

## Addiction Studies in Iran; Neuroscientists Need to Do More

Neuroscience, considered one of the most progressive sciences of the 21st century, can be defined as the study of the brain and nervous system, including molecular neuroscience, cellular neuroscience, cognitive neuroscience, psychophysics, neurocomputational modeling and diseases of the nervous system (MedicineNet.com). The field addresses consciousness, perception, memory, and learning, and links observations about cognitive behavior with the actual physical processes that support such behavior (<http://www.funderstanding.com/neuroscience.cfm>). Its broad-ranging scientific fields, its relationships with many of the humanities—including philosophy and sociology—and the ideal opportunities it presents for multidisciplinary collaboration are some of the major scientific and research attractions of neuroscience. An indication of the burgeoning interest in and dynamic nature of this field is the fact that there is increasing membership in international scientific associations – for example, the Society for Neuro Science (SfN) has more than 48,000 active members and there are annual conferences with more than 30,000 participants and more than 16,000 scientific presentations and significant increases in scientific articles published in peer-reviewed journals.

Addiction and Substance Abuse, as neuronal-related disorders that would benefit from neuroscience research, are among the most significant health concerns in Iran. The prevalence here is now considered among the highest in the world and the specific biobehavioral, cultural and ethnic characteristics of addiction in Iran have amplified the necessity for prevention and treatment policies and programs that are derived from and specific to our country.

Globally, knowledge of trends and disparities in addiction incidence and prevalence, and scientific evidence of prevention and treatment effectiveness has contributed to increased development of effective and cost-effective interventions. In recent years, global scientific experience has demonstrated that approaching addiction as a brain disease from the neuroscience perspective is one of the most successful and developing methods of prevention, intervention, treatment and de-stigmatization. Importantly, this is due in large part to the fact, as mentioned above, that neuroscience incorporates the humanities in its broad panoply of fields.

It is critical that Iran, as a leader in the field of addiction science, assume the role of leader in the field of neuroscience. However, notwithstanding the existing neuroscience

sub-departments in psychiatry, neurology, psychology, neuro-radiology, and other related fields of neuroscience in universities and research centers in Iran, there has yet to be a dedicated effort to consolidate or integrate these specialties in the framework of a multidimensional neuroscience department or field. In the future, non-substance addictions (such as gambling) may also be worth bringing under the umbrella of addiction neuroscience, given the various conceptual similarities between substance and non-substance addictions, and the co-morbidity of these conditions.

In consideration of the importance of neuroscience, and the contribution of individual Iranian scientists to this field and to the field of addiction sciences, it is recommended that addiction can serve as a central functional and structural axis for studies in the field of neuroscience. The following neuroscience fields and studies are exemplary of utilizing addiction sciences for this purpose.

**1. Basic and Clinical Neuro Psychology and Behavioral Neurology:** One of the most important fields of neuroscience is the investigation of specific brain functions, including memory, concentration, decision making, and motivation. Considering the damage done by addiction to these important brain functions (cognitive functions), research in the field of addiction, using the neuropsychological approach, can provide the opportunity to better understand the different disorders of cognitive function (pre, co or post-morbid) correlated to addiction as well as positive and negative effects of various treatment approaches. In addition to boosting local knowledge of clinical neuropsychology, this research provides the opportunity to improve prevention and treatment methods in addiction medicine.

**2. Cognitive Science:** Understanding important brain functions in the context of cooperating functional modules and use of this knowledge, in recognizing individual and social behaviors and designing artificial intelligence systems and models of human societies under the title of “cognitive sciences”, is one of the most rapidly progressing branches of neural science. Collaboration among activists in such diverse fields as anthropology, sociology, computer sciences, and philosophy represents an opportunity for scientists from various fields to collaborate on developing an understanding of human behavior and effective related policies and programs. The advances in cognitive sciences related to motivation, emotion, decision making, and social cognition for example, contribute to an understanding of addiction and scientific research in addiction has created

new horizons for multiple disciplines to explore cognitive scientific research.

**3. Psycho Pharmacology:** Effective medicines that act on the function of humans' neural system compose almost half of manufactured drugs. Such pharmacological interventions generally take place based on cellular and molecular knowledge of the living organisms. The absence of effective medicines for use in treating addiction, in particular the divergent types of drugs to which the population is addicted -- prescribed medicines, hashish, opium, cocaine, methamphetamines, for example- is a hindrance to treatment. It also has made the addiction field one of the most attractive Fields for psychopharmacological researchers.

**4. Genetics:** Recent years' advances demonstrate the influence of genetics in neural system activities and individual and population variations. Genetic differences --the appearance of various proteins at the cellular level in neural cells-- can explain many different behavioral and genetic variations in biobehavioral and other illnesses. In drug addiction, polymorphism of dopamine and serotonin receptors is one of the genetic features which are proving to be one of the main causes of differences in predisposition to addiction and response to treatment. For this reason and because of the rapidly advancing field of pharmacogenetics generally, addiction can be considered one of the attractive fields in neurogenetics.

**5. Neuro Radiology:** Modern methods of quantitative structural brain imaging and new advances in laboratory and other equipment for use in molecular and functional neuroimaging have opened new horizons in specifically recognizing brain diseases in the early stages. Considering the structural and functional influences of addiction on the brain, addiction disease can be a point of concern for neuroscientists. Neuroimaging studies contribute significantly to careful recognition of the process of becoming addicted, determining the specific effect of different substances, and investigation of effectiveness of different addiction treatment methods.

**6. Computational Modeling, Neuro Computation, and Behavioral Modeling:** Use of computer sciences methods, mathematics and statistics in recognizing the function of human's neural system has been made possible by the new computational modeling approaches.

Mathematical analysis of the function of different areas of the brain in personal and social behaviors of individuals and population subgroups is carried out in the framework of neurocomputation, micro models and macro models.

Addiction as a brain disease can be investigated and analyzed using these modeling techniques. More detailed rec-

ognition of addictive behavior, predicting the behaviors of each addicted individual and strategic management of the production, abuse and addiction treatment market are of the basic uses of applied modeling methods in the field of addiction.

**7. Electro Physiology:** Electrical functions are one of the main indices of physiologic activity of humans' brain neurons. Therefore, noting the brain's electro activity and its changes by Electroencephalography (EEG) and also intervention in brain's areas' electrical function using repeated trans cranial magnetic stimulation (rTMS) is one of the newly expanding areas in neural sciences. Using EEG in recognizing brain disorders resulting from addiction and use of rTMS to control different brain functions in addiction is considered as a treatment method from different shared points among neural and addiction sciences.

Approaching the addiction phenomenon from the point of view of brain disease can lead to neglecting some aspects of addiction, such as psycho social, cultural or legal dimensions; however, this approach can, according to many experts, also be a highly successful tool in addiction intervention and treatment. In this way, creating a constant and mutual relation between addiction medicine and neuro sciences in Iran will enhance the implementation of neural sciences research. It will also contribute to developing the scientific infrastructure for neuroscience as a strategic science in Iran and to improving our understanding of and responses to substance abuse.

Through continued support from President of Tehran University of Medical Sciences and the infrastructures provided by the neurocognitive laboratory in Iranian National Center for Addiction Studies, INCAS intends to strengthen its research tools and equipment in the field of neural sciences and expand active units in its basic and clinical departments. It will do so in collaboration with other research centers of the Tehran University of Medical Sciences and other universities and research centers through the Islamic Republic of Iran and with similar centers internationally.

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