



**Henry A. Nasrallah, MD**  
Editor-in-Chief

### A prediction about our specialty

"I recall reading *Future Shock* during medical school. This seminal book jarred and inspired me with its predictions of how rapid change will be stressful and disorienting. I sense that we are on the verge of a "psychiatry future shock" that will shatter comfortable clinical notions and usher in dizzying discoveries that transform psychiatry."

—Henry A. Nasrallah, MD

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## Psychiatry's future shock

It might seem business as usual in clinical psychiatry, but major transformative changes in the scientific foundation of the specialty are taking place. The "neuroscientification" of psychiatry, ongoing for more than 3 decades, is now approaching a tipping point: The specialty is on the verge of an unprecedented denouement of the old tenets and assumptions. Just as smartphones have made a 25-volume encyclopedia set obsolete, coming changes in scientific psychiatry will be fully disruptive to your father's practice of psychiatry.

### Many psychiatrists still practice like it's 1999

That situation will change, soon—as surely as medieval times gave way to the Renaissance. Psychiatry of the future will be drastically different once new models of objective diagnostic tests and physiologically specific interventions emerge from fast-moving discoveries of the molecular biology of the mind and its pathologies.

Most psychiatric practitioners do not regularly read neuroscience journals that describe the accelerating progress in molecular psychiatry, where the text is replete with an alphabet soup of terminology that one day will permeate the medical practice of the new psychiatry.

### Fuzzy ambiguities will be cleared away

There are many reasons to be optimistic that transcendent scientific transformations will sweep away the fuzzy biologic, diagnostic, and therapeutic ambiguities that have plagued psychiatry for so long—plagued us because of the herculean challenges of investigating the divinely complex brain and its gloriously enigmatic mind. New methods and tools

for exploration and paradigmatic shifts in conceptualizing the etiopathogenesis of psychiatric brain disorders are rapidly leading to a discarding of many simplistic, even primitive, notions that have guided psychiatry over the past century. Psychopharmacological breakthroughs of the past 50 years, which, admittedly, have yet to cure or eliminate disabilities associated with major psychiatric disorders, are only a prologue to the coming revolution in neuropsychiatry, in which prevention, not just intervention, will change everything. Curing deteriorative brain disorders will be a reality once that revolution in neuroscience enters its propitious translational phase.

The *Table* (page 23) presents a sampling of scientific progress that is setting the stage for disruptive technologies and probes that will lead to far more advanced diagnosis, prevention, and treatment of neuropsychiatric diseases.

### Prepare for psychiatry's future shock!

We psychiatrists must keep up, regularly reading the latest literature to learn about the latest advances and to make sure we are familiar with the emerging language of psychiatric neuroscience. Instead of remaining fondly attached to ancient constructs such as id, ego, superego, and defense mechanisms, we should be thinking about the default mode network, seeking to understand the connectome, the envirome, the metabolome, and the proteome; microglial activation, inflammatory markers, IL-6, TNF alpha, oxidative and nitrosative stress, and physiologic vs pathologic apoptosis; BDNF, FGF, VEGF, MIF, GFAP, and S100B; neuroplasticity and dendritic spines; and genes such as CLOCK, NOTCH3, and Met-to-Val

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## Scientific tools and methods are leading to momentous discoveries in psychiatry

### Progress in technology

- **Neuroimaging techniques**
- **Cerebral blood flow measurement**
- **Positron-emission tomography.** Measures blood flow and images receptors
- **MRI.** Offers detailed morphological imaging of brain structures
- **Magnetic resonance spectroscopy.** For conducting chemical biopsy of all brain structures and regions in vivo; also, nuclear magnetic resonance to measure those structures and regions in vitro
- **Functional magnetic resonance imaging.** Detects activation of brain structures in response to cognitive, verbal, and nonverbal stimuli
- **Diffusion tensor imaging.** Measures the integrity of white matter fibers throughout the brain
- **Magneto-encephalography.** Provides noninvasive neurophysiological imaging

### Neuromodulation techniques

- Deep brain stimulation
- Repetitive transcranial magnetic stimulation
- Vagus nerve stimulation
- More than a dozen still-unapproved techniques

### Supercomputers

For applying bio-informatics to patient care and performing data mining, disease modeling, and “big-data” explorations

### Progress in molecular genetics

- **DNA sequencing with real-time polymerase chain reaction.** Maps the human genome in health and disease for each patient
- **Genome-wide association studies.** Uncover risk genes, copy-number variations, and rare mutations
- **Small interfering RNAs.** Regulate expression of specific genes in neurons
- **Correlating genetic influences with abnormalities on neuroimaging**

### Breakthrough methods

- **Nanomedicine.** Enables measurement of extremely low concentrations of biomarkers in serum, cerebrospinal fluid, and neural tissue; also applied to drug development and drug delivery systems
- **Pluripotent stem cells.** Used to program a patient’s skin cells into his (her) neurons, for the study of the microstructure and function of the brain in neuropsychiatric patients, without brain biopsy
- **Optogenetics.** Uses light to explore or control brain activity, by inserting light-responsive genes, known as opsins, from bacteria into neurons
- **Clarity.** Renders the postmortem brain completely transparent using a hydrogel process, thereby visualizing complex ultrastructures of the brain
- **Stereology.** Offers a more valid approach to neurohistological research
- **Immunohistochemistry and immunocytochemistry.** Techniques that allow measurements in tissue and cells not otherwise possible
- **Metabolomics, lipidomics, and proteomics.** Identify the cellular signatures of all metabolites (ie, end products of cellular processes) in cells, tissue, organs, and organisms
- **DNA microarrays.** So-called biochips that measure expression of many genes at the same time; particularly useful for studying complex genetics of psychiatric disorders

mutations—and so on.

Those of us who do not adapt to swift transition of knowledge might suffer the fate of clinical dinosaurs, as the massive asteroid of neuroscientific advances smashes into the placid landscape of psychiatry. As Alvin Toffler, author of *Future Shock*, proposed, the illiterates of

the future will not be the people who cannot read or write. They will be the ones who fail to learn.



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