Opportunities for Psychological Scientists at the National Institute on Drug Abuse

April 01, 2008

The fiscal year 2008 federal budget for research and development did not keep pace with inflation for the fourth consecutive year. The budget for research and development at the National Science Foundation (NSF) is only 1 percent higher than last year, and the budget for most institutes at the National Institutes of Health (NIH) is unchanged from 2007. The consequence, illustrated in Figure 1, is that funding levels are declining for research project grants (RO1s) – the primary funding mechanism at NIH (http://www.aaas.org/spp/rd/nihmech08.pdf). Knowledge of institute priorities can be helpful in this competitive funding environment, so featured here is an interview with Nora D. Volkow, Director of the National Institute on Drug Abuse (NIDA), a NIH institute that supports most of the world’s research on the health aspects of drug abuse and addiction. NIDA is also considered a primary “home” for behavioral science at NIH.

Volkow became Director of NIDA in May 2003. As a research psychiatrist and scientist, Volkow pioneered the use of brain imaging to investigate the toxic effects of drugs and their addictive properties.
Her studies have documented changes in the dopamine system affecting the actions of frontal brain regions involved with motivation, drive, and pleasure and the decline of brain dopamine function with age.

As Director, what are your goals for the NIDA?

The overarching goal of our Institute is to better understand drug abuse and addiction and related consequences, so as to develop more effective strategies for their prevention and treatment. To this end, we use a multipronged approach that includes research programs in basic, clinical, and social neuroscience; genetics; therapeutics (both medications and behavioral interventions); basic and applied prevention research; translational research (from bench to bedside and bedside to community); comorbidity with other psychiatric disorders; and medical consequences, with special emphasis on HIV/AIDS.

Within this overall framework, NIDA’s goals are to:

Understand and prevent addiction. Decades of research have led to today’s improved understanding of addiction. Our growing knowledge is leading to prevention strategies that are not just empirically or experientially derived, but build upon solid epidemiological, genetic, and neuroscience research. NIDA will continue to support wide-ranging and interdisciplinary research to disentangle the biological (e.g., genetic and epigenetic), developmental (e.g., brain maturation pathways and age of onset), and environmental (e.g., cultural and socioeconomic) factors that can influence the development and progression of drug abuse and addiction, and thus inform strategies to facilitate noninitiation, abstinence, and relapse prevention. NIDA is committed to taking full advantage of the powerful and evolving new tools and technologies that will enable investigations to discover the underlying vulnerabilities and varied trajectories of drug abuse and addiction.

Treat addiction. NIDA recognizes the need for a “whole systems” approach to treating addiction. The interconnected brain circuitry is our major target as we strive to develop more responsive, integrated treatments. Drugs of abuse alter normal brain functioning in profound and long-lasting ways, whereby the addicted person is “conditioned” to need the drug and finds it difficult to resist. Recent discoveries have uncovered an expanded range of possible targets within this interconnected system, including those that modulate craving, euphoria, motivation, learning, memory, inhibitory control, and interoception — key contributors to relapse and to the compulsive nature of addiction. NIDA’s comprehensive therapeutic research portfolio focuses on the development of medications and behavioral therapies and reflects the need for customized treatments where possible, taking into account genetic variation and comorbid conditions (e.g., other mental illness, chronic pain).

Prevent HIV. Drug abuse continues to be a major vector for the spread of HIV/AIDS, owing in large part to the connection between drug abuse and other risky behaviors, such as needle sharing and/or having unprotected sex. NIDA-supported research, from basic to clinical to health services, has shifted focus to align with the evolving HIV epidemic. This includes research to mitigate the health disparities that particularly affect African Americans — who tend to be late testers, putting them at greater risk for disease transmission and accelerated disease progression — as well as research to better understand the linkages between noninjection drug abuse and risky sexual behaviors prompted by impaired judgment and decision-making. Our research has furthered understanding of this nexus and has shown the value of drug abuse treatment in preventing HIV spread.
Translate research. Despite major strides in drug abuse prevention and treatment research, limited improvements have occurred in implementing drug abuse prevention and treatment services in non-research settings. NIDA engages in multiple activities to more effectively bring such services to the public, strengthening productive partnerships — with treatment practitioners, state substance abuse programs, and other federal agencies — to help move proven treatments into clinical practice at the community level.

An integral component of our translational efforts is the dissemination of scientific knowledge to help the public better understand addiction and to further the translation of research findings that reveal:

- drug addiction as a disease of the brain that translates into abnormal behavior.
- addiction as a developmental disease that usually starts in adolescence.
- the impact of health disparities and gender issues on substance abuse risk and research.
- comorbidities between substance use and other mental disorders.
- innovative treatments and modalities that can change the course of substance abuse.
- the role of protective and resiliency factors.
- intersections among substance abuse, addiction, and other disorders including HIV, obesity, and pain.

NIDA, like all institutes at NIH, has seen increasing numbers of applications, increased costs per application, and a steady or decreasing real-dollar budget for funding grants. What are your priorities during these difficult times, and what do you see to be the funding prospects over the next few years? In addition to NIDA’s overall priorities discussed in the answer to #1 and despite funding constraints (following the end of NIH’s budget doubling period), we remain committed to tackling the essential aspects of drug abuse and addiction and to exploring the most promising areas for discovering effective prevention and treatment strategies.

It is important to realize that, regardless of budget constraints, there will always be emerging scientific areas so promising that we simply cannot risk turning away from investing in them. This is precisely the case with the reinvigorated fields of social neuroscience and epigenetics. Progress in the former will allow us to better understand the influence of social factors in both individual and group decision-making by exploring how genetic and neurobiological mechanisms underlie social and individual behaviors related to drug abuse and addiction. This knowledge will be critical not only to understanding drug abuse but other health behaviors as well. Similarly, the application of epigenetic tools will give researchers a completely different perspective with which to investigate gene-environment interactions, including the deleterious changes to brain circuitry resulting from drug abuse as well as those resulting from exposure to social stressors during development. The fact that NIDA is the co-lead with the National Institute of Environmental Health Sciences in a new NIH Roadmap activity focused on epigenetics underscores its importance to our Institute and to NIH as a whole (http://nihroadmap.nih.gov).

Research to develop treatments (medications and behavioral interventions) is another priority area for NIDA, regardless of budget constraints. This includes research to evaluate new targets for medications, promote use of imaging modalities to tailor behavioral interventions, seek partnerships with the pharmaceutical industry, and promote the evaluation of medications that can interact with behavioral interventions to strengthen their effectiveness.
Finally, to ensure that we maintain a cadre of fresh scientific minds to address issues of importance to NIDA, we will continue to offer training and provide opportunities for new researchers, minority researchers, and those from different backgrounds to study drug abuse and addiction and tackle crucial related issues.

**In what ways has psychological science contributed to your goals for the NIDA?**

Basic psychological research has contributed broadly to our goals; indeed, most of the behavioral therapies used for addiction draw from the theoretical framework of the psychological sciences. Examples include:

- **Contingency management**: A technique that applies the basic principles of behavioral modification in substance abuse treatment settings. Rewards in the form of privileges granted or vouchers exchangeable for goods or services are given for verified abstinence. Recent research from NIDA’s Clinical Trials Network show that contingency management approaches can be implemented cost-effectively and meet with approval by treatment providers, who enjoy rewarding positive behavior over punishing negative behavior.

- **Cognitive behavioral therapy**: A collection of strategies intended to enhance self-control by anticipating likely problems and helping patients develop coping strategies through teaching particular techniques. Our current research focuses on how to elicit even more powerful effects by combining cognitive behavioral therapy with medications for drug abuse and with other types of behavioral therapies. Researchers are also evaluating how best to train treatment providers to deliver cognitive behavioral therapy.

Treatments on the horizon offer promise for affecting the conditioned responses to drugs that go hand in hand with addiction, leading people to compulsively seek and take drugs, or to relapse even after long periods of abstinence. New therapies, exemplified below, will take advantage of new technologies, medications, and basic and behavioral research to help us understand and modify the circuitry affected by addiction — this circuitry is part of a wider network in which pathways influence one another in highly complex ways.

- **Extinction therapies**: A class of interventions to facilitate the “unlearning” or extinction of conditioned drug responses. Although this approach has had limited success in its practical application so far, its efficacy may be enhanced by medications aimed at diminishing conditioned responses, promoting new learning, and inhibiting stress-induced relapse. New medications are already being tested in this capacity, particularly for other psychiatric disorders that also benefit from extinction therapies.

- **Neurofeedback**: The use of noninvasive real-time brain imaging technologies to teach patients to regulate neural activity in specific brain regions. A proof of concept for this therapy has been shown in healthy subjects trained to regulate their perception of pain and in patients with chronic pain. The potential applicability of this concept to control drug craving is one that also needs further research.

The tools of psychological science are particularly well suited to help test and make these emerging approaches successful realities. NIDA will continue to fund studies that look at all stages of behavioral therapy development — from the discovery of new approaches to the refinement of well-established treatments to improve their implementation (i.e., community friendliness) and adoption. We will also
focus on how behavioral treatments work and for whom they work best.

Animal models are a mainstay of psychological science and play a critical role in drug abuse research. Animal studies provide knowledge about how the brain reacts to drugs of abuse and how this leads to addiction. Because animals will self-administer nearly all drugs of abuse and continue to take them when available, they allow us to study how voluntary drug taking alters the brain and behavior. Basic animal models continue to be refined to better represent different aspects of drug abuse, such as abuse liability and relapse, and even individual differences in vulnerability based on genetic variation or exposure to environmental challenges, such as maternal deprivation.

Stress and trauma, particularly when they occur early in a person’s life, can forever change the way the brain responds to stress. Factors such as being poor, socially isolated, or the victim of parental abuse and neglect are all known to influence the age of first use, the degree and duration of use, as well as the co-occurrence of mental health problems. Many people who experience trauma turn to alcohol or other drugs to help them deal with chronic emotional pain and its deleterious consequences, such as bad memories, poor sleep, shame, anxiety, or terror. Animal models allow us to systematically investigate the biological mechanisms involved in the connections between stress and drug taking, even suggesting ways to reverse or mitigate these effects.

In addition, genetic “knockout” mice are elucidating the contribution of genes to this complex equation, which will lead to more effective counter strategies. Animal models of addiction continue to grow in sophistication, revealing useful knowledge about addictive behaviors. Psychological sciences have made seminal contributions to our understanding of these complex systems and complement the knowledge gained from clinical research — each informing the other in a cycle of continuous improvement.

In what ways can psychological science contribute better or differently to these goals in the next few years?

In addition to the potential contributions that psychological science can make to the goals already elucidated — such as improving behavioral treatments, furthering basic science findings, and enlarging our understanding of gene-environment interactions — it also stands to directly contribute to enhancing knowledge of the impact of other mental disorders on drug abuse and vice-versa. We need to gain a better understanding of how comorbidity develops and how it should be handled. Many individuals simultaneously suffer from substance abuse and other mental illness, with studies showing that as many as 6 in 10 people with an illicit drug use disorder also suffer from other mental illnesses. Among the mental disorders commonly reported to co-occur with substance abuse are mood and anxiety disorders (especially in women), antisocial personality disorder (particularly in men), and schizophrenia (highly comorbid with nicotine dependence).

Because comorbidity touches on the missions of other NIH Institutes (NIMH, NIAAA), NIDA will continue to work with our colleagues to encourage research on the epidemiology and genetics of comorbidity and its neurobiological underpinnings, spurring further exploration of the brain regions and common circuitry associated with drug abuse and other mental disorders.

To optimize treatment effectiveness for drug abuse, we must take a comprehensive therapeutic approach that seeks to customize treatments where possible, taking into account comorbid conditions such as mental illness and chronic pain. Psychological science can help by strengthening the link between
neuroscience and treatment development — both pharmacological and behavioral.

**Among the psychological scientists who have applied for funding to NIDA, some have been trained in the fields of clinical psychology or psychiatry whereas others have been trained in more traditional fields but have research interests that bear on mental health. What advice would you give to young investigators from each of these backgrounds if they were considering NIDA as a possible source of research funding?**

NIDA has a broad portfolio and seeks to cast a wide net in our quest to solicit innovative grant applications from within and without the field of drug abuse and addiction. A guiding priority area for NIDA (and NIH) is the training of clinical researchers interested in working with patients and with other entities to facilitate getting better treatments out to the field. Basic science will always be valuable in advancing our multi-pronged approach to discovering better prevention and treatment interventions.

In terms of advice, we would encourage those with treatment research interests to learn about and collaborate with researchers in one or more areas of basic behavioral science, neuroscience, or genetics/epigenetics to propel the clinical science area forward — by incorporating new ideas and by increasing the rigor and strength of the science through interdisciplinary collaboration and improved and theoretically based research designs.

We also encourage basic behavioral scientists and both basic and clinical neuroscientists to learn about treatment. By understanding the treatment issues, new questions may arise and researchers can design their studies to have more clinical relevance, thus increasing its public health significance. To this end, NIDA is participating in an NIH Roadmap initiative to foster interdisciplinary research via methodological and technological innovation in the behavioral and social sciences. Applications will seek to develop new/innovative measures, methods, and technologies that support the interdisciplinary integration of human social and/or behavioral science with other disciplines across varying levels of analysis.