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PROFESSIONAL EXCHANGE

Psychopharmacology and Mental Health Practice: An Important Alliance

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Many mental health professionals are concerned about an increasingly "medicalized" society, driven in part by significant growth in biomedical research and biological perspectives on psychological disorders. The modern medical era, which has endorsed reductionism as the principal way of viewing many health conditions, offers many options for treating psychiatric diagnoses. Pharmacology is a major influence in psychiatric treatment decisions, and despite questions by mental health practitioners about reliance on drugs (Murray, 2009), psychopharmacology provides helpful alternatives. However, pharmacological options for mental health concerns should not be considered in isolation, and the use of drug treatments for cognitive, emotional, and behavioral disorders warrants careful contextual analysis. Mental health practitioners are encouraged to view pharmacology within a comprehensive sociohistorical framework that recognizes the value of a reductionist perspective as part of psychology's rich cognitive and behavioral contributions to contemporary mental health assessment and intervention.

The past 40 years have produced remarkable medicines that can ameliorate much of the symptomatology and suffering that accompanies both acute episodes and chronic persistence of ... central nervous system disorders. (Julien, 1998, p. 430)

It would be difficult to overestimate the significance of pharmacology in our lives today. Drugs are nearly ubiquitous in the modern medical and social landscape, from the ever-expanding selection of medications, prescription and non-prescription, to the growing impact abused drugs are having on individuals, families, and society (Fogarty & Lingford-Hughes, 2004). For better or worse,

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drugs will continue to play a major role in health care. One of the major challenges for mental health practitioners—particularly given advances in medicine, pharmacology, and managed care (Nys & Nys, 2006)—is the need to continually update how they conceptualize client mental health needs and intervention strategies within a rapidly changing environment (Cohen, 1993).

Despite the tremendous emphasis in health care on biomedicine, particularly pharmacology, concerns have recently been raised about the role of drug therapy in mental health (Jureidini & Tonkin, 2006; Murray, 2009; see also Peele, 1981). The criticism is not necessarily about the impact pharmacology has in general, at least not with the application of pharmacological interventions to the treatment of medical conditions for which there are known biological causes and targeted drug mechanisms. Instead, concerns about the expansion of *psycho*-pharmacology seem to reflect fundamental questions about how we view or understand mental health conditions, and the extent to which the biomedical approach to treatment should be unquestioningly applied to all types of psychiatric diagnoses.

Naturally, such questions relate in part to how we as professionals view the nature of mental and affective processes and the relative emphasis we place on reductionism (i.e., observable behavior reduced to neurobiological mechanisms) versus more global socially and environmentally associated influences on behavior (see Peele, 1981). Our definitions, typically constructed out of educational background, personal beliefs, and professional experience, influence mental health delivery. Even in considering mental health assessment models that advocate an appreciation of bio-psycho-social-spiritual facets of behavior (Hoffman, 2000; Kaut, 2005), most practitioners bring to a therapeutic relationship or an applied client context biases that constrain how they view mental health conditions and treatments. For instance, some professionals advocate for pharmacological strategies in appropriate situations, while others might be reluctant to consider drugs as a responsible aspect of therapy.

In addition to professional perspectives that can impact mental health decision-making, we must recognize the role of public perception itself: Clients bring to mental health scenarios their own understandings—and misunderstandings—of behavior, medicine, and treatment (Cohen, 1993; see also Kaut & Dickinson, 2007). Client understanding of mental health issues likely reflects socially biased attitudes and media-driven conceptualizations of psychological conditions. Again, modern perspectives of biomedicine, including our understanding of the brain, drugs, and behavior (Cohen, 1993; Drevets, 2000) significantly affects how people approach mental health issues—most notably whether they request treatments and comply with treatment recommendations. Uptake of mental and behavioral health services is certainly influenced by a growing awareness of modern medicine, but the extent to which the medical model (that disorders are biological manifestations) determines the future of

mental health treatment depends on careful consideration and a willingness to accept the realities of today's pharmacological milieu.

The principal goals of this article are to underscore the clinical utility of psychopharmacology in mental health and to encourage mental health professionals to evaluate their own understanding of mental health conditions and treatments as biomedical discoveries and potential clinical applications are expanding. I view pharmacology as an essential component in mental health treatment (see Kaut & Dickinson, 2007) and believe the advances of modern neuroscience and psychopharmacology are creating new opportunities for treating a variety of psychological and behavioral issues. Naturally, some professionals might express concern about the appropriateness and efficacy of psychoactive drug treatments amidst the growth of the pharmaceutical industry, particularly where the financial cost (and gains) of drug research, development, and implementation is so high. It is here that mental health professionals, especially those directly involved in client care, must analyze mental health research and practice and consider ways to judiciously incorporate the results of the growth of psychopharmacology into the services they provide.

This article will sequentially address the following:

1. The contextual basis of pharmacology and the need to identify a framework for placing mental health within a much larger psychopharmaceutical industrial culture (Murray, 2009)
2. Modern reductionism as a philosophical perspective that guides belief in the medical model; practitioners and researchers alike must be challenged to critically evaluate the relationship between neural reductionism and mental health
3. Recommendations for mental health counselors based on endorsement of reductionism and the embrace of pharmacology within a more inclusive bio-psycho-social context.

PSYCHOPHARMACOLOGY AND THE MODERN MENTAL HEALTH CULTURE

A brief consideration of a relatively recent—possibly watershed—historical debate at the confluence of pharmacology and mental health practice may be relevant here. Nearly two decades ago the American Psychological Association (APA) undertook an extensive initiative to promote prescription privileges for qualified psychologists (see DeLeon & Wiggins, 1996; DeNelsky, 1996; Lorion, 1996). Although not directly relevant for most mental health care providers, raising the issue helped shape a discussion about changes in how mental health care was being delivered. The ensuing debate stimulated much

discourse about the qualifications of psychologists to write prescriptions (e.g., Gutierrez & Silk, 1998; Robiner et al., 2003; Sammons, Gorny, Zimmer, & Allen, 2000). It also helped bring attention to pharmacology as a useful tool in mental health treatment.

Whatever a counselor's personal or professional position may be on the merits of psychologists as prescribers, pharmacological treatment of psychiatric conditions remains an important contemporary mental health issue (Barnett & Neel, 2000). Looking back, it would seem that advocacy for prescription privileges was predicated at least in part on a reductionist perspective (see Sammons & Brown, 1997), thus substantiating a belief in the relevance and effectiveness of pharmacology for the treatment of mental health concerns. Moreover, and central to my position here, this debate underscored the ever-growing influence of pharmacology in modern health care and reinforced the link between psychoactive drugs and mental health interventions. Today, because drugs are commonly recommended for a variety of mental health clients in community mental health centers, public schools, university counseling centers, and medical facilities, their use often intersects with emotional and behavioral issues.

Unequivocally, the prescription privilege debate affected relatively few professionals and seems to have faded into relative obscurity. Nevertheless, its essence still has implications for all types of mental health professionals. Concern with the interface between drugs, the brain, and behavior is not limited just to psychiatrists or general medical practitioners. Biomedical research is progressively deepening our appreciation of the biological foundations of human cognition, emotion, and behavior (e.g., Drevets, 2000; Ochsner & Gross, 2005; Steele, Currie, Lawrie, & Reid, 2007; see also Machamer & Sytsma, 2007). Modern advances in areas like medical and behavioral genetics, neuroscience, and pharmacology may impact how we understand behavior (e.g., Raine, 2008) and how we treat conditions ranging from attention deficit disorder (Fone & Nutt, 2005; Mazei-Robison, Couch, Shelton, Stein, & Blakely, 2005) to schizophrenia (Rhen & Rees, 2005). Scientific progress can thus affect professionals at every level of human service (including educators) where mental health may be at issue.

No matter how exciting advances in biomedical and pharmacological research may be, there is always a need for caution along with optimism and for a tempered approach to the acceptance of scientific applications. Enthusiasm about the promise of biomedical science is not intended to suggest that all treatments for psychological diagnoses should be approached first through a biomedical lens. Indeed, it is here that the work of Murray (2009) can be of particular value for mental health professionals—but with a measure of scientific balance.

Understanding the Pharmacological Context

Murray (2009) offers a unique perspective on what he terms the psychopharmaceutical industrial complex (PPIC) and expresses considerable concern about endorsement of the “disease model” as a way of understanding and treating psychiatric conditions. His description of the PPIC reflects skepticism about the enormous influence the pharmaceutical industry has on mental health practice; moreover, he questions the prevailing concept of mental health conditions as “biological manifestations”—a perspective he suggests serves merely to reinforce adoption of a restrictive biomedical lens through which we evaluate (or potentially *mis*-evaluate) clients.

Although a complete review of Murray’s work is beyond the scope of this paper, his concern about the potential for pharmacology to shape mental health practice is particularly worth discussing. Logically, endorsement of a disease model or a highly reductionist perspective of psychological disorders presupposes the need to link diagnosis (e.g., major depressive disorder [MDD]) with underlying causes (e.g., serotonin, norepinephrine, or dopamine insufficiency) and specific pharmaceutical interventions (e.g., Cymbalta®; Wellbutrin®). This synergy between behavior, disease, and treatment reflects the very essence of reductionism and is a driving force in the pharmaceutical industry’s approach to psychiatric conditions. However, such synergy also requires careful evaluation if it is to be a primary explanation for, and approach to, the treatment of psychological disorders.

In his contribution to the debate about the role of pharmacology in mental health treatment, Murray (2009; see also Kaut & Dickenson, 2007) rightly identifies a need for caution and an attitude of skepticism when evaluating pharmaceutical claims. However, his notion that the PPIC operates according to cult-like principles, somewhat insidiously biasing the perspective of consumers and professionals alike and potentially maintaining them in a cycle of pharmacological dependence, warrants further consideration that may suggest a more measured approach.

Here I would emphasize that psychoactive medications, which are but a small component of the pharmaceutical industry’s interest in health care, reflect less what he termed a “cult” and much more a modern *culture*. The contemporary medical context in which we live is pervaded by pharmacology. Rather than criticizing the pharmaceutical industry, I suggest, there is more to be gained by trying to understand the pharmacological context of mental health (see Figure 1), which can provide insight into how best pharmacology can influence mental health practice.

Figure 1. The Pharmacology-Client Interface (PCI) in Context

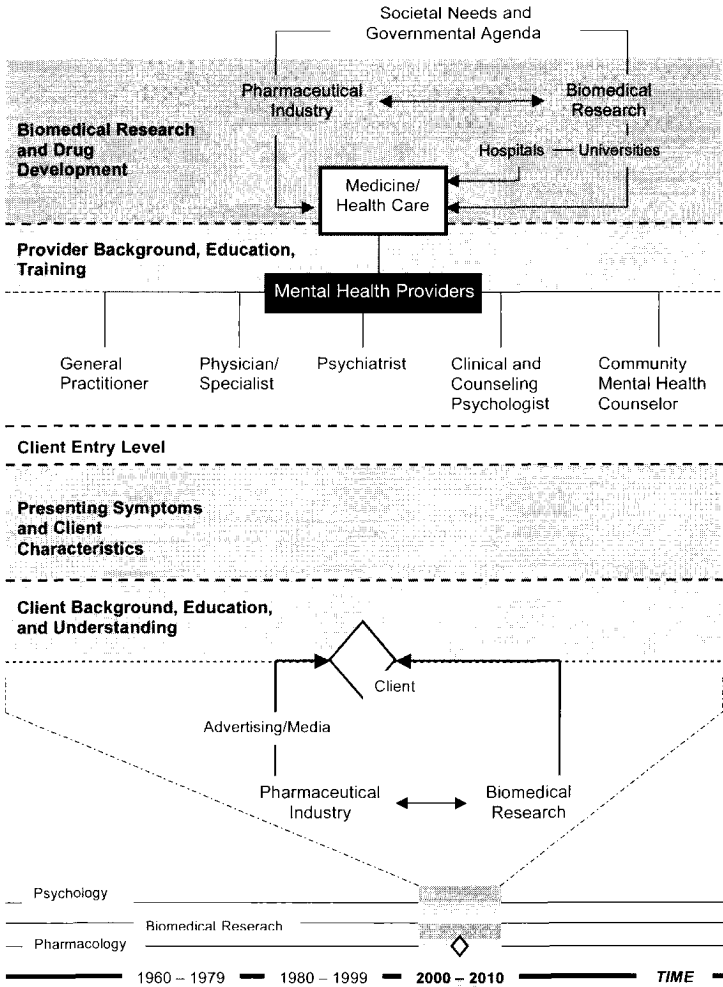


Figure 1. The time dimension (bottom) represents the sociohistorical context influencing developments in psychology, biomedical research, and pharmacology. In seeking mental health support (i.e., client entry level), a client experiencing specific symptoms at a particular point in personal and social history is influenced by intra-individual characteristics (e.g., cognitions, emotional stability, problem-solving style) and external moderators (e.g., background, education, understanding of mental health issues). Background, education, and training subject mental health practitioners to various influences (pressures) for treatment selection (e.g., drugs). The mental health context is influenced by biomedical research, in hospitals, universities, and the pharmaceutical industry. Societal and governmental priorities influence the research and development context (top); and client awareness of disorders and treatments is shaped by his or her attitudes toward drug treatment options (pharmaceutical advertisements, media, and “medicalization” of health issues) (bottom).

An Ecological Framework

I find it helpful here to begin with an ecological framework, modeled in part on the work of Bronfenbrenner and its application to various other issues in human development (Campbell, Dworkin, & Cabral, 2009; Swick & Williams, 2006). A key application borrowed from ecological theory is the notion of a chronosystem level of analysis (Figure 1, bottom), which suggests the need to understand human development—and the factors influencing behavior—through the lens of both a person's own developmental history and the larger sociohistorical context. Applied here, this suggests to me that the multiple levels and varied contexts illustrated in Figure 1 must be considered within our contemporary historical era—an era marked by unique and significant advances in our understanding of genetics, physiology, brain, and behavior (e.g., Raine, 2008). Through this context many individuals, each with their own unique developmental histories, seek and receive mental health interventions.

Our sociohistorical context has changed markedly even in the last half century, and the ways in which we can view psychological conditions continue to change with advances in psychology, biomedicine, and pharmacology. Some 30 years ago Peele (1981) commented on this influence of reductionism in psychology and identified the growing recognition of brain science as an influence on mental health practice:

The area of psychology in which this shift is most apparent is that having to do with psychopathologies and their treatment. The study of neurosciences is now often the one common link in training programs for counseling, clinical, and educational psychology, as psychology practitioners come to believe that such grounding is necessary for their work. (p. 810)

This influence of modern neuroscience and related instruction in the biological bases of behavior is reflected in Figure 1, where medical professionals (general practitioners, medical specialists, psychiatrists) and mental health practitioners (clinical and counseling psychologists, community counselors, social workers) represent the first line of client interface with mental health treatment options. It is at this entry point, particularly with medical professionals, that individuals presenting with mental health concerns (e.g., anxiety, depression, bipolar symptoms, thought disorder) are typically introduced to pharmacology. Given the modern scientific and medical context that influences the education, training, and professional perspectives of providers of health care, particularly mental health care—plus the impact modern medicine has on patient/client understanding—it is reasonable to expect that medications would be part of today's discussions about treatment.

The Client in Context

Recognition of the modern medical context is not intended to advocate blind

acceptance of the disease model for mental health; rather, the objective is to identify variables influencing the beliefs, expectations, and decisions associated with psychological conditions and treatments. Accordingly, mental health providers must first think about how clients conceptualize health conditions in general. For example, the use of prescription medications to treat physical conditions or ailments is reasonably well accepted. Today's patients, no matter what their conditions, are accustomed to leaving a doctor's office, hospital, or medical center with prescriptions. The contemporary availability of drugs to address a host of medical concerns—infections, inflammatory conditions, pain, cardiac issues, cholesterol problems, and blood pressure regulation, for instance—would seem to support public acceptance of the broad role pharmacology has in managing virtually *all* health concerns. It is thus understandable that clients might view the use of medications as sufficient for treating mental health concerns (a perspective I do not endorse entirely).

Murray (2009), borrowing from Gosden & Beder (2001), places considerable blame on pharmaceutical companies and their relationship with psychiatry, research institutes, public media, and the federal government for public acceptance of, and reliance on, drug use in mental health practice. Essentially, he argues that the relationship promotes a context that subverts client agency (responsibility for health care independence) and undermines the breadth of mental health interventions.

I see this differently. I would advocate that the elements in Figure 1 (each represented to some degree in the model Murray uses) reflect productive (though imperfect) components of an *evolving mental health care system* (see below). As providers deal in many different contexts with client mental health issues (e.g., childhood ADHD, adult major depression, drug abuse, workplace or school-related anxiety), decisions to treat with medications, or the need to monitor drug effects as part of treatment, can be construed as emerging under the influence of selective pressures that influence the provider and similar pressures that affect client willingness to accept pharmacotherapy (see Table 1; also Kaut & Dickinson, 2007). Rather than criticizing the pharmaceutical industry, it might be better to identify issues that shape the perspectives of mental health providers *and* clients as they consider treatment alternatives.

In this microcontext (client interacting with mental health provider), practitioners should think carefully about factors that affect client beliefs about mental health and associated interventions (see Table 1). Whether a client is taking, seeking, or avoiding medications, it is helpful to understand what motivates or influences that approach. More important, providers must be sensitive to how *their own* training and background affect decision-making. Certainly, the pharmaceutical industry as a major player in drug development, distribution, and information dissemination exerts a significant influence on medicine and health care delivery (Figure 1; Healy, 2009; see web review in endnote 1).¹ However,

Table 1. Considerations Influencing Practitioner and Client Decision-Making in Mental Health Treatment

Treatment Issue	Considerations for Mental Health Provider	Considerations for Client
Nature of condition or symptoms	What is indicated by the present symptoms or behaviors?	Does the client have any insight into the symptoms or behaviors in question?
	What variables might influence development of these behaviors?	Does the client understand the potential influences on behavior?
Pharmacology as a treatment option	What drug approaches are typically used?	What does the client know about drug therapy?
	What do I understand about drug treatments for the condition in question?	What factors influence the client's <i>knowledge</i> of drug therapy?
	What is my personal bias concerning drug therapy in general?	Does the client have specific <i>beliefs</i> about medications for psychological conditions?
	How does pharmacology fit within my model of human behavior?	What are the client's <i>expectations</i> about drug therapy?
Therapeutic drug and behavior monitoring	How should this drug impact behavior over time?	How is this drug likely to affect client behavior?
	Are there time limits to using this drug?	Are there side effects or interactions that should be known?

the uptake of pharmacological resources is multidimensional; it is not necessarily driven solely by an industrial objective. To extend the comments of Peele (1981; see above), some practitioners will naturally be influenced by biomedical research that informs their current understanding of brain, behavior, and pharmacology (see Drevets, 2000; Ebert, 2002; Nandham, Jhaveri, & Bartlett, 2007; Pilc, Chaki, Nowak, & Witkin, 2008; Preskorn, 2006). Such a context is much broader, and deeper, than the pharmaceutical enterprise alone.

Essentially, the way we view mental health issues should reflect the synergy in biological, psychological, and behavioral research (Hoffman, 2000; Kaut, 2005). Over the last half century, advances in our understanding of the biological underpinnings of behavior seem to have somewhat exceeded the relative contributions of disciplines, such as behavioral interventions or psychotherapy.² The micro-context surrounding the client-practitioner interface may thus be

heavily influenced by the impact of neuroscience research and biological reductionism in general. To me, this is an appropriate and logical consequence of our research, development, and education.

The Evolution of Pharmacological Thinking

Unlike Murray (2009), I consider research and development by the pharmaceutical industry and allied health entities to be a positive driving force in human health and wellness (see Figure 1, top section). Without their investment in basic and applied research for a great number of conditions—including psychological disorders—advances in our understanding of how to treat such conditions would be drastically limited. In some ways, the emergence of pharmacological alternatives for mental health disorders has been evolutionary, with treatment options that have succeeded and failed throughout previous decades analogous to functional adaptations and failures to environmental pressures. Drug therapies change (see Julien, 2008) as new medications “adapt” to pressures for more efficacious treatments, fewer side effects, and more symptom specificity (Preskorn, 2006; Slattery, Hudson, & Nutt, 2004). Typically, the drugs reaching the market treat specific conditions more appropriately, safely, and competitively than other drugs. The pharmaceutical industry is under enormous pressure to design, produce, and monitor pharmaceutical products, and the product pipelines of the major pharmaceutical companies are impressive.³ Given the extensive research, development, and financial requirements for bringing a drug to market (Berkowitz & Katzung, 1998), I have confidence in the integrity of the modern pharmacological enterprise and believe it contributes in important ways to today’s biomedical context.

Understandably, part of this context is established and moderated by priorities of government and other institutions that reflect our interest in science and medical research (e.g., hospitals, universities, research foundations; see Figure 1). Such priorities influence how federal funds are allocated and to some extent which issues are investigated. Few would question why conditions like HIV/AIDS, cancer, spinal cord injury, genetic disorders, Parkinson’s disease, and Alzheimer’s disease have high priority today. We tend to view these and many other disorders through a biomedical lens, which magnifies the salience of reductionism and certainly influences the way we educate and train professionals to evaluate, diagnose, treat, and monitor physical maladies. This pervasive philosophy of reductionism adds yet another contemporary pressure that helps shape research priorities, methods, and ultimately knowledge.

When I also look at research to identify and clarify biological mechanisms associated with various psychological conditions and drug therapies (see Table 2 and the next section), I believe firmly that *pharmacological thinking*, predicated on a bio-psycho-social base, can be beneficial in preparing future mental health practitioners. By this, I mean a reasonable understanding of cognitive,

affective, and behavioral neuroscience (or neuropsychology; see Banich, 2004; Zillmer, Spiers, & Culbertson, 2008) and how pharmacology influences diverse aspects of health and behavior (for an excellent and readable reference, see Julien, Advokat, & Comaty, 2008). Appreciation for the way drugs are researched and brought to the clinical market can also offer a helpful perspective on pharmacological research and drug efficacy (e.g., Berkowitz & Katzung, 1995).

Table 2. Biomedical Research and Psychological Disorders

Biological Level ¹	Putative Brain-Behavior Mechanism ^{2,3}
Systems-structures	Limbic system ^{MDD} Amygdala ^{MDD, ANX} Nucleus accumbens ^{MDD} Hippocampus ^{MDD, SCZ} Prefrontal cortex ^{MDD} Anterior cingulate ^{MDD, BD} Striatum (basal ganglia) ^{MDD} Thalamus ^{MDD}
Cellular-physiological	5-HT transporters (SSRI/TCA) ^{MDD} NE transporters (SSRI/TCA) ^{MDD} DA transporters ^{MDD} 5-HT _{1A, 2C, 2A, 7} receptors ^{MDD} NK ₁ receptor ^{MDD} Substance-P ^{MDD} CRH _{1,2} ^{MDD} GABA receptors ^{ANX} Glutamate (metabotropic receptors) ^{MDD} NMDA receptor (glutamate) ^{MDD} Neurotrophins (growth factors) ^{MDD}
Intracellular-genomic	Lithium (Li+) ^{BD} PAP phosphatase ^{BD} Cyclic AMP response protein (CREB) ^{MDD} BDNF (growth factor) Neurogenesis (new cell growth) Synaptic remodeling

¹Biological levels correspond to Figure 2.

²Superscripts: ANX: Anxiety disorders; BD: Bipolar disorder; MDD: Major depressive disorder; SCZ: Schizophrenia.

³BDNF: Brain-derived neurotrophic factor; CRH: Corticotropin-releasing hormone; DA: Dopamine; GABA: Gamma aminobutyric acid; NE: Norepinephrine; NK: Neurokinin; NMDA: N-methyl-D-aspartate; PAP: 3'(2'')-phosphoadenosine-5'-phosphate.

Insights into the science behind pharmacology can be of particular benefit, especially when practitioners can extrapolate from them conceptual frameworks (Figures 1 and 2) and practical considerations to help them better evaluate medications that will inevitably be part of mental health interventions. While I do not believe that recovery rates for psychological disorders will necessarily parallel advances in biomedicine, I believe that as biomedical knowledge of psychological disorders increases, so too will the potential to better understand etiologies, appreciate person-environment interactions, and consider new treatment strategies. Here again it is helpful to identify how a spirit of reductionism—judiciously incorporated into approaches to research, education, and professional training—affects the way we view mental health conditions and how we evaluate the range of solutions available to promote best practices in mental health care.⁴

Figure 2. The Biology-Environment Interface

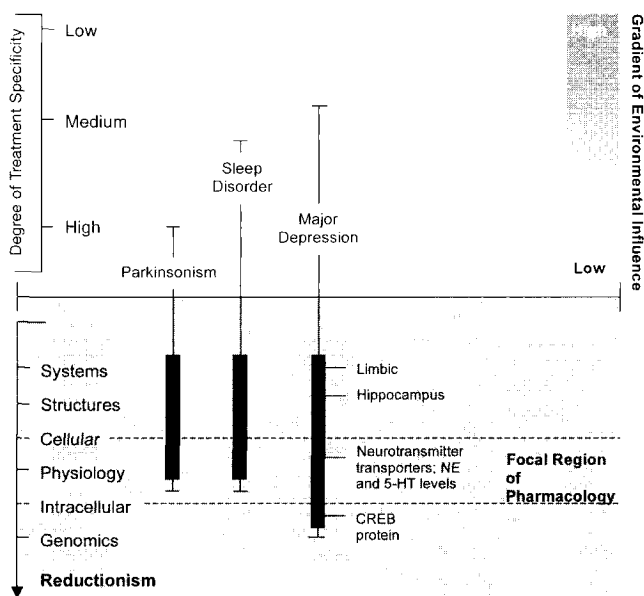


Figure 2. Some conditions are conceptualized as having more treatment specificity when a drug with a known mechanism of action is the most effective treatment for the behavior in question. Other conditions might be viewed as positioned somewhere along a continuum of treatment specificity and the corresponding gradient of environmental influence. For many conditions, pharmacological specificity might be considered moderate to low, reflecting a greater influence of individual, situational, or environmental factors.

REDUCTIONISM AS A POSITIVE INFLUENCE IN MENTAL HEALTH

As a psychologist, I teach students to appreciate the complexities of human behavior and respect the diverse influences on behavioral development over time. Psychology enjoys a rich tradition of behaviorism in psychology (Bolles, 1993), not to mention the substantial influence of cognitive psychology in its efforts to help scientists peer into what was known as the "black box." However, I caution students to anchor their models of human behavior in the modern context of significant developments in the natural sciences. The black box, formerly "mind," is now "brain," and (to extend the metaphor) it is filled with smaller and more integrated mini-boxes that collectively yield what we identify as the thinking, feeling, and behaving brain.

As a neuroscientist I expect students to understand the biological bases of behavior, with particular attention to the systems level of analysis and the genetic and molecular aspects of human experience.⁵ Reductionism can of course be viewed with skepticism, and rightly so, as it tends to medicalize many conditions and treats the complexity and richness of human behavior as reducible to progressively smaller parts (Cohen, 1993). This emphasis on internal rather than external factors has naturally enjoyed the support of the pharmaceutical industry (see Cohen) and tends to reduce psychological conditions to quantifiable, measurable, and natural components (Nys & Nys, 2006). Such an approach "[detaches a] disease from a patient's natural history" (Nys & Nys, p.111), which essentially minimizes clinical judgment and a holistic perspective of client health and illness (see also Murray, 2009).

Cartesian duality, which separates the natural (biological) components of behavior from the more uniquely human dimensions of thought, feeling, and memory (spirit, soul, transcendent aspects), must be viewed with skepticism. On the one hand there is a need to recognize "mind" as a reflection of "brain," but on the other we must recognize the uniqueness of individual history, culture, environment, and even behavior on the development of adaptive and maladaptive tendencies. A conceptual framework (see Kaut & Dickinson, 2007; also Kaut, 2006) therefore serves to clarify the interface between biology and environment in shaping behavior (see Figure 2).

Disorders as Diseases

The belief that behavioral and psychological disorders can be reduced to biochemical disturbances is naturally linked to the expectation that treatments will correct the biochemical dysfunction or imbalance (Nys & Nys, 2006). The fundamental premise (and criticism) of this medical or disease model is the assumption that all conditions are reducible to specific biological mechanisms (see Nys & Nys). The problem with this model is not the expectation that disorders, or selected features of disorders, are manifestations of biological system

dysfunction (imbalances); it lies in the failure to identify the limits of reductionism and the inherent opportunities for a holistic approach—even when pharmacology is part of the treatment algorithm.

The Biology-Environment Interface

When a disorder has a known biological mechanism, we might suppose a highly specific relationship between the behavior of interest, a biological target, and the mechanism of treatment (Figure 2). For example, Parkinson's disease follows from a drastic reduction in dopamine activity in cells making up a specific structure (the substantia nigra) that regulates a particular system in the brain (the basal ganglia). Dopamine-enhancing drugs (e.g., Sinemet®, Stalevo) directly influence motor activity in a dose-dependent manner. In such cases, the gradient of environmental influence would be fairly low insofar as treatment of the condition per se is concerned. However, there may still be a need for mental and behavioral health interventions to promote or enhance adaptive behavior.⁶

In other conditions, such as sleep disorders, the relationship between known biological elements and the behavior itself might be less specific. A number of prescription medications are available to promote and sustain sleep; typically they manipulate the GABAergic system in the arousal circuits of the brain (Prosom®, Dalmane®, Restoril®, Lunesta®; see also Julien et al., 2008). Nevertheless, sleep architecture is complex and is multiply determined by various neurotransmitter systems and brain circuits. Moreover, stress, activity levels, dietary habits, and other manageable environmental issues can be targeted to help bring about sustainable change in sleep behaviors.

The point here is that a reductionist perspective alone is unlikely to offer singular solutions to the more complex conditions that afflict the cognitive and affective integrity of the human brain. Nevertheless, for many psychological disorders, including attention deficit disorder, major depression, anxiety, bipolar disorder, obsessive-compulsive disorder, and schizophrenia (American Psychiatric Association [DSM-IV-TR], 2000), a variety of genetic, structural, and physiological issues might be addressed. Even when the relationship between biological mechanisms and behavioral symptoms seems low to moderate (e.g., MDD; Figure 2), the biomedical approach can offer significant insights into the etiology and nature of such conditions (Drevets, 2000; Fitzgerald, Laird, Maller, & Daskalakis, 2008; Gupta, Elheis, & Pansari, 2004).⁷

Support for Reductionist Beliefs

My training as a psychologist emphasized the research, theories, and applications of cognitive and behavioral approaches to child development and disorders. As a practicing school psychologist, I recognized environmental, social, and behavioral contingencies that might influence manifestation of certain

disorders in children. Nevertheless, somewhere during my formal education I acquired an appreciation for the biological correlates of many cognitive, educational, and emotional disorders. In practice, this was reinforced by reading case histories, having discussions with parents and with other professionals, and dealing with use of medication to manage challenging behaviors.

As a neuroscientist, my training exposed me to the richness of neurobiology and the intricate relationship between brain and behavior. Through coursework with medical students, seminars, and my own research (Kaut & Bunsey, 2001; Kaut, Bunsey, & Riccio, 2003) I glimpsed how modern education—driven by biomedicine—influences the knowledge, beliefs, and values of professionals (see Figure 1). Society at large may have been similarly influenced, affecting the expectations of patients and clients dealing with health, including mental health, issues.

Although I often expect students to appreciate the synergy between biological and environmental factors in producing a given psychological outcome (Kaut, 2005, 2006; Kaut & Dickinson, 2007), my proclivity is to consider the weight of evidence concerning the biological foundations of behavior. Medical and mental health professionals can understandably be influenced by their experience in educational systems shaped by a growing biomedical research agenda and an emphasis on the disease model as a way of understanding human disorders.

The Value of the Modern Research Agenda

Critics of the medical or disease model so pervasive in mental health today sometimes suggest that many medical treatments have questionable efficacy (Murray, 2009). There is particular concern that clients seeking mental health treatments are encouraged to suspend critical thinking about the reality of pharmacological treatments:

Anecdotal evidence suggests that psychiatric consumers rarely criticize the chemical imbalance theory despite not having their chemicals measured, as would be done with diabetes, to verify that there is indeed a brain imbalance. (Murray, 2009, p. 297)

Certainly, there is always the need for caution when incorporating pharmacology into a mental health treatment program, and Murray's concerns are in part well-founded. However, such criticisms might also lead to the erroneous belief that research is not seriously looking for, or successfully identifying, the biological mechanisms underlying many mental disorders. Table 2 (modeled after the reductionist elements shown in Figure 2) offers a limited perspective on research linking psychological disorders with biological mechanisms; it is intended here to underscore the value of pharmacological interventions as treatment strategies.

The Neurochemistry of Emotion. The complexities inherent in mental health research and treatment are well-represented in the case of mood disorders, particularly MDD (see Figure 2). The notion of chemical imbalance is embodied in the biogenic amine theory of depression that implicates the neurotransmitters norepinephrine (NE), serotonin (5-HT), and dopamine (DA) (Ebert, 2002; Julien, 2008); the theory has long been central to the development of tricyclic antidepressants (TCAs); serotonin selective reuptake inhibitors (SSRIs); monoamine oxidase inhibitors (MAOIs); and newer-generation serotonin and norepinephrine reuptake inhibitors (SNRIs). Though their efficacy, selectivity, and patterns of over-use have been questioned (Juereidini & Tonkin, 2006), these drugs are still widely marketed and are among the medications most frequently prescribed (Abilify®, Cymbalta®, Effexor XR®, Lexapro®; see rxlist.com).

Further research to expand understanding of antidepressant mechanisms is therefore important (Table 2). Apart from clarifying the blockade of neurotransmitter reuptake in TCAs, SSRIs, and SNRIs (e.g., Preskorn, 2006; Slattery et al., 2004), researchers have also identified new serotonergic receptor targets (e.g., 5-HT variants) and have suggested as potential targets for antidepressant activity receptors for glutamate (i.e., NMDA; Petrie, Reid, & Stewart, 2000; Pilc, Chaki, Nowak, & Witkin, 2008); substance-P (neurokinin-1 [NK1]; Adell et al., 2005); and even stress-related hormones (corticotropin-releasing hormone [CRH]; Taylor, Fricker, Devi, & Gomes, 2005).

This limited review is intended to underscore how contemporary research continues to investigate the chemistry (e.g., “imbalance”) of psychological disorders and offers support for the focal mechanisms of pharmacotherapy (neurotransmitter activity; see Figure 2). Naturally, there are concerns about the potential for abuse by pharmaceutical companies in the way drugs are clinically evaluated and “proven” to be selective and effective for psychological conditions (Healy, 2004). However, it is hoped that diverse lines of research across the world will provide convergent support (or the lack thereof) for pharmacological claims. In this way, drugs are subject to rigorous and incisive studies concerning the many known, and potentially new, targets for therapeutic agents (e.g., Adell et al., 2005).

In the true spirit of reductionism (see Table 2), representative studies continue to test theories of depression (e.g., biogenic amine), yielding intriguing insights into the cell-signaling pathways affected by psychoactive drugs (Slattery, Hudson, & Nutt, 2004; Taylor et al., 2005). Collectively, such efforts have extended our understanding of how genetic activity (e.g., cyclic AMP response element binding protein [CREB]; Blendy, 2006; Yamada, Yamada, & Higuchi, 2005; see also Adell et al., 2005) triggers intracellular cascades resulting in the neuronal growth factors (e.g., brain-derived neurotrophic factor [BDNF]; Altar, 1999; Duman & Monteggia, 2006; Taylor et al., 2005), protein

synthesis, and cellular changes associated with better behavior (Yamada et al., 2005).

A Context for Reductionism. Clearly the precise causes of such psychological disorders as depression, anxiety, bipolar disorder, and schizophrenia have yet to be determined. And I would agree with Murray (2009) that there are no tests of neurotransmitter levels or receptor-mediated effects that would confirm a given diagnosis; diagnosis is not yet precise. Even with the tremendous research advances suggesting neurological regions and systems affected by psychological disorders (Table 2, Figure 2), there is no clinical utility in prescribing MRI, CT, or PET scans to identify structural or functional alterations in limbic anatomy, hippocampal volume, or amygdala reactivity (Addell et al., 2005; Drevets, 2000). And despite our understanding of the role served by the prefrontal cortex in emotional behavior and mood in general, there is insufficient evidence to support evaluation of this and other regions of the brain (e.g., nucleus accumbens, basal ganglia) involved in affect and emotional regulation. Here, in the midst of so many advances in biomedical knowledge, reductionism (like the disease model) is limited and must be judiciously integrated into a more holistic (e.g., ecological) clinical perspective.

THE DISEASE MODEL IN CONTEXT: RECOMMENDATIONS FOR MENTAL HEALTH PRACTICE

Formerly the magic was in the therapist; he or she might also give pills, but these were an extension of his or her impact on us.... Therapists have forgotten how to manipulate their impact on patients. With the focus both doctor and patient have on the pill, neither heeds the context in which the patient has become distressed. (Healy, 2009, p. 24)

The disease model, buttressed by the influence of biomedical research, professional education (e.g., universities, hospitals, see Figure 1), the media, and the health care industry itself (Cohen, 1993), will continue to be part of the mental health system. And it should. But it need not be the primary perspective with which individual providers render their services. It can be part of a larger approach where well-informed clinicians draw from a variety of treatment approaches to best serve each client. Graduate students in training need to become knowledgeable in the range of treatment options available to a client and carefully consider where pharmacotherapy might fit into the treatment plan.

Here clinical judgment is of paramount importance. Such judgment requires an informed professional perspective balanced by openness to therapeutic alternatives. Toward this end, I offer recommendations for promoting eclecticism in clinical practice, while emphasizing the need for mental health providers ultimately to recognize the potential value of pharmacology in client care. (The

conceptual models in Figures 1 and 2 and the suggestions in Table 1 can also provide anchors for thinking about how biomedicine influences or might influence mental health care.)

1. Take a Position on Drugs in Mental Health.

My intent is to avoid another piece that merely advocates the need to integrate pharmacology into practice (Kaut & Dickinson, 2007). What is necessary is critical examination of one's beliefs about the nature of human cognition and emotion, coupled with a deeper examination of how reductionism fits within this model (Cohen, 1993; Nys & Nys, 2006; Peele, 1981). I begin with the fundamental assumption that biology is the essence of our functional being, but as we develop our biological inheritance interacts in complex ways with environmental circumstances. Even in the womb the nervous system can be influenced or otherwise shaped by the uterine environment and maternal physiology (e.g., stress, anxiety; DiPietro, 2004; Dipietro, Costigan, & Gurewitsch, 2003). Beyond development, various conditions have differing levels of biological specificity (see Figure 2) that *always* reflect the need to consider the "gradient of environmental influence" resulting in behavioral manifestations. Pharmacology should be part of an individual's model somewhere, even if only in a limited way.

2. Recognize the Benefits and Limitations of Pharmacology.

Building on the previous recommendation, it is important to recognize that drug therapies can have tremendous benefits for some clients (Julien et al., 2008), sometimes being central to the resolution of symptoms (high treatment specificity, Figure 2), but for others the use of medications might address only certain aspects of a disorder or be of clinical use for only a limited time. Antidepressants or anxiolytics, for example, might help a client manage difficult affect-driven physiological manifestations, which might then facilitate therapeutic work dealing with adaptive behaviors and cognitions (i.e., higher gradient of environmental influence, Figure 2). The "magic" (Healy, 2009) is neither in the drug nor the therapist; rather, the therapeutic process yields its greatest proximal and long-term impact when multiple treatment pieces fit together cooperatively. Therapeutic success is an emergent property, better viewed as the unveiling of new adaptations as balance is restored to cognitive, affective, environmental, and biological processes.

I have rarely if ever experienced a clinical situation where clients were pressured to take medications or intentionally driven to dependence on pharmacology (see Murray, 2009), but I recognize the potential for abuse and certainly understand that some individuals might be more vulnerable to such abuses than others. Clearly, the astute clinician must be aware of a client's medication

history and carefully consider how and why medications are used (see Table 1). Awareness of a drug's intended effects, side effects, and possible interactions with other drugs is imperative (see www.RxList.com; www.drugs.com).⁸

3. Educate Practitioners.

Education of mental health providers that takes into account advancing knowledge is particularly important. Frankly, better approaches to education about mental health issues is needed for many professionals, including physicians, psychologists, community mental health providers, and social workers. Advocacy for mental health provider education and training in psychopharmacology was clearest during the APA endorsement of prescription privileges (see Gutierrez & Silk, 1998; Kaut & Dickinson, 2007; Scovel, Christianson, & England, 2002; see also Snibbe, 1975), but attention to training in pharmacology has apparently subsided. Yet the need is growing.

Training for Psychologists and Counselors. Finding space in professional training curricula is difficult, but change must begin there. However, rather than specific courses or course sequences (Fox, Schwelitz, & Barclay, 1992), what might work better is a systematic attempt to integrate pharmacological knowledge into the curriculum as a whole. The graduate program with which I am affiliated has little freedom for additional coursework—or at least for coursework not directly related to core faculty interests. In such cases psychopharmacology can become relegated to a position of minimal impact, despite anecdotal evidence that students involved in clinical practica and internships often comment that pharmacology is pervasive in their client contact hours (see Scovel et al., 2002).

With a minimal amount of curricular time and careful consideration of topical areas of opportunity, biomedical principles and pharmacological issues can be incorporated into a great many content areas, such as assessment, vocational behavior, individual differences, ethics, and practicum experiences themselves. What is required is coordination among faculty and a willingness to seriously identify content that will have the greatest real-world influence. Again, regardless of one's specific position on the use of medications in mental health practice, I strongly advocate for background in at least three areas: (a) reductionism and the disease model (see Engel, 1977; Kaut & Dickinson, 2007); (b) the clinical interface between psychological diagnoses and neural science (e.g., Drevets, 2000; see also APA, 2000); and (c) appropriate use, potential misuse, and warnings associated with psychoactive medications.

Training for Medical Personnel. Unequivocally, one of the greatest needs in mental health today is for education of primary care physicians. Patients with mental health or related concerns often turn first to their general practitioner (Figure 1), who might prescribe any number of medications to treat symptoms associated with sleep problems (Lunesta®), depression (Cymbalta®), anxiety

(Paxil®), or sexual dysfunction (Cialis®). Any of these conditions might have an etiology for which psychological intervention might be indicated. While I fully endorse the use of medications for any one of the conditions mentioned, I also believe in the need to evaluate diagnoses according to the Figure 2 framework. My concern is not necessarily with psychiatry (but see Nys & Nys, 2006); rather, the point of entry through general practitioners reflects a place where education about disorders and referral networks can affect the greatest number of patients *and* providers who deal with mental health issues.

4. Educate the Public.

Mental health practitioners are information providers (Ingersoll & Brennan, 2001; Kaut & Dickinson, 2007) who must educate the public about mental health conditions. For most people the media significantly affect how psychological conditions are viewed. Television advertisements for such problems as allergies (Claritin®), insomnia (Lunesta®), gastric reflux (Prilosec®), erectile dysfunction (Cialis®, Viagra®), social anxiety (Paxil®), depression (Abilify®, Cymbalta®, Wellbutrin®), and cholesterol (e.g., Crestor®, Lipitor®, Zocor®) actually educate the public about physical and mental health while offering a biomedical (pharmacological) perspective on preferred treatment options.

I support what to some seems to be a pharmacological intrusion into the public's living rooms. Normalizing certain disorders—even depicting individuals suffering from them—can help persons struggling with similar issues. Such advertisements, by reinforcing the disease model for virtually all health conditions, essentially direct the public to the *lower half* of Figure 2 as a way of understanding clinical disorders. This might be beneficial in helping them to identify the nature of various conditions; however, the possibility for misconceptions can potentially undermine holistic mental health perspectives (Healy, 2009; Murray, 2009).

Informing the Consumer. Education will help the public to understand the multiple dimensions surrounding mental health issues and treatments (Figure 2). The inability to identify a neurochemical imbalance (see Murray, 2009, p. 297) should in no way undermine consideration of pharmacological approaches to mental health issues. Practitioners must exercise good judgment in facilitating client understanding and refrain from minimizing or criticizing a particular treatment approach. The mental health disciplines have a rather unfortunate history of perpetuating untestable assumptions about human nature (e.g., psychodynamic forces) and incorporating them into long-term investments in treatment (e.g., psychotherapy). Nevertheless, there is value in some aspects of such theoretical approaches to behavior (e.g., defense mechanisms; unconscious activity), although there is considerably more support for pharmacological perspectives on mental health treatment—even if chemical tests are unavailable.⁹

Certainly, members of the public do not need either a mental health degree or an education in physiology or biology. Yet exposing them to certain principles seems advantageous. The way to educate the public is not through newspapers (e.g., letters to the editor; see Murray, 2009) or even the electronic media. Such efforts must begin at the K-12 level, where young people can learn how to evaluate claims, ask questions, seek information, and make informed decisions. As professionals and educators, we should be less concerned with telling individuals *what* to think than with helping them understand *how* to think.

A model of human behavior, one that reinforces the interface between biology and environment (Figure 2; see also Hoffman, 2000; Kaut, 2005, 2006; Kaut et al., 2003; Kaut & Dickinson, 2007), is typical of my own instructional work and central to my work in behavioral health (e.g., end-of-life intervention, genetic testing, head trauma/concussive head injury, pharmacology). Models are excellent instructional aids and can help students, and providers, critically examine mental health treatments. Ultimately, a conceptual model (see Figures 1 and 2 here) can be used to generate questions for both provider and client that promote awareness, insight, and increased responsibility for treatment adherence and compliance. Helping clients work through a series of questions about both drug and non-drug therapies (see Table 1), while placing their mental health issues within a biopsychosocial context (Figure 2) can be educational. Most important, clarifying a client's understanding of treatment options—and the role of pharmacology in treatment—can be an adaptive approach to developing an informed consumer and can have long-term problem-solving advantages.

5. Contextualize Mental Health Treatments.

Above all, I encourage practitioners to view mental health interventions within a larger context—one embedded in what Bronfenbrenner likened to a sociohistorical developmental timeframe (e.g., Swick & Williams, 2006). The pattern of development for each client intersects with a larger medical-health context comprised of physicians, mental health professionals, social and cultural influences, and a historical timeframe. One of the distinguishing characteristics of our own period in history is the advanced pharmacological milieu that pervades mental health treatment.

It is important to advocate assiduously for traditional mental health practice (cognitive and behavioral therapies), which includes establishing relationships with other mental health disciplines. Rather than undermining the approach of professions like psychiatry (Cohen, 1993; Nys & Nys, 2006) it is most helpful to identify the strengths of different perspectives (e.g., general practitioner, psychiatrist, community counselor) and seek to integrate their unique health emphases into a unified framework for serving diverse client needs (see

Figure 1). One of the indicators for the future success of mental health will be the degree of synergy between psychological disciplines, in both research and practice. Recognizing how various professions contribute to mental health practice (see Figure 1) and understanding how modern pharmacology influences treatment perspectives and preferences can facilitate practitioner and client awareness of the role drugs and traditional psychotherapies have in treatment options and the success of treatment.

The goal of mental health care is to provide the most effective and durable treatment for clients. Depending on the etiology, intensity, and duration of symptoms, pharmacology is likely to be part of a treatment approach for many of today's clients. Given the extensive research into the underpinnings of mental disorders and into drug treatments, pharmacology *should* be part of modern therapies, and mental health practitioners should adapt accordingly. The pharmaceutical industry is a major influence in modern health care. As Healy (2009) noted, the failure is when practitioner *and* patient *both* become focused on the pill (p. 24, emphasis added). Pharmaceutical companies will continue to do what they are essentially intended to do—design, develop, produce, and market drugs. Accordingly, mental health practitioners (perhaps psychology professionals in particular) should be vigilant about their focus on “the pill” and help clients understand both the potential benefits and the limitations of drug therapy (as well as traditional psychotherapies).

I do not believe pharmaceutical companies are the problem. What Murray (2009) refers to as the PPIC contributes enormously to the greater good of society. Nor are physicians, notably psychiatrists, necessarily the problem. Frankly, I see modern psychopharmacology as more a solution to psychological disorders. Yet selecting (or at least integrating) a medication approach to behavior requires openness, scientific awareness, clinical insight, and attention to treatment monitoring (see Julien, 2008). Though drugs are well-established in the modern biomedical context, drugs alone are not always well-suited to a given client. Therefore, mental health practitioners must conceptualize the pharmaceutical-client interface (Figure 1) as a function of modern reductionism, while recognizing the limits of drug specificity in relation to what I term the gradient of environmental influence (Figure 2) for each condition.

Indeed, contextual analysis is the clinical advantage of mental health providers—something that drugs independently cannot provide. Management of client mental health is thus a privileged aspect of a profession that skillfully recognizes how to identify the relative influence on behavior of various internal and external variables (Figure 2) while helping clients understand the role of different treatment options (see, Table 1) in the development of adaptive behavior (see DeNelsky, 1996).

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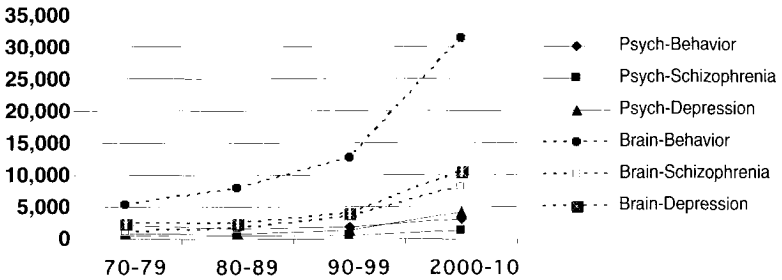
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ENDNOTES:

1 The reader is encouraged to consult some of the excellent websites established by pharmaceutical manufacturers, such as Merck (www.merck.com), Eli Lilly (www.lilly.com), and Pfizer Inc. (www.pfizer.com). The intent is not to promote specific products but to highlight the far-reaching work in health care the companies are doing. Certainly, a review of products is enlightening and helps place psychopharmacology within the broader health care context (e.g., cancer, cardiology, neuroscience, antivirals, vaccines). The Lilly site offers helpful product information (click on 'Products') on such neuroscience drugs as Cymbalta®, Prozac®, Strattera®, Symbyax®, and Zyprexa®.

2 A review of Medline-referenced publications, 1970–2010, shows a significant increase in research on biomedical issues, particularly brain-related studies, over the last 40 years (key terms: brain-behavior; brain-depression; brain-schizophrenia; see inset figure below, dashed lines). Indeed, such studies noticeably exceed research limited to those publications queried without a brain reference (e.g., key terms: psychotherapy-behavior; psychotherapy-depression; psychotherapy-schizophrenia; solid lines). From 2000 through 2010, there were over 50,000 citations for brain-related research involving behavior (31,411), schizophrenia (8,163), and depression (10,654); there were markedly fewer citations for psychotherapy-related research associated with behavior (3,175), schizophrenia (1,392), and depression (4,303).



3 The reader may be interested in examining some of the research pipelines for major pharmaceutical companies. For example, the GlaxoSmithKline (www.gsk.com) product development pipeline (click on Research & Development, then follow Development) contains numerous new drugs for conditions (and putative mechanisms) like depression and anxiety (CRF1 antagonist), drug dependency (DA₃ antagonist), bipolar disorder (sodium channel blocker), sleep disorders (orexin antagonist), and dementia (5-HT₆ antagonist) (February 2010 download). Lilly, Merck, and Pfizer have similar pipelines.

4 One of the most helpful starting points can be such online resources as RxList.com and Drugs.com, both of which offer exceptionally instructive information about psychoactive drugs. Even if an individual disagrees with the use of a particular medication for a given condition, the information can be of substantial value for client monitoring and education.

5 By systems level, I mean appreciation of the neurological structures and systems involved in higher-order thought (prefrontal cortex); emotional behavior (limbic system); memory systems (e.g., hippocampus); sensation; perception; and motor behavior (e.g., basal ganglia).

6 The interested reader is encouraged to review online information about Parkinson’s disease (e.g., [Wikipedia.org/wiki/Parkinson’s_disease](http://Wikipedia.org/wiki/Parkinson's_disease)). Wikipedia gives an overview of the biological basis of this condition, underscoring dopamine as the primary neurotransmitter of interest (scroll down to the *Management* section: see references to Levodopa (L-DOPA); and dopamine antagonists; MAO-B). It is also noteworthy that other problems—such as sleep, cognitive, and mood disturbances (under Signs and Symptoms)—are cited as related to this brain disorder. It is also of interest to follow the links to deep brain stimulation (DBS) as a remarkable treatment alternative that reinforces the relevance of reductionism and biomedical research in thinking about human behavior. Interestingly, one of the potential applications for DBS is the treatment of major depression (see Wikipedia.org/wiki/Deep_brain_stimulation). Note: This online source is readily available and its review of a topic is often helpful, but care is warranted in relation to the scientific sources used and how the content is interpreted.

7 Wikipedia.org/wiki/Biology_of_depression identifies various neural structures, neuro-

transmitter systems (monoamine hypothesis), and even genetic factors related to depression. While not intended to be exhaustive, the site provides helpful information, especially in conjunction with the Wikipedia.org/wiki/Major_depressive_disorder, which deals with *Causes* (e.g., monoamine, 'other' biological mechanisms, psychological, social, evolutionary, and drug-related).

8 Clinical experience with individuals diagnosed with schizophrenia has shed some light on the mental health approach to pharmacology. Psychiatrists, psychologists, and case workers certainly view such conditions through a biomedical lens and often encourage clients, and caregivers, to stay vigilant about drug adherence. It is helpful to review the extensive medication information available on excellent web sites as a basis for evaluating intended drug effects and possible emergence of side effects.

9 Without criticizing the extensive history of psychodynamic perspectives on behavior, or minimizing the extensive coursework and clinical practice devoted to highly questionable projective techniques (Rorschach; Hand Test), I have yet to see a reliable measure or therapeutic application of such non-empirically-established constructs. On the other hand, and despite some criticism, few would question—for example—the intracellular IP3 pathway responsive to Lithium ions (Li+) as a mechanism for mood stabilization (see Agam & Shaltiel, 2003; Julien et al., 2008; Manji, Moore, & Chen, 1999).