CHAPTER 11 FINDING A RESEARCH PROBLEM

> Asking the right question is more than half the work of science. When we can understand how scientists do that, then we will understand how to do science. *ROOT-BERN STEIN*

Being asked to conduct an original research project raises doubts and fears in most students. You may see yourself as about to enter "a vast uncharted region . . . with a good deal of mistrust in the appropriateness of [your] equipment," as John Lilly, the pioneering researcher on dolphin and whale communication we quoted in Chapter 1, put it. What kinds of research will make the grade? How can I find a good enough project? How can I come up with a question that hasn't been answered before? What if I can't think of a testable hypothesis? Fears such as these are common among students and not at all unusual even among seasoned research scientists. Janet Bavelas, a social psychologist, writes:

> Volumes could be written on the role of fear in research. . . . Fear stalks us from the beginning and continues throughout, until the results are in and checked (Bavelas, 1987, p. 321)

Recognizing the inevitability of anxiety and frustration, and realizing that even professional researchers experience these emotions is helpful as you begin.

Starting a project is especially anxiety provoking. So naturally beginners are eager for any help they can get on how to come up with that all important question and that new and useful hypothesis. Unfortunately, discussions of scientific method by philosophers of science or in handbooks of research often are of little help. Most of these focus on the *later* stages of research when scientists attempt to *answer* research questions and *test* hypotheses. They rarely discuss how scientists come up with testable research questions or invent hypotheses to answer them.

Those accounts of the early phases of scientific research that are available aren't of much help to beginning researchers either. Typically they offer little how-to information. Instead, we find mystifying, perplexing, and discouraging stories of people of extraordinary genius (the Curies, Pasteurs, and Einsteins); of creative inspiration coming from "out of the blue," while the scientist is asleep, taking a bath, or relaxing under a tree; and tales of discoveries happened upon while the scientist worked on other problems. Although such stories do contain some truth—some scientists are brilliant, insights can seem to arrive from nowhere, and luck can be involved—historians of science, who study scientific discovery, believe that such irrational processes play a very small role in creativity.

Robert Weisberg (1986), for example, looked at how two important scientific discoveries came about: the Nobel Prize-winning discovery of the structure of the DNA molecule by the geneticists James Watson and Francis Crick and Charles Darwin's discovery of evolutionary theory. Weisberg concluded, based on his study of these scientists, that you don't have to be a person of extraordinary genius to do outstanding scientific work. Scientific discovery, Weisberg believes, involves the same kinds of rational and logical thought processes as day-to-day problem solving. So as you begin to think about your project, you can take courage from the findings of historians of science. Since we all solve problems on a daily basis, we all should be capable of asking significant research questions and formulating testable hypotheses.

Robert Root-Bernstein (1989), another historian of science, found that as a group innovative scientists are deeply curious about the problems they study. They need to be. A research project is a big undertaking; it involves time-consuming exploration into the work of other scientists and a substantial investment of the researcher's time and energy designing the study and collecting observations. It is their deep curiosity about the questions they seek to answer that sustains scientists through this process, even when progress seems far off and discouragement close at hand.

Research often is inspired by questions raised but unanswered by other scientists, by the desire to see whether a published result can be replicated, or because the researcher sees flaws in the design, measures, findings, or interpretations of other researchers. Students often become intrigued with problems suggested by their academic mentors or by working as a member of a research team. Working on a research project is a great way to develop ideas for further research, and once you get one idea you will find that others soon follow. Sometimes the enthusiasm of other scientists is the spark. It is exciting to imagine yourself resolving a controversy being debated in scientific journals and at professional conferences.

Like Weisberg and other historians of science, we are convinced that curiosity, careful thinking and hard work are much more important to developing good research questions and sound hypotheses than creative inspiration or luck. And, like the scientists Root-Bernstein studied, we believe that you will not go wrong if you follow the advice of Jonas Salk, inventor of the polio vaccine, and "do what makes your heart leap!" (Salk, in Root-Bernstein, 1989, p. 410). As you explore possibilities for research, pay attention to what excites you. At this stage of the research, your passion should be your guide, and on that subject you are the undisputed expert.

This chapter is designed to get you started on the sometimes frightening, sometimes frustrating, but always exciting process of developing an idea for research. It focuses, first, on how to become knowledgeable in a particular area of psychology and, second, on how to zero in on a specific research question and hypothesis to investigate.

PREPARING THE MIND

Once you decide on a general area of psychology to study, your first task will be to learn as much as you can about it. Innovative scientists agree with Pasteur's maxim that "in the fields of observation, chance favors only the prepared mind" (in Roberts, 1989, p. 244). On the basis of interviews she conducted with winners of the prestigious MacArthur Fellowship, a prize given for competence and creative potential in science and a variety of other fields, Denise Shekerjian concluded that to do creative work in any field requires you to "know—intellectually, or spiritually, or instinctively—what you're talking about" (Shekerjian, 1990, p. 59). Knowledge seems to be essential to creative work in any field.

There are two main ways to become expert in an area. The first is to learn what others have thought and done, by attending conferences, talking to professors, or searching the published literature by reading books, chapters, and journal articles. The second, which relies more on yourself, involves learning about a phenomenon by collecting observations yourself, for example, by carefully observing seating patterns in the student cafeteria, or looking for patterns in how good friends negotiate disagreements. We will discuss both of these general strategies to developing expertise in this chapter.

Whether you use one or both of these approaches, your goal at this stage will be to open yourself to the full range of data and possibilities. As Goleman and his coauthors put it:

> The first stage is preparation, when you immerse yourself in the problem, searching out any information that might be relevant. It's when you let your imagination roam free, open yourself to anything that is even vaguely relevant to the problem. The idea is to gather a broad range of data so that unusual and unlikely elements can begin to juxtapose themselves. Being receptive, being able to listen openly and well, is a crucial skill here. (Goleman, Kaufman, & Ray, 1992, p. 18)

A major obstacle to such receptivity that you will have to overcome is the tendency toward premature self-criticism. Janet Bavelas (1987), a social psychologist who has written about creativity in research, believes that there is a time to subject your ideas to critical scrutiny, but it is not when they are just beginning to surface and are most vulnerable. If you take care not to kill your hunches, Bavelas advises, and care for and feed them instead, after a while they will become strong enough to stand on their own. Then the time will be right for criticism.

Bavelas (1987) compiled a list of don'ts for students to follow to avoid killing their newborn ideas and observations. She advises: Don't dismiss ideas that you get, as though they didn't happen. Don't immediately find categories to put them in; putting new observations into old categories just reinforces the view that there is nothing new under the sun. Don't belittle them. Don't be practical or critical. Don't panic.

The Literature Search

As you begin to search the published literature, your thinking is likely to be relatively unfocused. You may only be able to define general topics of interest, like the determinants of self-esteem, or the effects of birth order on personality. As you familiarize yourself with the literature on these topics, you will be acquiring the raw materials you need to formulate a specific research question and hypothesis.

To be most useful in generating ideas, your review of the literature should be systematic. It will help to know the theories that have been advanced, the questions and controversies that have arisen, the types of research that have been done, and the findings that have been generated. The following strategies should help to make your search a thorough one.

Gradually narrow your focus. As we have said, your goal at this stage of your research should be to open yourself up to the widest possible range of ideas. To accomplish this, we recommend that you start by reading broad overviews of the theories, research, methods, and findings in a given area. Then gradually narrow your focus until you hit upon a research question that you want to explore.

One good place to start is with textbooks. First, think of the subfield within psychology of which your topic is a part (e.g., social psychology, personality, perception), then look at one or more texts on that topic. Texts in a particular area tend to cover the same general set of topics, focusing on the established theories and findings, the issues that have generated research, and the unresolved controversies. They usually include extensive bibliographies that you can use as a guide to the important readings on the topic of interest to you. If you don't have a text in that area, ask your professors for help in finding one. Professors often have many texts on the subjects that they teach.

If you have even the vaguest idea of what topic you would like to explore, *Psychological Abstracts, PsycINFO,* or *PsycLIT* will get you off to a good start. *Psychological Abstracts,* issued monthly by the American Psychological Association (APA), from 1927 to the present, contains summaries of published works in psychology and related disciplines. The bound volumes for each year contain subject and author indexes, and there are separately bound cumulative subject and author indexes, each covering several years. *PsycINFO, PsycLIT,* and other computer searches are another good place to start. Most libraries now enable students to conduct bibliographic searches using computers rather than printed indexes like the *Psychological Abstracts*.

PsycINFO is the on-line computer version of *Psychological Abstracts*. It contains citations and abstracts for the journal, book, chapter, and dissertation literature in psychology, for the years 1967 to the present. *PsycLIT* is a subset of *PsycINFO* covering the journal, book, and chapter literature and available on CD-ROM. Like *PsycINFO, PsycLIT* is cumulative, incorporating the contents of *Psychological Abstracts* since 1974. In addition, *PsycINFO* and *PsycLIT* have an optional historical database that includes references dating from 1887. The education literature, which covers many similar topics to those in psychology, can be searched with *ERIC*. If your library does not have access to these sources, it is well worth the trip to the nearest library that does. Box 1 discusses how to use these psychological sources.

Finding a review article can be invaluable as you begin. This special type of article, like a text, does some of the summarizing and integrating work for you. Its focus can be on theory, research, methods, or some combination of these. The *Annual Review of Psychology,* published yearly since 1950, summarizes recent developments in various subfields within psychology (Reed & Baxter, 1992). *Psychological Bulletin* focuses on evaluative and integrative reviews of research. *Psychological Review* covers articles presenting new theories or criticizing current theories. Articles in these journals usually contain comprehensive bibliographies that can be a great help in finding research studies on a topic. You also can find review articles in *PsycINFO /PsycLIT* by searching the *Thesaurus* term LITERATURE REVIEW.

BOX 1 USING PSYCLIT, PSYCINFO, AND PSYCHOLOGICAL ABSTRACTS

To use PsycLIT, PsycINFO, or Psychological Abstracts, first look for your subject category in the Thesaurus of Psychological Index Terms (APA, 1997). The thesaurus lists words and phrases in psychology that have been authorized by the APA for use in Psychological Abstracts (Reed & Baxter, 1992).

If you are using Psychological Abstracts, you will have to check for your search terms in each volume. Searching with a computer based system, like PsycLIT and PsycINFO, is easier.

A brief guide to PsycLIT is given in Box 2. The search words you type are used to scan all the references on the CD. If PsycLIT comes on more than one disc at your library, be sure to use all the discs to extend your search back to 1974. As the example of a journal record in Box 2 illustrates, each reference is divided into several fields, the title, author, author affiliation, and so on. These fields can be searched separately or together using the logical operations described in Box 2. Look at the search examples in the box to see how this is done. The exact form of search statements varies according to the search system being used. This one is for the Silver Platter system. The results of your search can be printed at the library or saved on a floppy disk.

If you use the right search terms, PsycLIT, PsycINFO, or Psychological Abstracts will provide you with a list of publications on the topic of interest to you. If you are having trouble finding research on your topic, it's possible that you have discovered an area that has not been studied; but maybe you just aren't using the right search terms. Check the thesaurus again for other possible search terms or ask the reference librarian for help. Librarians are up to date on a variety of different databases and search strategies that may be helpful to you.

The list of references that you get from PsycINFO, PsycLIT, or Psychological Abstracts will include books and chapters only for some years. Psychological Abstracts included abstracts of books and chapters from its beginning in 1927 up to 1980. It did not cover books or chapters from 1981 through 1991. Between 1987 and 1990, the American Psychological Association published a set of volumes called PsycBOOKS, which abstracted books and chapters. Beginning in 1992, PsycLIT and Psychological Abstracts once again included books and chapters. PsycINFO and PsycLIT provide access to books and book chapters published from 1987 to the present.

Spend time at this stage of your project; the leads you find will be well worth your effort. But be cautious because searches can be temperamental; for example, authors' names may be misspelled in the database, so if you search by author you may miss a critical study. Also, you need to know the conventions of the database and the search system. If you want to search for articles published in the American Psychologist on Silver Platter, for example, you have to use the search term American-Psychologist; the hyphen is critical. So try multiple searches to overcome any idiosyncrasies in how the articles are indexed.

Box 2 PSYCLIT QUICK REFERENCE GUIDE

PsycLIT® SilverPlatter®

Quick Reference Guide

To restart system	Press **F7 (Restart)**	**A phrase**	**Find:** well being
		A word root	**Find:** famil*
To select a database	Use arrow keys to highlight database Press spacebar, then **Enter**	**Internal or limited truncation (one or no characters)**	**Find:** behavio?r; **Find:** norm?
List of commands	Press **F10**, then highlighted letter	**To combine concepts:**	
Database information	Press **F10**, then **G** for **Guide**	**Use AND to narrow search**	**Find:** symbolism and language
To use Thesaurus	Press **F10**, then **T** for **Thesaurus**	**Use OR to broaden search**	**Find:** wellness or health
To link chapters, books	Place cursor on <<SEE BOOKS>> or <<SEE CHAPTER>> Press **L** (for **Link**)	**Use NOT to narrow search**	**Find:** advertising not television
		Use WITH to restrict search to same field	**Find:** crowd* with violence
To search authors	Press **F10**, then **I** for **Index** Type last name, then **Enter**	**Use NEAR to narrow search to number of words in proximity**	**Find:** computer near anxiety
To look for: **A word**	**Find:** hesitation		**Find:** expert near2 system?

The computer search will give only references to the research articles not the articles themselves. Getting the articles, which is necessary, may be more challenging. If your college library's journal collection is extensive, you will find most of the articles you need there. If it is smaller, your librarian can help you find the closest libraries that hold the journals you are looking for. You can have the papers or books sent to your library through interlibrary loan or go to the libraries to copy the articles yourself. If you photocopy the articles, be sure to include the references at the end of each article. The references are a valuable part of the paper because they are a list of relevant studies and theoretical papers that at least one researcher found helpful. Read the references, one by one, to get leads on other paper Also, be sure to search the Internet, the information superhighway, fast becoming the eighth wonder of the world, for material related to your research topic. The Internet is by far the most diverse and dynamic of the new computer based information sources.

Information searching and retrieval on the Internet is made possible by networking a vast number of computers located all over the world. All the computers on this "World Wide Web" of networks can share information.

With an Internet connection, you can join live electronic conferences on academic topics, subscribe to electronic journals and newsletters, read scientific articles that are awaiting publication in print, access libraries, get

FIELD NAME	SAMPLE JOURNAL RECORD	SEARCH EXAMPLES
Title	TI: Effects of rock and roll music on mathematical, verbal, and reading comprehension performance.	rock with music in ti
Author	AU: Tucker,-Alexander; Bushman,-Brad-J.	tucker-alexander in au
Author Affiliation	IN: Iowa State U, US	iowa state in in
Journal Name	JN: Perceptual-and-Motor-Skills; 1991 Jun Vol 72 (3, Pt 1) 942	perceptual-and-motor-skills in jn
ISSN	IS: 00315125	00315125 in is
Language	LA: English	english in la
Publication Year	PY: 1991	1991 in py ; py=1989-1992
Abstract	AB: 151 undergraduates completed mathematics, verbal, and reading comprehension problems while listening to rock and roll music played at 80 db or in silence. The music decreased performance on math and verbal tests but not on reading comprehension. (PsycLIT Database Copyright 1992 American Psychological Assn, all rights reserved)	rock near1 roll in ab
Key Phrase	KP: rock & roll music; mathematics & verbal & reading comprehension performance; college students	mathematics with performance in kp
Descriptors	DE: ROCK-MUSIC; READING-COMPREHENSION; MATHEMATICAL-ABILITY; VERBAL-ABILITY; ADULTHOOD-	rock-music in de ; adulthood- in de
Classification Codes	CC: 2340; 23	2340 in cc ; 23 in cc
Population	PO: Human	human in po
Age Group	AG: Adult	adult in ag
Update	UD: 9201	9201 in ud
Accession Number	AN: 79-00362	79-00362 in an
Journal Code	JC: 1576	1576 in jc

Prepared by PsycINFO User Services, a department of the American Psychological Association.

shareware computer programs, view the collections of art galleries, listen to recordings of speeches and other events, watch live video, retrieve pictures taken from the Hubbell space telescope, publish your own electronic articles, and send E-mail (electronic mail) to other Internet subscribers world wide. *Every Student's Guide to the Internet* (Pitter et al., 1995) will get you started.

After you read various overviews (texts, books, chapters, review articles), you can follow your interests and begin reading more specialized theory and research papers. As you proceed, your ideas will become more and more focused. The more you read, the clearer you will be about which methods to use to test your ideas.

Search from the present to the past. We think the best strategy for reviewing the literature is to read up-to-date books and articles first. But don't consider your job done once you have looked up references from the last couple of years. Remember that the degree of confidence you have in the potential contribution of your research idea and the validity of your hypothesis will depend on how systematic your review of the literature has been.

Once you zero in on a topic of interest to you in the recent literature, follow up by reading the theory and research papers that led up to the modern work. In most cases, you will find that certain articles are referred to over and over again. When this happens, go back and read these frequently cited, and therefore influential, papers, chapters or books. Many researchers before you have considered them to be important.

From there you might follow up with a search using the *Social Science Citation Index (SSCI). SSCI* lists alphabetically by author all the published works that cite a particular publication. Using *SSCI* will bring you up to date on research and theoretical developments that were inspired by the study that interests you. *SSCI,* first published in 1966, covers a wide range of journals in the social sciences.

Whatever the specifics of your search, eventually you will reach a point of diminishing returns when reading further yields little in the way of new information. Then you can stop, confident in the adequacy of your search.

Use all the resources available to you. In addition to reading, talk to professors and fellow students about your ideas. A professor often will be familiar with books, chapters, or articles that you might not find on your own or able to suggest resource persons to contact for leads. Also be sure to use the available library resources fully. Don't hesitate to ask the reference librarians for help; they are there to assist you and are well trained in the library skills that you need to acquire at this phase of your research.

Collecting Your Own Observations

The second approach to becoming well informed in a given area of psychology is making your own observations. This strategy can be an excellent follow-up to the literature review. Jean Piaget (1954) used it as he observed the development of intelligence in his two young children; so did Jane Goodall (1986) when she studied chimpanzees in the wild, and Erving Goffman (1959) as he collected information on "the presentation of self in everyday life" among the Shetland Islanders of Scotland.

Twins Brielle and Kyrie snuggle together in their incubator.

Much of the advice on observing offered by scientists, who pride themselves on their ability to notice what others do not, has to do with getting rid of preconceptions, prejudices/and assumptions that can blind us to seeing what would be seen and understood with unobstructed vision. The following example highlights the importance of paying attention to what these scientists have to say.

It is standard practice in hospitals to isolate newborn premature babies in individual incubators to protect them from infection. When premature twin sisters Brielle and Kyrie, each weighing only about two pounds, were placed in their incubators, Kyrie was doing well but Brielle was having breathing problems, an accelerated heart rate, and was gaining weight slowly (Sheehan, 1995). When Brielle's heart rate suddenly became unstable and she started to change color, the attending nurse, Gayle Kasparian, tried the standard medical procedures—suctioning breathing passages and giving more oxygen, but Brielle didn't improve.

Then, as a last chance effort and ignoring established practice, Kasparian put Brielle into Kyrie's incubator where the tiny infants could snuggle together. Because Brielle's heart rate stabilized instantly, the sisters were allowed to stay together. Brielle started to gain weight and had no further heart rate problems. These dramatic and unexpected results led the hospital to begin scientific studies of "double bedding" in 1996. If the nurse who was watching the twins had not been able to go beyond the dictates of her training and experience, a young life might have been lost and a beneficial medical innovation missed.

"Bracket" preconceptions. Since training in one's discipline always leads to preconceptions, their potential blinding effects on researchers is a serious problem. Phenomenological researchers (see Chapter 2), who try to discover the essence of particular human experiences, often begin their studies by looking inward at their own perceptions of them. By reflecting on their own personal experiences, they hope to identify any preconceptions and biases that might color their receptivity to the experiences reported by their subjects. Once identified, they attempt to "set aside [these] theories, research presuppositions, ready-made interpretations, etc." in a process called "bracketing" (Ashworth, 1996, p. 1).

Karl Duncker (1945), a research psychologist, also devised an approach to reducing the impact of preconceptions in his research subjects. Duncker found that prior training with a complex solution in a problem-solving experiment could blind his subjects to easy and otherwise obvious solutions. In follow-up experiments, it became clear to Duncker that such blindness could be overcome by saying to subjects, "Don't be blind!" With this warning, subjects could overcome their expectations and see the simple solutions that they previously had missed.

A word to the wise should be enough. As you struggle to come up with a research question and hypothesis, think of Kasparian, Duncker, and the phenomenological researchers, and remind yourself periodically not to be blind. Or you might try the following strategy for minimizing the impact of biases, one that first was suggested by T. C. Chamberlin, a geologist, more than a century ago, and rediscovered by scientists three quarters of a century later.

Entertain multiple hypotheses. Chamberlin (1890/1965), like phenomenological researchers, was concerned with how scientists' preconceptions can unconsciously influence their observations and interpretations. He reasoned that if researchers can cultivate several potential explanations to account for a given phenomenon (the example he used was how the Great Lake basins were formed), they will be less likely to invest themselves in any particular one. As he put it, "with this method the dangers of parental affection for a favorite theory can be circumvented" (Chamberlin, 1890/1965, p. 754). Chamberlin believed that scientists who entertain multiple hypotheses will be less likely to selectively attend to data and less likely to offer interpretations distorted by their expectations and desires. Today Chamberlin's approach is routinely applied in investigative work outside of psychology.

When Trans World Airlines flight 800 mysteriously crashed in the summer of 1996, investigators looking for the cause of the crash considered several possible scenarios—pilot error, mechanical failure, explosive devices, and a missile fired from the ground or air. The investigators kept each of these possibilities in mind as they searched the wreckage for chemical traces of explosives, studied the physical damage to the plane, listened to the recording of the plane's last seconds, and examined reports of eyewitnesses.

Within psychology, D. B. Bromley (1986), an expert on case study methodology (see Chapter 2), also advises researchers to formulate and test multiple alternative hypotheses as they attempt to account for the data collected on a case. By being open to the full range of possible interpretations, he believes, the chances of arriving at a valid understanding increase. So follow Chamber-lin's and Bromley's advice and consider many different hypotheses as you strive to understand unfamiliar and puzzling phenomena. Or try breaking free of preconceived ideas by adopting one of the following "tried-and-true" strategies of innovative scientists.

Make the familiar unfamiliar. Scientific observers recognized for their expertise advise beginning scientists to wonder about and question everything. Ask how, when, why, and what if in regard to the everyday happenings around you. Take nothing for granted. The biochemist Szent-Gyorgyi provides a model of this approach to observing familiar events:

> I like to see things simple, a bit infantile, without much sophistication, and to wonder about the simple things. People often fail to see that something is a miracle if they see it often. To me the greatest and most exciting miracles are what I see around me every day. (Szent-Gyorgyi, in Root-Bernstein, 1989, p. 32)

To foster this freshness of perspective in yourself, imagine how a child might view the phenomena you are observing. Think about what the child would notice and wonder about. Or try to adopt an outsider's perspective as you make your observations. Imagine that you are a being from another planet. What would an extraterrestrial focus on? How would the extraterrestrial describe the event and explain it to a fellow alien?

Make the unfamiliar familiar. Barbara McClintock, the Nobel Prize-winning geneticist, spent a lifetime in systematic research. The fact that she lived and breathed genetics was important in fostering the kind of intimate understanding that can spark innovation. But McClintock also developed imaginative abilities that allowed her to see things that were not visible to others. As she peered through the lens of her microscope at neurospora chromosomes, McClintock imagined she was a part of the microscopic world she observed:

> I found that the more I worked with them the bigger and bigger [they] got, and when I was really working with them I wasn't outside, I was down

> there. I was part of the system. I was right down there with them, and everything got big. I even was able to see the internal parts of the chromosomes. ... It surprised me because I actually felt as if I were right down there and these were my friends.
>
> As you look at these things, they become part of you. And you forget yourself. The main thing is that you forget yourself. (McClintock, in Ferrucci, 1990, pp. 228-9)

Although McClintock had only her own resources as tools on these forays into the unknown, today technological advances allow any scientist to make the same kinds of up close and personal observations of microscopic material. Virtual reality headsets and motion sensors enable modern researchers to have the experience of walking on the surface of microscopic substances and studying the structure of their atoms at close range.

According to Root-Bernstein (1988), Alexander Fleming, the scientist who discovered penicillin, used a different approach to make the unfamiliar about microorganisms familiar. Like McClintock, he observed carefully and systematically. Although his peers threw out their cultures once an experiment was complete, Fleming saved his for weeks so that he could examine them regularly for any new and unusual developments. Fleming also played with his cultures. He painted pictures on petri dishes with different microorganisms so that he could watch images emerge in Technicolor as the cultures grew.

David Krech, a psychologist, found that a playful attitude helped him in his research as well:

> I play with my ideas, I live with them, and fantasize about them. I build them into a big, whole *megillah,* a systematic solution to all the problems of brain chemistry. In that way I keep them salient. (Krech, 1970, p. 62)

Be open to serendipity. Serendipity is a word that was coined by Horace Walpole in 1754 to refer to findings that researchers come across unexpectedly while trying to answer other questions (Roberts, 1989). Walpole had read a fairy tale about the three Princes of Serendip who were always happening upon discoveries they were not looking for.

Wilder Penfield, a neurologist and neurosurgeon, claims that such accidental discovery was involved in an important discovery he made as he "mapped" the cortex of an epileptic patient. Mapping involves probing different locations on the cortex with electrodes and noting the behavioral effects. During this painless procedure, a necessity prior to surgery on the brain, patients are awake and alert and can report on their experience.

> The first time I caused a patient to vocalize startled me much more than it did the patient. It came as a complete surprise. We had never caused vocalization. . . . And I remember the man on whom I used the electrode. He began to cry in a certain tone. I took the electrode away and he stopped instantly. I put it on again and he started, without knowing what I did. . . . The fact that it opened up one of the mechanisms that makes it possible for a man to talk, a control of vocalization upon the cortex, that was exciting. But, that was stumbling on something. (Penfield, 1970, p. 105-6)

There are plenty of other examples of serendipity in science. A breakdown in his apparatus for delivering reinforcements led B. F. Skinner to discover curves of extinction. Alexander Fleming's discovery of penicillin and Rontgen's discovery of X-rays were serendipitous. The events leading to these discoveries might have passed unnoticed by differently prepared minds.

EUREKA!—DISCOVERING IDEAS

As you read the literature and observe the world around you, you finally will reach the point when you must come up with a specific idea to research. You may or may not make a prediction, a hypothesis, about how the results will turn out. Some projects don't have clearly developed expectations—the researcher simply wonders "What would happen if?", or "How do scores on this measure relate to scores on this other measure?" In other cases, the researcher is able to come up with a hypothesis, a hunch that given certain conditions, certain other events or conditions will hold true as well. Whether your project has a hypothesis or not will depend on what is already known about the phenomena that you are interested in. Although you must know something to identify a research question, you must be even more knowledgeable to come up with a specific expectation of how the research will turn out.

Although we would like research ideas to come effortlessly from reading the research of others or from gazing at the world about us, this doesn't happen. Developing an idea almost always is a great deal of work. To make progress you must read and observe actively with a view to generating ideas. What follows are some suggestions for structuring your search. Keep them in mind as you think, read and observe.

Use Theory to Generate Ideas

One mark of a good theory is that it is heuristic, that is, that it inspires testable hypotheses. The approach to generating research ideas by deriving hypotheses from theory is called deductive reasoning.

Examples of deductive reasoning are easy to come by in psychology and this book is filled with them. In Chapter 1, for example, we discussed Mesmer's theory of animal magnetism and the commission's research evaluating that theory. The commissioners designed several experiments to test the conflicting predictions derived from their own psychological explanation of animal magnetism's effects and Mesmer's physical explanation of the same events. The prediction that Kohler made in his study of transposition (see Chapter 1) came from the Gestalt theory of learning. Kohler's research pitted this conception against Thorndike's S-R theory.

To apply this approach, first learn everything you can about a particular theory, like social learning theory (Bandura, 1971), Gestalt theory (Koffka, 1935), or Bern's self-perception theory (Bern, 1972). Then think about potential hypotheses based on the theory that might apply to your areas of interest. Consider whether established hypotheses based on that theory might be generalized to the phenomena of interest to you or whether you need to formulate a new hypothesis from the theory to account for the behaviors you plan to investigate.

Explore Analogies and Metaphors

Analogies and metaphors point to parallels between unfamiliar phenomena and more familiar objects and events. Biologists compare parts of the body to machines—the heart to a pump, the nervous system to an electrical system, the eye to a camera. The functioning of the brain often is compared to that of a computer. Thinking in terms of analogies like these can inspire hypotheses and inventions, as the following example illustrates.

Some of the technology that underlies modern cellular phones was patented half a century ago by Hedy Lamarr, a Viennese-born movie star of the 1930s and 1940s, then called "the most beautiful girl in the world" (Associated Press, 1997). In the 1930s, Lamarr's parents arranged a marriage for her to an Austrian armament manufacturer, with whom she attended business dinners and meetings at which weapon systems were discussed and filmed field tests watched. Curious from childhood about how things work, Lamarr listened and learned. When her husband's business dealings increasingly involved the Nazis, Lamarr left him and came to the United States.

When World War II began, Lamarr wanted to help in the war effort. Because of her experiences in Europe, her thoughts turned to weapon systems. She began to think about ways to get around the jamming that prevented the United States from using radio-controlled missiles against the Germans. One day, while fooling around at the piano, she and a musician friend, George Antheil, played a game. He began playing notes at one end of the piano and she echoed what he played at the other. She realized, "Hey, look, we're talking to each other, and we're changing all the time." Using this idea, they went on to invent a radio system for controlling torpedoes. It changed from one frequency to another at split-second intervals, so that the signal would control the torpedo but sound like random noise to anyone listening to it. They patented their "Secret Communication System," based on an analogy with their synchronized piano game, on August 11, 1942.

Analogies also suggest hypotheses in psychology. William Dement (1960), for example, found that subjects in his sleep experiments showed an unexpected consistency in the amount of their rapid eye movement (REM) sleep each night. This finding led Dement to hypothesize that dreaming, which is associated with REM sleep, might be a psychological need, analogous to the physical need people have for food or water. Dement then went on to test and confirm this hypothesis by depriving volunteers of REM sleep and studying the effects on their behavior.

Metaphors are figures of speech, based on analogies, that are applied to objects or events to which they do not literally apply. Models derived from studying physical disease, infection, and inoculation are applied to human behavior; for example, psychologists use terms like inoculation against stress and inoculation against attitude change to point to the ways in which small doses can build a kind of immunity to major assaults on the nervous system or attitudes.

Theodore Sarbin (1969/1982), a social psychologist, discussed how the metaphors we use have implications that direct our action and thought, including the ideas we develop and test in research. When we use terms like "mental illness," he argued, we extend models of physical disease to the mind (itself a metaphor), highlighting a narrow range of potential hypotheses about disturbed behavior and ignoring others. Because of the damaging consequences of the metaphor for the people to whom it is applied and the limited perspective it suggests to psychologists looking for the causes of misconduct, Sarbin called for the replacement of the "mental illness" metaphor.

In its place, Sarbin offered what he saw as a more appropriate and benign metaphor—"the transformation of social identity." In Sarbin's view, substituting this new metaphor for the old one would lead to a shift in the kinds of hypotheses that psychologists would entertain. Guided by the new metaphor, researchers would identify people whose attempts to establish viable social identities have been unsuccessful. With their help, they would study the "behavioral effects of prolonged degradation," and investigate other hypotheses about "the outcomes of upgrading social identities through commendation, promotion, and so on." In research inspired by the new metaphor, "the search for 'causes' will be in social systems, not in mythic internal entities" (Sarbin, 1969/1982, p. 147-8).

The examples we have presented in this section illustrate that when we apply analogies and metaphors to puzzling phenomena, what is known shapes our perceptions and thoughts about what is not known, suggesting hypotheses for research in the process. To find ideas for research, practice reasoning in analogies and critique common metaphors. As you work at understanding a new phenomenon, ask yourself what it is similar to. Let your imagination run wild as you generate ideas about other events that might be related to the ones you are interested in. Make connections.

Keep Alert for Anomalies

Oliver Sacks (1985), a neurologist, was asked to consult on a baffling case involving an accomplished professor of music who began to make absurd, even comical, perceptual errors in his everyday life. The man, whose eyesight was unimpaired, patted the top of parking-meters thinking they were children, couldn't distinguish between his foot and his shoe, and tried to pick up his wife's head, mistaking it for a hat. Sacks used the case to illustrate a complicated example of visual agnosia due to damage in the visual parts of the right hemisphere of the brain.

Anomalies are phenomena that make no sense given established thinking in a field. Sacks believes that understanding these rare events is critical to developing our understanding of brain functioning. In his words,

> Such cases constitute a radical challenge to one of the most entrenched axioms or assumptions of classical neurology—in particular, the notion that brain damage, any brain damage, reduces or removes the "abstract and categorical attitude." Here in the case of Dr. P, we see the very *opposite* of this. (Sacks, 1985, p. 5)

Like Sacks, researchers interested in psychological phenomena have spent their lives trying to understand anomalies.

Toward the close of the 19th century, Sigmund Freud, a young Viennese neurologist, struggled to understand the causes of his patients' unexplained symptoms, which included paralyses, visual and auditory disturbances, weakness, coughs, headaches, tics, and other bizarre phenomena. Freud invented psychoanalysis as a strategy for uncovering the psychological causes of such symptoms, which he believed were buried deep in the sufferers' unconscious minds. Later in his life Freud worked at understanding the causes of slips of the tongue, mysterious lapses of memory, dreams, and many psychological disorders, all puzzling anomalies.

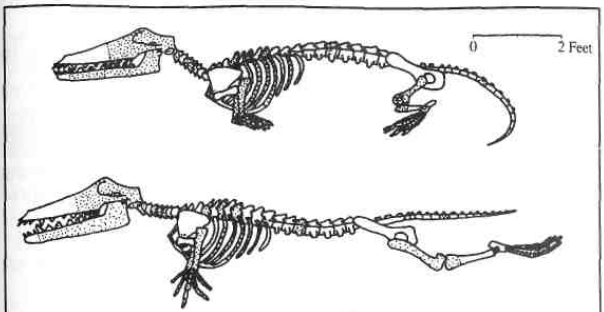
Jean Piaget, perhaps the foremost developmental psychologist of the 20th century, like Freud, hit upon the idea of using anomalies to reveal the course of children's cognitive development. He devised ingenious tests showing that very young infants have no concept of the permanence of objects. He demonstrated the difficulties children experience in understanding that volume and number remain constant when objects change their shape or spatial arrangement. By studying anomalies of childhood reasoning, Piaget "provided the field with an entirely new vision of the nature of children, and of the what, when, and how of their cognitive growth" (Flavell, 1996, p. 200).

Life is full of puzzling and rare phenomena. So keep alert for them as you observe the world around you. When you find an anomaly, you also will have found a research question. If you come up with a tentative explanation, you will have invented a hypothesis.

Look for Gaps in Knowledge

Some of Oliver Sacks's work was inspired by his attempt to fill gaps in the published information on brain functioning. For instance, in his introduction to the case of the musician with visual agnosia, he wrote:

> Although right-hemisphere syndromes are as common as left-hemisphere syndromes—why should they not be?—we will find a thousand descriptions of left-hemisphere syndromes in the neurological and neuropsychological literature for every description of a right-hemisphere syndrome. It is as if such syndromes were somehow alien to the whole temper of neurology. (Sacks, 1985, p. 3)



Reconstruction of Ambulocetus standing on land (top) and swimming (bottom). Adapted from Thewissen, Hussain, and Arif (1994); in Gould (1995).

Advances frequently are made by scientists who attempt to fill gaps in knowledge, and when such gaps are filled there is much excitement. One of the criticisms raised against Darwin's theory of evolution, for example, was the absence in the fossil record of the kinds of intermediate species that his theory predicted. When the *Archaeopteryx,* a so-called "missing link" between birds and reptiles, was discovered in 1861, Darwin's ideas gained in acceptance. The credibility of Darwin's theory continues to increase as the fossils of extinct transitional species are discovered in modern times. One of these, found in 1994 in Pakistan, is *Ambulocetus natans,* the swimming walking-whale, an intermediate form between land and water species with legs for walking on land and large feet and a flexible spine for swimming (Gould, 1995).

Gaps in knowledge regularly inspire research. In fact, many journal articles end by suggesting ideas for further research. As you read texts and review articles, ask yourself what questions remain to be answered, what controversies are not yet resolved, what types of research questions have been dismissed, ignored or overlooked. Root-Bernstein (1989) recommended searching old books for unanswered research questions or data overlooked or forgotten by modern researchers. In the following example, a desperate father found a treatment that saved his young son's life by doing just that *(Dateline NBC,* 1996).

Charlie was just one year old when he began to have epileptic seizures, which increased in frequency until he was having a hundred seizures a day. His doctors tried anticonvulsant drugs; none worked and their side effects, which were turning Charlie into "a zombie," were devastating. Because unchecked seizures can lead to brain damage, Charlie's doctors/operated on his brain to stop the seizures, but their efforts were fruitless. The seizures did not stop.

Charlie's father, Jim Abrahams, then began attending medical lectures and reading everything he could find on how to treat epilepsy. One day he came upon a book, written by John Freeman of Johns Hopkins University in the 1920s, describing the ketogenic diet, a diet for epilepsy. The diet had been widely used, with great success, until the 1950s, when it was largely replaced by drug treatments. It consists of some protein, but mostly "lots of fat, bacon, butter and heavy whipping cream," all of which must be precisely measured for the diet to work *(Dateline NBC,* 1996, p. 19).

As soon as Charlie started on the diet, his seizures lessened. He was seizure free within two days. Since Charlie's father appeared on NBC's news magazine *Dateline,* fifty thousand people have requested and received copies of this new old diet for epilepsy.

Turn Assumptions on Their Heads

David Krech reported that he had been working for some time attempting to relate levels of enzyme activity in the brain to learning.

> But after about four years we just got bored with that problem. We quite deliberately reversed our thinking then. Instead of saying, "How do chemical differences in the brain affect learning," we asked the reverse problem, "How does learning affect brain chemistry." . . . Having asked that question, a whole new world opened up. (Krech, 1970, p. 63)

Krech went on to study the impact of enriching the environment of rats on their brain chemistry.

Since Krech made these remarks, whole new fields have developed to examine the complex interactions between biochemical and psychological processes. One of these is the field of psychoneuroimmunology, the study of the interactions between behavior and immunity (Maier, Watkins, & Fleshner, 1994). Researchers in this new field are discovering that psychological events, like stress and depression, alter immunity, a not too surprising finding. But they also are discovering that events in the immune system can modify behavior (e.g., changes in the immune system of animals can produce stress). Such studies have not been done with humans, but Maier et al. wonder whether the kinds of daily changes that occur in our immune systems might someday be shown to account for some of the unexplained mood swings most of us experience. Such hypotheses are sure to result in exciting new research in the years to come.

Krech's and Maier et al.'s remarks are testimony to the value of the strategy that Root-Bernstein (1989) calls "turning assumptions on their heads"— taking well-established findings and turning them around. Let's look at some examples of the many assumptions in psychology just waiting to be turned on their heads. You cannot take a course in child development without learning something about the effects of parents (usually mothers) on their children; but few researchers look at the ways that children's behaviors call out different responses in their parents. There are many claims made that pet ownership has a positive impact on people's health, but what is known about the impact of people presence on pets' health? Clearly, countless examples could be generated; use your imagination. As you learn about established ideas in the field, be inventive and practice turning assumptions on their heads.

Look for Patterns in Findings

Phenomenological researchers gather descriptions of people's experience which they analyze for patterns. A study by Ivana Guglietti-Kelly and Malcolm Westcott of "what shyness means to the shy person" (Guglietti-Kelly & Westcott, 1990, p. 150) is a good example of this approach to research. The researchers asked participants to describe a situation in which they felt shy, detailing what this experience was like. Once collected, the authors studied the descriptions for themes in how the subjects viewed their situation, themselves, and the activity of shyness.

On the basis of their analysis, the researchers formulated a description of the essence of shyness, which they asked their colleagues and the participants to read for missing elements. Incorporating their suggestions, they finally arrived at an "essential description of shyness" that captured the experiences of their subjects and was consistent with descriptions of shyness in the published literature.

> [Shyness is] an experience of separateness and aloneness in a social situation which is precipitated by one's feelings of uncertainty about the ability to establish an identity and a rapport with others, fear of behaving inappropriately, and awareness of oneself as inhibited in the interaction. It is an uncomfortable state of vulnerability, which the individual seeks to escape. (Guglietti-Kelly & Westcott 1990, p. 157)

Like this study, case studies, participant observation, and naturalistic observation attempt to find patterns in a wide array of data. So as you gather information about phenomena, from the literature or your own observations, look for patterns. And when you find them, don't take them for granted. Instead, ask how, why, when, and what if about the findings you discover. As you try to figure out the bases for the patterns, you will be generating research ideas using inductive reasoning.

Try to Resolve Discrepancies

Tiffany Field (1993) reported that discovering conflicting research reports on the effects of massage on premature infants inspired her own research. Some previous researchers had reported that massage led to weight gain, a desired outcome for preemies, but others did not find this. Field accounted for these conflicting findings by hypothesizing that the degree of pressure applied during massage is critical to reducing the stress of premature infants, that light stroking is aversive to them. She went on to do studies that confirmed this hypothesis.

Duane Rumbaugh (1993) recalls that an important finding about primate vision resulted from his attempts to understand discrepancies between the outcomes in his learning experiments for different species. Whereas most primates could learn his object discrimination tasks easily, gibbons and other tree-dwelling primates made little headway. Many experiments later, Rumbaugh concluded that tree-dwellers are at a disadvantage in his experiments because they attend to near visual stimuli rather than distant ones.

In Rumbaugh's experiments, the animals were required to peer through a

Plexiglas divider to solve the problems. Instead of looking through the Plexiglas, though, the gibbons looked at the Plexiglas, studying its surface scratches and reflections, and paying no attention to the objects they were supposed to differentiate.

You can use Field and Rumbaugh as models in developing your research question. Like them, keep alert for conflicting findings. When you find discrepancies, generate hypotheses to explain them.

Develop Skepticism about Findings, Methods, and Interpretations

At the time that Barry Marshall began his research on ulcers, most scientists believed that they were caused by psychological stress. But in 1983 Marshall announced that bacteria living in the stomach lining caused people's peptic ulcers (as cited in Monmaney, 1993). Marshall had seen the bacteria in the stomach tissue of one after another of his ulcer patients (a pattern). Although researchers before Marshall also had observed the bacteria, they had not connected them with ulcers; they believed, following the accepted view, that bacteria could not survive in the stomach, a sterile environment.

Having observed the bacteria and faced with the disbelief of other researchers, Marshall experimented on himself. He knew that other researchers, who refused to believe what he had reported, would need experimental results *to* be convinced that he was correct. So Marshall drank a potent solution of the "ulcer bugs" to see what would happen. Two weeks later a biopsy of his stomach tissue revealed inflamed tissue containing high concentrations of the bacteria. His hypothesis confirmed, Marshall went on to show that antibiotics provide the most effective ulcer treatment. Marshall's bacterial hypothesis finally was accepted only when subsequent research demonstrated that the bacteria, later named *Helicobacter pylori,* could burrow into the stomach lining away from the stomach acids that would destroy them. (Incidentally, Marshall got better, and without medication. His immune system apparently was able to fight off the infection with no outside assistance.)

Maintaining a skeptical attitude, questioning the methods and findings of one's predecessors, is a potent source of research hypotheses. So, as you read research, think about possible problems in its design, measures, analysis, or the interpretation of its findings. Wonder about whether the research could be replicated. Might biases result from the particular apparatus or tasks used in the research? Might the results be specific to the particular subjects or situation tested?

Improve Apparatus, Measures, and Procedures

Katharine Payne was observing elephants in the zoo when she "repeatedly noticed a palpable throbbing in the air like distant thunder, yet all around me was silent" (Payne, 1989, p. 266). Sometime later she recalled singing in the choir as a child, standing in front of the biggest pipe of the church organ and, when the organist played bass notes, feeling vibrations similar to the ones she felt at the zoo. Going on a hunch that perhaps the vibrations she experienced were coming from the elephants (an analogy), Payne decided to tape-record them through many hours of seeming silence.

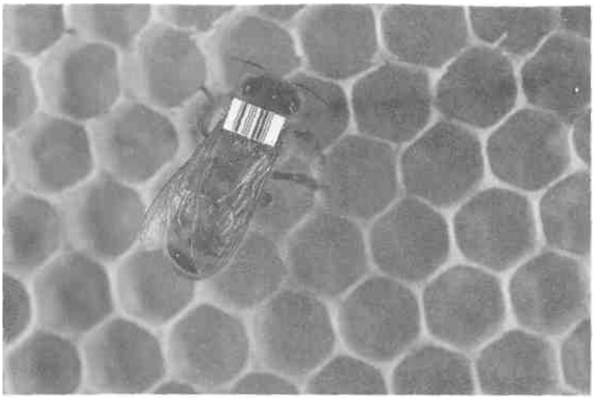
Electronic printouts of her recordings showed that she had recorded 400 calls, although only a third of them were audible to her. The printouts suggested that the elephants were communicating with one another by low-frequency sounds inaudible to the human ear. An improved measuring


Katherine Payne recording sounds in Africa

instrument (a recording rather than the human ear) and a device for revealing infrasound (the electronic printout) revealed a previously unknown world of animal sound. Payne continued her pioneering research on elephants in Kenya, Namibia, and Zimbabwe, where she and her colleagues conducted research to learn whether elephants use infrasound for long-distance communication. If so, many puzzling phenomena of elephant life, like how elephants get together when miles apart, would be explained. To test this hypothesis required sophisticated engineering and an ingenious and innovative method.

For one of their experiments, Payne and her colleagues recorded many hours of elephant calls, rich in infrasound. Later one researcher stationed himself in a van from which he later would play an infrasound call of his choosing over a loudspeaker. A second group of researchers, including Payne, were videotaping two male elephants at a water hole some distance from the van. These researchers did not know when the sound would be played, because it was inaudible *to* the human ear, nor which call the other researcher had selected. As they watched and waited, all of a sudden, the two elephants lifted their heads and spread their ears in unison; both then marched off together in the direction of the van. The broadcast sound had been the call of a female elephant ready to mate. The occupants of the van breathed a sigh of relief when the elephants continued oh past the van. In later experiments, the researchers planned to track elephants with electronic collars and microphones to learn more about how they communicate.

The history of science is full of cases where new measuring techniques opened up frontiers for study or advanced our understanding of well-known phenomena. We now can observe how the brain functions with magnetic resonance imaging, as Elbert et al. (1995) did in their study of the cortical functioning of stringed instrument players (see Chapter 2). Researchers studying the communication of bees no longer have to paint distinctive dabs of paint on their backs and visually observe their comings and goings, as von Frisch did (see Chapter 3). They now can monitor the bees electronically by placing bar codes on them and using automatic scanning devices, like the ones at supermarkets. Data can be collected even when researchers are not available, opening up possibilities for research that were not available to von Frisch.



A bar-coded bee.

So as you read reports of research, consider the measures, apparatus, or procedures employed in them. Ask whether they might be replaced by measures with better reliability and validity (see Chapter 12, Planning the Study), instruments that might reveal different phenomena, or whether a refinement in procedure might lead to new findings. Like Payne, you may come up with a better measure, a better set of questions, or an improved observational technique.

Focus on Practical Problems '

Psychologists always have been interested in addressing practical problems. Alfred Binet (1903) developed the first intelligence test to help school officials in France decide which students to keep in regular classes and which to educate in special classes. During World War II, Kurt Lewin collaborated with the anthropologist Margaret Mead to find ways to get people to eat plentiful and nutritious, but unpopular foods (e.g., turnips) when other more desired foods were in low supply (Hothersall, 1995). Inspired by observing the effects of different governments on their citizens, Lewin, Lippitt, and White (1939) conducted experiments to find out how authoritarian, democratic, and laissez-faire leadership styles affect children in groups. Countless studies have been done to assess therapeutic and educational techniques.

Tiffany Field's (1993) interest in premature infants began when her own child was born prematurely. As she witnessed the struggles of her newborn, she wondered how the stresses that premature babies suffer might be reduced. Her award-winning research, discussed earlier in the chapter, led to new understandings and practical recommendations for handling premature infants. Subsequent studies investigated the effects of massage on infants, looking at which preterm infants benefit most from massage, and examining the effects of massage on cocaine-exposed premature infants and on the infants of depressed adolescent girls. Field's subjects now include adults. Her study of the effects of massage therapy on adults' mental alertness is discussed in Chapter 13, Communicating Research, and reprinted in Appendix B.

Field points out that finding inspiration for research in one's own life, as she did, is by no means unique:

> If you conducted a survey among researchers you would find that nine out of ten are personally or socially concerned about the subject they are

> studying. Thus, the phrase, "research is me-search" appropriately describes this phenomenon. (Field, in Brannigan & Merrens, 1993, p. 3)

If your life is like everyone else's, it contains plenty of puzzles to be solved and phenomena to be curious about. So look around you. Think about recurrent problems that come up in college life—homesickness, making friends, getting along with roommates and others, issues concerned with eating, drinking, studying, grades. Are there ideas discussed in the literature that might be applied to understanding these problems? Might programs be developed to help students study more effectively, improve self-esteem, or alter attitudes toward different groups on campus? Use your imagination. Any number of programs might be instituted and evaluated.

Final Thoughts

We've focused in this chapter on the anxieties, the frustrations and the hard work associated with getting started in research. We wanted you to realize that your concerns as beginning researchers are not unique. But the picture we have painted is incomplete. In our eagerness to show you that some fear and frustration is to be expected, we've left out the joy and excitement that comes from finding the right problem or formulating a promising hypothesis.

To correct for this oversight, we now quote the last few lines of a poem, written by Root-Bernstein (1989, p. 420), entitled "How to Be a Maverick." Most of the poem summarizes Root-Bernstein's recommendations on how to develop the attitudes and lifestyles that foster scientific discovery. The poem ends with the following lines illustrating why discovery is well worth the price we pay for it:

Do these things and you shall find

surprises unexpected;

Detours left which turn out right,

old dogmas now corrected.

So do us all a favor: Start thinking

good thoughts now.

Discovering and inventing: There's no

better life, I vow!

So now, begin. Start keeping a research journal. Purchase a special notebook for the purpose, one that is convenient to carry around with you. In it, record ideas that you want to remember (they relate to what interests you) as well as things that strike you as personally relevant. The ideas that you put in your journal don't have to be momentous. Record any observations that you make or ideas that you encounter that strike you as especially fascinating, noteworthy, odd, disturbing, or puzzling. Use the journal to explore connections between ideas, to make notes on how an intriguing idea that you covered in your course on learning relates to the research you just read about in your personality, social psychology, or cognitive psychology courses.

Ideas are fleeting. For most of us, they go more quickly than they come. So capture your ideas as you get them by making a permanent record in your journal to mull over at your leisure later on. Whenever you are "struck" by an idea, jot it down for future reference. If you do this faithfully, you will end up with a list of ideas that could lead to a research project.

Before you know it, you are likely to see a pattern to your interests and soon you will be ready to focus on a particular area of study. And once you do, you may be pleasantly surprised. Many researchers find that as soon as they decide to work on a problem their world begins to change. Information and happenings related to their newfound interest are everywhere. Perhaps, like W. H. Murray, you will find:

> The moment one definitely commits oneself, then Providence moves too. All sorts of things occur to help one that would never otherwise have occurred. A whole stream of events issues from the decision; raising in one's favour all manner of unforeseen incidents and meetings and material assistance which no man could have dreamt would have come his way. (W. H. Murray, in Austin, 1977, p. 6)