My Favorite Case and What Makes It So

By Clyde Freeman Herreid, Nancy A. Schiller, Ky F. Herreid, and Carolyn Wright

You like potato and I like potahto,
You like tomato and I like tomahto,
Potato, potahto, tomato, tomahto!
Let's call the whole thing off!
—George and Ira Gershwin, 1937

There is no accounting for taste. Every language seems to have its version of the phrase, from Armenian (*on taste there is no friend*) to Turkish (*tastes and colors are not arguable*) and, of course, Latin (*de gustibus non est disputandum*). George and Ira Gershwin, those wizards of Broadway and Tin Pan Alley, put their own spin on it when they penned the tune "Let's Call the Whole Thing Off" for the Fred Astaire and Ginger Rogers film, *Shall We Dance*. It may be true in romance that there is no accounting for taste, but we do have a few insights about why some faculty and students prefer certain case studies and not others.

Last year we ran a survey asking faculty to identify their favorite case study and to tell us why they made their choice. We polled members of the National Center for Case Study Teaching in Science (NCCSTS), which has published nearly 450 cases on its website. We thought it would be instructive to identify the faculty's special favorites on our website but, more important, to help us to identify those characteristics that make a good case.

It is not that we haven't thought about this before. We wrote an essay "What Makes a Good Case?" on the topic some time ago (Herreid, 1997/1998). Back then, we based our comments on an article written for the 1978 Harvard Business School's *HBS Bulletin* presenting the results of detailed interviews and questionnaires of faculty and students (Bennett & Chakravarthy, 1978). We drew the following generalizations: A good case (a) tells a story, (b) focuses on an interest-arousing issue, (c) is set in the past 5 years, (d) creates empathy with the central characters, (e) includes quotations and dialogue, (f) is relevant to the reader, (g) must have pedagogical utility (i.e., it must serve a teaching function), (h) is conflict provoking, (i) is decision forcing, (j) has generality, and (k) is short. (This last point is rather paradoxical, for most of the case studies in the Harvard collection are lengthy, having 15 pages of text and perhaps five appendices.)

All this is well and good, but these points were conclusions made by business and public policy instructors rather than STEM faculty. Would their conclusions be similar? We caught a glimmer of the answer a few years ago before this present survey. We recruited 13 faculty members from 12 institutions to help run a study to investigate if "clicker cases" would lead to more learning than when the same subject was presented via a traditional PowerPoint lecture. Clicker cases combine two teaching techniques—case studies and clickers (personal response systems)—to offer an instructional strategy that allows active learning in even the largest of science classrooms (Herreid, 2006). Teachers participating in the study taught the same 6–8 cases in large introductory biology classes and, at the end of the study, were asked to rank the cases in terms of effectiveness. Our most important conclusion was that the cases that had emotional engagement promoted the greatest learning. Further, the good ones had an intriguing story line, were well organized, generated interaction, and contained strong visual material (Lundeberg et al., 2011).

When we revisited this issue by surveying teachers subscribed to the NCCSTS Listserv last year, 1,374 teachers responded to our questionnaire asking them to indicate which case(s) were their favorites and why. Our respondents were university (22%), 4-year college (25%), community college (15%), and high school (36%) faculty. Furthermore, based on our previous surveys, we know that 60% of the members on our Listserv who have responded in the past teach biology and another 30% teach health-related subjects. Strikingly, the physical sciences are poorly represented, chemistry making up only 8% and physics, math, geology, and engineering dividing up the remaining 2% (Herreid, Schiller, Herreid, & Wright, 2011).

With this as background, it will be obvious that the favorite cases were predominantly in the life sciences, as can be seen in a list in Figure 1. Interestingly, the top two favorite cases identified by survey respondents are also the same cases with the most internet page views according to Google Analytics: "A Can of Bull,"

which had 9,823 unique page views this past year, followed by "Chemical Eric," with 6,489. Figure 1 also shows that chemistry cases were not completely ignored; in position number 11 we find the popular chemistry case, "Avogadro Goes to Court," inspired by a successful lawsuit brought by students against a professor at Pace University who had assigned them the task of calculating the cost of a single aluminum atom in a roll of aluminum foil! One can see why this might be provocative, and this brings us to the point of why faculty cherish the cases they do. As with "Avogadro," although teachers emphasized that they chose the case because it introduced the mole concept, critical thinking, problem solving, and dimensional analysis, students were attracted to the case for altogether different and perverse reasons. Think about it: The students were finally getting even with the professor.

With this in mind, let's see what the faculty have to say about their favorites. We have classified the results into broad categories. Figure 2 shows the general pattern.

The right topic: It fits my needs for the course or curriculum (33%)

Not surprisingly, instructors choose cases that deal with topics that they teach. The two most often-chosen subject areas for cases were evolution/ecology/the environment (23%) and physiology (22%). Genetics (10%) and microbiology (6%) were the next contenders. Reflecting this, four of the cases that were among the top cases chosen by survey respondents were "An End to Ulcers," the story of the Nobel Prize–winning discovery that the bacterium *Heliobacter pylori* causes stomach ulcers; "The Hot Tub Mystery," in

FIGURE 1

The top favorite cases by the membership of the National Center for Case Study Teaching in Science—survey of 1,374 individuals in 2011.

1. A Can of Bull—biomolecules, nutrition, and product analysis of popular energy drinks (http://sciencecases.lib.buffalo.edu/cs/collection/detail.asp?case_id=203&id=203)
2. Chemical Eric—pituitary disruption and its effect on a young man (http://sciencecases.lib.buffalo.edu/cs/collection/detail.asp?case_id=343&id=343)
3. End to Ulcers—story of the Nobel Prize discovery that bacteria cause ulcers (http://sciencecases.lib.buffalo.edu/cs/collection/detail.asp?case_id=483&id=483)
4. The Hot Tub Mystery—alcohol, heat, Lasix lead to death in a hot tub (http://sciencecases.lib.buffalo.edu/cs/collection/detail.asp?case_id=242&id=242)
5. Kermit to Kermette?—unintended side effects of chemicals introduced into the environment (http://sciencecases.lib.buffalo.edu/cs/collection/detail.asp?case_id=189&id=189)
6. The Case of Desiree's Baby—genetics and the evolution of skin color (http://sciencecases.lib.buffalo.edu/cs/collection/detail.asp?case_id=454&id=454)
7. Mom Always Liked You Best—science in action; animal behavior and evolution (http://sciencecases.lib.buffalo.edu/cs/collection/detail.asp?case_id=505&id=505)
8. Those Old Kentucky Blues—genetics of a clan of "blue people" with a blood disorder (http://sciencecases.lib.buffalo.edu/cs/collection/detail.asp?case_id=208&id=208)
9. Bad Fish—two accidental poisonings and the effect of a neurotoxin (http://sciencecases.lib.buffalo.edu/cs/collection/detail.asp?case_id=507&id=507)
10. Search for Missing Sea Otters—an ecological detective story set in Alaska (http://sciencecases.lib.buffalo.edu/cs/collection/detail.asp?case_id=167&id=167)
11. Avogadro Goes to Court—a student takes his professor to court over an assignment (http://sciencecases.lib.buffalo.edu/cs/collection/detail.asp?case_id=446&id=446)
12. Microbial Pie—tracking down the source of a bacterial infection in the neighborhood (http://sciencecases.lib.buffalo.edu/cs/collection/detail.asp?case_id=382&id=382)
13. Bad Reaction—immunology and the transfer of a food allergy between patients (http://sciencecases.lib.buffalo.edu/cs/collection/detail.asp?case_id=496&id=496)
14. 2000 Meter Row—competitive rowing challenges homeostasis of the body (http://sciencecases.lib.buffalo.edu/cs/collection/detail.asp?case_id=366&id=366)

which students learn about blood pressure regulation while trying to figure out what caused the deaths of two people in their hot tub; "Kermit to Kermette?" which looks at conflicting scientific data on the feminizing effects of the herbicide atrazine on male frogs; and "The Case of Desiree's Baby: The Genetics and Evolution of Skin Color," based on a tragic short story by Kate Chopin first published in 1893. All of these top subject areas have one thing in common: The cases are relatively easy to write because there are obvious human problems to solve and the human drama is engaging. Cases on cell structure or biological molecules are tougher to write; they do not immediately conjure up dilemmas with story lines. Thus, we have few of those cases in our collection, though teachers tell us they need cases covering these basic elements, concepts, and mechanisms.

Case structure (28%)

This category collects together a potpourri of notions that the case be current, short, open-ended, user friendly, well organized, practical, lab oriented, and activity based; include a quiz; be complex (some folks said simple!); cover broad concepts, etc. But the two most common criteria that were repeatedly mentioned were that the case be realistic (15%) and relevant to the student (13%). When we run workshops and ask faculty in attendance to list the characteristics of a good case, they invariably list these same two qualities first. Business cases, too, are always based on real events. Indeed, if they are not, they are seemingly greeted with a dubious eye and are demoted to "arm chair cases." Not surprising, virtually all of the top NCCSTS survey case favorites are based on real events, such as the case documenting the "Search for the Missing Sea Otters: An Ecological Detective Story" or "Those Old Kentucky Blues," dealing with the genetics of a family from the Appalachian Mountains with a high occurrence of a rare blood disorder. Real is good**,** but relevant is even better. Regarding the top chosen case in our survey, "A Can of Bull: Do Energy Drinks Really Provide a Source of Energy?" teachers had this to say:

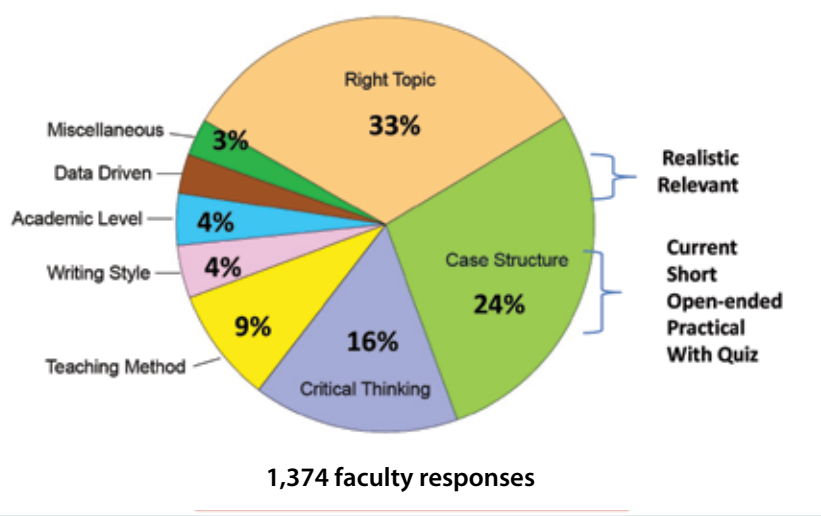
- High school seniors are interested in energy drinks and their relationship to athletic performance.
- Love how it ties in real life issues and the students can really relate to this!
- Relevant in both subject matter and student lives.

Promotes critical thinking (16%)

Teachers who have chosen their favorite case because of this quality are to be admired. Educators consistently cite critical thinking as the most important skill they can inculcate in their students. Yet, if we are to believe the work of the California Commission on Teacher Credentialing and the Center of Critical Thinking at Sonoma State University, few teachers really understand what constitutes critical thinking. Of the faculty surveyed by these organizations, 89% said critical thinking was a primary objective in their courses, but only 19% could explain what it was and were teaching it in any apparent way (Paul, Elder, & Bartell, 1997). Obviously, we admire this quality too, for we have recently published a book with the NSTA Press called *Science Stories: Using Case Studies to Teach Critical Thinking*. The book is a collection of cases that emphasize the scientific method as it is really practiced, where experimental design is adhered to, tests executed, evidence honored, assumptions examined, and conclusions questioned

FIGURE 2

Reasons faculty chose their favorite cases.



1,374 faculty responses

(Herreid et al., 2011). Indeed, one of the cases featured in this anthology was also selected as one of our top 10 favorites in our survey. "Mother Always Liked You Best" is based on an article published in *Nature* magazine that asks students to ferret out the steps that the scientist authors used to determine if bird parents were showing parental favoritism toward the "prettiest" chicks in the nest. It mimics many of the intellectual steps that expert scientists take as they try to solve an intriguing ecological and evolutionary puzzle. Here are two typical comments made about the case:

- It can be used across so many courses: lectures, labs, scientific method, and statistics.
- This case is an excellent introduction to the scientific method and also for introducing evolutionary concepts. It introduces a good bit of biological background in a concise package.

Teaching method (9%)

The teaching method turns out to be a major factor in whether a case is chosen. This statistic grossly underestimates its importance. We say this on the basis of comments made in workshops and data that we collected in a previous survey dealing with this point a couple of years ago (Herreid et al., 2011). In this earlier survey, over 1,600 people answered the question, "What is your preferred case method?" and gave these choices for possible answers: whole class discussion (15%), problem-based learning (41%), interrupted case method (24%), intimate debate (2%), directed case method (12%), and other (6%). The overwhelming choice of case teachers is to use cases in which information is given out in stages; both problem-based learning and the interrupted case method do just that, and together they constitute over 80% of the choices. Both disclose information to the students bit by bit; consequently, faculty have firm control over the classroom tempo and timing, and students working in small groups have the maximum opportunity to interact in collaborative teams as the mystery unfolds. Again, in the present survey, all of the top favorite cases were of this type; who doesn't like a detective story? As one respondent said, "The interrupted nature allows students to process information; [the] answer is not obvious in the beginning but becomes more clear as you work the case, which makes students continue to re-evaluate their assumptions and the data."

Writing style (4%)

Some cases are written well and others poorly. Science faculty are not noted for their skill with pen and paper, with notable exceptions such as the late Stephen Jay Gould, who could lure even English majors away from their Balzac into Darwinian minutiae. Or Richard Dawkins, who can make creationists tremble with his evolutionary rhetoric. It is with pleasure that we found teachers who honor good writing in their favorite cases. What do they identify particularly? First and foremost, they simply say they want clear writing. That, in fact, should be our first injunction: Be clear, for God's sake. Sure they want a good story, but they also like beguiling titles and a good hook into the material. Make that first sentence a grabber. This is one of the first commandments of all fine writers. Unless the first few lines make the reader want to push on, they won't. This is true for students as well as the general public. The top favorite of the faculty was "A Can of Bull," and here is a typical comment about why the case was chosen: "I like this case because it has a catchy title (more important than you might think for high schoolers), the science is relevant to my students' day to day lives, and it is sophisticated biochemistry presented in a mostly manageable way." Here's how this case opens:

> After spending several years working the Sport's Desk of the *Lansing State Journal*, Rhonda had landed the job of her dreams as a writer for *Runners' World* magazine. The job was fantastic! Since high school, where she had excelled in cross country, Rhonda had been a consistent runner, participating in local races and those assigned to her for her job. For her last assignment, she had run and reported on the Leadwood, South Dakota, marathon—it was a blast!
>
> As if reading her mind, her boss Charley walked in just then with a can of XS Citrus Blast® in one hand and a list of several other energy drinks in the other.

Here is how the second most selected case, "Chemical Eric," begins:

> He was, his mother always said, the cutest little boy ever, and she had always adored him. So strong, so sturdy, confidently charging through life. At 10, he joined a Little League baseball team, and made the All-Star team in his first year. It wasn't until quite some time later that she realized something was very wrong.

PHOTO COURTESY OF ERIC RIBBENS

Chemical Eric

Kind of makes you want to read on, doesn't it?

Right academic level (4%)

It goes almost without saying that if a case is too simple or too complex for your audience, you are in for some tough sledding in class. But this point was judged sufficiently important that some participants were inclined to underscore it. The folks who did so were mostly high school teachers. Notably, when we started our website and began posting cases in 1999, our focus was strictly on college and university faculty. To our surprise and delight, today almost 40% of our participants are high school teachers, and even some middle school teachers are using our collection. Unfortunately, few K–12 teachers are case authors, contributing only 1% of our collection.

Data driven (3%)

Many STEM cases have a quantitative piece embedded within them, be it graphs, tables, or clinical values that need analysis. Actually, this category could easily be incorporated into the critical-thinking category because a lot of higher-order thinking is required when dealing with data. Handling data is not simply a plug-and-chug operation, and all of us need to know how to deal with it. Science today is awash with numbers. Indeed, Patricia Cohen (2003) urged us to recall that an informed and quantitatively literate society is essential for democracy. It is surprising that we don't emphasize this point more in our daily classroom activities. We are currently assembling a collection of such cases in a book to be titled *Science Cases You Can Count On: Case Studies With Quantitative Reasoning in Biology* to help remedy this oversight. Here is one faculty member pleading her case:

> My students have two basic weaknesses; not understanding how science is actually done and not interpreting complex data/figures well. Both of these factors are important in the AAAS "Vision and Change" report. So it would be nice to see more cases that illustrate the "messiness" of what we really do. The studies that have a relatively clear-cut answer oversimplify the reality of science.

Miscellaneous (3%)

A few other categories were identified. A number of survey participants mentioned that they appreciated the excellent references in their favorite case (1%) or that they chose a case because it was an ideal introduction for students to case teaching (1%). One curiosity is that virtually no one mentioned that their favorite case complied with state or national standards. Another bit of unexpected news was that only a small percentage of folks mentioned that societal issues were important to their choice (1%).

This is not to say that teachers are uninterested in the societal questions; many of them chose environmental topics that impact society, but they didn't highlight the point explicitly. Previous generations of teachers often took a wide berth around anything controversial or politically tainted, saying these topics fell outside their realm of experience and the course description. Today, that still goes on in some public schools, with teachers steering clear of climate change and evolution. Nonetheless, now teachers are more in tune with the needs of society in general and the role that science plays. Government funding and accountability is pervasive in the United States. Indeed, in National Science Foundation and National Institutes of Health grant proposals, we must clearly indicate how our work impacts society at large. Many teachers recognize this point and make it an ingredient in their curriculum, emphasizing that science discovery and the consequences of our actions are not separate from society at large, but rather part and parcel of the whole shebang.

So, what makes a favorite case?

We found an extraordinary assortment of responses. To make the point forcibly, if we take the top 20 favorites, together they total only 5% of the choices. And, of course, at least 10% of those polled didn't want to choose at all. Diversity is the name of the game. But unlike the Gershwin brothers, we do know something about what accounts for their tastes. The data are in.

So, given the facts, would we change the conclusions made by the Harvard folks 35 years ago? Not much. We might stress that STEM cases should have critical-thinking challenges, be real, be taught using a progressive disclosure format, and use small student groups, but fundamentally we

stand with our first recommendations with a little tweaking: A good case should (a) tell a story, (b) focus on an interest-arousing issue, (c) be current, (d) create empathy, (e) have dialogue, (f) be relevant, (g) serve a teaching function, (h) be conflict provoking, (i) have a dilemma to be solved, (j) have generality, and (k) be short.

But we might add: be written with exuberance, charm, and wit. ■

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