have students write a brief in-class response that addresses the question they have gathered evidence to answer.

**Day Three: Instructional Exemplar for Hirshberg’s “My Mother, the Scientist”**

**Summary of Activities**

- 1. Teacher introduces the day’s passage with minimal commentary and students read it independently (5 minutes)
- 2. Teacher or a skillful reader then reads the passage out loud to the class as students follow along in the text (5 minutes)
- 3. Teacher asks the class to discuss the first set of text-dependent questions and perform targeted tasks about the passage, with answers in the form of notes, annotations to the text, or more formal responses as appropriate (40 minutes)
- 4. For homework, teacher asks students to answer a question on their own for homework

Text Under Discussion	Directions for Teachers/Guiding Questions For Students

*My mother taught me about resonances when I was about 12. We were on a camping trip and needed wood for a fire. My brother and sister and I looked everywhere, without luck. Mom spotted a dead branch up in a tree. She walked up to the trunk and gave it a shake. "Look closely," she told us, pointing up at the branches. "Each branch waves at a different frequency." We could see that she was right...*

[read the intervening paragraphs]

*... That's when I made the decision: the next day, in school, I wouldn't just tell them what my father did. I'd tell them about my mother too.*

**1. Introduce the passage and students read independently.**

Other than giving the brief definitions offered to words students would likely not be able to define from context (underlined in the text), avoid giving any background context or instructional guidance at the outset of the lesson while students are reading the text silently. This close reading approach forces students to rely exclusively on the text instead of privileging background knowledge and levels the playing field for all students as they seek to comprehend Hirshberg's memoir. It is critical to cultivating independence and creating a culture of close reading that students initially grapple with rich texts like Hirshberg's prose without the aid of prefatory material, extensive notes, or even teacher explanations.

**2. Read the passage out loud to the class as students follow along in the text.**

Asking students to listen to "My Mother, the Scientist" exposes students a second time to the rhythms and meaning of his language before they begin their own close reading of the passage. Speaking clearly and carefully will allow students to follow Hirshberg's narrative, and reading out loud with students following along improves fluency while offering all students access to this complex text. Accurate and skillful modeling of the reading provides students who may be dysfluent with accurate pronunciations and syntactic patterns of English.

**Text Under Discussion**

**Directions for Teachers/Guiding Questions For Students**

The catalog of abuse to which my mother was subjected, beginning in 1944 when she entered Oberlin College, is too long and **relentless** to fully record. At Oberlin, her lab partner was ill-prepared for the advanced-level physics course in which they were enrolled, so my mother did all the experiments herself. The partner took **copious** notes and received an A. My mother got a D. "He understands what he's doing," the lab instructor explained, "and you don't." In graduate school, a professor of solid state physics advised her to do her Ph.D. dissertation on cobwebs, because she would encounter them while cleaning. She did not take the advice; her thesis was titled "Absorption of infrared radiation in crystals of diamond-type lattice structure." After graduation, she found that the "Situations Wanted" section of The New York Times was divided between Men and Women, and she could not place an ad among the men, the only place anyone needing a research scientist would bother to look.

At that time, even the dean of women at Columbia University argued that "sensible motherhood" was "the most useful and satisfying of the jobs that women can do." My mother tried to be a sensible mother and it damn near killed her. For three years, she cooked, cleaned, and looked after my brother and me, two stubborn and voluble babies.

*a book-length  
essay or  
report  
written to  
achieve a  
specialized  
degree*

*noisy,*

**3. Ask the class to answer a small set of text-dependent guided questions and perform targeted tasks about the passage, with answers in the form of notes, annotations to the text, or more formal responses as appropriate.**

As students move through these questions and reread Hirshberg's memoir, be sure to check for and reinforce their understanding of academic vocabulary in the corresponding text (which will be **boldfaced** the first time it appears in the text). At times, the questions themselves may focus on academic vocabulary.

**(Q11) What "abuses" or obstacles does she encounter in this passage? What do they have in common?**

- Lab instructor who gave her a D
- Professor who suggested she get a degree in dusting ("dissertation on cobwebs")
- Dean of women at Columbia who tried to be helpful by telling her that "sensible motherhood" was "the most useful and satisfying of the jobs that women can do."
- The NY Times *Situations Wanted* ads

All are people and things in respected positions of authority; they are also a list of people whom one would expect to be more enlightened—like her mother, the suffragette.



**Text Under Discussion**

**Directions for Teachers/Guiding Questions For  
Students**

One day in 1964 she found herself preparing to hurl the dish drain through the kitchen window and decided to get professional help. "I was incredibly lucky," she remembers, "to find a shrink who was enlightened enough to urge me to try to get a job. I didn't think anyone would hire me, but I did what he told me to do." She applied to Lamont-Doherty Observatory and, to her astonishment, received three offers. She chose to work part-time, studying the relationship between the solar wind and the magnetosphere. Soon she would be among the first to announce that the magnetosphere-the part of space in which Earth's magnetic field dominates and the solar wind doesn't enter-was open-ended, with a tail on one side, rather than having a closed-teardrop shape, as had been widely believed. She was off and running.

*My mother introduced me to physics when I was about 14. I was crazy about bluegrass music, and learned that Ralph Stanley was coming to town with his Clinch Mountain Boys. Although Mom did not share my taste for hillbilly music, she agreed to take me. The highlight turned out to be fiddler Curly Ray Cline's version of "Orange Blossom Special," a barn burner in which the fiddle imitates the sound of an approaching and departing train. My mother stood and danced a buck-and-wing and when, to my great relief, she sat down, she said, "Great tune, huh? It's based on the Doppler effect." This is not the sort of thing one expects to hear in reference to Curly Ray Cline's repertoire. Later, over onion rings at the Rockybilt Cafe, she explained: "When the train is coming, its sound is shifting to higher frequencies. And when the train is leaving, its sound is shifting to lower frequencies. That's called the Doppler shift. You can see the same thing when you look at a star: if the light source is moving toward you, it shifts toward blue; if it's moving away, it shifts toward red. Most stars shift toward red because the universe*

*educated  
, open-  
minded*

**(Q12) Which words and phrases in the "One Day" paragraph help us see her as a real person? As a scientist? Why does Hirshberg include both in the paragraph?**

Much like he did in the Aurora Borealis paragraph, Hirshberg juxtaposes the ordinary and everyday with the sophistication found in scientific discovery. He describes his mother as "preparing to hurl the dish drain through the kitchen window..." and "off and running" and employs the informal slang of "lucky...to find a shrink..." Against this description is the elevated vocabulary of "solar wind" and "magnet field". This makes Joan both a real person and mother, as well as an impressive scientist.

**(Q13) What is the mode of writing for the two italicized paragraphs beginning with "My mother..."? What is the effect of including them in the essay?**

Hirshberg uses these interludes to show Joan as both a mother and a scientist while reinforcing the earlier lesson that science exists in the everyday just as much as it can be found studying the cosmos.

Text Under Discussion	Directions for Teachers/Guiding Questions For Students

I cannot pretend that, as a boy, I liked everything about having a scientist for a mother. When I saw the likes of Mrs. Brady on TV, I sometimes wished I had what I thought of as a mom with an apron. And then, abruptly, I got one.

[read the remaining paragraphs]

**Students should reread the remainder of the essay and write down what they noticed or observed. They should then be tasked with leading the discussion of the remainder of the text, using their observations to make bigger connections to the overall themes of the essay.**

Now that students have a strong foundation in the text, it is important for them to practice silent, sustained reading. This also allows students to enjoy the uninterrupted flow of the essay.

When asking students to lead discussion, begin by simply asking students, “What do you want to say? What have you noticed? What lines or phrases do you like?” A few guiding questions and comments are highlighted below, but ultimately, it is the students themselves who should guide the conversation now. Teachers can encourage focused dialogue by asking students to frame their comments as developing or disagreeing with what other students have said before they speak.

- Like all the narrative scenes, the one portraying Hirshberg’s mother when she was unemployed is domestic. Hirshberg includes very specific details (“stuffing food into the refrigerator, then pulling out the vacuum cleaner...bursting into tears”), and the verbs convey her very human and real frustration (She vacuums with a vengeance!).
- The other scientists are real too (brought down to the level of unemployed eggheads at a rabbi’s networking event).
- The writer notes that the rabbi was a civil rights activist, educated like the other people who discourage her from being a scientist.
- The last line of the unemployment scene—“..I can either be a part-time mama, or a full-time madwoman”—displays a complex mix of humor and sadness.
- The list of her impressive scientific accomplishments shows her eventual acceptance within the scientific community.
- Despite her accomplishments, she still explains scientific ideas through down-to-earth examples (the effect of solar changes by saying it could “turn Long Island into a skating rink”).
- The returning at the end to the beginning of the essay via a narrative of his decision to tell his class about his mother.

### Final Writing Prompt and Guidance for Teachers

A good final assessment for “My Mother, the Scientist” will encourage students to work with the ideas they discussed in class, but also give them an opportunity to express thoughts of their own that might not have surfaced during class discussion. Here are two different ways to do this.

**Choice One:** Science teachers at Weddles Middle School want their students to become more interested in science. Therefore, they are planning to offer a class called *Science for Everyone*. But, the teachers disagree about what the students should read during the first week of class. One group wants students to read an essay called, “Madame Curie, Heroine in the Laboratory.” Another group prefers “My Mother, the Scientist.”

You have not read the essay about Marie Curie, but you do have a very good knowledge of “My Mother, the Scientist.” Based on the knowledge you have, write a letter to the teachers at the Weddles school telling them why “My Mother, the Scientist” is the appropriate text for a class called *Science for Everyone*.

In your letter, be sure to clearly establish your position, persuade your readers by offering thorough and compelling evidence for your reasons, and organize your ideas such that your letter has a beginning, middle, and end, and paragraph breaks wherever they are needed.

**Choice Two:** On the next page are three separate passages from “My Mother, the Scientist.” Choose one and write a thorough, organized essay explaining how the passage develops one or more idea that is central to the text as a whole.

Be sure to plan your essay in advance so your ideas are organized, establish the main idea or ideas you will discuss, cite specific evidence from the passage. Include discussion of other parts of the text where appropriate.

Teachers should choose three passages most appropriate for their own class, but possibilities include:

1. Mother and son in the kitchen (*My introduction to chemistry came in 1970... when they said that science was boring.*)
2. Joan’s childhood (*One of my mother’s earliest memories...My mother had discovered her destiny.*)
3. Joan’s challenges when she becomes a full-time housewife (*I cannot pretend that, as a boy...or a full-time madwoman.*)

## Appendix A: Additional Instructional Opportunities for Charles Hirshberg's "My Mother, the Scientist"

1. This exemplar is obviously an excellent companion to the Richard Feynman exemplar, and a culminating assessment can certainly be structured around the Feynman exemplar. Students would find it intriguing to read or return to a text that is actually written by someone who appears in the text that is the focus of this exemplar. Students may want to consider whether or not Feynman seems real or mythological, how he is either similar or different from the image that emerges of him in Hirshberg's work, or how the presentation of science differs or is the same.
2. The piece naturally suggests itself to enrichment opportunities in science. Consider pairing up with the science teacher for further research on the Aurora Borealis, Doppler radar, or other scientific concepts introduced in the passage. (Students might like hearing the music of Curly Ray and particularly Orange Blossom Special where you can hear the Doppler effect: <http://www.youtube.com/watch?v=EoQ3WmuJzGE&feature=related>.)
3. Marie Curie was a real person, not a myth. Give students an opportunity to research her with an eye to making her real. What were some of the troubles she faced? What examples of her "humanness" can they find? Students can summarize their findings in a brief essay or report what they learn to the class.
4. Marie's daughter, Irene, was a scientist herself and worked with her mother. There are young reader's biographical material available about both women which might yield rich comparisons to the present text. Students might like writing their own vivid narrative of an imagined, domestic scene.