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# The Mystery of the Vanished Citations

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## James McConnell's Forgotten 1960s Quest for Planarian Learning, a Biochemical Engram, and Celebrity

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### James V. McConnell

Note. Courtesy of John A. Popplestone, Director, Archives for the History of American Psychology, University of Akron, Ohio.

James V. McConnell was born in Okmulgee, Oklahoma, in 1925 and died in Ann Arbor, Michigan, in 1990. He received his PhD in experimental psychology from the University of Texas in 1956 and joined the faculty of the University of Michigan the same year. He received a Career Development Award from the National Institute of Mental Health in 1963 and became affiliated with Michigan's Mental Health Research Institute. In 1976, he was awarded the American Psychological Foundation's (APF's) Gold Medal Award for Distinguished Teaching. He was recognized by APF as, "A distinguished scientist who loves to teach, an outstanding teacher who loves science, a scholar who learns with his students." He served as president of Teaching of Psychology (Division 2) in 1979. He wrote an introductory psychology textbook, *Understanding Human Behavior*, that was very well received because it was comprehensive and appealed to students. McConnell always endeavored to bring psychology's contributions to the attention of the general public and not only used his own journal, *The Worm Runner's Digest*, to this end but also appeared on television shows and cooperated with the popular media to show how psychology could be applied to real-world problems. This may have been why he was a target of the person known as the Unabomber.

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During the 1960s, at a time of skepticism about the possibility of invertebrate learning, James McConnell and other researchers attracted to the glamour created by McConnell for planarian learning established invertebrate learning with a Pavlovian conditioning paradigm and a wide variety of control groups and procedures that are still used today in work on the biochemistry of learning and memory. McConnell abandoned his dream of a Nobel prize and turned to popularizing psychology after a failed attempt to transfer memory from one organism to another through RNA as a "memory molecule." As a science writer and "pop" psychologist, McConnell was a public relations genius who oversold planarian learning and, later, behavior modification. This article solves the mystery of why the Unabomber tried unsuccessfully to kill McConnell with a letter bomb.

A piece of scientific research, like a work of fiction or a set of laws is never the result of a single individual's efforts. It is rather the end product of myriad thoughts and actions and discoveries that have gone before. What debts a researcher does not owe to his contemporaries and his immediate mentors, he owes to his predecessors. In truth as Newton observed we all stand on the shoulders of giants of the past and present. (James McConnell, 1956, preface to dissertation).

McConnell and other researchers who worked during the 1960s on the biochemistry of memory deserve a place in the pantheon for the founders of the modern search for

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the engram because their work was a bridge that connected the older nonphysiological tradition of the comparative psychology of invertebrate animal learning with modern developments in biochemistry and molecular biology. The legacy of McConnell and the other planarian researchers is the establishment, with very well-controlled experiments, of classical conditioning in invertebrates.

### **The Search for the Engram Before McConnell and the 1960s**

To appreciate McConnell's successful struggle to establish learning in invertebrates and his contribution to neuroscience in the area of the biochemistry of memory, it is necessary to consider the state of knowledge about invertebrate learning and the physiological basis of memory around 1950. Lashley is cited frequently by contemporary researchers in neuroscience who work on the cellular basis of learning and memory, but McConnell is largely forgotten. Lashley's failure by 1950 to localize the engram or memory trace at a place in the nervous system (see Donegan & Thompson, 1991; Finger, 1994) led to speculation that the engram was biochemical (McConnell, 1967a).

Urged on by a suggestion in Hilgard's (1948) classic text on learning theory, researchers in animal learning and comparative psychology were searching for an invertebrate preparation as a launchpad for the physiological study of learning because invertebrate nervous systems have fewer neurons than vertebrate systems. Unfortunately, there was a major conceptual stumbling block. The conventional wisdom, especially among zoologists and others who were not experts in animal behavior, was that invertebrates were little robots without an internal state for memory, in which behavior was guided by instincts. Even Maier and Schneirla (1935), in the leading textbook of comparative psychology, described inverte-

brate learning as ephemeral when they wrote, "Experience may temporarily alter the form of behavior by inducing local tissue change . . . but such changes are wiped out by subsequent events, and *have no permanent altering effect*" (p. 84). However, by citing a study on planarian learning from the 1920s, Maier and Schneirla left open the possibility that their generalization about invertebrate learning might not apply to planaria.

Richard Thompson, the senior author with James McConnell (Thompson & McConnell, 1955) on a now-classic study on learning in planaria, studied with Lashley. Thorne (1995) designated the little-known and publicity-shy Thompson as Lashley's heir. Because Lashley failed to find the engram with rats, Thompson and McConnell were motivated to investigate learning and memory with an invertebrate preparation, so as to succeed where Lashley had failed.

### **The Missing 1960s Decade**

During the 1960s, James McConnell was one of psychology's most visible and colorful public personalities, a celebrity-scientist who made entertaining appearances on television. As the head of the Planarian Research Group at the University of Michigan, McConnell's research program was a precursor of the kind of interdisciplinary approach to brain and behavior that is now called neuroscience. He wrote, "This prospect of working with a covey of bright scientists in disciplines other than Psychology pleases us immensely" (McConnell, 1961a, p. 2). His approach encompassed measurement at multiple levels of investigation. As he put it:

If learning is (at one level of discourse) a matter of some kind of structural or functional change at the synapse, shouldn't we also wonder what chemical change takes place at the synapse when 'learning' occurs? . . . antireductionism is misplaced. Each scientific discipline surely has something unique and important to contribute to the solution of the problem of memory formation; . . . all the disciplines are equally important. (McConnell, 1967a, p. 2)

Usually a field honors its pioneers. Yet McConnell and many of the other scientists who pioneered the biochemistry of learning and memory during its modern, formative period in the 1960s have become nonpersons—eclipsed, put down, or written out of the contemporary story of the search for the engram. Alport (1986), a science writer, called this omission "citation amnesia." Although McConnell wrote an annual review of invertebrate learning in 1966, the most recent annual review of invertebrate learning by Krasne and Glanzman (1995), which included references to the late 19th and early 20th centuries, contained no primary citations of McConnell and the work from the 1960s on planarian learning. McConnell's (1966) article contained 109 references, none of which survived for citation by Krasne and Glanz. Why has this work virtually disappeared from contemporary citation?

### **Memory Transfer: McConnell's Blind Alley**

One reason for the missing citations to McConnell is that his memory transfer paradigm was a failure. In these

“cannibalism” studies, which McConnell (1962) saw as a technique for transferring a memory molecule of RNA from trained to untrained organisms, a naive planarian showed savings in the acquisition of a conditioned response (CR) when fed the body parts of a planarian that had learned a classical conditioning task. McConnell’s research program with planaria collapsed when other scientists failed to replicate the phenomenon of memory transfer. The failure of memory transfer has probably overshadowed McConnell’s success with invertebrate learning. Because others (Collins & Pinch, 1993; Donegan & Thompson, 1991; Rose, 1992; Travis, 1980, 1981) have told the colorful story of the failure of the memory transfer research, this article concentrates on McConnell’s successful struggle to establish the study of invertebrate learning as a respectable endeavor.

### McConnell’s Struggle With Critics Over Invertebrate Learning

Today invertebrate learning is well established (Abramson, 1994) as a robust, long-lasting, ecologically valid phenomenon (Krasne & Glanzman, 1995), presupposed by the scientists who work on the molecular dissection of memory (DeZazzo & Tully, 1995). In McConnell’s day, the critics simply did not believe that invertebrates could learn.

The original Thompson and McConnell (1955) study, a demonstration of Pavlovian conditioning in planaria, is a classic article on invertebrate learning (Abramson, 1994). It launched McConnell’s career. Planaria live in water and normally glide along the bottom of pools on slime trails they lay down. The classical conditioning trials were administered while the planarian was gliding in water from one end of a foot-long trough to the other. Rather than recording the CR automatically, Thompson and McConnell followed a more ecological tradition of comparative psychology and used naturalistic observation to score contraction. For the experimental group, which consisted of the pairing of a light from above with shock through the water, the percentage of trials with a contraction CR increased modestly from about 2% during the first 50 trials to 10% during the last 50 trials. Another response, turns which were more common, increased from a high baseline of about 25% to a conditioned rate of 35%. For the three control groups (light alone, shock alone, and a naive group with neither a CS nor an unconditioned stimulus [US]), the rate of contractions did not change.

Thompson and McConnell were graduate students of M. E. Bitterman at the University of Texas. Bitterman, a distinguished comparative psychologist, had studied with Schneirla, so these students inherited a great tradition of comparative psychology. McConnell’s first struggle over planarian learning was with his mentor, Bitterman, and it occurred before the article was even submitted for publication. Bitterman (1975), who wanted a control group with unpaired presentations of light and shock, left us with a very critical commentary on the scientific skills of his neophytes. Here is Bitterman’s retrospection:

Is it really so difficult to understand that CS-alone and US-alone groups do not, even together, control for the effects of stimulation per se on an experimental group exposed to both stimuli? . . . Not only are the controls employed in the search for invertebrate learning generally inadequate, but the techniques are crude and subjective. (Bitterman, 1975 p. 140)

Bitterman’s critique raises an important question about the conflict between novice innovators and established scientists. Creative—especially young—scientists may want to publish innovative findings as rapidly as possible to establish their reputations, sometimes even before the technique is perfected and all of the relevant variables are understood. More established scientists, whose reputations are secure, want to protect the literature from unreplicable phenomena and poorly controlled experiments. Here, the conflict was resolved in favor of publication by Harry Harlow, editor of the *Journal of Comparative and Physiological Psychology*. History shows that Harlow made the right decision.

In 1955, Harlow wanted to publish articles using nontraditional (i.e., nonrat) species because of a famous article by Beach (1950) called “The Snark Was a Boojum.” Beach’s point was that the journal was becoming a journal of rat psychology, so he called for a greater variety of species. A game that a sophisticated reviewer for a journal can always play with a novice investigator who is moving a line of work in a new direction is to demand additional control groups that are different from those used in the article under review. By relaxing the editorial criterion for originality, some flaky articles will be published, but then other scientists can sort out the issues by running replications that include the inevitably necessary controls.

The controversy about planarian learning highlights the constructive role of the scientific critic. McConnell, an innovator, raced from one exciting phenomenon to the next without comprehensive experimental analysis or adequate controls. McConnell’s controls were often developed as a response to his critics. McConnell’s students and other scientists were left the task of cleaning up after McConnell by adding the control groups that he omitted. After his arrival at the University of Michigan, Donald Jensen became McConnell’s nemesis over invertebrate learning—Jensen’s position was “that *no* invertebrate, no matter how complex is capable of showing ‘true [associative] learning’ ” (McConnell & Shelby, 1970, p. 75). Jensen (1965) attributed the results of planarian learning to sensitization and called for better control groups. McConnell met Jensen’s objections by upgrading the quality of the control groups. As he put it, “There is probably no other group of scientists as enamored of the use of ‘control groups’ as are psychologists; indeed the entire history of scientific psychology may be viewed as a continuing search for better controls” (McConnell, 1967a, pp. 25–26). The planarian learning controversy brought passion to the discussion of control groups for classical conditioning because a Nobel prize was thought to await the discovery of a biochemical engram.

### **Controlling for Experimenter Bias**

Experimenter bias was one of the simplest criticisms. Cordaro and Ison (1963) manipulated the expectancy of students in a course in introductory psychology who were running an experiment in classical conditioning on planaria. Sure enough, the students who were led to expect contractions reported more responses than students who were led to believe that conditioning would not occur. McConnell (1967a) quickly instituted a blind control procedure in which the experimenter did not know the group to which the planarian was assigned, so experimenter bias did not explain the data.

### **Controlling for Pseudoconditioning and Sensitization**

Baxter and Kimmel (1963) repeated the original Thompson and McConnell (1955) study with the addition of an unpaired control group. The unpaired group equated experimental and control groups for the amount of exposure to the CS and US. For the classical-paired group, the number of trials with a CR increased to 50%, whereas the unpaired group showed a steady decrease in responding during conditioning. To distinguish between *pseudoconditioning*—the enhanced responding to a CS that is not dependent on a forward, temporal CS-US relationship—Jacobson, Horowitz, and Fried (1967) added a backward conditioning control group. There was no learning with the backward conditioning group. Ultimately, by giving the animals only a few trials per day, lengthening the intertrial interval, and not running the animals each day, McConnell (1964) was able to obtain a CR on 90% of the trials. Thus, the controversy about planarian learning produced a steady improvement in the quality of the data as the researchers identified optimal parameters.

Today, a common control procedure in invertebrate learning is a discrimination in which a CS+ is paired with the US, and a CS- is presented alone. This procedure controls for *sensitization*, an increase in responding to a CS that does not depend on the forward pairing of the CS with the US. This control was introduced to invertebrate learning with planaria by Block and McConnell (1967) to address concerns raised by Jensen (1965) about sensitization as an alternative explanation to associative learning. Block and McConnell established exactly the kind of discrimination called for by Jensen by implementing an elegant A-B-A-B reversal design within-subjects. One CS was vibration produced by a speaker mounted below the trough, and the other CS was the traditional illumination from lights mounted above the trough. Paired presentations in Phase A increased responding to CS+ but not CS-, whereas extinction in Phase B reduced responding. As Block and McConnell concluded in their study, "The findings of the present study . . . should go a long way towards answering in the affirmative the question, 'Can planarians be conditioned reliably?' " (p. 1466). Amen.

Even after he was well established as a comparative psychologist at the University of Michigan, McConnell

was sometimes unable to obtain respect for his work on planarian learning from scientists in other disciplines. Libbie Hyman, a zoologist, was the world's leading expert on invertebrates. After establishing that invertebrates could learn, McConnell moved on to the problem of memory. McConnell, Jacobson, and Kimble (1959) demonstrated that planaria could retain an association established by Pavlovian conditioning for four weeks. During the early 1960s, when McConnell visited Hyman at her office in the American Museum of Natural History in New York City, Hyman dismissed McConnell's article on retention with the following words, "I'm very sorry, but I just can't believe that. No that just can't be. I could believe that a planarian might remember something for five minutes or so. But weeks or months? No that just can't be" (McConnell, 1970 p. 1). Clearly, the expertise of comparative psychologists in behavior analysis had not yet earned the full respect of scientists in other disciplines during the 1960s. Some simply did not believe the data.

### **McConnell's Origin Myth for Planarian Learning**

McConnell was a charter member of the Science Fiction Writers of America, and his stories were good enough to appear in magazines for science fiction. In his story, "Learning Theory," (McConnell, 1965), McConnell is the protagonist who is abducted during the preparation of a lecture on learning theory onto an interstellar labship to become a subject, confined to a series of chambers that resemble the Skinner box, T-maze, and Lashley jumping stand. After first behaving according to the predictions of learning theory, McConnell realizes that he will be returned to Ann Arbor if he misbehaves by violating the predictions of his captors' theory of learning. McConnell was an iconoclast, and his story is a spoof on learning theory in 1960.

After the loss of grant support produced the demise of the planarian research project around 1971, McConnell wrote a very innovative textbook of introductory psychology (McConnell, 1974a). Given his background in science fiction, it was natural for McConnell to blend fiction with the factual material of a textbook. To capture student interest, a unique feature of McConnell's text was a short story wrapped around the psychological meat of each chapter (McConnell, 1978). The fictional stories were deliberately written to avoid gender and ethnic bias in language (McConnell, 1973).

For his chapter on memory, McConnell (1983) wrote a fictional version of the Thompson and McConnell (1955) study called "Where Is Yesterday?" The heroes of the story were students who were running an experiment on planarian learning. The antagonist was an establishment teacher of the students called Sauerman. These characters were obviously inspired by Thompson and McConnell's experience with Bitterman. Notwithstanding McConnell's quotation at the beginning of this article, he rewrote history by cutting Bitterman out of the origins of planarian learning while incorporating into the fictional

account the very control Bitterman had required for his endorsement.

To readers of McConnell's (1983) introductory textbook, he and Thompson appeared as antiestablishment youth heroes of the 1960s who single-handedly took on the scientific establishment of learning theory from a laboratory in a kitchen sink of an apartment in Austin, Texas, with a budget of \$3.89 for equipment and then, somewhat like Horatio Alger, earned fame and fortune with federal research grants. McConnell's story had a kernel of truth: Planarian learning really did begin in McConnell's kitchen sink. McConnell gave Bitterman the fictional name, Sauerman. McConnell wreaked his revenge on Bitterman for the low opinion of his article in the following lines:

Sauerman hates flatworms . . . he won't let us work in the animal labs. . . . There's no way to get an A on our project, you know. . . . Doing research that Sauerman doesn't approve of. . . . [but this experiment] might even make us famous." (McConnell, 1983, p. 366)

Here, McConnell's fiction deprives Bitterman of the due credit for originally suggesting a planarian preparation.

In the fictional study, McConnell (1983) demonstrated after a delay of almost 20 years that he really did understand Bitterman's lesson about the appropriate control groups for classical conditioning. In his fictional version, McConnell added the unpaired control group recommended by his former mentor, Bitterman. This control, actually run by Baxter and Kimmel (1963), was not present in the original Thompson and McConnell study. "We've got to prove that it's the *pairing* of the light and shock that causes any change in the way the worms respond. And the third group gets both light and shock, but they are not paired" (McConnell, 1983, p. 368). The moral that McConnell chose for the fictional story was a lesson about the importance of control groups. How ironic that McConnell was often accused by critics of running experiments that were poorly controlled!

### Escaping Peer Review as a Celebrity-Scientist

Most scientists probably consider their task complete when an article is finally in press. Because the public does not read scientific journals, McConnell believed that a scientist also has an obligation to communicate significant findings to the public through the mass media. Such communication requires skills in public relations, a field in which few psychologists have expertise. McConnell had an edge because he worked in radio and television before his career as a psychologist. He cultivated the press throughout his career as a psychologist, and he thought that professional scientists should cooperate with the press as much as professional athletes (McConnell, 1967b). McConnell was not only a scientist, but also a very successful science writer and pop psychologist. McConnell's media strategy is best described by the person who knew him best, his personal secretary and business manager of

*The Worm Runner's Digest*, Marlys Schutjer (personal communication, January 7, 1995):

Jim wanted to say things that would shock people, to create controversy, so as to make people think. He wanted to be controversial. He wanted to get people to say, 'You've got to be kidding!' He wanted to interest people, but in the end he wound up alienating his colleagues.

For most scientists, the news is the discovery, the original data presented in the article. Journalists also want to know from scientists about their discoveries, but there is more to news than just discovery. For research on animals, journalists also want to know about potential applications of scientific findings to humans. News sometimes involves predicting the future, so journalists often ask scientists for forecasts. In a modern culture permeated with science, the public expects a scientist to assume the role of a prophet. McConnell was a futurist who believed in a behavioral revolution similar to the industrial revolution, so his media work often contained predictions that went well beyond the data. The problem with scientific journalism is that, unlike the editors of American Psychological Association (APA) journals, journalists do not provide peer review. They are not experts on the science.

Benjamin's work on the history of psychology's public image from the 1880s through the beginning of World War II revealed that psychologists "promised more than they could deliver, a situation that fueled public distrust" (Benjamin, 1986, p. 945). The APA has long encouraged coverage of its annual meeting by the media, but Benjamin's work revealed that, historically, the coverage has often been sensational, a tradition McConnell continued.

McConnell's work on retention following regeneration in planaria provides a case study in sensational journalism and illustrates how his media work escaped the normal mechanisms of peer review. When McConnell submitted an article (McConnell, Jacobson, & Kimble, 1959) on retention following regeneration to Harry Harlow, editor of the *Journal of Comparative and Physiological Psychology*, his cover letter contained the following statement: "At the close of the article we permitted ourselves the liberty of making some perhaps wild-sounding conjectures to explain our results. I hope that you will not find them too wild, nor out of place in your journal" (McConnell, letter, January 27, 1958). In his acceptance letter, Harlow gracefully insisted that McConnell delete the speculative material from the discussion so as to comply with journal policy (Harlow, letter, April 23, 1958). Thus, peer review restricted McConnell's ability to speculate in the pages of the journals of the APA. The irrepresible McConnell sought other venues for speculation. The annual APA meeting in 1959 provided an opportunity.

How did McConnell catapult an arcane topic in comparative psychology, retention following regeneration in planaria, to an international news story? First, for the audience of psychologists, he (McConnell, Jacobson, &

Maynard, 1959) speculated about a memory molecule; then, for the press, he speculated about a memory pill. When a planarian is cut in half, each half regenerates in about two weeks to form two regenerated planaria. After cutting a planarian in half, the head was conditioned. Repeating the surgery twice, on first- and then on second-generation animals, produced a third-generation planarian in which the nervous system was entirely regenerated compared with the organisms that experienced Pavlovian conditioning. When the third-generation animals regenerated from the tail showed savings, McConnell concluded that the engram was biochemical, not neural as Lashley had supposed. The headline for the story became "How Tails Remember."

Just a few weeks after the APA meeting, *Newsweek* ran a prominent story indicating that McConnell had discovered that "memory and learning appear to have a chemical inherited basis" ("Animal Life," 1959, p. 110). McConnell never mentioned applications to humans in his talk, yet the readers of *Newsweek* were promised that "It may be that in the schools of the future students will facilitate the ability to retain information with chemical injections" (p. 110). McConnell (1974b) later recalled the *Newsweek* story as a "a tongue in cheek article," a joke not shared with his readers.

McConnell's next big break in scientific journalism was provided by Arthur Koestler (1965), the British novelist, social critic, and scientific journalist. Koestler and McConnell became friends when Koestler visited Ann Arbor on a personal quest for an experience of LSD. Koestler had a bad trip with LSD, but he was impressed with McConnell. Koestler was one of the 20th century's great writers, and he wrote a superb article for the *London Observer* that was reprinted in the United States in *The Washington Post*. For scientists, the news was that invertebrates could learn, but inherited memory, not learning, was the element of the story that was emphasized by Koestler and the media. The figure for the story had the following caption: "How a Worm's Tail Inherits Memory: University of Michigan Researchers Use Flatworms to Demonstrate How Learning May Be Inherited." In *The Washington Post*, the headline for the study was "Michigan Crawlies Are Crossing Up Mendel" and "Some Genetic Heresies Are Suggested by Experiments in Ann Arbor." The media wrapped planarian learning with a bizarre cachet about inherited memory. The public was not let in on the inside story—that language McConnell borrowed from genetics about successive generations was metaphorical, so a casual reader could easily have been misled into believing a story about a Lamarckian inheritance of acquired characteristics.

In 1964, the *Saturday Evening Post*, the magazine of middle America, carried a feature story on McConnell (Bird, 1964). By 1964, McConnell had moved from regeneration to cannibalism, so now the public relations effort switched to the new work on memory transfer. The magazine told readers (Bird, 1964) that "uneducated worms can acquire the wisdom of more intellectual ones by eating them. This suggests a theory of knowledge

which, avoiding outright cannibalism, might someday enable us to learn the piano by taking a pill, or to take calculus by injection" (p. 66).

McConnell was one of the first psychologists to recognize the potential of radio and television for public education. Prior to receiving his PhD, McConnell worked in radio and television as a disc jockey and script writer. During the 1960s, Steve Allen was one of the pioneers of the television talk show. His shows were seen by millions. The script for McConnell's appearance on the Steve Allen Show (Moskowitz, 1964) was simply a televised version of the McConnell story in the *Saturday Evening Post*. McConnell carried his apparatus to Los Angeles for the taping, so millions of viewers heard a lecture from McConnell about Pavlovian conditioning in invertebrates. However, the price for communicating the basic science was packaging the top and bottom of the show with wild science-fiction speculation about memory pills, predictions about the future of man, and showbiz hype.

McConnell was extremely skillful in calibrating his rhetoric to his diverse audience, even to the extent that his scientific writing and private letters to individuals sometimes contradicted the impression left by his media work. McConnell generalized freely from planaria to humans when his audience was the readers of *Time*, *Newsweek*, and the *Saturday Evening Post*. When writing for a scientific audience, he cautioned that "one obviously should not generalize these results to the human level too readily" (McConnell, 1967a, p. 7). Although McConnell's media work made it appear that memory pills were just around the corner, individuals who wrote to McConnell requesting information on where to obtain memory pills received a very conservative, cautious form letter (McConnell, January 14, 1966), which stated that "the 'memory molecule' [RNA] is merely an assumption on our part. . . . At the moment, there is no such thing as a 'memory pill.'" McConnell's strategy of publicity at any price was a double-edged sword. The publicity probably attracted some scientists to planarian learning, but McConnell's flair for speculation put him on the fringe of scientific respectability.

Evaluating McConnell's public relations blitz for planarian learning and memory from the vantage point of 30 years is difficult. To market his ideas to a mass audience, McConnell connected planarian learning to the American myth of the quick, easy, simple technological fix for complex problems. McConnell knew when he was kidding, but his less sophisticated mass audience could easily have been misled. By appealing directly to a mass audience, McConnell escaped the peer review that would have tempered his hype. He outmatched the few dissenters with charisma.

The profession does not have a mechanism for providing peer review for the attempts of psychologists to popularize the discipline. Because psychologists have a First Amendment right to express their views on psychological topics to the public as they see fit, the problem of how to popularize psychology does not have a simple solution. Fidelity to the peer-reviewed literature is pro-

posed as an ethical standard for evaluating coverage of psychological topics by the media. When a topic is controversial, the media could present alternative viewpoints, dissenting opinions, and heavy doses of old-fashioned scientific skepticism. The coverage of planarian learning by the media provides lessons of contemporary relevance. Although the coverage of contemporary neuroscience by the media is well beyond the scope of this article, basic research on neural mechanisms of memory is still sometimes accompanied by speculation about a memory pill (Service, 1994).

Our graduate institutions do not provide psychologists with training in the art and ethics of public relations. This represents a failure to build public support for science. Many responsible psychologists shun the media and are even reluctant to cooperate with professional science writers because of a desire to avoid the sensational. By their silence, such scientists bear some responsibility for the distorted messages about psychology that reach the public through the media.

### **The Worm Runner's Digest: Peer Review Versus the 1960s Counterculture**

McConnell's name is inevitably linked with the infamous *The Worm Runner's Digest*, McConnell's house organ. Today McConnell would have set up a Web site on the World Wide Web, but there was no Web site in McConnell's day, so he founded his own journal. The journal is hard to pigeonhole. It is funny and strange: an improbable, flawed, and ultimately unworkable combination of a humor magazine and a scientific journal. It is one of the great cultural relics of psychology from the 1960s, a scientific incarnation of the counterculture. Cmiel (1994), a social historian of the counterculture of the 1960s, analyzed the rhetoric of the counterculture and observed that it represented an attack on the prevailing norms of discourse. For McConnell, the rhetoric of the scientific establishment was serious, so as an antiestablishment scientist he countered with humor.

The *Digest* was a counterculture version of the *Journal of Comparative and Physiological Psychology* and was born in the burst of public enthusiasm for planarian learning that followed the story that appeared in *Newsweek* in September 1959 ("Animal Life"). Below the masthead, the digest was identified as "An Informal Journal of Comparative Psychology." The idea was to provide a clearinghouse for research with planarians, that is, to publish pilot studies before final versions were published in traditional scientific journals. At first, a clear consequence of McConnell's (1959) editorial policy was that articles would escape the rigorous peer review of the establishment journals. After the *Digest* was founded, McConnell never again published an article in the *Journal of Comparative and Physiological Psychology*. The *Digest* soon became a home for memory transfer research. At first, the ideas about memory transfer that McConnell placed in the *Digest* were taken very seriously by other

scientists until "failure to replicate" letters and articles in *Science* consigned memory transfer to the scientific fringe.

In addition to the serious science, the *Digest* was clearly part of a counterculture effort to poke fun at the scientific establishment. The masthead of each volume of the *Digest* included a shield with a two-headed planarian, below which was a Latin inscription *Ignotum per Ignotius*, translated humorously as "the unknown explained through the still more unknown." The problem was that as the head of the Planarian Research Laboratory at one of the finest research institutions ever assembled and as a scientist whose research grants were subsidizing the *Digest*, McConnell (1961b) was attacking himself because he was part of the scientific establishment.

The scientists who published the serious articles in the *Digest* wanted to receive credit from others for their work. Citation by others is one of the clearest ways of providing credit. One issue that surfaced early was "Does one dare cite an article from *The Worm Runner's Digest*?" (McConnell, 1960, p. 3) in a peer-reviewed journal. For some editors, the answer was clearly "no." McConnell was never able to achieve a satisfactory resolution between his sense of humor and his sense of science. McConnell's first solution was to put the serious articles at the beginning of the journal and the satire at the end. When the serious authors of the scientific articles complained that abstracting services refused to consider citation for any article that appeared in a journal with such a strange title as *The Worm Runner's Digest*, McConnell twinned the journal. The front half was called *The Journal of Biological Psychology*, but the back half, which was published upside down, was *The Worm Runner's Digest*. Suddenly, libraries wanted to subscribe to *The Journal of Biological Psychology*, and *Psychological Abstracts* requested a copy of this "new" journal for abstracting (McConnell, 1969). By 1967, McConnell announced a policy of peer review for both journals; thus, even McConnell was forced to adopt a policy of peer review. McConnell poured thousands of dollars over the years from his own pocket to keep the *Digest* alive, so the journal represented a financial loss for him. In his closing editorial, he recognized that "it is impossible to publish a journal these days without the backing of some organization" (McConnell, 1979, p. 1).

McConnell was a precursor of the neuroscientists who took up the biochemistry of memory where he left off. McConnell only got inside his organism with biochemical rhetoric, never with a valid neurophysiological technique. Today planaria are no longer used in research in the biochemistry of learning, so McConnell's planarian learning program represents the end of a line.

However, the torch of the search for the engram was passed to the next generation. The location of the books in the library at Michigan State University provides a metaphor for this historical transition. *The Worm Runner's Digest* was passed to history when it ceased publication in 1979. In this library, a few feet away from the last volume of the *Digest*, is the first volume of *The Jour-*

*nal of Neuroscience*, which began publication in 1981. No one could ever confuse *The Journal of Neuroscience* with a humor magazine. That journal was published by the Society for Neuroscience, and in its first volume there was an article on classical conditioning of a simple withdrawal reflex in the invertebrate, *Aplysia californica*, by Carew, Walters, and Kandel (1981). After a quarter of a century, this article is a worthy successor to Thompson and McConnell's (1955) first article on planarian classical conditioning. There is no reference to McConnell or the controversy over planarian learning, but Carew et al. followed in McConnell's footsteps with the following procedures: visual observation of the dependent variable; five control groups, each of which had been used earlier in invertebrate learning; and the testing, which was carried out using a blind procedure. The lessons from the planarian controversy had been mastered by those who were about to write the next chapter in the search for the engram by watching siphons withdraw instead of planaria turn. With settlement of the invertebrate learning controversy by the specification of control groups, McConnell liberated the next generation. The dream of a Nobel prize for unraveling the biochemistry of memory now belongs to a new group.

## **Attracting the Unabomber While Overselling Behavior Modification**

### **The Assassination Attempt**

On November 15, 1985, James McConnell became the victim of an assassination attempt by a serial bomber who is known to the media as the Unabomber because his earlier victims included professors and executives of airlines. At this writing, a man suspected of being the Unabomber has been arrested. Fortunately, McConnell was not killed, but his hearing was impaired by the sound of the blast (McConnell, 1987).

As far as I am able to determine, this sad episode marked the first time in the history of psychology that the murder of a psychologist was attempted, by an individual who did not know his victim, for the sole reason that the would-be assassin found the psychologist's ideas offensive. McConnell was the intended victim of the bombing, but the Unabomber's real target was applied psychology, specifically behavior modification. Unfortunately, the Unabomber selects his targets from those scientists who popularize technology with bold, simplified rhetoric that includes sweeping predictions about how technology will change society ("Bomber Links an End," 1995). McConnell wrote two magazine articles about behavior modification, "Psychoanalysis Must Go" for *Esquire* (McConnell, 1968) and "Criminals Can Be Brainwashed Now" for *Psychology Today* (McConnell, 1970), either of which could have caught the Unabomber's eye. The Unabomber targeted McConnell because he popularized behavior modification ("Serial Bomber," 1995).

### **Overpopularizing Behavior Modification**

After McConnell's planarian research program collapsed, he turned to B. F. Skinner's brand of behavior modifi-

cation, but his contributions to the field were not distinguished. Much as Thomas Huxley was a bulldog for Darwin's theory of evolution, James McConnell used his considerable rhetorical and public relations skills to popularize behavior modification. Just as John Watson oversold behaviorism during the 1920s in the media (Todd, Dewsbury, Logue, & Dryden, 1994), James McConnell wrote articles for the popular press that oversold behaviorism during the 1960s.

McConnell (1967a), who wrote that "the entire history of scientific psychology may be viewed as a continuing search for better controls" (pp. 25-26), failed to generalize this truism from planarian learning to behavior modification. McConnell naively believed that the application of a behavioristic conception of reward and punishment would solve the social problems of crime and mental illness. He failed to recognize that the evaluation of a behavioral modification program required control groups.

*Esquire* (Polsgrove, 1995) tried to be funny about the 1960s, so the magazine provided an ideal forum for McConnell. In 1968, when its 35th anniversary coincided with political assassinations, *Esquire* commissioned a set of articles around the theme "Salvaging the Twentieth Century." McConnell was commissioned to write not only about what was wrong with psychology, but also about what was worth salvaging. McConnell's piece was "Psychoanalysis Must Go" (McConnell, 1968), an article accompanied by a drawing in which Freud, his diploma, and his couch were caught in free fall against the background of a multistory, dingy, office building. After an unsupported, bald assertion that "psychoanalysis doesn't really help the patient at all" (McConnell, 1968, p. 280), McConnell went on to predict that behavior modification would eliminate the need for mental hospitals and prisons. His article concluded with the following predictions:

Mental hospitals as such will probably disappear in the next twenty years or so. . . . Indeed, we should be able to discover methods of retraining criminals that will be so powerful we can guarantee that, once released, the prisoners will be most unlikely to commit a crime again. (McConnell, 1968, p. 287)

However, history shows that behavior modification led to the disappearance of neither crime nor mental illness.

By overselling behavior modification as a panacea for crime, McConnell helped plant the seeds for the public disillusionment with psychological interventions that haunts our profession today. McConnell did not realize that his overoptimism set a trap for the next generation of applied psychologists. Today, a social critic could say that these programs were not as effective as promised.

Brown (1992) demonstrated that the promoters of early applied psychology often drew metaphors from more prestigious professions such as medicine, as when the early promoters of IQ tests compared the IQ tests with thermometers. Because physics had high prestige from the nuclear weapons developed during World War II and because McConnell (1973) also knew that scary stories made news, he combined fear and the metaphor of the atomic



bomb as a public relations tool to sell behavior modification when he wrote the following: "The techniques of behavioral control make even the hydrogen bomb look like a child's toy." (McConnell, 1970, p. 74). In "Psychoanalysis Must Go," McConnell frightened his readers with a vision of an ascendant behavioral revolution "so powerful and so pervasive [that] it's doubtful that your life will ever be quite the same again" (McConnell, 1968, p. 176). Totalitarian, antidemocratic threats also scared the American public. In a book devoted to the cultural significance of American psychology following World War II, Herman (1995) noted that "No science poked more holes in democratic ideals than psychology" (p. 23). McConnell knew that he could scare his readers by comparing behavioral engineers with an Orwellian vision of a totalitarian state. Therefore, he ended his editorial in *Psychology Today* with a vision of a behavioral engineer with a license to redesign American society along anti-civil liberties principles: "Today's behavioral psychologists are the architects and engineers of the Brave New World" (McConnell, 1970, p. 74).

With his most provocative statement, McConnell wove prophecy, behavior modification, and antidemocratic rhetoric into a very scary, antidemocratic scenario: "I believe the day has come when we can . . . gain almost absolute control over an individual's behavior. . . . and there is no reason to believe you should have the right to refuse to acquire a new personality if your old one is antisocial" (McConnell, 1970, p. 74).

McConnell lived in a period in which the popular culture was saturated with revolutionary rhetoric (Farber, 1994). In the United States during the 1960s, there was rhetoric of a sexual revolution, a Black power revolution, a revolution in the culture of popular music called rock 'n roll, and the Vietnam War produced calls for a political revolution. Therefore, it is not surprising that McConnell, who was closely attuned to popular culture, would adopt revolutionary rhetoric to advance his views. As a Skinnerian behaviorist, McConnell could honestly write that

Today's revolutionary concept is that man's behavior can be studied, and explained, in objective terms without any necessary reference to supernatural or spiritual or mentalistic entities. 'Mind' . . . is as useless an explanatory concept to today's scientific psychologist as the mythical element 'phlogiston' that chemists once believed caused all fires. (McConnell, 1968, p. 176)

McConnell caught a high-water mark of behaviorism, just before its ebb and the rise of modern cognitive psychology.

### **Conclusion: Some Historical Lessons for Today From the 1960s**

The history of invertebrate learning illustrates how ideas are assimilated by the scientific community. During the 1930s, invertebrates were considered little robots, guided by instincts, in which the ability to learn was, at most, ephemeral. During the 1960s, James McConnell, a creative, charismatic comparative psychologist, used the media and revolutionary rhetoric from the counterculture

to glamorize planarian learning and to attack the view of the scientific establishment that invertebrates could not learn. McConnell used a Pavlovian conditioning paradigm. When the adequacy of the early data was challenged by critics, McConnell and others caught up in the esprit de corps for planarian learning introduced control groups that are still used today for Pavlovian conditioning. Although his memory-transfer paradigm for studying the biochemical basis of memory was a failure, McConnell has not received the credit he deserves for establishing invertebrate learning. Today, invertebrate learning is so well established that citations to the earlier work are no longer considered necessary. Replication and peer review worked well for evaluating McConnell's scientific ideas.

Unfortunately, peer review does not provide a mechanism for regulating the popularization of psychological ideas by the media because journalists and the producers of television shows are not experts on the science. Because psychologists have a First Amendment right to express their views on psychological topics as they see fit, the problem of how to popularize psychology without misleading the public does not have a simple solution. As a celebrity-scientist, McConnell presented the mass audience of television, radio, and the popular press with a mixture of basic scientific information about Pavlovian conditioning in invertebrates, futuristic predictions about a memory pill, and entertainment. As a science writer, McConnell promised the public more than he could deliver. After the collapse of the planarian project, McConnell became a shill for B. F. Skinner's brand of behavior modification. A behavioral engineer could "guarantee" that a suitably retrained prisoner with a new personality would never commit a crime. Ultimately, McConnell became more adept at publicity than in providing original contributions to the science. It appears that McConnell's public relations efforts on behalf of behavior modification led to an assassination attempt on him by the Unabomber, a Luddite opposed to behavioral engineering.

McConnell deserves to be remembered not only for his scientific creativity, but also because he was one of our field's great popular writers. The public expects prophecy from its scientists. However, McConnell did pay a cost. He provided the public with the prophecy they expected and received the fleeting fame that comes from the publicity of the moment, but at the price of professional ostracism. Fidelity to the peer-reviewed literature is proposed as an ethical standard for evaluating coverage of psychological topics for and by the media.

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