# A Recommended Dose of Psychopharmacology

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Despite the prominence of drugs in society, both illicit and prescribed, psychopharmacology — a hybrid discipline of psychological science and pharmacology — remains surprisingly obscure to people outside the discipline. *Training in* psychopharmacology is typically represented in academia either as a distinct program within a department or as an advisor-mediated research focus within a larger discipline. Although many students of psychopharmacology follow a pre-clinical track (i.e., working with animal models rather than human participants), there are programs in clinical psychopharmacology that focus more on evaluating novel pharmacotherapies in human populations. As with the wide range of training programs, the job market for a student of psychopharmacology is equally diverse. Employment can be found in research, teaching, drug development, consultation, sales, and many other fields.

The history of psychopharmacology is closely tied to its parent discipline, pharmacology, which was started in America by John Jacob Abel at the University of Michigan in 1890. Formal investigations of psychopharmacological questions began in the early 1950s, setting the foundation for the widespread use of psychoactive drugs in medical settings. In 1954, chlorpromazine (marketed as Thorazine in the United States) was the first psychoactive drug used in clinical trials to treat schizophrenia. Chlorpromazine, similar to many antipsychotic medications on today's market, had side effects, and researchers soon discovered alternative compounds with greater clinical efficacy. Unfortunately for many participants, these early days of drug development were largely unregulated, and volunteering for clinical trials was often a "participants-beware" situation. This trend in clinical trials changed in the early 1960s when reports documented frequent and severe birth defects (e.g., missing limbs) in children born to mothers who had taken thalidomide, which was a drug ironically marketed as a remedy for morning sickness. Because of the horrific side effects of thalidomide, the *Kefauver Harris Amendment* was added to the *Federal Food, Drug, and Cosmetic Act (1960)* in 1962, which increased the standards of efficacy and safety testing for new drugs. The FDA is now proactive rather than reactive with regard to new drug development, and the agency carefully scrutinizes attempts to bring new drugs to market.

Prior to discussing the therapeutic value, clinical application, or use of psychoactive drugs, a psychopharmacologist is primarily concerned with two fundamental principles. The first, *pharmacokinetics*, involves understanding how a particular drug is absorbed, distributed, metabolized, and excreted by the human body. A given drug may have multiple pharmacokinetic profiles that depend on its preparation (e.g., solution, tablet) and route of administration (e.g., inhalation, injection, ingestion). The second principle, *pharmacodynamics*, refers to the interaction of a drug with various receptors, enzymes, or other sites of action. Understanding the pharmacokinetic and pharmacodynamic principles of drug action is necessary to create and test hypotheses concerning the behavioral and psychological effects of a drug of interest. Thus, there are a few basic steps most psychopharmacological investigations will follow. First, a drug of interest must be chosen. Known drugs can be screened for potentially valuable and unidentified therapeutic effects, but novel drugs may also be synthesized. Second, the drug of interest is evaluated for a hypothesized effect (e.g., change in observable behavior or mood via self-report) alone and in the presence of other drugs (e.g., antagonists and agonists) known to

target specific receptors or pathways to confirm the drug's efficacy and site of action. Although the end stage of drug research and development is largely the treatment of human disease, nearly all of the initial neurological, behavioral, and toxicological data are obtained through animal studies. If a drug appears to have substantial therapeutic value, it may be moved onto human clinical trials in which more extensive and diverse applications are tested. Clinical studies might also include a treatment group that receives a known therapeutic (a positive control), because in some cases (e.g., treating syphilis), it may not be ethical to provide one group with no treatment or a placebo.

Psychopharmacology is a part of many large research programs found in universities, government labs, and pharmaceutical companies around the world. More often than not, a psychopharmacologist will be one member of an interdisciplinary research team. For example, in a large-scale study of Alzheimer's disease, there may very well be simultaneous investigations of cell, animal, and human models of the disease. A microbiologist might examine the development of A?-plaques (i.e., the plaques that form in the brains of Alzheimer's patients) in cell cultures; a biochemist might synthesize novel drugs that reduce A?-plaques in cell cultures; a geneticist might work to develop an animal model of Alzheimer's disease; and a psychopharmacologist might administer the drugs synthesized by the biochemist to the animal model and examine behavioral (in vivo) as well as neurological (postmortem) differences between drug-treated and control animals. Drugs found to be effective in the animal model may then be passed on to a clinical psychopharmacologist for cognitive and behavioral testing in human Alzheimer's patients. In this translational pathway from petri dish to animal science to human medicine, psychopharmacologists play a vital role.

The future of psychopharmacology is bright. The advent of new technologies (e.g., highly specific drugs, transgenic animal models, imaging techniques) and methodologies (e.g., genetic screening, combination therapies, interdisciplinary approaches) will undoubtedly increase the rate at which science generally, and psychological science specifically, is able to unravel the mysteries of the human condition. While the field of psychopharmacology is unlikely to ever wholly merge with another field, training in psychopharmacology can complement any research orientation. With sufficient interest and training, subspecialists such as a developmental-, cognitive-, social-, or personality-psychopharmacologists could arise. As the future unfolds, pre-clinical and clinical psychopharmacologists will continue to play pivotal roles in the translation of animal science to human medicine, psychoactive drugs will continue to be refined in terms of their target specificity — leading to simultaneous increases in therapeutic effects and decreases in side effects — and the treatment of diseases both somatic and psychological will be facilitated by advancing genetic medicine. Ideally, parallel advances in the rate of discovery, manufacture, and distribution of therapeutic drugs will result in cheaper and more efficient drug delivery, allowing a greater number of people to take full advantage of psychopharmacological discoveries.