Sometime shortly after a young child is diagnosed with autism or pervasive developmental disorder, the quest for help begins. Families typically feel an understandable urgency to get treatment for the child as soon as possible. When they seek information about available treatments, they often get a long and perplexing list that includes education, Auditory Integration Training, various drugs, vitamins and other “natural” substances, imitation therapy (Options), Facilitated Communication, Sensory Integration Therapy, music therapy, Gentle Teaching, special diets of various kinds, Applied Behavior Analysis, patterned, deep pressure therapy, dolphin therapy, rhythmic entrainment (drum therapy), and more. Some treatments are said to produce miraculous results overnight (or even faster), with relatively little effort or expense. Some are reported to benefit most, if not all, people with autism. For many such claims, a moment’s careful reflection may be all it takes to assess the odds that they could be true and to realize that the odds are slim to none.

It’s rarely that easy, however, for a host of reasons. First, virtually everyone who works to better understand and serve people with autism wishes ardently for breakthroughs. We all want a cure for this puzzling disorder; short of that, we want at least to enable people with autism to live the most full and happy lives possible. But this is a two-edged sword. The same factors that make dedicated and enthusiastic parents, advocates, teachers, and researchers can produce a special kind of vulnerability, a tendency to accept claims about treatments without scrutinizing the basis for those claims as closely as we should. Additionally, when the exact cause of a condition is not known and the prognosis is not especially good, new treatments are invented (or old ones are recycled) with astonishing frequency. Reports about quick fixes, miracle cures, and breakthrough treatments have proliferated since autism was first labeled over 50 years ago. They have never been more prevalent—or confusing—than they are today.

Unfortunately, as the number and variety of therapies has increased, it seems that professionals are less and less inclined to provide families with strong, data-based advice to help them make informed choices among the various therapies. The prevailing view seems to be, “Since we don’t know the cause of autism, we don’t know what might or might not work. So we might as well try everything, including the implausible and even the outlandish. What have we got to lose?” Arguments like these seem reasonable on their face and can be very appealing to someone who feels that doing something—anything—is better than doing nothing. But this hit-or-miss approach is no more likely to lead to positive, lasting outcomes for any individual with autism than it is to produce solid, reliable advances in knowledge about the disorder in general. In fact, it can lead to harm, or at the very least, perpetuation of the current situation: an ever-changing kaleidoscope of therapies, most with little or no sound evidence to support their effectiveness, many with potential or known harmful side effects (for a review, see Chapter 4).

Finally, perhaps as a function of the perplexing nature of autism and the severity of its impact, debates about causes and treatments tend to provoke intense emotional responses. The search for information and help is thus influenced at least as much by ideologies, personal beliefs, and social movements as by logic and objective data.

**SCIENCE, PSEUDOSCIENCE, AND ANTISCIENCE**

For purposes of this chapter, approaches to answering fundamental questions about how and why the world works, including questions about the nature of autistic behavior and what might be done about it, can be grouped into three broad categories: science, pseudoscience, and antiscience. Science relies on direct,
objective observation and measurement of phenomena, systematic arrangements of events, procedures to rule out alternative explanations for what is observed, and repeated demonstrations (called replications) by individuals working independently of one another. Descriptions and examples of these and other features of scientific method, as they relate to treatments for autism, make up most of this chapter. Pseudoscience treats phenomena that do not have the hallmarks of scientific methods or evidence as if they were scientific. Beliefs that are not based on objective facts are “dressed up” to superficially resemble science. For example, by the use of selected scientific jargon or endorsements by people with scientific credentials. Antiscience is the outright rejection of the time-tested methods of science as a means of producing valid and useful knowledge. In the extreme antiscientific view, there are no objective facts. Pseudoscience and antiscience are not new by any means; both are widespread in modern Western culture. They are the basis for lucrative industries ranging from astrology to certain psychotherapy practices to medical quackery (Jacobson, Mulick, & Schwartz, 1995; Pendergrast, 1994; Randi, 1982; Shermer, 1994; Stanovich, 1992; Wolfensberger, 1994).

Many therapies that are currently being promoted for autism are pseudoscientific or antiscientific. They are said to produce high success rates very rapidly with a wide range of disorders. Little training or expertise is required to administer them; belief and faith, on the other hand, are essential. Other proven treatments for autism are said to be unnecessary, inferior, or harmful, but no objective evidence is provided to back up those assertions. In fact, little or no objective evidence is offered in support of claims about the therapies—only testimonials, anecdotes, and personal stories (more on these later). Catchy, emotionally appealing slogans are used in marketing the therapies and associated products. Claims of effectiveness, as well as the “theories” underlying the therapies, often contradict immense bodies of empirical knowledge as well as common sense, which are instantly discounted and discarded in favor of anecdotal evidence about the new therapy. New evidence from objective scientific research is also rejected if it does not reinforce the promoters’ claims about the therapies. Promoters of some therapies for autism are working outside their areas of expertise. They do not conduct rigorous objective evaluations, often maintaining that the therapy’s effects are real but so fragile that they are destroyed by the mere suggestion of critical scrutiny, or that the effects cannot be measured by standard methods, or that practitioners and parents should not wait for careful research to be completed. Researchers who do use rigorous methods to study the therapies and produce evidence contrary to promoters’ claims, along with others who voice honest skepticism, are labeled narrow-minded, out of date, resistant to new ideas, and intent on persecuting the promoters. Coincidentally, promoters often benefit financially and otherwise from adoption of the therapies.

To complicate matters even further, some of these therapies appear to work: the child might seem to be better while in the therapy, or for a short time after. Very often the family and those who administer the therapy feel good simply because they are doing something. If the therapy also seems to help the child—whether in actuality, or simply in the perception of hopeful families and therapists—a behavioral trap is set: Using the therapy is reinforced powerfully, making its continued use likely even when objective evidence shows that the child is not actually improving, or that other treatments are more effective. Escaping traps like these can be extremely difficult. When caregivers and professionals get caught in them, the child is denied the benefits of validated treatments.

Scientists are certainly not immune to the seductions of fame and fortune, nor to errors of judgment, nor even full-blown delusions. Arguably, scientists are among the more suggestible among us. The scientific method is not fail-safe, but it has built-in checks and balances in its emphasis on objective data, independent replication, and critical peer review of research reports (Cromer, 1993; Shermer, 1994; Stanovich, 1992; Wolfensberger, 1994). Unfortunately, many of the elements of science are omitted from (or worse, declared irrelevant to) the evaluation and promotion of many therapies for autism, so the self-correcting mechanisms of science have no opportunity to rein in unsubstantiated claims. The situation in autism treatment is largely the opposite of disciplined science. The “anything goes” approach that many adopt, an over-reliance on personal accounts and testimonials, and the desperation that characterizes many family members and service providers combine to produce the perfect breeding ground for pseudoscience and antiscience (Stanovich, 1992; Wolfensberger, 1994). It’s no wonder that the history of autism treatment is replete with fad therapies and frauds, repeated cycles of false hopes raised and dashed, millions of dollars wasted, and thousands of children deprived of effective or potentially effective treatment.

**WHY THIS CHAPTER?**

Even the most experienced, highly trained professional can find it difficult to sort through the claims and evidence about treatments for autism. For fami-
lies who may know little or nothing about autism at the moment someone applies that label to their young child, the task can seem overwhelming. The problem is compounded by an urgent desire for treatment now: It would be nice if there were some simple way to determine which treatments were likely to have some real benefits, which were not likely to be effective but probably wouldn’t do much harm, and which held hidden dangers. Unfortunately there are no simple tests or rules. Many therapies that appear benign or even highly beneficial at first blush, prove harmful on close examination or when used for an extended period of time. There are, however, some features that distinguish plausible claims from the implausible, relatively unambiguous evidence from suggestive but inconclusive reports, and treatments that have been subjected to rigorous scientific scrutiny from pseudoscientific treatments and social movements.

This chapter attempts to provide some guidance through the maze of autism treatments. (The terms treatment, therapy, and intervention are used interchangeably here to refer to anything that is done to or with a child that may change the child’s behavior and/or biology, both broadly defined.) It suggests a number of questions to ask about treatment claims, and some decision rules for evaluating answers to those questions. All aim to produce an answer to one overriding question: Is there convincing evidence from sound scientific research that the treatment is effective? The main premise of this chapter is that treatment effects must be verified through systematic, experimental research using objective measurement procedures and controls to rule out alternative explanations for apparent effects. Identifying treatments that are supported by sound scientific evidence entails gathering and weighing different kinds of evidence, the methods by which the evidence was gathered, and the qualifications of those who study, promote, and implement the treatment. Each of those topics is addressed in this chapter, with reference to additional sources of information. One source that I drew from liberally and recommend highly is How to Think Straight about Psychology by Keith E. Stanovich (1992, 3rd edition), published by HarperCollins. (This book could well be titled simply How to Think Straight.) Another is Tristram Smith's chapter in this book.

A related premise of this chapter is that for every child with autism, every waking moment is precious. The vast majority of the child’s time and other resources ought to be invested in treatments that have been shown, through scientific research, to produce the most lasting beneficial effects on the broadest range of behavioral deficits and excesses that constitute autism. Every moment the child spends in therapies that are minimally effective, ineffective, unproven, or likely to be harmful is a moment that he or she could have spent participating in treatment that has a known probability of success in the hands of a competent therapist or teacher. When the child is very young, those may be moments that are lost forever. It appears that there is a relatively narrow “window of opportunity” for young autistic children during which the most effective available treatment—Applied Behavior Analysis—can mean the difference for many between lifelong severe disability and some approximation to normal functioning (Anderson, Avery, DiPietro, Edwards, & Christian, 1987; Fenske, Zalenski, Krantz, & McClannahan, 1985; Harris, Handleman, Gordon, Kristof, & Fuentes, 1991; Lovaas, 1987; Maurice, 1993; McEachin, Smith, & Lovaas, 1993; Perry, Cohen, & DeCarlo, 1995; Smith, 1993).

To underscore the importance of subjecting claims about autism treatments to rigorous scrutiny, imagine that you are making a decision about a drug or surgical procedure that someone recommends for your child. Before accepting the recommendation, you owe it to your child to ask, “Just what is this treatment? Exactly what is it supposed to do? Who will administer the treatment, and how can I be sure they are qualified to do so? How will its effects on my child be evaluated, and by whom? What is the likelihood that the treatment will actually help? How has that likelihood been determined? If the treatment has proven effective, how long do the effects last? What are the risks of short- and long-term negative side effects? How have they been determined? What safeguards are in place if my child experiences negative side effects? Is this the most effective treatment available? How was that determined? Is there another treatment that is similarly effective but has fewer negative side effects? What is the cost of the treatment? What will happen if we do nothing?”

The guidelines suggested here should be applicable to almost any treatment modality, therapy, program, or therapist. In fact, I urge readers to use them to evaluate every bit of information they obtain about treatments for autism, including information presented in this book.

**TYPES OF EVIDENCE**

When someone says, “This treatment can help your child with autism,” the first and most important questions to ask are, “How do you know that? What exactly is the basis for your claim?” The task is to sort the wheat from the chaff—to find out just what the evidence is, then to decide if it is solid enough to support the
claims, and if you can feel confident and safe in subjecting your child to the treatment. Several different kinds of evidence may be offered in support of treatment claims. They vary along several dimensions. The “end points” of some of the most important dimensions are described next, with examples to help you make the relevant discriminations.

Speculation vs. Demonstration

A distinction that is extremely important but not always obvious is the difference between pure speculation about a treatment and actual, documented demonstrations that the treatment works. Given the number and variety of therapies that are said to help children with autism, the rate at which new ones come along, and the resources required to do careful research, it stands to reason that at any point in time there will be many therapies that have not been subjected to comprehensive evaluation, and some that have never been tested rigorously.

Many people to whom parents turn for help with their autistic child recommend treatments just because they think the treatments might be helpful. Some of those people can be very persuasive by virtue of their personal repertoires, professional titles (“doctor” is especially impressive to many people), or both. For example, consider the following: “We know from medical research that the brain is pliable, especially in children, and that it can change physically in response to sensory input. So I highly recommend Sensory Integration Therapy for your young autistic child, because the people who promote it say that it improves the way the brain organizes sensory input, and I believe that’s possible.” Statements like these have the ring of authority (e.g., “medical research”) and seem plausible. Spoken by someone with “M.D.” after his or her name (e.g., a neurologist or pediatrician) to a parent or teacher who desperately wants a treatment that will fix a child’s brain, such statements can have a tremendous impact. No matter who utters them, statements like these should always be questioned and investigated thoroughly before resources are invested in the treatment. To follow through with the example, at this writing there have been no published, scientifically sound demonstrations that Sensory Integration Therapy actually produces measurable changes in autistic brains. In fact, methodologically sound studies have failed to document any specific, positive, lasting changes in brain function or behavior that could be attributed with confidence to Sensory Integration Therapy (more on this later, and in Chapter 4).

Subjective vs. Objective Evidence

Subjective evidence is information based on someone’s personal perspective. Because people are imperfect and variable in their abilities to observe, remember, and report events, subjective reports are inherently biased and inconsistent. A large number of subjective reports that seem to describe the same events are no more unbiased or reliable than one, especially when the reports come from people who are predisposed (by strong suggestions, common wishes, or common profits) to produce similar reports. Put simply, people see what they want to see, and are extraordinarily easy to fool (Randi, 1982; Sagan, 1993; Shermer, 1994; Stanovich, 1992). These are facts of human behavior that apply to parents of children with autism, promoters of treatments, and scientists alike. Well-trained scientific researchers, intensely aware of these facts of human behavior, know that the evidence they should question most stringently is their own subjective impression. Good scientists take special precautions to minimize the influence of natural human biases on the evidence they obtain and the conclusions they draw. That is, they use procedures to ensure that evidence is obtained by objective means.

Perfect objectivity is unattainable in any enterprise involving humans, but there are a number of ways to approximate it. One is to define the phenomena of interest—for example, a treatment procedure and the behavior and/or biology of a child with autism that the treatment is supposed to change—in terms of observable, measurable events. Then anyone who can understand the definitions and carry out the measurement procedures can determine whether or not the phenomena occur, how much or how often, when, and under what conditions. (A crucial assumption, of course, is that those who develop the definitions and measurement procedures have specific expertise in the topic under study.) In short, operational definitions and measurements make phenomena accessible to public evaluation, verification, and replication, which are not possible when events are described in terms of individual perceptions or intuitions. Operational definitions allow debates about conflicting claims to be resolved on the basis of something other than personal beliefs and dogma (Christensen, 1985; Green, 1994b; Shermer, 1994; Stanovich, 1992).

Another step toward objectivity is accomplished by minimizing human bias in the measurement process. Accurate, reliable measurement is essential for evaluating whether a treatment does what it is expected to do. The most objective measurement is done by instruments or machines, which is standard practice in the measurement of biological variables, but of-
ten not feasible for measuring many behavioral variables. For instance, if a dietary treatment is claimed to change the biochemistry of a child with autism, that claim can be evaluated in part by using instruments to measure certain substances in blood samples taken before, during, and after treatment. (Of course, humans still have to read the instruments and interpret the results, so a prudent evaluation will also include procedures to control for likely biases on their part—to be discussed shortly.) It would be more difficult, though not impossible, to use machines to evaluate claims that the dietary treatment also changes the child’s behavior (e.g., attending, activity level, learning rate, social interactions). Instead, evaluations of behavior change may rest entirely on direct observations of the child by other people.

Given the natural tendency of people to bring their own biases to everything they observe, how can direct observational data be collected and measured with any degree of objectivity? Behavioral scientists routinely employ a number of practices to increase the objectivity of evidence about treatment effects:

1. Operational definitions, mentioned above, are a must. The behavior of interest is defined in observable terms, as specifically as possible.

2. Measurement procedures are also specified clearly.

3. Individuals who are not involved in delivering the treatment are trained to observe and record the level of the behavior (e.g., how often it occurs, at what intensity, for how long, in what proportion of opportunities, under what circumstances) according to the operational definitions and measurement procedures. Usually two or more trained observers conduct observations at the same time, but independently of each other, (i.e., they do not talk about or look at each other’s recordings). At the end of each observation, their recordings are compared, and the degree to which their observations match is calculated. Data are considered accurate and reliable only when the observations of two or more independent observers match both the operational definitions and each other’s observations to a high degree (Christensen, 1985; Kazdin, 1982; Page & Iwata, 1986; Stanovich, 1992).

4. To the greatest extent feasible, those who deliver the treatment and record and analyze the data are kept unaware of the investigator’s hunches (hypotheses) as to what she expects to find. If possible, participants are also kept unaware that they are receiving treatment. Alternatively, participants may be told that the treatment is in effect when it is not. Procedures like these are referred to as “blind” controls for bias. In drug research, for example, double-blind procedures are stan-

dard: Participants are sometimes given the active drug, sometimes an inactive placebo, but neither they nor the people who give them the substances are informed as to which one is in effect at any given time. In general, if the participants’ behavior changes simply because they believe they are receiving treatment, the change will be observed when they are receiving the placebo. In fact, the strong tendency for people to report that they feel better when they think they’re receiving treatment is called the “placebo effect.” When participants unknowingly receive the active drug and an effect is seen that is over and above the effect found in the placebo condition, the effect can usually be attributed to the treatment with reasonable confidence (Christensen, 1985; Stanovich, 1992).

5. Multiple measures of the effects of treatment can be obtained (e.g., direct observations by trained observers, plus standardized tests administered by others, plus parental ratings of behavior). If they produce similar findings, it is likely that the effects are real and do not simply reflect the bias of a single observer or set of observers.

Examples of Subjective Evidence

Biographies, autobiographies, and other personal accounts (e.g., describing how an individual experiences autism and what he or she finds helpful) fall in the category of subjective evidence. So do testimonials, anecdotes, rumors, and uncorroborated self-reports. Even the personal observations and opinions of experienced clinicians and scientists are no more than subjective impressions unless they are verified, measured objectively, and repeated by others. A good deal of case study evidence is subjective (although case studies can yield relatively objective evidence, if they include operational definitions, quantitative measurement, controls for observer bias, and other features; Kazdin, 1982).

Facilitated Communication is a classic example of a procedure that is claimed to be extraordinarily effective for individuals with autism and other disabilities. Many are said to reveal literacy and other skills they do not demonstrate by any other means when a normally capable person (“facilitator”) touches their hand or arm to assist them in pointing to letters or words (e.g., Belden, 1990, 1992, 1993; Crossley, 1992). To date, virtually all of the evidence backing that claim is subjective: personal accounts, anecdotes, and testimonials, mostly from people who are invested emotionally (and in some cases, financially) in proving the claim. Numerous evaluations using objective measurement procedures show that
the vast majority of "facilitated" communications come from facilitators, not people with disabilities (e.g., American Psychological Association, 1994; Cummins & Prior, 1992; Felsce, 1994; Green, 1993, 1994a, 1994b; Green & Shane, 1994; Hudson, in press; Jacobson et al., 1994; Jacobson et al., 1995; Smith & Belcher, 1994; also see Chapter 4).

**Examples of Objective Evidence**

As mentioned earlier, data produced by instruments or machines (e.g., X rays, various medical laboratory tests, computer-managed tasks or tests) are relatively objective, assuming that the instruments are working properly and that the humans who read and interpret the data are well trained and monitored. Results of standardized measures like intelligence and achievement tests can also be relatively objective if the people who administer, score, and interpret the results adhere strictly to prescribed procedures and rules, which are usually developed through rigorous research. Likewise, evidence obtained through any of a wide range of direct observational methods can be relatively objective if it meets the criteria described earlier.

Objective, scientific evidence about treatment effectiveness makes up much of the research literature in Applied Behavior Analysis. Many examples relevant to treatments for autism can be found in a number of scientific professional journals—Journal of Applied Behavior Analysis; Research in Developmental Disabilities; Behavior Modification; Journal of Autism and Developmental Disorders; Journal of Behavioral Education; Education and Treatment in Mental Retardation and Developmental Disabilities; and the American Journal on Mental Retardation, to name a few. Several illustrations can be found in studies of the effectiveness of early behavioral intervention for autism. For example, to minimize one important source of bias, children were diagnosed by qualified professionals other than those delivering the treatment. Treatment effects were measured with standardized IQ, language, and other tests as well as direct observational methods (e.g., Anderson et al., 1987; Birnbrauer & Leach, 1993; Fenske et al., 1985; Harris et al., 1991; Lovaas, 1987; McEachin et al., 1993). At least one study also asked parents to report their impressions about how treatment of their children impacted on their own stress levels (Birnbrauer & Leach, 1993). In follow-up evaluations of autistic children who received early intensive treatment, Lovaas and his colleagues kept evaluators "blind" as to children's histories, that is, their diagnoses and what kind of treatment they had received (Lovaas, 1987; McEachin et al., 1993).

**Indirect vs. Direct Measures**

One way to evaluate the effects of a treatment is to ask the person receiving the treatment to report what happened. Another is to ask those around the person receiving treatment to report their perceptions. In addition to being subjective, these types of measures (especially the latter) are indirect. The alternative is to measure the effects of treatment by observing directly what happens to those receiving the treatment. Of course, procedures like those described previously should be used to make direct measures as objective as possible. For example, consider a treatment that is supposed to alter the way someone's brain works. The effects of the treatment could be evaluated indirectly by asking the individual whether he thinks his brain functions differently after treatment than before, or by asking his family and friends to make that same judgment. Alternatively, a direct measure of brain function before and after treatment could be obtained with a technique such as functional magnetic resonance imaging (MRI), which provides a picture of what the brain actually does. For treatments that are intended to change the behavior of a child with autism (e.g., attending, communicating, interacting with others, playing), indirect measures include caregiver reports in various forms (e.g., surveys, questionnaires, interviews, and the like); direct measures include real-time observations of the child's behavior, preferably by trained observers using objective behavioral definitions and specific measurement procedures.

Indirect measures of treatment effects are important data in and of themselves, and should be part of all comprehensive evaluations. They do not, however, constitute complete, accurate, or conclusive evidence about treatment effects. Direct measures are necessary.

**Noncomparative vs. Comparative Information**

Evidence offered to support claims about a treatment should also be scrutinized for the quality and type of comparisons it implies or makes possible. The all-important question, "What is the most effective treatment available for my child's condition?" implies the need to know how each treatment compares with no specific treatment and with many other treatments. Parental reports such as, "My child's behavior is much better now that he's had Therapy X" suggest comparison, but their value for drawing any general conclusions is extremely limited, no matter how many such reports there are or how strong the conviction with which they are delivered. The same applies to reports from clinicians that are based solely on informal observations.
Anecdotal evidence (like the kinds of parental and clinical reports mentioned above) has limited usefulness. In addition to the problems inherent in all subjective reports, each such report represents an isolated event: the observation, experience, or perception of one person, unmeasured and unverified by any impartial outside party. Additionally, it is easy to generate testimonials in support of almost any treatment. Naturally, almost anyone who invests time, money, and hope in a treatment will tend to report that the treatment is helpful. Indeed, all of the treatments that are claimed to be effective for autism have their fans, many eager to testify to the effectiveness of their favorite(s). Reliance on anecdotal reports and testimonials to evaluate treatments for autism, however, has many serious shortcomings. For one, it would lead to the conclusion that all of the various therapies for children with autism are equally effective. Common sense suggests that this is probably not true. Overdependence on anecdotal evidence also helps perpetuate false explanations and ineffective treatment approaches, and holds back real progress toward understanding autism and developing effective treatments for it. In short, anecdotal reports and testimonials lack the comparative information that is logically necessary to support a conclusion that a treatment is effective or that one treatment is better than another (Green, 1994b; Stanovich, 1992).

On the other hand, personal reports and clinical observations can identify variables that might be worthy of further investigation. They often spawn systematic, objective research that yields important information, even if it shows only that there was no substance to the anecdotal reports. Sometimes informal observations about treatment effects are borne out by scientific research, resulting in new facts and improved treatment methods with broad applicability. That happens only as a result of many careful comparisons using objective measurement procedures like those described previously. It is not sufficient, however, merely to compare a child’s condition after some months of Therapy Z with his condition before that therapy began. The apparent change could be caused by any of several events or variables. One of the most potent alternatives that must be ruled out in evaluating treatments is the placebo effect: The child might seem better after exposure to the therapy simply because those making the evaluation expect him to be. Other possible explanations for the apparent change are that time has passed and the child has matured physically, learned from things that have been happening in his life in addition to Therapy Z, or benefited from the extra attention that came with the therapy (Campbell & Stanley, 1963; Huck, Cormier, & Bounds, 1974; Kazdin, 1982; Stanovich, 1992).

The goal of scientific research—whether it addresses a basic question, such as how one type of learning occurs, or a practical question like whether a particular method is effective for teaching a child with autism to communicate—is to sift through the possible explanations for the phenomenon to find the variable or variables that actually cause it. This requires observing and measuring the phenomenon under different conditions, and comparing the results. At the very least, comparisons must be constructed so that some of the potential explanations can be ruled out, and others can be confirmed. Over the course of many systematic comparisons (i.e., tests of the potential explanations), one explanation usually emerges as the best (Campbell & Stanley, 1963; Huck et al., 1974; Kazdin, 1982). Again, anecdotes and testimonials simply do not provide enough information to allow false explanations to be ruled out (Green, 1994b; Sagan, 1993; Stanovich, 1992). This leads to a related distinction between types of research and the evidence they produce.

Descriptive (Uncontrolled) vs. Experimental (Controlled) Research

Research comes in many varieties. All good research starts with careful observation and description of the phenomena of interest under natural conditions. This is necessary to get an accurate picture of the dimensions of the phenomena, and the other events or variables that tend to occur with them. When behavior is the topic of interest—for example, a child’s vocalizing—it is essential to see and describe its current level and forms, and events that precede and follow occurrences of the behavior. The conscientious observer might watch a child and record vocalizations occurring under various conditions: different times of day, settings (e.g., school, home, car or bus), social situations (e.g., alone, with adults, with other children), and activities (e.g., free play, teaching sessions, peer interactions). The observer would take detailed notes about the ambient conditions and what happened before and after each vocalization by the child. She might also observe or interview other important people in the child’s life, such as caregivers, siblings, and peers.

Obviously this kind of observation and description can provide rich and interesting information. A great deal of research (e.g., qualitative research, currently popular in education) is purely descriptive, painting comprehensive and detailed pictures of phenomena and the contexts in which they occur, often organizing the details in ways that can serve a host of purposes. Careful observation and description are essential for generating questions or hypotheses.
about the phenomenon: Is the child more likely to vocalize in the presence of adults or other children? Do the child's vocalizations change when an adult imitates what the child has vocalized? How do the vocalizations vary in form, volume, and inflection in different situations? Simple observation and description alone cannot provide conclusive answers to questions like these, because none of the several possible explanations for variations in the child's vocalizations can be ruled out. To do that, it is necessary to arrange observations so that possible explanations can be tested systematically—that is, to conduct controlled observations. Instead of simply observing what happens to the behavior of interest under conditions where all of the events that might affect it are free to vary, the scientist often selects one event that is likely to affect the behavior and explicitly arranges for it to be present and absent, while measuring carefully to see if the behavior changes. All other factors are held constant. In research jargon, the behavior under study is called the dependent variable, and each event that can potentially affect the behavior (e.g., a treatment or teaching procedure) is called an independent variable. (Campbell & Stanley, 1963; Christensen, 1985; Huck et al., 1974; Kazdin, 1982; Sidman, 1960; Stanovich, 1992.)

Suppose a researcher wants to test the possibility that having an adult imitate a child's vocalizations (the independent variable) will increase the child's rate of vocalizing (the dependent variable). The researcher might measure rates of vocalizing during several observation sessions with an adult present who does nothing when the child vocalizes, then during several sessions when the adult imitates every vocalization the child makes. Preferably, both of those conditions should be repeated at least once more each. Other factors that might influence the child's vocalizing are kept the same throughout all observations, for example, the setting, the adult, the time of day, the length of the observation sessions, the number of sessions in each condition or phase, and so on. If the child's vocalization rate is higher when the adult imitates the child than when he does not, and that difference holds when the conditions are repeated, we could have some confidence that the independent variable—the adult imitating the child's vocalizations—and not some other event caused increases in the child's rate of vocalizing.

Before the researcher could be confident that adult imitation was a generally effective intervention for increasing vocalization rates in children with autism, however, the experiment just described would have to be repeated with other children, other adults, other settings, and so on. It would also be important to do additional controlled comparisons to rule out or confirm other plausible explanations. For instance, the observed increase in vocalizations might have been due to the fact that the adult interacted with the child each time the child vocalized, rather than to the adult's imitative responses per se. To test the specific effects of the adult's imitative responses, an adult imitation condition could be compared with a condition in which the adult interacted with the child and vocalized something other than what the child had just vocalized. Still other controlled comparisons would be needed, of course, to justify the conclusion that adult imitation was more effective than any other intervention for increasing child vocalizations.

The complexities and intricacies of experimental control are well beyond the scope and purpose of this chapter. Suffice it to say that all controlled comparisons are not created equal. How well experimental control is achieved in any given experiment is a function of many factors. When alternative explanations (also called extraneous variables) are well controlled, an experiment is said to be internally valid. That is just another way of saying that we can be reasonably confident that the observed effects were due to the independent variable(s) manipulated in the experiment. If important extraneous variables are not well-controlled, then it is possible that they (or some other unidentified events), and not the independent variable, were responsible for the effect. For these reasons, it is always risky to take the reported results and conclusions of any study at face value without scrutinizing the research methods (Campbell & Stanley, 1963; Christensen, 1985; Huck et al., 1974; Kazdin, 1982; Sidman, 1960).

While it is easiest to achieve the necessary control in artificial situations like laboratories, it is entirely possible to do controlled experiments in naturalistic settings. It's just trickier. Experiments are done in everyday settings all the time, whether or not they are identified as such. For instance, every time a parent tries a new strategy to get a child with autism to sample a food the child has been refusing, the parent is doing an experiment of sorts. Add some objective measurement, systematic comparisons, and a few other wrinkles, and you have a formal experiment. Behavior Analysis treatment with a young child with autism actually can be seen as a series (perhaps a multitude) of little experiments, in which the effects of various independent variables (teaching strategies) on various dependent variables (responses by the child) are evaluated systematically. Cumulatively, they can provide invaluable objective evidence about the efficacy of the entire treatment "package" for that particular child. Such evidence accumulated across many children can be powerful indeed (Barlow & Hersen, 1984; Kazdin, 1982; Sidman, 1960).
There is also the matter of external validity, or generalizability, which refers to the confidence with which the results of an experiment can be applied to people and situations other than those involved in the experiment. Of course, this is a very important issue in treatment research; it's one of the main reasons for doing treatment research. If an experiment is not internally valid, however—if we can't be reasonably sure that the treatment (and not something else) produced the observed effects—then there is nothing to generalize (Campbell & Stanley, 1963).

Many factors determine the external validity of an experiment. In general, it is enhanced to the extent that the participants, settings, and other aspects of the experiment resemble those to which we wish to apply its results (Barlow & Hersen, 1984; Campbell & Stanley, 1963; Christensen, 1985; Kazdin, 1982). This brings up another set of questions that would be prudent to ask anyone who suggests a treatment for your child: Has the treatment been evaluated by several independent investigators with a reasonable number of children with autism? How were their diagnoses determined? What were the children's characteristics and histories? Were they representative of children with autism in general? With what proportion of children studied was the treatment effective? Did the effects last? Did they carry over to situations outside the study? What negative side effects were observed? Were there any positive side effects? What were the competencies of the people who delivered the treatment in the research studies? Am I likely to be able to find people with the necessary expertise to provide this treatment to my child?

Facilitated Communication

Three currently popular therapies for autism illustrate three different points along the continua described in the preceding sections. For example, claims that Facilitated Communication (FC) is a remarkably effective intervention for many people with autism have been backed up mainly with anecdotal evidence, as noted earlier. The only published research that seems to support the claims about FC consists of a few qualitative studies describing astonishing communications that appeared to be produced by people with autism with the physical assistance of facilitators. These studies did not define the treatment or its supposed effects specifically, measured nothing, provided no specific information about the participants, and employed few controls for observer or researcher bias. Most important, they included no controls for the very plausible alternative explanation that the facilitators were doing the spelling. Yet the authors of these reports concluded that FC was effective for dra-}

matically improving the communication and cognitive skills of people with disabilities (e.g., Biklen, 1990, 1992, 1993; Biklen et al., 1991; Biklen & Schubert, 1991; Sabin & Donnellan, 1993). Dozens of investigators from around the world, however, have found that when they implemented simple controls for the possibility that facilitators were doing the spelling (e.g., by preventing facilitators from knowing what communications were expected, or simply by having facilitators look away from the spelling device), very few articulate or accurate responses were spelled. Well-controlled studies so far have found no evidence that FC is an effective and reliable intervention (Cummins & Prior, 1992; Felce, 1992; Green, 1993, 1994a, 1994b; Green & Shane, 1992; Hudson, in press; Jacobson et al., 1994; Jacobson et al., 1995; Smith & Belcher, 1992).

Sensory Integration Therapy

Sensory Integration Therapy is said to be effective for improving the sensory processing capabilities of the brain. That is inferred from observing improvements in a number of areas in people with autism, mental retardation, cerebral palsy, and other disabilities: eye contact, learning, self-injurious behavior, stereotypic responses, hyperactivity, communication, motor skills, and others. Although it has been promoted for at least 25 years and is widely used, Sensory Integration Therapy has been the subject of relatively little rigorous research. Typically, Sensory Integration Therapy in one or more of its various forms is delivered in one-to-one sessions over extended periods of time. It involves activities that many children (and adults, for that matter) might find enjoyable (e.g., swinging, rocking, massage). Observation that a child likes an activity, however, is not by itself evidence that the activity is producing significant, lasting changes in the child's brain and/or behavior, or any short-term benefits other than momentary pleasure. For a sound conclusion that this therapy alone was responsible for any apparent changes in the child, the changes would first need to be documented over time by objective methods. It would also be necessary to conduct controlled experiments to rule out several plausible alternatives to the possibility that Sensory Integration Therapy per se produced the changes: placebo effects; maturation; the potential reinforcing effects of sensory stimulation, motor activities, and adult attention; escape from demands; and others. Most studies reporting that Sensory Integration Therapy is effective lack the necessary controls to permit any alternative explanations to be ruled out. Many lack operational definitions of the critical variables as well as objective measurement procedures and controls for observer bias. Well-
controlled studies found that Sensory Integration Therapy was ineffective or no more effective than other treatments (Arendt, MacLean, & Baumeister, 1988; Lindscheid & Valvaro, 1987; Shore, 1994). One study found that it increased, rather than decreased, self-injurious behavior in one subject (Mason & Iwata, 1990).

**Applied Behavior Analysis**

Studies of the effectiveness of Applied Behavior Analysis for young autistic children have employed a variety of objective assessment and control procedures. All of the published studies had children diagnosed by professionals other than those delivering treatment or conducting the study, employed operational definitions of variables, provided specific information about the participants, and used objective procedures to measure treatment effects (in some, both standardized tests and direct observational measures). Some kept the professionals who recorded the treatment outcome measures blind to the children's diagnoses and histories (Birnbrauer & Leach, 1993; Lovaas, 1987; McEachin et al., 1993). Comparisons of the behavior of young children with autism were made both before and after treatment and with children who began treatment after the age of 5 (Fenske et al., 1985), with normally developing children (e.g., Harris et al., 1991; McEachin et al., 1993), with comparable autistic children who did not participate in behavior analytic treatment (Birnbrauer & Leach, 1993), and with comparable autistic children who received less intensive behavior analytic treatment and a variety of other therapies (Lovaas, 1987). Much research remains to be done to replicate these studies, and to determine precisely why some children show dramatic improvements while others make modest or few gains. Direct comparisons with other specific treatments are also needed. For these and other reasons, generalizations from the existing research should be made cautiously. On the other hand, these studies were sufficiently well-controlled to allow some important alternative explanations for the documented effects to be ruled out (e.g., maturation, placebo effects, more typical education, and other therapies).

**Statistical vs. Clinical (or Educational) Significance**

This distinction is a little different than those discussed so far. A good deal of scientific treatment research uses group research designs and statistical tests to determine if a treatment is more effective than one treatment or some other treatment. For example, one group of participants might receive the treatment of interest (and be labeled the “treatment” or “experimental” group), and another comparable group might receive no specific treatment or some other treatment (the “control” or “comparison” group). Generally speaking, the same measures (e.g., one or more behavioral tests or observational ratings) are administered to all participants in both groups before and after (and sometimes during) the period of time in which the experimental group receives treatment. Individual scores are summed and averaged to yield a statistic called the mean. A statistical index of overall variability in scores (the standard deviation) is usually calculated also, along with other statistics appropriate to the research question and design. The statistics for the experimental group are compared mathematically with those of the control group to determine the probability that the measured difference(s) between the groups could have occurred by chance. If that probability is very low, then the difference is said to be “statistically significant.” Assuming that the experimental group’s mean score was the higher, the treatment is then said to be more effective than no treatment or another treatment, whichever the case may be.

Group and statistical comparisons are important and necessary for determining if one treatment approach is better than another for producing an outcome with a group of individuals in general—for example, to answer “actuarial” questions like, “Is Program A better than Program B, on average, for developing prereading skills in kindergartners?” They have some serious limitations, however, when it comes to making decisions about individuals. For one thing, group mean scores may not accurately reflect the actual effects of treatment on any individual in the group. Means can be inflated or deflated by single high or low scores respectively, especially if the sample (group) size is relatively small. Mean scores and statistical comparisons actually “wash out” or obscure individual differences. Indeed, reports of group design studies often include no information whatsoever about individual participants, such as how many individuals in each group improved, stayed the same, or got worse over the course of the study, how much each individual was affected by the treatment, and the characteristics of those who responded positively, negatively, and not at all to the treatment. In short, it can be very difficult to tell from reports of group design studies how closely any participant resembled an individual with whom one is concerned, and how likely it is that the treatment will have a desirable effect on that individual. Similarly, statistical differences among group averages on some measure(s) of treatment effectiveness may not reflect treatment effects that had practical significance for many
(or any) individuals who received the treatment. For example, statistically significant differences can be obtained when many in the treatment group improve a little while many in the control group improve less or not at all; or when a few in the treatment group improve a lot while many in the control group improve a little, or a few get worse; or any of several other combinations. In other words, statistically significant group differences may not indicate that a treatment produced clinically or educationally significant benefits for most of those who received it.

Many behavior analysts use single-subject, rather than group, research designs. They focus on measuring the level(s) of an individual's behavior(s) on several occasions when a particular treatment is not in effect (often called the baseline), implementing treatment over a period of time while measurement continues, and evaluating how much the treatment affects behavior by looking at graphed representations of all measurements. This process is typically repeated (replicated) with the same participant, if practical, or with other participants, or in other settings. Variability in behavior is generally considered interesting and important, rather than something to be reduced or eliminated mathematically. Individual characteristics that may be relevant to treatment effectiveness are also considered important, as are details about how the treatment was delivered to each individual and under what conditions. Behavior analysts sometimes use statistics, and often study the behavior of groups and aggregate data from a number of single-subject experiments to broaden the base from which generalizations about treatment effects may be drawn. In general, however, treatment research in Applied Behavior Analysis is much less concerned with statistically significant differences between group average measures than with differences that are functionally important to the individual in her everyday life.

**SUMMARY**

In examining claims about any treatment for autism, the goal should be to discover the quality of the evidence that supports the claims. The more objective and rigorous the methods by which evidence is produced, the less ambiguous it is, and the more confidence one can feel about basing important decisions on it. The range of evidence that might be offered to back up treatment claims is represented in Figure 2.1, with some descriptors to help identify specific types of evidence and methods used to produce them.

![Figure 2.1. Types of evidence about treatment effects.](image-url)
Personal accounts, testimonials, and anecdotal reports can be intriguing. They may suggest interesting questions that should be explored further. They are virtually worthless, however, for evaluating treatment effectiveness or producing substantive knowledge (Campbell & Stanley, 1963; Shermer, 1994; Stanovich, 1992). In addition, compelling personal stories have many pitfalls. Their vividness tends to overshadow less ambiguous information, provoke emotional responses, and distract us from more rational, objective evaluation (Stanovich, 1992). Subjective reports about treatment effects should be treated with extreme caution, regardless of their source(s), unless they are corroborated with solid objective data. This is not to say that the personal experiences of people who receive treatments, their families, and others around them are unimportant. The importance of including such information in the overall evaluation of any treatment has long been recognized by most disciplines involved in treatment research, including Applied Behavior Analysis (e.g., see Birnbrauer & Leach, 1993; Fuqua & Schwade, 1986; McClearnah & Krantz, 1993; Meyer & Evans, 1993). Subjective reports and uncontrolled observations alone, however, are inadequate for determining whether a treatment works. Controlled experiments using objective measurement procedures are necessary (Campbell & Stanley, 1963; Green, 1994b; Green & Shane, 1994; Meyer & Evans, 1993). The more remarkable the claims about a treatment, and the more profound their implications, the more rigorously the treatment should be evaluated (Wolensberger, 1994).

RECOMMENDATIONS

What then is the most prudent course for a family to follow in deciding whether to try Therapy X, Y, or Z for their child with autism? Several recommendations follow from the premises presented at the beginning of this chapter:

- First, ask those who claim that the treatment might help, “How do you know that?” along with the follow-up questions suggested throughout this chapter.

- If it sounds too good to be true, it probably is. Be very skeptical about all astonishing claims.

- Beware of those offering nothing more than testimonials, especially if they stand to gain financially from sales of the therapy or its accoutrements.

- Seek published scientific research articles about the treatment and critical reviews of research written by qualified professionals.

- If you can, ask someone who is skilled in reading and interpreting research reports for help.

- Evaluate the evidence you obtain against the criteria described in this chapter.

- If a treatment is new, or the evidence about it is highly ambiguous, steer clear of the treatment. If there have been only a few “preliminary” or “pilot” studies, remain very cautious until more data are available.

- If a number of published studies seem to show that a treatment is effective, scrutinize them very carefully. Were they published in respected, peer-reviewed scientific journals? What are the backgrounds and qualifications of the investigators? How were treatment effects measured? How sound are the controls for likely alternative explanations? What benefits and risks have been well documented?

- Regardless of the current status of scientific evidence about a treatment, if it is going to be used with your child you have the right and the obligation to find out specifically what the treatment is, exactly what it is supposed to do for your child, the competencies of those who will deliver and evaluate the treatment, the risks and benefits, and the costs (in money, time, and emotional energy).

- Demand objective evaluation of the effects of every treatment used on your child.

All this does not necessarily imply that new treatments should not be explored, merely that you should view them with healthy skepticism and caution until they have been evaluated by objective methods. Any treatment that has beneficial effects will stand up to rigorous scientific scrutiny, and all children with autism deserve treatment by methods that have the most sound objective evidence behind them. That is where the vast majority of resources should be invested. This is not to say that you should avoid other therapies completely; some might be helpful adjuncts to the main treatment approach. Here too, caution is advised. Take care that adjunct therapies do not counter the intended effects of the main treatment, or carry harmful side effects, including the temptation to take the child's time away from the most potentially effective treatment to invest it in therapies that give the illusion of quicker results, or mainly benefit someone other than the child.
Personal accounts, testimonials, and anecdotal reports can be intriguing. They may suggest interesting questions that should be explored further. They are virtually worthless, however, for evaluating treatment effectiveness or producing substantive knowledge (Campbell & Stanley, 1963; Shermer, 1994; Stanovich, 1992). In addition, compelling personal stories have many pitfalls. Their vividness tends to overshadow less ambiguous information, provoke emotional responses, and distract us from more rational, objective evaluation (Stanovich, 1992). Subjective reports about treatment effects should be treated with extreme caution, regardless of their source(s), unless they are corroborated with solid objective data. This is not to say that the personal experiences of people who receive treatments, their families, and others around them are unimportant. The importance of including such information in the overall evaluation of any treatment has long been recognized by most disciplines involved in treatment research, including Applied Behavior Analysis (e.g., see Birnbrauer & Leach, 1993; Fuqua & Schwade, 1986; McClannahen & Krantz, 1993; Meyer & Evans, 1993). Subjective reports and uncontrolled observations alone, however, are inadequate for determining whether a treatment works. Controlled experiments using objective measurement procedures are necessary (Campbell & Stanley, 1963; Green, 1994b; Green & Shane, 1994; Meyer & Evans, 1993). The more remarkable the claims about a treatment, and the more profound their implications, the more rigorously the treatment should be evaluated (Wolfensberger, 1994).

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- If you can, ask someone who is skilled in reading and interpreting research reports for help.
- Evaluate the evidence you obtain against the criteria described in this chapter.
- If a treatment is new, or the evidence about it is highly ambiguous, steer clear of the treatment. If there have been only a few "pilot" or "preliminary" studies, remain very cautious until more data are available.
- If a number of published studies seem to show that a treatment is effective, scrutinize them very carefully. Were they published in respected, peer-reviewed scientific journals? What are the backgrounds and qualifications of the investigators? How were treatment effects measured? How sound are the controls for likely alternative explanations? What benefits and risks have been well documented?
- Regardless of the current status of scientific evidence about a treatment, if it is going to be used with your child you have the right and the obligation to find out specifically what the treatment is, exactly what it is supposed to do for your child, the competencies of those who will deliver and evaluate the treatment, the risks and benefits, and the costs (in money, time, and emotional energy).
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All this does not necessarily imply that new treatments should not be explored, merely that you should view them with healthy skepticism and caution until they have been evaluated by objective methods. Any treatment that has beneficial effects will stand up to rigorous scientific scrutiny, and all children with autism deserve treatment by methods that have the most sound objective evidence behind them. That is where the vast majority of resources should be invested. This is not to say that you should avoid other therapies completely; some might be helpful adjuncts to the main treatment approach. Here too, caution is advised. Take care that adult therapies do not counter the intended effects of the main treatment, or carry harmful side effects, including the temptation to take the child's time away from the most potentially effective treatment to invest it in therapies that give the illusion of quicker results, or mainly benefit someone other than the child.
Suppose we are considering treatments for a child with some disorder other than autism, say a curable type of cancer, and that a number of different treatments are available for this cancer, some of which have little or no objective evidence supporting them. Scientific research has shown that the most effective treatment currently available for this cancer returns about 50% of children to normal or near-normal health, but it requires that the child spend most of her waking hours receiving the treatment. It must be administered by specially trained individuals who know how to evaluate its effects precisely. For most of us, the decision would not be very difficult in this case: We would choose the treatment with demonstrated effectiveness. While the child is undergoing treatment, would it be wise to attend to related health issues like making sure that she is receiving good nutrition, and controlling bona fide allergies, infections, and sources of discomfort as best we can? Of course. Might we also arrange for the child to have as many enjoyable experiences as possible, such as affectionate physical contact, play activities, contact with peers, sensory experiences, interactions with animals, or listening to music? Sure. But if any of these adjunct therapies jeopardized the chances for the main treatment to work, even if only by taking time away from it, would we subject the child to the adjunct therapy? Hopefully not. The issues in choosing treatments for autism are much the same.

WHICH PATH: SCIENCE OR PSEUDOSCIENCE/ANTISCIENCE?

Paradoxically, in an age when the array of therapies for autism may be at its largest and most perplexing, the main choice for parents—indeed, for the field of autism research and treatment as a whole—seems more clear than ever. It is a choice between pseudoscience/antiscience and science. Pseudoscience and antiscience have not produced any real progress in understanding and treating autism. Science has. Many questions about autism have not yet been answered, and never will be unless parents and professionals choose the path that is more likely to lead to real long-term solutions for children, individually and collectively. The choice is clear.

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REFERENCES


Early Behavioral Intervention for Autism

What Does Research Tell Us?

Gina Green

Autism. For most of the half-century that label has been in use, many have understood it as a life sentence for the individuals to whom it has been applied. Most were expected to have serious and permanent deficits in communication, play, relating to others, and learning. A very small proportion of people with autism (less than 5%) might be expected to achieve independent functioning as adults, but even within this tiny group many retain at least some autistic characteristics. Historically, most people with autism have required extensive treatment and supports throughout their lives (Rapin, 1991; Rimpland, 1994; Rutter, 1970; Rutter & Schopler, 1987; Szatmari et al., 1989). Today the mainstream position is that autism is a “severely incapacitating lifelong developmental disability.” It is considered treatable; indeed, a wide variety of treatments, therapies, and techniques are claimed to help (or even cure) people with autism, and new ones are invented regularly (Autism Society of America, 1995).

Until recently, however, none of those treatments has offered any solid, realistic basis for changing the view that autism is a permanent disability. Several studies have now shown that one treatment approach—early, intensive instruction using the methods of Applied Behavior Analysis—can result in dramatic improvements for children with autism: successful integration in regular schools for many, completely normal functioning for some (Anderson, Avery, DiPietro, Edwards, & Christian, 1987; Birmbrauer & Leach, 1993; Fenske, Zalenski, Krantz, McClannahan, 1985; Harris, Handleman, Gordon, Kristoff, & Fuentes, 1991; Lovaas, 1987; Maurice, 1993; McEachin, Smith, & Lovaas, 1993; Perry, Cohen, & DeCarlo, 1995; Sheinkopf & Siegel, in press). In fact, there is abundant scientific evidence that Applied Behavior Analysis methods (also called behavioral intervention or behavioral treatment) can produce comprehensive and lasting improvements in many important skill areas for most people with autism, regardless of their age. No other treatment for autism offers comparable evidence of effectiveness (Lovaas & Smith, 1989; Schreibman, 1988; Schreibman, Charlop, & Milstein, 1993; Smith, 1993; see also Chapters 2 and 4 in this manual).

Despite the evidence, families with young autistic children are often told incorrectly that all treatments are equally effective or, even more inaccurately, that behavioral intervention is ineffective or harmful. They are likely to be encouraged to try whatever fad treatment is currently in vogue, or to mix and match among the many options on the market. Families who are fortunate or diligent enough to discover the one approach with scientifically proven effectiveness often express the need for a single, fairly concise summary of research on early behavioral intervention for autism. This chapter attempts to address that need. Its purposes are to (a) provide a brief overview of Applied Behavior Analysis principles and methods as they apply to teaching young children with autism; (b) review studies of early behavioral intervention for autism that have been published in the peer-reviewed professional literature; and (c) summarize what research tells us about early behavioral intervention for autism, as well as questions that remain to be answered by further research.

THE INTERVENTION OF CHOICE: APPLIED BEHAVIOR ANALYSIS

Applied Behavior Analysis employs methods based on scientific principles of behavior to build socially useful repertoires and reduce problematic ones (Cooper, Heron, & Heward, 1989). The behavior analytic view is that autism is a syndrome of behavioral deficits and excesses that have a neurological basis, but are
nonetheless amenable to change in response to specific, carefully programmed, constructive interactions with the environment. Extensive research has shown that children with autism do not learn readily from typical environments, but many can learn a great deal given appropriate instruction (e.g., Harris & Hundleman, 1994; Koegel & Koegel, 1995; Lovaas & Smith, 1989; Schreibman, 1988; Schreibman et al., 1993).

Behavior analytic treatment for autism focuses on teaching small, measurable units of behavior systematically. Every skill the child with autism does not demonstrate—from relatively simple responses like looking at others, to complex acts like spontaneous communication and social interaction—is broken down into small steps. Each step is taught (often in one-to-one teaching situations, to begin with) by presenting a specific cue or instruction. Sometimes a prompt is added (such as gentle physical guidance) to get the child started. (A word of caution: Prompts of all kinds should be used sparingly and faded quickly to avoid making the child dependent on them.) Appropriate responses are followed by consequences that have been found to function effectively as reinforcers—that is, when those consequences have consistently followed the child’s response, it has been shown that the response was likely to occur again. A high-priority goal is to make learning fun for the child. Another is to teach the child how to discriminate among many different stimuli: his name from other spoken words; colors, shapes, letters, numbers, and the like from one another; appropriate from inappropriate behavior. Problematic responses (such as tantrums, stereotypies, self-injury, withdrawal) are explicitly not reinforced, which often requires systematic analyses to determine exactly what events function as reinforcers for those responses. Preferably, the child is guided to engage in appropriate responses that are incompatible with the problem responses.

Teaching trials are repeated many times, initially in rapid succession, until the child performs a response readily, without adult-delivered prompts. The child’s responses are recorded and evaluated according to specific, objective definitions and criteria. Those data are graphed to provide pictures of the child’s progress, enabling the teacher or parent to adjust the teaching procedures whenever the data show that the child is not making the desired gains. The timing and pacing of teaching sessions, practice opportunities, and consequence delivery are determined precisely for each child and each skill. In this way, instruction can be highly personalized and tailored to each child’s learning style and pace.

To maximize the child’s success, emerging skills are also practiced and reinforced in many less structured situations. With some children, certain skills can be taught entirely in relatively unstructured situations from the outset. Such “incidental” or “naturalistic” practice opportunities have to be arranged carefully, however, to ensure that they occur frequently, and that consequences are provided consistently. Ideally, there is a gradual progression from one-to-one to small group to large group instruction. Simple responses are built systematically into complex and fluid combinations of typical, age-appropriate responses. The overall emphasis is on teaching the child how to learn from the normal environment, and how to act on that environment in ways that will consistently produce positive outcomes for the child, her family, and others (Harris & Hundleman, 1994; Koegel & Koegel, 1995; Lovaas et al., 1981; Lovaas & Smith, 1989; Schreibman et al., 1993; and Chapters 6 and 7 in this book).

The effective and ethical use of Applied Behavior Analysis methods requires special training, which interested parents should seek. Like any treatment procedures, these can be misused, inadvertently or intentionally. It is particularly important to have competent, well-trained behavior analysts guiding and supervising behavioral treatment for autistic children for several reasons. Research has shown that stereotypic, disruptive, and destructive responses are often provoked by specific (but not always obvious) events, and maintained by sensory stimulation, attention from others, the termination of events like requests or demands, or combinations of these (Green & Cuvo, 1993; Lovaas & Smith, 1989; Repp & Singh, 1990; Taylor & Carr, 1992, 1994). Individuals who mean well but are unaware of this research and its implications, and unskilled in the necessary assessment and behavior-change procedures, may interact with the child in ways that actually make problem behavior worse (Eikeseth & Lovaas, 1992; Meinhold & Mulick, 1990; Taylor & Carr, 1992, 1994; Vuye & Mulick, 1988). For example, providing an autistic child with attention, sensory stimulation, or the opportunity to escape from demands following instances of self-injury may very well increase the rate of occurrence of self-injury (e.g., Lovaas & Simmons, 1969; Mason & Iwata, 1990; and see Chapter 6).

Additionally, procedures that are intended to reduce inappropriate responses, such as time out from positive reinforcement, are easy to misuse and abuse. Unless they are administered carefully, with supervision and monitoring by well-trained professionals, such procedures can jeopardize the child’s fundamental rights and worsen rather than improve behavior (e.g., Green, 1990; Repp & Singh, 1990). One of the keys to producing lasting treatment gains in children with autism is consistency. Caregivers who do not know the events that can trigger or maintain prob-
лем behavior are often inconsistent in their interactions with autistic children. They may unintentionally provide a child with mixed messages, impeding rather than fostering the development of adaptive skills, and strengthening rather than decreasing problematic responses. Further, if behavior-change procedures are not carried out consistently across settings, people, and time, any gains the child makes are likely to be lost. Happily, research shows that many parents learn to be consistent, effective behavior-change agents for their children, and can play a vital role in their treatment (Koegel & Koegel, 1995; Lovaas, 1987; McEachin et al., 1993; Schreibman, 1988).

The discipline of Applied Behavior Analysis is based on more than 50 years of scientific research and evolves continually as new evidence emerges. Ideally, behavioral intervention for autistic children should be guided by ongoing, competent professional analysis of previous and current research findings in behavior analysis, as well as related areas (Green, 1990; VanHouten et al., 1988).

**EARLY BEHAVIORAL INTERVENTION: RESEARCH FINDINGS**

Applied Behavior Analysis techniques have proven effective for improving a wide range of skills in children and adults with autism. So far, however, only a few studies have evaluated the effectiveness of many behavioral techniques combined into a comprehensive, intensive program for preschool-age children with autism. Those that have been published in peer-reviewed research journals are described in the following sections. Research on home-based early intervention is presented first, followed by research on school- or center-based early intervention.

The studies included here evaluated the effects of comprehensive behavioral programming on the overall functioning of children with autism or pervasive developmental disorder (PDD). That is, the investigators measured effects on children’s intellectual functioning, language, social interaction, adaptive (or self-care) skills, play, and maladaptive behavior. Some investigators used global measures that encompassed several of those skill domains (e.g., standardized, objective intelligence [IQ] tests, developmental scales, adaptive behavior scales, or enrollment in schools for typically developing children); others used several specific measures.

Studies showing that behavioral intervention can produce large improvements in specific and important areas like peer interactions and classroom behavior (e.g., Strain, Hoyson, & Jamieson, 1985), imitation (e.g., Young, Krantz, McClannahan, & Poulsen, 1994), self-care (e.g., Pierce & Schreibman, 1994), and various language skills (e.g., Taylor & Harris, 1995) were not included in this chapter simply because there are too many of them. Also, reports about program effectiveness that have appeared in sources other than peer-reviewed research journals (e.g., Strain & Cordisco, 1994, and others in Harris & Handleman, 1994) were not included.

**Home-based Behavioral Intervention**

**The UCLA Young Autism Project**

The most thorough studies of home-based behavioral intervention for young children with autism have been conducted by Ivar Lovaas and colleagues at the University of California-Los Angeles (UCLA). The first was reported by Lovaas in 1987. An intensive-treatment experimental group of 19 children with autism reportedly received 40 hours a week of one-to-one behavioral treatment from trained therapists (mostly UCLA students). A comparable group of children received fewer than 10 hours a week of one-to-one behavioral treatment with UCLA-trained therapists (the minimal-treatment control group). A second control group of 21 comparable children was treated in programs other than the UCLA project. All children received a diagnosis of autism from qualified professionals not associated with the study, and started treatment before the age of 4 years. The three groups of children had similar measured developmental levels, language and play skills, and rates of stereotypic behavior when treatment began. All participated in treatment for at least 2 years.

The children in the intensive-treatment group received one-to-one teaching at home, at school, and in the community (when appropriate). Instruction focused on increasing language, attending, imitation, social behavior, appropriate independent play, cooperative peer play, and self-care skills, as well as decreasing aggressive, stereotypic, and ritualistic behavior and tantrums. After the first 2 years, it was determined that children who were able to benefit from regular school placement received behavioral treatment for 10 hours or fewer each week while they completed regular kindergarten, and minimal consultation from trained therapists while they completed first grade. Children who did not gain enough skills to function successfully in regular classrooms continued to receive 40-hour-a-week treatment for up to 6 years. Children in the minimal-treatment control group received a variety of other interventions in addition to 10 hours a week of behavioral
intervention; the second control group also received various other interventions (but not intensive behavioral treatment).

All children were reevaluated between the ages of 6 and 7 years by examiners who did not know which group they were in. Their educational placements were also verified. These follow-up measures revealed striking differences between the experimental group and both control groups. Of the 19 children in the intensive-treatment group, nine (47%) successfully completed regular first grade and obtained average or above-average scores on IQ tests (94–120; 100 is average). This was an average gain of 37 IQ points over the course of treatment, and a gain of 31 points more than the minimal-treatment group, on average. Eight children (42%) successfully completed first grade in classes for language-delayed or learning-disabled children, and had IQ scores that were, on average, in the mild range of mental retardation. They had made substantial improvements in most other areas (communication, adaptive behavior) but not enough to enable them to participate fully in regular classrooms. The remaining two children were placed in classes for autistic/mentally retarded children and had IQ scores in the profoundly mentally retarded range. In contrast, only one child from the two control groups completed regular first grade successfully and achieved an IQ score in the average range. Eighteen (45%) were in classes for children with language and learning disabilities, and 21 (53%) were in classes for autistic/mentally retarded children. Their IQ scores remained unchanged from the beginning of treatment, which is consistent with other follow-up studies of children with autism who have received typical educational services (Freeman et al., 1991; Rutter, 1970; Schreibman, 1988; also see Chapter 4).

The nine children in the original (Lovaas, 1987) intensive-treatment group who had achieved normal functioning by the end of first grade, participated in a long-term follow-up study (McEachin et al., 1993). These children were reevaluated when they were 13 years old, on average. They were compared with children from the minimal-treatment control group from the 1987 study. Examiners who were not familiar with the children's histories administered intelligence tests, adaptive behavior scales, and a personality inventory to those from the intensive-treatment group, as well as age-matched children whose development had always been typical. Similar evaluations were conducted with children from the control groups. Educational placements were also evaluated. Results indicated that the effects of the intensive behavioral treatment persisted: Eight of the nine formerly autistic children continued to succeed in regular classrooms. One was in a special education class, but another child from the original experimental group who had not completed regular first grade successfully had later moved into regular classes and was enrolled in junior college at the time of the follow-up study. Thus the proportion of intensively treated children who attained normal functioning in school remained 47% (9 of 19). Similarly, IQ score gains these children had shown at the end of first grade were maintained, and scores remained on average 30 points higher than those of the control group. Scores on adaptive behavior and personality measures were also significantly higher than those of the control group, whose school placements (all in special education classes) had also remained unchanged. In fact, "blind" examiners could not distinguish the formerly autistic children who received early intensive behavioral intervention from typically developing children of the same age on measures of cognitive, academic, social, or adaptive skills.

The groundbreaking research by Lovaas and his colleagues raises several intriguing possibilities. First, it suggests that intensive teaching that requires young children with autism to engage actively with their physical and social environments and provides them with consistent, differential consequences can result in completely normal functioning for many. Contrary to what some critics have said, behavioral intervention does not necessarily result in children who merely "act normal" in rote fashion. If that were the case, the children who achieved the best outcomes would not have demonstrated sufficiently flexible behavior to be judged normal by teachers and examiners who did not know their histories. Indeed, there is no solid evidence that behavioral intervention makes autism worse or makes children robot-like—but these misconceptions persist. Second, the studies suggest that intensive behavioral intervention produces substantially better outcomes than other available treatments for young children with autism. Children in the control groups, who received a variety of other interventions, generally did not fare nearly as well as children in the intensive behavioral treatment group over the same period of time. Third, the studies suggest that young children with autism must be involved in behavioral intervention for a large number of hours every week over an extended period of time to have the best chance for optimal outcomes. Normal functioning was achieved only by children who received intensive behavioral treatment for 40 hours a week, 50 weeks a year, for at least 2 years. Those who received behavioral treatment for only 10 hours a week or not at all, with one exception, did not show much improvement.

As with most studies, those reported by Lovaas and his colleagues do not by themselves provide con-
clusive answers to all questions about early intervention for autism. They raise several important issues; some have been addressed by other published studies discussed in this chapter, some are the focus of ongoing research, and still others remain to be answered in future studies. Among the more burning questions are these: Exactly how did the majority of children in the intensive treatment group differ from the 47% “best-outcome” minority before treatment, and in their responsiveness to particular components of treatment? This leads to a broader question: Which children are likely to respond best to intensive behavioral intervention? Are there characteristics (e.g., degree of developmental delay or disorder, level and course of language development, learning style, etc.) that can be assessed before treatment begins, or early in treatment, to determine if a child is going to be more or less responsive? For example, other research has shown that the development of useful language by the age of five is associated with more positive outcomes for children with autism. Also, despite its limitations, IQ score is a relatively good predictor of later academic and overall adjustment (Rapin, 1991; Rutter & Schopler, 1987; Schreibman, 1985). Consistent with those findings, most of the best-outcome children from the 1987 study learned to imitate adult speech by the end of 3 months of intensive treatment, although many had little or no useful vocal speech when they entered treatment (ASA, 1994). The best-outcome children also had somewhat higher IQ scores before treatment than those in the intensive-treatment group who did not achieve normal functioning (Lovaas & Smith, 1988). Otherwise, the reports published by Lovaas and colleagues provided little information about individual children that might have revealed exactly how those who responded dramatically to intensive behavioral intervention differed from those who did not.

Other questions have to do with the nature of the intervention. Many different individuals served as therapists in the Lovaas (1987) study, most of them college students and parents. It is very likely that the manner and skill with which they delivered the intervention varied, which may account in part for the variability with which the children apparently responded. The published articles reported only general information about how the therapists were trained and what they did, and no direct measures of how well or how consistently the therapists performed over the course of treatment, exactly how much treatment was provided by parents vs. other therapists, and so on. Of course, authors usually have to omit some details from published research reports because of space limitations imposed by journals. Accordingly, Lovaas and his coauthors referred readers of their journal articles to *The ME Book* (Lovaas et al., 1981) for details about treatment procedures. That begs the question of how well therapists actually carried out the procedures as intended, however. In addition, since *The ME Book* was published a number of years ago, it does not include the many new teaching techniques and refinements that have resulted from research conducted in the meantime by the UCLA Young Autism Project as well as many other behavior analysts.

Answers to these and other questions are very important not only to other researchers, but also to families, advocates, service providers, policymakers, and others concerned with providing effective treatment to young children with autism at a time when resources are becoming ever more scarce. More careful, rigorous studies like those conducted by Lovaas and his colleagues will be needed to obtain credible, reliable answers (see Chapters 2 and 4).

The studies reported by Lovaas and his colleagues suggest that early, intensive, home-based behavioral intervention provides the best opportunity for a sizable proportion of children with autism to have normal lives. Those studies would have relatively limited value, however, if they could not be repeated (replicated) by other, independent practitioners, families, and researchers (Foxe, 1993). Fortunately there have been several efforts to replicate them, at least in part, and others are in progress at this writing.

**The May Institute Study**

In a study conducted in Massachusetts, 14 youngsters with autism (average age: 43 months) received 15–25 hours per week of intensive behavioral teaching from trained teachers and parents in their homes (Anderson et al., 1987). Their overall mental age (MA), adaptive behavior, and language development were measured with standardized tests administered by professionals not directly associated with the project. Parents and teachers also recorded data every day on each child’s progress toward instructional goals as well as levels of maladaptive behavior. Additionally, project staff used a standardized measure (the Uniform Performance Assessment System, or UPAS) to assess each child’s progression through normal developmental sequences in several skill domains. These measures were taken before treatment and after one year of treatment. For seven children who completed a second year of treatment, assessments were repeated at the end of the second year.

After one year of treatment, MA and social-age scores increased to some degree (ranging from 2 to 23 months) for 12 of 13 children tested. Nine of the eleven children with whom language tests were repeated after one year of treatment made gains of 3–18 months. Similar improvements were revealed by the UPAS, but
gains in communication skills were smaller than gains in other skill areas (e.g., social and self-help). Children who received a second year of intensive behavioral treatment continued to improve in most areas at about the same rates as they had in the first year. Improvements were significant as measured by statistical tests comparing average group scores on standardized tests completed before treatment with those readministered after one year of treatment. For eight of the thirteen children, rates of learning in the first year of treatment were also found to be accelerated relative to normal development; this was true for all children who continued in treatment for another year. All children progressed on their individual instructional objectives, mastering 20 objectives in the first year, on average. None, however, were integrated full time in regular classrooms at the time the study ended, although 31% were integrated at least 2 hours a week (Anderson et al., 1987).

As Anderson and his coauthors were careful to point out, their study differed from the study by Lovaas (1987) in a number of ways. Any of several characteristics of the children and the treatment might account for the less favorable outcomes obtained by Anderson and colleagues. The children were nearly a year older, on average, and there was a larger difference (by an average of 6 months) between their chronological ages and measured mental ages when treatment started. They participated in treatment about half as many hours per week as the children in the Lovaas (1987) intensive treatment group (an average of 20 hours per week vs. 40 hours or more per week), over a shorter total duration (1–2 years vs. 2–6 years). No physically aversive procedures were used by Anderson et al. (1987), whereas reprimands and thigh slaps were provided as consequences for aggression, noncompliance, and other maladaptive responses by some children in the Lovaas (1987) study. Additionally, there was no control group of comparable children who received another type of intervention, or no particular intervention, for direct comparison with behavioral intervention.

On the other hand, Anderson et al. (1987) obtained detailed data on all children before they began treatment (baseline) and throughout the course of treatment. Baseline data showed that none of the children were making appreciable progress in the preschool programs in which they were participating. For each child, appropriate responding increased and maladaptive behavior decreased when and only when behavioral intervention began. That is, behavioral intervention was compared directly with no particular intervention (i.e., typical education) for each child, and replicated across children and behaviors. Such within-subject comparisons and replications, or single-subject experiments, can provide powerful evidence of treatment effectiveness (Barlow & Hersen, 1984; Kazdin, 1982; also see Chapter 2). In addition they can document specific changes in behavior that may be too small to be detected by broad measures like standardized tests, but are nonetheless very meaningful and important to the individual child and those around him. Finally, unlike Lovaas (1987), Anderson and colleagues evaluated the skills of the parent therapists, providing some evidence that the treatment procedures were carried out with relative consistency and skill across all participating children.

The Murdoch Early Intervention Program

Another evaluation of intensive, home-based behavioral intervention for autism was conducted by behavior analysts at Murdoch University in Western Australia (Birnbrauer & Leach, 1993). Nine young children with autism or PDD (average age: 39 months) received an average of 18.72 hours per week of one-to-one instruction from trained parents and volunteers (college students, other family members, friends) supervised by individuals with advanced training in Applied Behavior Analysis. A control group of five similar children did not receive behavioral treatment. Standardized assessments of intellectual functioning (IQ), language development, and adaptive behavior were administered to all children before and at the end of a 2-year treatment period by examiners who were not associated with the program. Direct observations, parent interviews, and a personality inventory were used to evaluate the severity of each child's autistic behavior before and after treatment. Additionally, samples of each child's play, instruction-following, imitation skills, and maladaptive behavior were videotaped before, during, and at the end of the treatment period, and scored by "blind" independent raters. For children in the treatment group, performance data and details about individual programs were recorded during every teaching session. Finally, parents completed a stress index twice a year.

At the end of the 2-year treatment period, four of the nine children in the treatment group had made substantial gains as measured by IQ, language, and adaptive behavior tests. They achieved IQ scores of at least 80 (89–103), whereas before treatment the independent examiners had judged them untestable. Language and adaptive behavior test scores also improved considerably, but not as much as IQ, so that measured performances in those areas were still below chronological-age levels. The communication, play, instruction-following, social, self-help, and tantrum behavior
of these four children had also improved considerably as measured by direct observational assessments and the personality inventory. Stereotypic response levels were essentially the same as before treatment, however. Four of the other five children in the treatment group made moderate improvements, while one made only minimal gains. In contrast, one of five children in the control group made substantial improvements in adaptive behavior and language, but not in intellectual functioning, over the 2-year period. That child had the most advanced skills and least severe autistic characteristics of all the children when the study began. One other child in the control group made moderate improvements, but three made few or minimal gains on any measures.

Scores on the stress index were high for parents of children in both groups when treatment started. By the end of 2 years, scores for parents of children in the behavioral treatment group had improved (i.e., their reported stress levels had decreased) by an overall average of 12.8 points, in comparison to an overall improvement of 1.8 points for parents of children in the control group.

The Birnbrauer and Leach (1993) study had many features in common with the Lovaas (1987) study. Children in the treatment group were slightly older and had slightly lower adaptive behavior and intelligence scores before treatment than those in the Lovaas study, but they were otherwise very similar. Outcomes were similar as well, in that just under half of the children in both studies made substantial improvements in 2 years of treatment; however, the best-outcome children in this study were not shown to achieve completely normal functioning as did those in the UCLA studies, although they seemed to be moving in that direction at the end of 2 years. The major difference between the studies was that the Australian children received considerably fewer hours a week of treatment than those in the UCLA intensive-treatment group were said to receive, and less than the 30 hours the investigators sought.

The quality of treatment delivered in the two studies may have differed as well. Like Anderson et al. (1987) but unlike Lovaas (1987), Birnbrauer and Leach used no physically aversive consequences in treatment. Additionally, their volunteer therapists received most of their training on the job, while the college student therapists in Lovaas' study reportedly had prior and ongoing academic as well as practical training in behavioral principles and procedures. It is impossible to determine how treatment differed in the two studies, however, because neither measured the competencies of therapists or the extent to which they adhered to treatment protocols (see Birnbrauer & Leach, 1993, p. 72).

**The UC—San Francisco Study**

Recently the effects of intensive, home-based behavioral intervention on young children with autism were evaluated by researchers at the Pervasive Developmental Disorders (PDD) Clinic, Langley Porter Psychiatric Institute, University of California at San Francisco (Sheinkopf and Siegel, in press). This clinic was conducting a long-term study of young autistic children who had received initial diagnostic evaluations at the clinic. On follow-up evaluations, the researchers happened to notice that a number of children were reported to have received intensive, home-based behavioral intervention. They designated 11 of those children to constitute a treatment group. Each was paired with a child from the larger study who did not receive behavioral intervention. Pairs of children were matched for chronological age (which averaged just under 3 years), mental age (MA; just under 2 years, on average), diagnosis (10 pairs, autism; 1 pair, PDD), and the interval between their initial and follow-up evaluations. Each child's intellectual ability (mental age and/or IQ) was estimated with standardized tests on initial and follow-up evaluations at the clinic. Additionally, the severity of their autistic symptoms was rated on a scale from zero (symptom not present) to three (severe), and a diagnosis was established by consensus of at least three clinic staff.

The researchers were not involved in deciding which children received behavioral treatment or in providing treatment. They were "blind" to group membership when they compared the measures of the children's status before and after treatment. This effectively ruled out the possibility of biased selection of children for the behavioral treatment group, a criticism that some have made about the Lovaas (1987) study (e.g., see Schopler, Short, & Mesibov, 1989; Lovaas et al., 1989).

Information about interventions in which children participated was obtained through phone interviews with parents. From these reports it appeared that children in the treatment group received an average of just under 20 hours a week of one-to-one, in-home instruction with behavioral methods (range: 9.43–38.75 hours per week) for periods ranging from 7 to 24 months. Trainers were mostly paraprofessionals (college students, relatives, friends) recruited by parents, who reportedly were assisted in training and supervision by one of three master's-degreed "behavior therapists" working in the San Francisco area. Children in the treatment group also attended school an average of a little more than 6 hours per week. None of the children in the control group received intensive behavioral intervention, according to parental reports,
but they attended school an average of 10.7 hours per week. All children in both groups were placed in special education classes initially.

Statistical comparisons of averaged test results indicated that, as a group, the children who received intensive behavioral treatment had significantly higher MA and IQ estimates after treatment than matched children in the control group (recall that these scores were very similar for both groups initially). Examination of individual IQ test data reveals some interesting patterns. All 10 children in the behavioral treatment group for whom follow-up data were available improved on IQ measures, most of them by substantial amounts. In the control group, six children improved by small to moderate amounts, four had lower scores, and one stayed the same. After treatment, six of the ten children in the behavioral treatment group achieved IQ scores of at least 90. However, three of them had scores near 90 before treatment began; all three of those children had higher scores after treatment (about 95, 100, and 115). Three of the eleven control group children had IQ estimates of 90 or above after the treatment interval, but two of those had scored around 90 before treatment. When the IQ data for matched pairs of children are compared, it appears that for seven pairs the child receiving behavioral treatment improved more than his matched partner over the same time period. Within those pairs, the IQ scores of three control group children decreased from initial assessments, while two remained the same and two increased slightly. For two other pairs, treatment and control group children made roughly equivalent IQ gains. In one case the control group child's IQ increased more than that of the matched child receiving behavioral intervention, and for one pair no follow-up data were available for the treatment group child.

The authors reported that the number of autistic symptoms did not differ significantly for the two groups of children either before or after treatment, but the symptoms of the children in the treatment group were rated as significantly less severe after treatment (Sheinkopf & Siegel, in press).

Results of this study add to the evidence that intensive behavioral intervention increases the intellectual functioning (as measured by standardized, objective tests) of many young autistic children. Behavioral intervention also appears to be more effective than other interventions in that regard, or at least the typical interventions that are available to autistic preschoolers. In this study, the “blind” assignment of children to groups and evaluations by professionals who were not associated with treatment, together with the matching procedures employed, lend credence to these conclusions. Unfortunately no measures of adaptive behavior, language, social skills, or educational performance were obtained, so there is no basis for judging whether any children attained normal or near-normal functioning in those important domains, nor for evaluating how specific characteristics of the children (e.g., language skills, learning styles) were related to outcomes.

More important, the only information about the nature of the behavioral treatment provided to children in the Sheinkopf and Siegel study was obtained indirectly through parental reports. These included general information, such as how long treatment was provided and by how many therapists, but nothing specific about the training or competencies of the therapists or precisely what they did. No information was provided about the level of involvement of the master's-level behavior therapists in training and supervising those working directly with the children, nor how much of the direct intervention was provided by parents vs. paraprofessionals. The studies summarized earlier all had at least one doctoral-level psychologist or behavior analyst providing overall supervision for treatment implementation and evaluation; that did not appear to be the case here. Further, there is not enough information in the report to determine whether the amount of behavioral treatment (in number of hours per week and total number of weeks) related to individual outcomes, although the authors did report that the IQs of children who received an average of about 30 hours a week of behavioral treatment generally improved more than the IQs of those who received about 20 hours a week. (Readers should note, however, that this author reviewed a prepublication version of the Sheinkopf and Siegel report, cited here with the investigators' permission. More details may be included in the version that is revised for publication.)

The Maurice Children

The effectiveness of early intensive behavioral intervention for two siblings with autism was documented in a book written by their mother (Maurice, 1993), as well as a case study published in a professional journal (Perry et al., 1995). The two children were each diagnosed with autism at about the age of 2 years by independent professionals who did not know about each other's evaluations. Intensive treatment was provided by master's-degrees behavior analysts and the children's mother, along with a speech-language pathologist. Formal, one-to-one teaching sessions were conducted for 10-35 hours per week, but incidental and informal instruction provided by the parents outside of those sessions meant that the children participated in intervention during most of their waking moments. The first child, a girl, made rapid progress within the first year of treatment, at
which point her younger brother was diagnosed and started an intensive behavioral program. He too responded well to behavioral intervention. Intensive treatment continued for both children for about 2 years, and was reduced gradually as they began to attend regular preschools. By the ages of 39 and 53 months respectively, they no longer met criteria for the diagnosis of autism, and behavioral treatment was discontinued.

Both children successfully completed regular kindergarten, and have gone on to do very well in typical classrooms where teachers who do not know their histories evaluate them as academically advanced and socially well-adjusted. Three of the professionals who diagnosed the children evaluated their progress (on a standardized test of adaptive behavior as well as their impressions from direct observations) at intervals of 6-9 months until behavioral treatment was discontinued. At that point these professionals, who were not involved in providing treatment to the children, reported that both were fully recovered from autism (Perry et al., 1995).

While they were not formal experiments, the case studies of these two children include several features that make them credible: documentation of little or no progress before treatment (baseline); objective measurement of treatment effects repeated over extended periods of time; intensive behavioral treatment introduced systematically across many behaviors, producing relatively rapid and dramatic improvements each time; and verification of diagnoses, pretreatment (baseline) measures, and outcomes by several independent observers (Kazdin, 1982).

School- or Center-based Behavioral Intervention

The effectiveness of educational programs using the methods of Applied Behavior Analysis with preschool and school-age children with autism has been documented in countless articles published in scientific journals like the Journal of Applied Behavior Analysis, Research in Developmental Disabilities, Journal of Autism and Developmental Disorders, Behavior Modification, and others. Many have been reviewed and compiled in books. Several respected preschool programs were described in considerable detail in a recent book edited by Harris and Handleman (1994). Only a couple of programs, however, have documented broad effects of comprehensive, intensive behavioral programming provided in a school or center in reports published in peer-reviewed research journals.

The first study of this kind was conducted by staff of the Princeton Child Development Institute (PCDI), a private nonprofit program that provides educational and other services to children with autism and their families on a thoroughgoing Applied Behavior Analysis model. Outcomes for nine children who enrolled at PCDI before the age of 60 months (Group 1) were compared with outcomes for nine comparable children who enrolled after the age of 60 months (Group 2). All were diagnosed by agencies outside PCDI, and were enrolled in the program for 24 months or more. Behavioral intervention was delivered primarily in the PCDI school program for about 27.5 hours per week, 11 months a year, by a number of teachers and therapists trained in Applied Behavior Analysis. Most children lived with their families, and their parents were trained to implement behavioral procedures at home. One child in Group 1 and four children in Group 2 lived in PCDI-run community group homes, where professional staff also provided behavioral intervention.

Treatment outcomes were defined as positive (the child lived at home and was enrolled full-time in a regular school) or not (the child remained in treatment). It is important to note that children began to make transitions from PCDI to regular school programs only when objective, direct observational data showed that they had language, social, self-care and leisure skills, and control of problem behaviors that were sufficient for them to benefit from placement in regular classrooms (McClannahan & Krantz, 1994). Transitions were accomplished gradually while the children's progress was measured by PCDI staff, and were completed when data showed that skills had generalized to the regular school setting. Results of the study showed that six of nine children who enrolled at PCDI before the age of 60 months (i.e., 67%) achieved positive outcomes, compared to just one of the nine children who enrolled after the age of 60 months (Fenske et al., 1985).

This study had a number of limitations: It did not employ an experimental research design; there were no direct measures of specific outcomes (e.g., language development, maladaptive behavior, self-help skills, social skills, intellectual functioning); and the published report did not include any detailed information about the intervention, or measures of treatment integrity. Nor was any information about individual children included in the report. However, PCDI researchers have a long and distinguished record of scientific research on behavioral teaching procedures for children and youth with autism, staff training, parent training, and program evaluation (e.g., Krantz, Zalenski, Hall, Fenske, & McClannahan, 1981; McClannahan & Krantz, 1993; McClannahan, Krantz, & McGee, 1982). The study by Fenske et al. (1985) provides important evidence about the relation between age of entry into a high-quality, school-based behavioral program and outcomes for children with autism.
Another study was conducted by researchers at the Douglass Developmental Center, Rutgers University (Harris et al., 1991). This center provides preschool education using methods of Applied Behavior Analysis for children with autism in a segregated classroom as well as a classroom in which children with autism are integrated with typically developing peers (Handleman & Harris, 1994). The study evaluated changes in intellectual functioning and language development in children with autism over the course of about a year's participation in the center's program, in comparison with their same-age, typically developing peers. Diagnoses of autism were made by outside agencies and confirmed by a clinical psychologist at the center. Typically developing children were drawn from the center's integrated preschool and day care center.

A standardized IQ test (the Stanford-Binet IV) was administered to nine preschoolers with autism when they were 50 months old, on average, and to nine typically developing preschoolers (average age: 45 months). The same test was given again 10–11 months later (posttest). On the first test administration (pretest), the average IQ score for the children with autism was 67.5; the average for the typical youngsters was 114.11. On posttesting, the children with autism achieved an average IQ score of 86.33 (an average gain of 18.78 points), while the average for the typical children did not change significantly. Scores of seven of the nine children with autism improved by at least 10 points.

A different group of 16 preschoolers with autism and a sample of 12 typically developing peers were pre- and posttested on the Preschool Language Scale at intervals of 9–10 months. Scores for both groups increased by about eight points, which was statistically significant, but scores of the children with autism were well below those of their typical peers on both pre- and posttests.

As the authors noted, the children with autism were relatively advanced when this study began. Their average IQ score was nearly 70, their average age was more than 4 years, and their autistic characteristics were rated mild to moderate. Nonetheless, the gains they made in intellectual functioning over a period of just under one year were substantially greater than the negligible changes that have been documented in other research with 4-year-olds with autism, and exceeded those of their normal peers. It is not known whether the improvements maintained because no long-term data were reported. Unfortunately the study included no measures of other important skills like social interaction, play, self-help skills, and maladaptive behavior, which do not necessarily improve with increases in IQ scores, so the impact of behavioral intervention on the children's overall functioning cannot be determined. In addition, no specific information was provided about the nature or intensity of the intervention, and there were no comparisons involving preschoolers with autism who received no treatment or some other type of intervention. Thus it is not clear whether the improved intellectual functioning demonstrated by seven of nine children with autism was the direct result of their participation in a behavioral preschool program, but it seems likely given the other research reviewed above and in Chapter 4.

**SUMMARY AND IMPLICATIONS**

The body of research on early behavioral intervention for autism is quite small, and many important questions remain to be answered. Taken together, however, the studies just reviewed provide reasonably strong evidence about a number of issues. Those are summarized next, along with their implications and questions that need to be addressed in future research.

**Effectiveness**

There is little doubt that early intervention based on the principles and practices of Applied Behavior Analysis can produce large, comprehensive, lasting, and meaningful improvements in many important domains for a large proportion of children with autism. For some, those improvements can amount to achievement of completely normal intellectual, social, academic, communicative, and adaptive functioning. In fact, a large majority of young children with autism benefit from early behavioral intervention. Most show substantial improvements in many adaptive, useful skill areas and reductions in problematic behaviors. Only a small proportion (about 10% of those studied so far) have been found to make few or no improvements despite intensive efforts (e.g., Anderson et al., 1987; Birnbrauer & Leach, 1993; Lovaas, 1987; McEachin et al., 1993; Sheinkopf & Siegel, in press).

The best documented positive effect is improved intellectual functioning as measured by standardized IQ tests or developmental scales. Virtually every study reviewed here found this effect. Again, the majority of children studied made at least some gains in IQ scores over the course of 1–6 years of behavioral treatment; slightly fewer than half made large gains (from levels indicative of moderate to severe mental retardation to levels in the normal range, in many cases), and a small percentage made few or no gains (Anderson et al., 1987; Birnbrauer & Leach,
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Improvements in language, social skills, play, self-help, and problematic behavior (e.g., tantrums, stereotypic and ritualistic responding, withdrawal, self-injury, aggression) were found to be somewhat less widespread and robust than IQ changes, although that may be a function of characteristics of the children or the treatment provided in different studies, or other variables (e.g., Anderson et al., 1987; Birnbrauer & Leach, 1993). Clearly, large and meaningful improvements in all domains were attained by some children who ultimately became indistinguishable from their peers on every dimension (Maurice, 1993; McEachin et al., 1993; Perry et al., 1995).

Successful integration in regular schools is another positive effect that is well supported by data. Many children with autism who received at least 2 years of intensive behavioral intervention starting at an early age went on to participate in classrooms for typical children of the same age, some with no or relatively little ongoing special support (Fenske et al., 1985; Harris et al., 1991; Maurice, 1993; Lovaas, 1987; McEachin et al., 1993; Perry et al., 1995; Sheinkopf & Siegel, in press). It is important to emphasize that the researchers represented in this chapter, for the most part, had extensive objective data showing that the skills of children with autism actually persisted or continued to improve when they were placed in regular classrooms, which happened only after there was clear evidence that the children had developed the skills necessary to succeed in those settings (see Chapter 16). This approach differs considerably from the “total inclusion” social movement that would have all children with autism (and other disabilities) placed immediately and permanently in regular classrooms regardless of their beginning or ongoing skill development, and without regard to objective evidence of effectiveness (e.g., Biklen, 1992; Stainback & Stainback, 1992).

There is strong evidence that behavioral intervention is more effective for young children with autism than no intervention, and more effective than typical early education services and assorted other therapies. This inference is based on the results of studies reviewed here that compared early behavioral intervention to no treatment or typical education (i.e., control groups or individual pretreatment baselines); a large body of research comparing the effectiveness of behavioral intervention to other procedures for changing specific behaviors of young children with autism (e.g., social skills, communication, and maladaptive responses); and the lack of strong scientific support for almost every other specific therapy for autism (Anderson et al., 1987; Birnbrauer & Leach, 1993; Harris et al., 1991; Lovaas, 1987; Maurice, 1993; McEachin et al., 1993; Sheinkopf & Siegel, in press; also see Schreibman, 1988; Smith, 1993; and Chapters 2 and 4 in this book).

To this author’s knowledge, however, no studies have directly compared comprehensive, intensive behavioral intervention with intervention based on another orientation (e.g., play therapy, sensory integration, a child-centered developmental model) provided to comparable children for a comparable amount of time. There are some hints that early educational efforts that are not explicitly behavior-analytic can produce some improvements in children with autism who participate in them for many hours a week over an extended time (e.g., Rogers & Lewis, 1989). In addition, some of the studies reviewed here found that an occasional control group child who participated in other interventions improved substantially (e.g., Birnbrauer & Leach, 1993; Lovaas, 1987; Sheinkopf & Siegel, in press). Few details about those children were reported, but some of them appeared to be relatively advanced prior to intervention (Birnbrauer & Leach, 1993; Sheinkopf & Siegel, in press). Further, the other interventions have not been well-specifed or evaluated in scientifically rigorous studies to date. The limited objective evidence available so far suggests that other interventions do not produce improvements as large as those that have been shown to result from behavioral intervention (Lovaas, 1987; Sheinkopf & Siegel, in press; also see Smith, 1993).

Age for Optimal Effectiveness

The optimal age to begin intensive behavioral intervention is before the age of 5. So far, the best outcomes have been reported for children who started treatment at age 2 or 3 (Birnbrauer & Leach, 1993; Lovaas, 1987; Maurice, 1993; McEachin et al., 1993; Perry et al., 1995; Sheinkopf & Siegel, in press). At present there seems to be no compelling reason to delay intervention as soon as autistic behavior is verified and the child has sufficient motor skills to carry out simple actions. It remains to be seen, however, whether very young children (i.e., 2 years or younger) will tolerate and benefit from teaching sessions that are as lengthy and structured as those commonly used with children ages 3 and older; that is, there may prove to be an interaction between the child’s age or developmental level and treatment intensity, however, the latter is defined.

There may be an optimal period during which the young, developing brain is very modifiable. In some children with autism the repeated, active interaction with the physical and social environment
that is ensured by intensive behavioral intervention may modify their neural circuitry, correcting it before the neurological correlates of autistic behavior become relatively permanent (Lovaas & Smith, 1989; McEachin et al., 1993; Niemann, in press; Perry et al., 1995; Smith, 1993). At this point in time, of course, these are merely plausible speculations that remain to be investigated in scientific studies.

The Nature of the Intervention

Behavioral intervention is a “package” treatment with many elements and dimensions. The studies reviewed in this chapter represent some of the first attempts to evaluate the whole package, applied in a comprehensive, intensive, and sustained way, with young children. Families, researchers, practitioners, service providers, policymakers, and others naturally have many questions about the nature of the treatment: What are the essential components? Exactly how is it done? Who can deliver the intervention effectively? What does intensive mean, in practical terms? How intensive does intervention have to be to have the desired effects? How long should it continue? Unfortunately, most studies published so far include very little specific information about how behavioral intervention was provided to the children studied, so many of the foregoing questions need to be addressed in future research. Some points that can be inferred from existing research, with varying degrees of confidence, are summarized next.

Components

Applied Behavior Analysis comprises many assessment and behavior-change procedures. They are all derived from scientifically established principles of behavior. Many procedures, singly and in certain combinations, have been validated repeatedly in scientific studies, but new techniques and combinations are constantly being developed and evaluated. The only published, comprehensive package of procedures and skill sequences for teaching young children with autism is The ME Book (Lovaas et al., 1981). As mentioned earlier, the version that is currently available does not incorporate techniques and strategies that have been developed since its publication. Most of the published research reports reviewed earlier did not describe specifically which of the many components of behavioral intervention were employed in the studies. That was partly out of necessity, not only because of space limitations in professional journals but because the very nature of Applied Behavior Analysis is that it is highly individualized. Behavior-change procedures and progressions are tailored to each child’s current levels of functioning and projected future needs. It would be helpful nonetheless to know more about specific aspects of the intervention provided to participants in treatment evaluation studies like the ones reviewed here.

One component of behavioral intervention for young children with autism that has been addressed to some extent in the formal studies is the use of aversive consequences to reduce levels of inappropriate responding. Lovaas (1987) reported that sharp verbal reprimands and light thigh slaps appeared to be necessary to effect meaningful reductions in problem behavior for some children. Both the Anderson et al. (1987) and Birnbrauer and Leach (1993) studies opted not to employ aversive physical stimulation. In general their approach did not produce outcomes as impressive as those of Lovaas (1987), which may have been due to the exclusion of aversive treatment components or to any of several other differences. Children in both of those studies received fewer hours of treatment per week than reported in the Lovaas (1987) study; children in the Anderson et al. (1987) study were older; and therapists in the Birnbrauer and Leach (1993) study may have had less extensive training. On the other hand, physical aversives were not part of the intervention for the Maurice children, both of whom achieved normal functioning (Maurice, 1993; Perry et al., 1995). In short, it is not possible to draw any strong conclusions from the available evidence as to whether aversive components add to or detract from the effectiveness of early behavioral intervention.

Intensity

This may be one of the most important dimensions of behavioral intervention; surprisingly, it has not been well defined. Researchers have described intensity only in terms of the number of hours that children were reported to be receiving treatment. Those reports appear to have been largely anecdotal; no measures of actual time children were engaged in treatment, verified by independent observers, have been provided to date. Nor was information provided on other important dimensions of treatment intensity, such as proportions of time spent on discrete-trial drills vs. incidental teaching opportunities, or the amount and type of programming provided by parents vs. other therapists.

Much more specific, reliable information about treatment intensity is needed, for many reasons. For
one, it is very difficult to draw comparisons across studies when we do not know how they differed on this important treatment variable. Then there is the question of cost-effectiveness, which is vitally important to families and advocates who are trying to procure funding for behavioral intervention, and to families, insurance companies, service providers, and policymakers who must make difficult decisions about resource allocation (time and labor, as well as money). Obviously the intensity of treatment must be well specified if valid and useful cost-effectiveness formulas are to be developed. Further, common sense as well as empirical facts about behavior suggest that it is not the number of hours allocated for intervention that is important, but rather what is done during that time. A very skilled therapist or parent could probably accomplish more with a child in 10 hours than a less-skilled individual could do given 30 hours with the same child. The crucial aspect of treatment intensity will probably prove to be something like rate of learning opportunities (e.g., number of programmed arrangements of specific antecedents, responses, and consequences presented for the child per minute).

A further qualification is that, to date, there is very little evidence from sound research about the relative effectiveness of behavioral intervention at different degrees of intensity. Lovaas (1987) reported that about 40 hours per week was considerably more effective than about 10 hours per week. Sheinkopf and Siegel (in press) inferred that about 30 hours a week produced greater IQ gains in children than an average of around 20 hours per week, but they determined treatment intensity from indirect, unverified reports and did not relate degrees of improvement to weekly or total hours of treatment specifically. The children who achieved positive outcomes in the study by Fenske et al. (1985) received at least 27.5 hours per week of intensive behavioral intervention as preschoolers in the Princeton Child Development Institute’s programs, but no comparisons were made with children who spent less time per week in intervention. Studies in which children received an average of about 20–25 hours of treatment weekly (Anderson et al., 1987; Birnbrauer & Leach, 1993) found somewhat more modest effects than those reported to result from 40 hours per week (Lovaas, 1987). As noted above, however, those studies also differed from Lovaas’ study in other ways. The research designs employed have not made it possible to separate the effects of treatment intensity clearly from the effects of other variables in any studies published to date.

Given these limitations, inferences about optimal treatment intensity should be made cautiously. The only conclusion supported by the data at this point in time is that the best outcomes have been reported for children who participated in behavioral intervention for at least 30 hours per week.

**Duration**

Most of the questions and limitations just noted for treatment intensity also apply to treatment duration, or the total treatment period (months, years) that is likely to produce the best outcomes. Almost no comparative information is available from the published research. Not surprisingly, Anderson et al. (1987) found that youngsters who made good progress in 1 year of treatment made even more over a second year, but they did not compare the progress of children who had 2 years of treatment with that of children who terminated behavioral intervention after 1 year. Most of the best-outcome children in the initial Lovaas (1987) study achieved normal functioning after 2 years of intensive (40 hours per week, 50 weeks per year) behavioral intervention, but one child eventually did so after 6 years (McEachin et al., 1993). The retrospective study by Sheinkopf and Siegel (in press) included children who participated in behavioral intervention for periods ranging from 7 months to nearly 2 years. The data were not presented in such a way, however, that a relation between time in treatment and outcomes could be inferred. Further, it is likely that treatment effectiveness will prove to be the product of an interaction between treatment intensity and duration, therapist competencies, and child characteristics. Until those variables are defined specifically and studied rigorously, the question of optimal treatment duration cannot be answered conclusively. Again, the only safe conclusion at this point seems to be that the best outcomes have been reported for children who participated in intensive behavioral intervention for at least 2 consecutive years, if not longer (Anderson et al., 1987; Birnbrauer & Leach, 1993; Fenske et al., 1985; Maurice, 1993; Perry et al., 1995; Lovaas, 1987; McEachin et al., 1993; Sheinkopf & Siegel, in press).

**Quality**

Still another dimension of behavioral intervention is the quality with which it is delivered. Arguably, quality might encompass variables like intensity and duration, but for purposes of this discussion it is defined as the extent to which those providing treatment do so in accordance with empirically validated best-practice standards as well as legal and ethical guidelines. This is another issue in early behavioral intervention for autism on which objective evidence is
sorely lacking; its importance is self-evident. With the exception of Anderson et al.'s measures of parents' skills, none of the studies published to date have provided any data about the competencies of therapists, teachers, or trainers, or objectively verified information about what they actually did during intervention sessions. As Birnbrauer and Leach (1993) argued, measurement of treatment quality and integrity should be a high-priority topic for future research.

**Setting**

The bulk of the research reviewed here dealt with early behavioral intervention that was largely home-based, usually leading (when successful) to a combination of home-, community-, and school-based intervention. No direct comparisons of home- vs. school-based behavioral intervention for young children with autism have been published, to this author's knowledge. Given the well-documented effectiveness of school-, center-, and community-based programs for people with disabilities that use the methods of Applied Behavior Analysis, there is every reason to think that skilled parents, teachers, and therapists can provide effective behavioral intervention for young children in various settings. It is not the place but the quality with which treatment is delivered that is likely to play the greater role in producing good results. A couple of qualifications are in order, however: (a) Given the deficits in attending, observing, understanding spoken language, following instructions, and sustaining engagement in constructive activities that typify many young children with autism, initial instruction should take place in settings that are quiet and as free of distractions as possible; and (b) treatment must be extended to settings other than the primary one to produce lasting, generalized effects.

On the other hand, it makes good behavioral sense to teach children with autism in contexts that are as similar as possible to those in which their same-age peers live and learn. Since most very young children spend a good deal of their time at home, and learning how to function effectively within the family is one of the most important lessons of early life, it makes sense to provide behavioral intervention to very young children with autism in their homes, at least initially. Additionally, parental involvement in treatment may be a crucial component of effective behavioral intervention for young children with autism, and that may be enlisted more readily when treatment takes place in the home (Lovaas, 1987). Not all families, however, are able to take on an intensive home-based program, so it would seem best if a range of options were available, including school-based programs. Additionally, it is entirely possible and very desirable to involve parents as active partners in treatment delivered primarily by a school or center; indeed, virtually every behavioral preschool program does so (Harris & Handleman, 1994).

**Conclusion**

While many questions remain to be answered by sound scientific studies, the results of research conducted so far have several implications for making decisions about treatment for young children with autism:

1. The intervention of choice is intensive instruction using the methods of Applied Behavior Analysis. Intensive means that carefully planned learning opportunities are provided and reinforced at a high rate by trained teachers and therapists (including parents), under conditions that maximize the probability that the child will benefit from instruction, throughout most of every day, for a minimum of 2 years. It seems best to aim for at least 30 hours of intervention per week to begin with. That much time may not be necessary for every child, but if the intervention is delivered competently, the child is not likely to be harmed from participating for 30 hours or more a week, and is very likely to benefit substantially. After a while, if data show that the child does just as well with fewer hours, then the amount of time could be reduced.

2. Intervention should begin before the child reaches the age of 5.

3. To be effective, Applied Behavior Analysis treatment must be delivered by individuals with extensive training in the methods, ideally under the ongoing supervision of professionals who have advanced training and experience in Applied Behavior Analysis principles and methods.

4. The cost of providing intensive behavioral treatment for a young child with autism is minimal considering the gains that can be achieved. After about 2 years of intensive intervention, research would predict substantial cost reductions for most children, significantly lower or no continuing special expenditures for many. In contrast, the cost of lifelong specialized services to accommodate a severe disability—the likely outcome for most children with autism who do not receive early intensive behavioral intervention—runs into the millions of dollars for each individual (Birnbrauer & Leach, 1993; Lovaas, 1987). Autism is a low-incidence disorder, so the up-front investment in intensive behavioral intervention for any agency serving young autistic chil-
dren is likely to be relatively low, and the payoffs potentially monumental. For children with autism and their families, the benefits could be priceless.

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