

NIDA: 25 Years of Progress

Over the past 25 years, NIDA's scientific research program has addressed the most essential questions about drug abuse, ranging from causes and consequences to prevention and treatment. Among its many and diverse accomplishments, NIDA-supported research has:

- Identified the molecular sites in the brain where every major drug of abuse has its initial effect. These discoveries pave the way to development of novel medications to break the cycle of addiction.
- Taken two medications (LAAM and naltrexone) through the FDA approval process for the treatment of opiate addiction; a third medication, buprenorphine, awaits FDA approval.
- Developed and evaluated pharmacologic treatment for newborns in withdrawal from exposure to narcotics.
- Spawned science-based behavioral therapies for drug abuse, including effective therapies for cocaine and nicotine addiction; through the Institute's "Therapy Manuals for Drug Addiction," made methods widely available for the health care community.
- Completed longitudinal studies in large populations that helped researchers identify behavioral and social antecedents to drug abuse as targets for therapeutic intervention.
- Defined nicotine addiction and the scientific basis for therapy using nicotine gum and skin patches.
- Pioneered innovative community-based research on AIDS prevention; shown that drug users will change AIDS risk behaviors, reducing their susceptibility to and the spread of HIV/AIDS.
- Shown that successful drug abuse treatment reduces criminality and relapse to addiction.
- Proved the value of treating drug abusers' depression and other mental disorders.
- Measured the benefit of research-based drug prevention strategies in communities that involve the media, schools, families, neighborhoods, and the workplace.
- Pioneered the design of innovative epidemiological research into hidden and illegal behaviors associated with drug use and addiction.
- Used advanced imaging techniques to identify specific human brain circuits involved in craving, euphoria, and other sequelae of drug addiction; provided the foundation for development of new medications to block individual effects of drugs.
- Produced genetically engineered animals in which a particular drug receptor had been eliminated, or "knocked out," providing unprecedented insight about how drugs affect the brain and produce addiction.
- Demonstrated that prenatal exposure to cigarettes and marijuana have long-term effects on cognitive performance.
- Immunized rats against the psychostimulant effects of cocaine, opening the possibility of vaccination against cocaine addiction for people.

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Message

From the Director

We are experiencing remarkably rapid advances in scientific understanding of the nature of drug abuse and addiction and what to do about them. These advances provide unprecedented opportunities to achieve NIDA's overarching goal: to significantly reduce the health and social consequences of drug abuse and addiction throughout the United States. They also provide the foundation for even greater advances in knowledge and its application, particularly as new and improved technologies, like those of molecular genetics and brain imaging, allow scientists to ask questions heretofore unimagined.

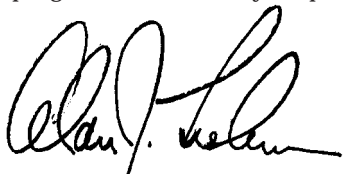
This document is a framework for our scientific future. Although this Strategic Plan is by no means comprehensive, it provides a three-pronged approach to illustrate how NIDA and its stakeholders (including Congress, NIDA's advisory groups and constituents, and members of the general public) foresee NIDA fulfilling its goal over the next 5 years. The Plan involves three fundamental strategies. The first is to provide communities with science-based tools to prevent drug abuse and addiction. This strategy includes NIDA's Vulnerability to Addiction Initiative, which has researchers working to understand the genetic and environmental risk and protective factors that make individuals more or less vulnerable to using drugs and to becoming addicted. Knowledge of those factors then will serve as a base for ever-improved prevention and treatment strategies.

The second strategy is to use scientific activities to improve the quality of drug abuse treatment nationwide. We have taken a giant step toward making this strategy a reality through the launching in 1999 of the National Drug Abuse Treatment Clinical Trials Network. This Network provides a national treatment research and research dissemination infrastructure through which new behavioral and pharmacological therapies can be tested in a wide range of community-based treatment settings with broadly diverse patient populations.

The third strategy includes extensive efforts to educate the public about the true nature of drug abuse and addiction and what to do about them.

It cannot be overemphasized that a broad portfolio of fundamental research has been the foundation for past accomplishments and is the base upon which NIDA's future strategy is built. Basic science discoveries over the past two decades have consistently been the basis for virtually all the major advances in both clinical and applied drug abuse research. Thus, as in our first 25 years, NIDA will continue over the next 5 years to support and develop its broad and diverse research portfolio, ranging from studies of the molecule to analyses of managed care and drug courts.

NIDA remains committed to having science replace drug abuse and addiction ideology. We hope this Strategic Plan gives readers an increased understanding of how our research programs will actually help accomplish that aim.



Alan I. Leshner, Ph.D.

Mission Statement

NIDA's mission is to lead the Nation in bringing the power of science to bear on drug abuse and addiction. This charge has two critical components: The first is the strategic support and conduct of research across a broad range of disciplines. The second is ensuring the rapid and effective dissemination and use of the results of that research to significantly improve drug abuse and addiction prevention, treatment, and policy.

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Introduction

There has never been a better time to look at the future of drug abuse and addiction research. Twenty-five years of NIDA-funded studies on the biological, behavioral, and social bases of drug abuse and addiction have brought us tremendous increases in our understanding of drug abuse and addiction and what we can do about them. This very strong science base, coupled with the availability of new biomedical technologies, has brought us to the cusp of even greater discoveries that will provide further insights about the root causes and consequences of illicit drug and tobacco abuse. These advances, in turn, offer unprecedented opportunities to develop new therapies and interventions for both treating and preventing drug abuse and addiction, and for dealing with their many direct and indirect effects.

There has never been another time in the history of biomedical science when so many new tools, particularly those of modern molecular biology, genomics, and real-time neuroimaging, have enabled researchers to make stunning advances in understanding how the human body functions at all levels, from basic cellular processes to complex behaviors. Problems that were once thought to be insurmountable are falling to scientific progress almost daily, and the optimism that pervades biomedical science in general, and drug abuse research in particular, bodes well for the future. For example, while there are still major questions about why drugs can have such powerful and long-lasting effects on those who abuse them, we now have insights about the molecular details of how every drug of abuse exerts its actions on the human brain and other organs. As a result, it is reasonable to believe that vexing questions will be answerable in ways that will generate new treatments and preventive measures for drug abuse and addiction.

NIDA's goal on the threshold of the 21st century is to seize upon these scientific advances and opportunities to significantly reduce the health and social consequences of drug abuse and addiction. Without a doubt, science will provide the means to accomplish this goal, not only in the conduct of state-of-the-art basic research, but also in our expanding effort to apply scientific understanding to the development of new treatments and prevention strategies. Indeed, NIDA has already begun to establish the vehicles for accomplishing this: the National Drug Abuse Treatment Clinical Trials Network (CTN), launched in the fall of 1999, and a solid foundation of prevention research that forms the basis of our new generation of prevention research.

As the CTN grows over the next 5 years, its goal will be to bring researchers and practitioners together as partners to conduct full-scale testing of promising new medications and behavioral treatments in a wide range of community drug abuse treatment clinics with patients from a variety of ethnic and social backgrounds. NIDA believes that its new CTN will revolutionize drug abuse treatment research, sow the seeds of scientific knowledge in every community in the Nation, and nourish the growth of more effective drug abuse treatment.

The CTN will strive to close the gap that for too long has existed between treatment research and community practice by blanketing the Nation with “research nodes,” which combine treatment research centers and a range of community-based treatment programs affiliated with those centers. By enabling researchers and practitioners to adapt science-based drug abuse therapies to real-world conditions and demonstrate their effectiveness in community settings, the CTN will foster incorporation of new interventions into treatment programs across the country. The CTN also will enable researchers to take the practical knowledge gained from clinicians back to the laboratory and apply it to the development of even more practical and effective drug abuse treatments.

The CTN also will be useful to other aspects of NIDA’s research portfolio. For example, multisite clinical trials with diverse patient populations could provide a valuable resource to researchers interested in elucidating genetic and environmental determinants of vulnerability. Ultimately, increased understanding of the roles played by genetics, environment, and their interaction in shaping an individual’s susceptibility to drug addiction will lead to a variety of more targeted drug abuse prevention and treatment approaches.

In 1997, NIDA published the first research-based guide to preventing drug use among children and adolescents. The prevention principles explained in “Preventing Drug Use Among Children and Adolescents” are now ready to be taken to a new and greater level of specificity. NIDA is launching a new prevention research initiative that will seek to identify how these prevention principles can best be translated into practice. Prevention programs cannot simply be replicated in any new setting, but must be adapted to the special characteristics of different locales and settings as well as to differences in the needs and responses of audiences that vary in gender, ethnicity, and age. As we develop the drug abuse prevention programs of tomorrow, NIDA will aggressively promote the integration of the latest research-based drug abuse prevention programs into existing State, county, and community systems and programs that play an important role in community life.

Members of minority populations are disproportionately affected by the consequences of drug abuse. Accordingly, NIDA is taking extra effort to understand the causes of and factors contributing to these inequalities. In the next 5 years, NIDA will be intensifying its efforts in all areas of its portfolio, including basic, clinical, and epidemiological research, to increase our understanding of the link between drug abuse and various diseases that predominantly affect underserved populations, so that treatments, interventions, and prevention programs that are culturally relevant can be developed to eliminate health disparities.

In the next 5 years, NIDA will also continue its strong commitment to the training and support of future drug abuse researchers, including minority researchers. In the past 10 years, NIDA has been aggressively expanding the National Research Services Act awards to increase the number of scientists conducting drug abuse and addiction research. In addition, NIDA has been a leader among NIH institutes in developing other funding opportunities for investigators early in their careers. To achieve the goals of this strategic plan, NIDA recognizes the importance of maintaining this tradition.

NIDA remains committed to sharing its research findings with the broadest community possible. We know that we cannot just disseminate research findings through journal articles in the hopes that busy treatment and prevention providers or policymakers will have time to read, analyze, and implement a particular finding. That is why we will make every effort to translate these findings in a way that is both useful and used. As we move into the new millennium, NIDA will continue to expand its dissemination efforts to ensure that not only the Nation's treatment and prevention providers, but everyone, will benefit from the fruits of NIDA research.

In NIDA's first 25 years, the power of science has begun to dismantle ideologies, myths, and superstitions about drug abuse and addiction; improve the lives of drug-addicted patients; and reduce the harmful individual, social, and public health consequences of this destructive disease. In the next 5 years, the combined power of science and practice will accelerate the development and application of the next generation of drug abuse prevention and treatment programs to ensure even greater reductions in the Nation's drug abuse problems.

NIDA Strategic Plan

Five-Year Goal

To Significantly Reduce Drug Abuse and Addiction and Their Behavioral, Health, and Social Consequences

Strategy 1

Give communities science-based tools to prevent drug abuse and addiction.

- Understand genetic and environmental risk and protective factors.
- Enhance assessment of drug problems at the local level.
- Translate prevention principles for communities.
- Determine the link between drug use and infectious diseases.

Strategy 2

Develop and distribute tools to improve the quality of drug abuse treatment nationwide.

- Translate basic neurobiological and behavioral research into new treatments.
- Ensure that science-based treatments are translated to community settings.
- Bring scientific methods to the examination of community-based treatments for addiction.
- Understand the medical consequences of drug abuse and use that knowledge to develop new treatments.

Strategy 3

Educate the public about drug abuse and addiction.

- Develop science-based educational materials presenting research findings and their implications in plain English.
- Disseminate materials broadly to reach as wide an audience as possible with information that is useful, usable, and used.

Increase Understanding of the Nature of Addiction Through Basic and Clinical Research.

Strategic Plan

Five-Year Goal: To Significantly Reduce Drug Abuse and Addiction and Their Behavioral, Health, and Social Consequences

NIDA's overarching goal for the next 5 years is to significantly reduce the health and social consequences of drug abuse and addiction. Using input from Congress, the Institute's staff, its advisory groups, and its constituents, NIDA has developed three broad strategies and several priority areas within each that it will pursue to fulfill this goal. Successfully enacting these strategies, and promoting the priority areas, will ultimately rely on NIDA's most important tool—its ability to promote and conduct cutting-edge research, including basic, clinical, epidemiological, and services research, aimed at developing practical treatments, prevention strategies, and educational efforts to address the problems of drug addiction and abuse.

For the past 25 years, NIDA has funded a wide range of basic research endeavors aimed at answering fundamental questions such as:

- What are the root causes of drug addiction?
- Why do people take the risk of using illicit drugs?
- What factors predispose someone to use and then become addicted to drugs?
- What factors protect against initial drug use turning into drug abuse and addiction?
- How does the transition from drug abuse to addiction occur?
- What biochemical and behavioral effects do drugs produce, both short-term and long-term?
- What impact does drug abuse have upon racial and ethnic minorities?

To answer these questions, research on drug abuse and addiction must cross many scientific, social, and cultural boundaries, and it must be transferred from the laboratory to the clinic to the community and back again. For example, our ability to improve the effectiveness of drug abuse prevention and treatment depends on our understanding the underlying neurobiology of addiction as well as the biological, genetic, social, psychological, and environmental factors that predispose individuals to drug addiction.

In addition, NIDA must ensure that the infrastructure is in place to successfully advance its research efforts. This includes providing the resources necessary to train a broad-based, diverse cadre of researchers to lead the Nation's research efforts.

The NIDA research portfolio has already produced important new treatment and prevention strategies, and it will continue paying dividends to society in at least two major ways. First, specific accomplishments that generate new insights into drug abuse and addiction will continue, producing new treatments for drug addiction and even better prevention methods, and enabling us to disseminate new information to the community and general public. However, just as important, scientific research and clinical experience will continue to teach us much about what really matters in addiction and where we need to concentrate both research and policy efforts.

Strategy 1: Give Communities Science-Based Tools To Prevent Drug Abuse and Addiction

The adoption of effective drug abuse prevention programs by communities nationwide will significantly reduce the toll of drug abuse and addiction on our society, especially our Nation's youth. Over the next 5 years, research advances in the following areas will significantly enhance our Nation's prevention efforts:

- Understanding of the genetic and environmental risk and protective factors that can prevent or lead to drug abuse and addiction;
- Enhancement of the assessment of drug problems at a local level by providing communities with effective research-based tools;
- Translation of research-based prevention principles for the specific needs of local communities;
- Determining the link between drug abuse and infections such as HIV and hepatitis to reduce the local impact of these devastating illnesses.

Understanding what determines vulnerability to substance abuse is crucial to the development of effective prevention programming. At this point, there is no evidence that a single, unique factor determines which individuals will abuse drugs; rather, drug abuse appears to develop as the result of a variety of genetic, biological, emotional, cognitive, and social risk factors that interact with features of the social context. Thus, both individual-level factors and social context-level factors appear to make an individual more or less at risk for drug abuse and influence the progression from drug use to drug abuse to drug addiction.

NIDA-supported research has already identified many risk factors associated with the development of drug problems. These factors typically have been organized into categories that represent individual, familial, and social risks. For example, we now know that individual-level risks include shy, aggressive, and impulsive personality traits and poor academic achievement; and family-level risks include poor monitoring by parents and exposure to substance use by parents and siblings. School-level risk factors include a pro-drug-use norm and availability of drugs on or near the school campus; and community-level risks include lack of positive academic and recreational programming for children and adolescents after school hours and on weekends, as well as low levels of law enforcement with respect to minors' use of licit and illicit substances. This sampling of risk factors illustrates the breadth and complexity of the risks that can confront any one person.

For many years, our focus was on discovering the factors that put people, particularly children, at risk for drug use, abuse, and addiction. We now know that there are also protective or resiliency factors that protect individuals from developing drug-related problems. NIDA-supported research has already uncovered many such protective factors that operate at the individual and contextual levels through the family, peer group, school, community, workplace, and the media, among others. Examples of protective or resiliency factors include a stable temperament, a high degree of motivation, a strong parent-child bond, consistent parental supervision and discipline, bonding to prosocial institutions, association with peers who hold conventional attitudes, and consistent, community-wide anti-drug-use messages and norms. An accumulation of protective factors may counteract the negative influences of a few risk factors.

The challenge for the future is to understand how risk and protective factors interact to make individuals more or less vulnerable to trying drugs, abusing drugs, and/or becoming addicted to drugs. Additionally, we must understand the unique risk and protective factors that contribute to drug abuse among minority populations. This knowledge will allow prevention researchers and providers to design programs that can be more effectively tailored to individual needs.

Over the past 20 years, researchers have developed and tested a variety of efficacious prevention programs and have analyzed them to identify what we have come to know as fundamental principles of effective drug abuse prevention (see box). As useful as these principles are, they are quite general and must now be taken to a new and greater level of specificity. Prevention programs cannot simply be replicated in any new setting; they must be responsive to the special characteristics of different locales and settings as well as to differences in the needs and responses of audiences that may vary in gender, ethnicity, and age. We also need to determine how to best tailor programs to subpopulations that are at increased risk for drug abuse.

Preventing Drug Use Among Children and Adolescents: *A Research-Based Guide*

In March 1997, NIDA published the first science-based guide to drug abuse prevention. After a NIDA-convened national prevention research conference in September 1996, a group of NIDA researchers compiled “Preventing Drug Use Among Children and Adolescents.” The 38-page booklet provides prevention principles that a school or community can use to implement a prevention program specifically tailored to meet each community’s particular needs.

From extensive research with children and adolescents, we know that because prevention is basically a process of education and behavior change, and because behavior is shaped in a social context, changing children’s behavior must involve not just the school environment, but teachers, peers, parents, and the entire community. Many of the principles necessary as a base for an effective prevention program that encompasses all of these groups are outlined in NIDA’s research-based prevention guide. The guide first identifies risk and protective factors that can be used in determining who may or may not be more or less likely to develop drug abuse problems. The risk and protective factors help to set the primary targets for prevention intervention.

The guide then uses science-derived principles to establish the content, structure, and delivery of the selected intervention. In short, the content should target all forms of drug abuse, should include skills for resisting offered drugs, should include interactive methods, and should also include a parents’ or caregivers’ component that reinforces what the children are learning. The structure of the intervention should be long-term and family-focused if possible, include media campaigns, and work toward strengthening norms against drug use. The delivery of the intervention should be age-specific, developmentally appropriate, culturally sensitive, and adapted to address the specific nature of the drug abuse problem in the local community. All of these suggestions for developing effective interventions are based on elements of prevention programs that have been consistently found to be effective in preventing drug use. Many of these principles, as well as specific examples of successful prevention interventions, have been compiled into the prevention guide.

NIDA is now diligently working to make sure that its science-based principles of prevention are used in real-life prevention programming. The public response to the guide has been tremendous, and more than 200,000 copies have been distributed to schools and communities across the country; additional requests average about 20,000 per month. The challenge for the future is that NIDA continue to work with local communities to ensure that effective prevention programs are implemented and evaluated at the community level.

To give communities the science-based tools to prevent drug abuse, we must have research in several emerging areas of prevention. Strategies are needed that can help communities to better determine their own local needs and their readiness for interventions. For example, communities must be given the epidemiological tools to assess their needs. Research is needed also to aid understanding of the organization, management, financing, and delivery of prevention services. In the treatment arena there are established systems such as clinics, hospitals, outpatient centers, HMOs, and clinician training and certification systems. However, there are no defined systems for provision and financing of prevention services or training and credentialing of providers. Thus, it is difficult to determine how decisions are made about prevention implementation. A full understanding of these issues will help integrate prevention strategies and programs into existing community-level service delivery systems and sustain them.

There is little doubt that prevention efforts can play a critical role also in breaking the link between drug abuse and HIV infection, which leads to the development of AIDS. This is even more true now that research has proven the strong connection between drug abuse and other infectious diseases, such as hepatitis B, hepatitis C, and tuberculosis. Drug abuse is now the major risk factor identified in new cases of AIDS, hepatitis B, hepatitis C, and tuberculosis in the United States, and a growing number of cases of these infectious diseases are now reported among the partners of intravenous drug users. In addition, the majority of HIV-infected newborns have mothers who were infected through their own drug use or through sexual activity with a drug user. Research is also demonstrating that minority populations may have unique risks that must be addressed.

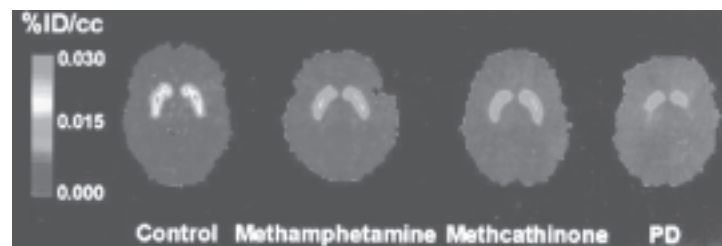
NIDA-funded efforts have repeatedly shown that even small amounts of education and counseling can help drug users modify those behaviors that put them at risk for acquiring and transmitting HIV, hepatitis, or tuberculosis, even without total abstinence from drug use. NIDA's Center on AIDS and Other Medical Consequences of Drug Abuse will spearhead the Institute's efforts to expand outreach to educate populations at risk about the relationship between drug abuse and serious infectious diseases, and it will support research to expand our understanding of the link between drug abuse and infectious diseases as well as the other health consequences of chronic drug exposure.

Strategy 2: Develop and Distribute Tools To Improve the Quality of Drug Abuse Treatment Nationwide

NIDA research has produced a number of effective medications and behavioral treatments for addiction, though there is still much work to be done. Research focused on the following areas will significantly improve how our Nation treats addiction in future generations:

- Translating basic neurobiological and behavioral research into new treatments;
- Ensuring that science-based treatments are translated for use in community settings;
- Bringing scientific methods to the examination of traditional, community-based treatments for addiction; identifying and standardizing the “active ingredients” of those treatments;
- Understanding the medical consequences of drug abuse and addiction and using that knowledge to develop new pharmacological and behavioral strategies to deal with those consequences.

Scientific advances, particularly over the past decade, have catapulted both our understanding of addiction and approaches to treating it. Research has, in fact, come to define addiction as a chronic disease, for many people a recurring disease, characterized by compulsive drug-seeking and drug use that results from the prolonged effects of drugs on the brain. Both animal and human studies have demonstrated that chronic drug use changes the brain in fundamental ways that persist long after the drug use has stopped. By using advanced brain imaging technologies, we can see what we believe to be the biological core of addiction.



The photo at left shows one example of how long-term drug abuse can dramatically alter the human brain. These PET (positron emission tomography) images show levels of

dopamine transporters in the brains of four different adults. Dopamine function is critical to emotional regulation, is involved in the normal experience of pleasure, and is involved in controlling an individual’s motor function. The dopamine transporter is an important protein involved in the communication process among neurons that contain dopamine. In the images shown here, brighter areas reflect greater capacity for binding the dopamine transporter. The scan on the left is that of someone who uses no drugs; the next shows the brain of a chronic methamphetamine user who had been drug free for about 3 years when the scan was taken; the third is that of a chronic abuser of methcathinone (a drug of abuse similar to methamphetamine), who also had been drug free for about 3 years. The last image shows the brain of an individual newly diagnosed with Parkinson’s disease, a disorder in which dopamine neuron degeneration is well documented. By comparing the control brain on the left with the other three, one can see the significant loss in the brain’s ability to transport dopamine back into brain cells.

Data now suggest that every drug of abuse appears to increase the levels of the neurotransmitter dopamine in the brain pathways that control pleasure. It is this change in dopamine that we have come to believe is one fundamental characteristic of all abusable substances and may be a central part of the common essence or biological core of addiction.

This kind of fundamental knowledge, which NIDA-supported researchers generate, gives us critical new insights into the long-term effects of drug exposure on the human brain and can provide new targets and approaches for the development of addiction medications.

It is of critical importance that we continue to expand our examination of the brain processes involved in addiction. NIDA-supported research has described in great detail some of the critical brain mechanisms involved in the initial experiences of pleasure and reinforcement following drug use. Much of that attention has been focused on one brain circuit at the base of the brain that runs from the ventral tegmentum to the nucleus accumbens. This circuit seems to be involved in the pleasurable experiences accompanying the use of all abusable drugs. In comparison, relatively little attention has been paid to the brain circuits and mechanisms involved in higher order cognitive and emotional processing of initial drug experiences, and little is known about the brain circuits subsuming the complex processes of addiction and, importantly, the transition process that underlies the conversion of a drug user from voluntary action to compulsive drug use. To effectively treat addiction and prevent relapse, we will need to have a better understanding of the cognitive factors and the corresponding brain circuits that are involved in addiction.

Given that the development of new and effective treatments for addiction is both a national need and a NIDA priority, it is imperative that we capitalize on recent research advances to rapidly bring new treatments to the clinical tool boxes of front-line clinicians who are treating addiction. Just like other chronic diseases such as hypertension, diabetes, and cancer, for which medications have been developed, drug addiction is a disease that merits medication for its treatment. We have already made great progress in bringing an array of useful tools to drug abuse professionals to treat addicted individuals, such as:

- the readily available nicotine addiction therapies;
- the most effective medications to date for heroin addiction, methadone and LAAM (levo-alpha-acetyl-methadol, trademark ORLAAM);
- a new medication, buprenorphine, also to treat heroin addiction (see box); and
- a number of notable standardized behavioral interventions, such as cognitive behavioral therapies and contingency management, that are effective in treating both adults and adolescents.

Buprenorphine: *A New Treatment Option for Heroin Addiction*

A substantial body of NIDA-funded research has laid out the neurochemical details of how opiates, including heroin, produce their analgesic and behavioral effects. Perhaps the most important work in this area has characterized the receptors that opiate drugs bind to in various parts of the brain, for this endeavor has led directly to the development of buprenorphine, which may soon become the latest pharmacological treatment for opiate addiction. While the ultimate decision about safety and efficacy rests with the U.S. Food and Drug Administration, many NIDA-funded studies support the safety and efficacy of this new agent for treating opiate addiction.

NIDA-supported research has shown that the so-called mu opiate receptor is responsible for the effects associated with morphine: analgesia, euphoria, sedation, and respiratory depression. Buprenorphine has the ability to bind to this particular receptor, but does not activate the receptor to the same extent as the opiates do. Thus it is classed as a partial agonist. As a partial agonist, buprenorphine does not produce the same high as heroin, for example, and is less likely to cause respiratory depression, the major toxic effect of opiate drugs. At the same time, buprenorphine leaves the mu receptor unusually slowly, so its effects last much longer than those of other opiates (methadone, for example). These properties make buprenorphine a valuable addition to the clinical tool box for the treatment of opiate addiction.

NIDA and its commercial partners are also developing the buprenorphine-naloxone combination tablet. As a partial mu agonist, buprenorphine has some potential for misuse. The combination of buprenorphine with the opiate antagonist naloxone would significantly reduce the potential of this medication for abuse. In fact, if a heroin addict attempted to abuse the combination product by dissolving and intravenously injecting it, the individual would experience unpleasant withdrawal effects induced by the naloxone. However, naloxone taken orally would not produce these effects. The safety and effectiveness profiles for buprenorphine and the buprenorphine-naloxone combination suggest they will be valuable new tools for the treatment of opiate addiction, likely administered through normal medical practice settings like physicians' offices.

What this new view of drug abuse means is that drug addiction, like heart disease, can be a serious, life-threatening disease that is both preventable through proper education and treatable with a combination of medications and behavioral treatments. And research has clearly shown that drug abuse treatment can reduce drug use. In addition, treatment can reduce drug-related criminal behavior and the health and social costs of drug use and addiction.

When their input was solicited for this Strategic Plan, NIDA's constituents recommended specifically that the Institute expand its efforts to push proven advances in treatment into as many environments as possible across the Nation. A major part of this effort will involve the National Drug Abuse Treatment Clinical Trials Network, which is placing special emphasis on testing new therapies (behavioral, pharmacological, and combination therapies) in a broad range of environments to facilitate the widespread use of any therapies found to be effective in clinical trials. NIDA envisions that, when fully implemented, the CTN will consist of 30 to 40 Regional Research and Training Coordinating Centers based in university medical and research centers, and that each Center will be linked in partnership with at least 10 community treatment providers that represent a variety of treatment settings and patient populations available in the region. Such diverse populations would include adolescents, patients with dual diagnoses, minority groups disproportionately affected by particular drugs, and patients in the criminal justice system. The CTN also will enable researchers to look at gender and racial differences in treatment efficacy, drug interactions in abusers of multiple substances, and the long-term efficacy of many treatment approaches.

To disseminate information as widely as possible, each Center, working with its partner community treatment providers, will establish specially designed clinical research training programs and clinical education programs for local treatment providers. Because of the scope of the CTN, NIDA is confident that it will create a new paradigm that will enable the quickest implementation of new therapies and intervention strategies possible across the entire Nation. In addition, technology transfer should be bi-directional; that is, seemingly effective treatments already in use in the community should be scientifically tested and standardized. The CTN can be an effective vehicle for this transfer.

The majority of research on drug abuse and addiction has focused on understanding the factors that lead to drug use, on preventing initial use, and on the development and treatment of the illness of addiction. In addition, much has been learned about the ways in which behaviors and patterns of drug abuse contribute to other public health consequences, particularly the spread of infectious diseases such as HIV/AIDS, tuberculosis, and hepatitis. However, in marked contrast to other addictions, particularly nicotine addiction and

alcoholism, relatively little is known about the medical and health consequences for the individual who has been abusing illicit drugs over a prolonged time. At minimum, prolonged drug abuse is associated with poor nutrition, inadequate housing, and only occasional health care. Moreover, there are extensive data from animal studies suggesting that various drugs of abuse alter immune system functioning. Yet, little attention has been focused on what happens to people who use drugs for many years. In order to truly reduce the health consequences of drug abuse and addiction in this country, we need to address this research need. NIDA's CTN will offer outstanding opportunities both for conducting this research and for developing approaches to treat the medical consequences of drug abuse.

Strategy 3: Educate the Public About Drug Abuse and Addiction

Given the impact of drug abuse and addiction on virtually every aspect of American society, it is critical that NIDA's research be both useful and used. Thus, NIDA's mission must include efforts to make the results of the Institute's research program available to as wide an audience as possible (see box). In recent years, the Institute has stepped up these efforts and plans to continue doing so in the next 5 years:

- Develop science-based educational materials presenting research findings and their implications in plain English.
- Disseminate materials broadly to reach as wide an audience as possible with information that is useful, usable, and used.

To ensure that treatment providers have available the most current science-based approaches, NIDA is supporting the development of a series of treatment manuals, "Therapy Manuals for Drug Addiction." This series reflects NIDA's commitment to ensure the rapid application of basic findings in real-life settings. The manuals will be based on therapies that have demonstrated their effectiveness in NIDA-supported community-based treatment studies, and they are intended for use by drug abuse treatment practitioners, mental health professionals, and other health care providers concerned with the treatment of drug addiction. The manuals present clear, helpful information to aid drug treatment practitioners in providing the best possible care that science has to offer. They will provide additional tools in an expanding clinical toolbox and will be an important supplement to the available therapies for meeting the differing needs of different types of patients and of clinical programs.



Mind Over Matter: *Science Education and Drug Abuse Awareness*

Science education plays an important role in NIDA's outreach efforts, and the award-winning Mind Over Matter series is just one of our important contributions to the science education field.

The eye-catching, thought-provoking series now includes eight magazines in a new, compact format for grades five through nine. The effects of methamphetamine on the brain are the latest topic in this popular series. This series uses what we know about drugs and the brain to educate young people both about neuroscience broadly defined and about the specific effects of particular drugs on the body, especially the brain. In each magazine, Sara Bellum, a budding science student, takes students on a scientific journey to learn about the brain's complex responses to specific drugs—inhalants, hallucinogens, marijuana, opiates, nicotine, stimulants, methamphetamine, and steroids. A brightly colored poster is included on the back of each magazine.

The Teacher's Guide, developed to accompany the Mind Over Matter magazines, includes chapters on inhalants, hallucinogens, marijuana, opiates, stimulants, methamphetamine, and steroids. Each chapter describes the effects of specific drugs or drug types on the anatomy and physiology of the brain and other organs. The Guide also contains activities that can be used in the classroom. Background information and lesson plans in combination with the magazines in the series will promote both understanding of the physical reality of drug abuse and curiosity about neuroscience.

To ensure that the series reached its intended audience, in 1998, NIDA launched its "NIDA Goes to School" campaign, in which the Mind Over Matter series and other NIDA educational materials were mailed to every public and private middle school in the United States as well as Department of Defense schools abroad. By the beginning of 2000, more than 1 million sets of Mind Over Matter materials had been distributed throughout the country.

In 1999, NIDA released the first science-based guide to drug addiction treatment, “Principles of Drug Addiction Treatment: A Research-Based Guide,” which describes the overarching conditions required for truly effective drug abuse treatment. The 54-page booklet also delineates the most common types of drug addiction treatment, identifies treatment approaches for which there is strong scientific evidence of efficacy, and answers the questions about treatment that are asked most frequently by providers, policymakers, patients, and the public. In the next 5 years, as the CTN advances our knowledge of what works in drug abuse treatment, NIDA will rapidly disseminate those findings in a number of different formats to ensure that research can both influence practice and inform policy.

One of the Institute’s more successful efforts has been the NIDA-sponsored “Town Meetings” that are held around the country to confront local drug abuse and addiction issues. For example, the Boston Town Meeting, “Understanding Drug Abuse and Addiction: Myths vs. Reality,” was coordinated by the Institute in the wake of community outrage that followed the heroin overdose death of a popular Boston firefighter. Attendees included scientists, civic leaders, policymakers, public officials, and drug abuse prevention and treatment professionals. Key drug abuse researchers discussed trends and patterns of drug abuse in the Boston area, community attitudes toward alcohol and drug abuse, effective drug prevention and treatment strategies, and the impact of managed care. In addition, participants considered how the results of research can be used to improve local responses to the problem and shape local and statewide policy.

To date, NIDA-sponsored town meetings have taken place in Atlanta, Seattle, Boston, Chicago, St. Louis, and 13 other cities. The Institute plans to continue to build upon the successful town meeting program by reaching out to other areas that are feeling a significant impact from drug abuse.

NIDA recognizes that supporting and conducting outstanding research is not enough, that the fruits of its research must be not only useful and usable, but used. Therefore, NIDA will continue in its efforts to disseminate its research to as wide an audience as is possible.

Appendices

Appendix 1: Participants in the Strategic Planning Process

NIDA acknowledges the contributions of the Institute staff and members of the public who offered their comments on the NIDA Web site. In addition, the following individuals and organizations participated in the planning process.

National Advisory Council on Drug Abuse

Susan Amara, Ph.D.	Nancy Kaufman, R.N., M.S.
Hortensia Amaro, Ph.D.	Alan Marlatt, Ph.D.
Andrea Barthwell, M.D.	Clyde McCoy, Ph.D.
Joe Bennett, M.D.	Thomas McLellan, Ph.D.
Kathleen Brady, M.D.	Kathleen Merikangas, Ph.D.
Rand Conger, Ph.D.	Perry Renshaw, M.D., Ph.D.
Gerald Friedland, M.D.	David Rosenbloom, Ph.D.
Morton Goldberg, D.Sc.	Kathy Sanders-Phillips, Ph.D.
Steven Hayes, Ph.D.	James Smith, Ph.D.

Strategic Planning Subcommittee of the National Advisory Council on Drug Abuse

Andrea Barthwell, M.D.	George Koob, Ph.D.
Rand Conger, Ph.D.	Thomas McLellan, Ph.D.
Gerald Friedland, M.D.	Perry Renshaw, M.D., Ph.D.
Nancy Kaufman, R.N., M.S.	

NIDA's Constituent Organizations

AIDS Action Council	American Osteopathic Academy of Addiction Medicine
The Alliance Project	American Psychiatric Association
American Anthropological Association	American Psychological Association
American Academy of Addiction Psychiatry	American Public Health Association
American Academy of Child and Adolescent Psychiatry	American Society for Pharmacology and Experimental Therapeutics
American Academy of Family Physicians	American Society of Addiction Medicine
American Bar Association	American Sociological Association
American College of Neuropsychopharmacology	Association for Health Services Research
American College of Physicians-American Society of Internal Medicine	Association for Medical Education and Research in Substance Abuse
American Foundation for AIDS Research	Association of Black Psychologists
American Medical Association	Black Psychiatrists of America
American Nurses Association	College on Problems of Drug Dependence

NIDA's Constituent Organizations (continued)

Community Anti-Drug Coalitions of America	National Coalition of Hispanic Health and Human Services Organizations
Consortium of Social Science Associations	National Council of La Raza
Drug Strategies	National Council on Alcoholism and Drug Dependence
Employee Assistance Professionals Association	National Families in Action
Entertainment Industries Council	National Governors' Association
Institute for the Advancement of Social Work Research	National Medical Association
Join Together	National Mental Health Association
Legal Action Center	National Minority AIDS Council
National Alliance for the Mentally Ill	National Nurses Society on Addictions
National Alliance of Methadone Advocates	National Prevention Network
National Asian-Pacific American Families Against Substance Abuse	Operation PAR
National Association for Children of Alcoholics	Parents Resource Institute for Drug Education
National Association of Alcoholism and Drug Abuse Counselors	Partnership for a Drug-Free America
National Association of Biology Teachers	Physicians Leadership on National Drug Policy
National Association of Drug Court Professionals	Robert Wood Johnson Foundation
National Association of People With AIDS	Society for Applied Anthropology
National Association of State Alcohol and Drug Abuse Directors	Society for Neuroscience
National Association of Social Workers	Society for Prevention Research
National Center for Tobacco-Free Kids	Society for Research in Child Development
National Center on Addiction and Substance Abuse at Columbia University	Society for Research on Nicotine and Tobacco
	Society for Women's Health Research
	Therapeutic Communities of America
	U.S. Conference of Mayors

NIDA Director's Selected Panel of Extramural Researchers

Huda Akil, Ph.D.	Nancy J. Kaufman, R.N., M.S.
Marianna Baum, Ph.D.	George F. Koob, Ph.D.
Warren Bickel, Ph.D.	Dennis McCarty, Ph.D.
Jean Bidlack, Ph.D.	Clyde McCoy, Ph.D.
Tony Biglan, Ph.D.	Thomas McLellan, Ph.D.
Kathleen Carroll, Ph.D.	Eric Nestler, M.D., Ph.D.
Thomas Crowley, M.D., Ph.D.	Charles O'Brien, M.D., Ph.D.
James Curran, M.D., M.P.H.	Kathy Sanders-Phillips, Ph.D.
Howard Fields, M.D., Ph.D.	Dwayne Simpson, Ph.D.
Gerald H. Friedland, M.D.	Zili Sloboda, Sc.D.
Mike Gazzaniga, Ph.D.	Jose Szapocznik, Ph.D.
Avram Goldstein, M.D.	Nora Volkow, M.D.

Appendix 2: Preparing for Progress: Crafting the Strategic Plan

Given the importance of both basic and applied research in fighting drug abuse and addiction, the enormous range of possible subjects for study, and the hundreds of talented investigators who apply for funding, NIDA must make choices, often difficult, about where and how it spends its money, approximately \$608 million in fiscal year 1999.

To help NIDA develop its Strategic Plan, the Institute called upon a large group of knowledgeable and interested parties to contribute their expertise. The process started with recommendations from a National Advisory Council on Drug Abuse subcommittee dedicated to overseeing the strategic planning process. After obtaining input from its many constituent groups and the Institute staff, NIDA developed a detailed outline of its Strategic Plan for review by the Council subcommittee, an extensive panel of NIDA-funded extramural researchers, and the NIDA staff. Using that review, the Institute developed a draft Strategic Plan that was reviewed by the entire NIDA advisory council and made available for public comment through distribution to NIDA's 67 constituent organizations and via posting on the Institute's Web page. NIDA then developed the final version of the Strategic Plan presented here.

An important fact to keep in mind is that science, in dealing with the unknown, is inherently unpredictable. History has repeatedly shown the benefits of allowing a significant portion of our research activity to be governed by the imagination and productivity of individual scientists, not by a regimented plan for alleviating diseases we do not yet fully understand. Moreover, unforeseen crises and opportunities may require NIDA and individual scientists to abandon their plans or change the direction and focus of their research. Consequently, a significant portion of NIDA's budget supports cutting-edge research proposals, regardless of their specific applicability to prevention and treatment of drug abuse and drug addiction. However, the Institute funds these projects at the frontiers of biomedical science in the expectation that their results will contribute to advances that will directly benefit the fight against drug abuse and addiction and its many consequences, both personal and societal, in addition to diseases in the purview of other NIH institutes and to our knowledge generally.

Answers to questions that affect resource allocation at NIDA are influenced by several factors:

- **An obligation to respond to urgent public health needs, as judged by the incidence, severity, and cost of specific disorders associated with drug abuse and addiction**— Changes in the nature or burden of a particular aspect of drug abuse are important considerations, as illustrated by the increased resources recently devoted to the emergence of methamphetamine as a growing drug of abuse. Another example would be NIDA's increasing allocation of resources to combat the rise of AIDS, hepatitis B, and hepatitis C among those who inject drugs.

- **A commitment to support work of the highest scientific caliber—**
A basic tenet of NIDA’s stewardship is the pledge to maximize the return on the public’s investment in research. To do this, the Institute demands that all requests for support pass stringent review for scientific quality.
- **A need to maintain a diverse portfolio that supports work in many scientific disciplines and on a wide range of problems associated with drug abuse and addiction—**Because no one can know when major discoveries will occur and what opportunities they will create, it is important to support ongoing research along a broad frontier.
- **An obligation to ensure a strong scientific infrastructure, with a high-quality workforce of researchers and health care professionals—**
Productive science cannot be done without well-trained investigators. Moreover, the new therapies that result from research might languish unused for want of well-trained health care professionals to take those therapies out to the public at need. For these reasons, NIDA provides significant support for research training programs and individual fellowships to both research and clinical communities.

NIDA Milestones

- 1999* Released “Principles of Treatment,” the first research-based guide for local communities; launched the National Drug Abuse Treatment Clinical Trials Network to test behavioral and pharmacological treatments in real-life settings.
- 1998* Established the Center for AIDS and Other Medical Consequences of Drug Abuse to coordinate a research program aimed at drug abuse and HIV/AIDS and other short-term and long-term health consequences of drug abuse and addiction.
- 1997* Released the first research-based guide to help communities prevent drug abuse by young people; in collaboration with the Entertainment Industries Council, presented first annual PRISM awards for accurate depiction of alcohol, tobacco, and drug abuse by entertainment media; launched the award-winning “Mind Over Matter” series to encourage young people to learn more about the physical effects of drug abuse.
- 1995* Cloned the dopamine transporter, cocaine’s primary site of action in the brain.
- 1992* Became part of the National Institutes of Health, the world’s premier biomedical and behavioral research organization.
- 1990* Established the Medications Development Program to focus efforts on new pharmacotherapies for drug addiction.
- 1988* Received increased funding for treatment research demonstrations, research on effects of drug during pregnancy, and medications development.
- 1986* Received fourfold funding to address the dual epidemics of drug abuse and drug abuse-related HIV infection and AIDS.
- 1974* Established as the Federal focal point for research, treatment, prevention, and training services, and data collection on the nature and extent of drug abuse.