PSYCHOTROPIC DRUGS IN THE YEAR 2000

Use By Normal Humans

Compiled and Edited by

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Published under the Imprimature of the American College of Neuropsychopharmacology

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To Professor J. E. P. Toman
A teacher, scholar and friend
His untimely death is
A loss to his
Friends and to the Science of
Psychopharmacology

PREFACE

THE AMERICAN COLLEGE OF NEUROPSYCHOPHARMACOLOGY was formed in 1961 as a scientific society limited to 150 fellows and members in which professional information could be exchanged between pharmacologists, neurophysiologists, psychiatrists, chemists, physicians and psychologists who were active researchers in the study of mind-altering drugs. Due to the large scale use of tranquilizers, both in mental hospitals and, also, for outpatients, it was felt that such an expert body should be assembled for the purpose of rapid communcation of scientific information. The College's membership composition reflected the interdisciplinary nature of the study of mind-altering drugs. Certainly, no one scientific discipline, by itself, could hope to encompass a field with as many complexities as that offered by the study of these drugs.

Since 1961 the College has undergone one minor and one major change: first, it has allowed its membership to increase to 185 of the most active and most expert investigators studying psychotropic drugs in the United States today; second, it has begun to change its role from an organization with the sole purpose of exchanging scientific information to one with a new sense of social responsibility to act as an information source about these drugs. This latter move is illustrated by the recent formation of a Public Information Committee under the chairmanship of Dr. Joel Elkes, Chairman, Department of Psychiatry, Johns Hopkins University, an expansion of the role of its Ethics Committee, under the chairmanship of the senior editor, to include ethical matters pertaining to society at large in relation to psychotrophic drugs, as well as of internal matters related to the ethics of mind-altering drug usage and, perhaps most noteworthy, the formation of a Public Drug Education Committee under the chairmanship of Dr. Oakley Ray, of Vanderbilt Uni-

versity. These changes reflect the growing realization that chemical substances which can alter mental, emotional, and perceptual processes are a ubiquitous phenomenon of our culture. Yet, careful, nonbiased descriptions of the actions of these drugs are difficult to obtain.

Mind-altering chemicals are the second most often prescribed type of drugs. Also, on a vast scale we consume over-the-counter psychotropic drugs such as aspirin, caffeine, and alcohol. From early morning until late at night advertisements from our communications media constantly flood us and our children with biased information from so-called "experimental" or "clinical" studies as to the efficacy of particular drugs. And, finally, we see the recent sensational publicity given to the illicit use of drugs of various types for recreational and aesthetic purposes by an increasing percentage of our population. It would probably not be an exaggeration to say that 95 per cent of the readers of this volume will, at some time today, take a drug for the specific purpose of changing their mood, mental functioning, or perceptual capacities. Thus, in light of this almost total usage, the College clearly sees that it has a societal duty to communicate its findings, in a language understandable to the intelligent layman, about the physiological, biochemical, and psychological effects of these compounds. Certainly, the College makes no pretense at having the ultimate societal or moral answers to the questions provoked by the massive use of these chemicals, but it does have the responsibility, within its technical expertise, to explain the known scientific data to the public.

The Study Group for the Effects of Psychotropic Drugs on Normal Humans was initiated four years ago. We recognized that normal humans have used drugs as analgesics, diet reducing compounds, sleeping pills, mood elevators, pep pills, and for recreational purposes since the beginning of man. Therefore, we conclude that this type of usage, i.e. nonpsychiatric, is a legitimate subarea of study in the field of mind-altering drugs. The Study Group was not formed initially to consider the problems of drug misuse. Rather, in its origin, it conceived its mission as a consideration of the possibility of enhancing the quality of human life by chemicals, and a review of the effects of these chemicals

when prescribed to the nonpsychotic, and possibly nonneurotic, patient treated in a general outpatient clinic or by a private practitioner. An examination of the contents of this volume will show that it is not directed specifically to the question of drug misuse. Other groups within the College have taken this problem as their particular specialty. However, when one considers the absolute number of people who indulge in caffeine, but not LSD; who use aspirin, but would never touch marijuana; or the moderate drinkers, who would react with horror to the suggestion that they are drug users, we can see that this area of study may constitute the largest, single category of drug use in the United States today. The assertion that we are a "pill taking culture" is perhaps an understatement of the true facts when one considers the amounts of the various drug-containing beverages, the "nondrug" drugs and the "over-the-counter" remedies which we buy.

The theme of the Study Group meeting for the year 1967 was "The Use of Psychotropic Agents in the Year 2000 by Normal Humans." At our meeting in Puerto Rico we concluded that the present breadth of drug use may be almost trivial when we compare it to the possible numbers of chemical substances that will be available for the control of selective aspects of man's life in the year 2000. In this effort we were greatly influenced by the reports in *Daedalus* on the year 2000 and the work of the Committee on The Year 2000. Thus, we decided to try to present to the general public a sample of some of the kinds of drugs that we believe we are capable of producing. It was our intent not only to provide knowledge of our technical capacity, but also a brief analysis of possible social effects of this capability. In this endeavor, we were fortunate to have with us the noted anthropologist, Professor Ashley Montagu, John Campbell, editor of *Analog Science Fiction,* Arthur Koestler, distinguished lecturer and author, and the Honorable John Oliver of the Federal Bench. These gentlemen sat patiently, and with great fortitude, through our technical presentations. At the end of our session, these distinguished gentlemen provided a very informative panel discussion on what they conceived to be the potential outcome of the invention of such drugs, an admonition as to how these drugs

should be used and what drugs probably should or should not be invented. It was our hope that by bringing together intelligent men from other areas of specialization, we could obtain a better perspective on our own work. We believe that this hope was more than adequately fulfilled by our panelists.

In considering the present volume it is our hope that the reader will not believe this to be an exercise in science fiction. It is well known that the world of fifteen years hence presently exists in the research laboratory of today. Thus, for at least a period of fifteen years, we are not truly guessing. Further, for the last fifteen years of this century, the speculations that were put forth by the group should be considered not as the only possibilities, but rather as a sampling of the types of potency and selectivity of drug action we have every reason to believe can be achieved. In an age when an opiate compound ten thousand times more potent than morphine has been an established reality for over five years, one cannot think of other possibilities of potent, selective drug actions as remote. If anything, as a criticism of the meeting, it would be our impression that the scientists were far too conservative in their ideas, as is usually the case at meetings of experts.

With these few thoughts we shall leave the reader to make up his own mind and stretch his imagination thirty years into the future to see the type of world in which we will live. Whether we live in a Utopia, an anti-Utopia, or muddle along in a pluralistic society is far more up to the intelligent reader than it is to a small group of psychopharmacologists.

The Study Group would particularly like to thank the National Institute of Mental Health for providing a grant to support its activity. The Workshop Meetings, the Study Group Meeting at our Annual Conference and the publication of the volumes produced by the Study Group would not be possible without the generosity, formerly of Dr. Frank Berger of Wallace Laboratories, and presently, of the National Institute of Mental Health, who provided the financial support required.

WAYNE O. EVANS, PH.D.
NATHAN S. KLINE, M.D.

INTRODUCTION

If we were asked to name the single most important psychological characteristic of our modern age, I am sure that most of us would answer immediately that it is the ubiquitous sense of rapid change. All around we see our technology, our environment, our institutions, and our values subjected to questions, doubt, attack, and flux. Yet, we are told that this process of change is accelerating and that we should expect even greater disruptions in the future. Whether in reality these changes are actually occurring at such a rapid acceleration is difficult to prove objectively. However, there can be no doubt that the firm conviction held by most people that things are changing explosively constitutes the single most pervasive and potent assumption of our society today. This belief, then, is a major determinant of our perceptions and reactions to the world in which we live, work, play, love and wonder.

When most people in a society feel that their world is changing with an alarming rapidity, anxieties develop as the appropriateness of traditional methods, attitudes, goals and beliefs are challenged. To those of us from the "square" generation, the new sexual liberality, loss of clearly defined sexual roles, affluence, freedom, mobility, protests and clothing styles of the younger generation seem to confront us at every turn as constant reminders of the contempt that many of the youth feel for us and for our institutionalized value structures—values we have striven so hard to attain.

From all our information sources, advertisements, books, editorials, periodicals and reviews, we are admonished to change the brands of the products we use, or build new cities, or change our laws, or worry about a new disease. With an aggravating pervasiveness, the communications media shout with an immediacy and urgency of changes going on, not only in our own

country, but all over the world. From the podium of technology and the university we hear the mounting voices of scientific "Cassandras" as they enjoin us not to pollute, not to use drugs, not to reproduce, not to litter, not to smoke, not to consume our vital resources and, of course, not to worry. Yet, at the same time, in the name of "Progress," these "technologists" tell us we dare not impede the cumulative growth of an unbridled science and technology or stop a pattern of ever-increasing consumption and discard cycle for fear of "lagging behind' 'or creating unemployment. Our political and military leaders proclaim to us the ever-present threat of the destruction of mankind and of the necessity for our deep involvement in political activities in countries all over the world—due to rapid modes of transportation and the variety of weapons of mass destruction. Yet, they assure us, the parochial, rural morality, individualism and nationalism of our country's colonial period is still our guiding ethic. In our cities we see the changes brought about by the mass society with its production of mass, "mediocre" culture, and we accept, with a minimum of complaint, the ever-lengthening queues in which we must stand to obtain even the simplest services. In the most unchanging of all our organizations, the church—the earthly representation of our "eternal" spiritual life—we see vast upheavals of faith and ritual. It is difficult to conceive of any time in history since the Protestant Reformation when a "Folk" Mass could be accepted or in which "love-ins" and "feel-ins" could be conducted in strict, Protestant Churches. The "new" church has moved to the suburbs and become an institutional mirror image of its members.

The effect of this overwhelming advertising campaign of change has been to produce a constant state of anxiety in many people and total alienation in some. We no longer know where to turn or whom to ask to obtain sincere answers to questions of identity and goals. When "God dies" lesser authority figures suffer an even worse fate—disbelief or disregard. In a "screaming" society, the quiet voice of reason is unheard. The deeds and goals of our past appear meaningless when applied to the future and the increasing specialization of information robs us of any hope of understanding our universe from a human perspective.

One of the least insane responses to the feeling of anxiety induced by our perception of a world in flux has been the reinstitution of Utopian thought. After a hiatus of over fifty years, the Utopian mode of thinking again has come to the fore and, with it, the proclamation of new goals, new men and new social orders, as envisioned by the authors of the Utopias—each contending that he (or she) will give a sense of order, meaning and stability to our lives. Prophets abound and we have to learn to be leary of "Learys."

One of the most interesting forms of the new Utopian thought is the emergence of the "futurologists." Intellectuals of the standing of Daniel Bell of Columbia University, Herman Kahn of the Hudson Institute and Bertrand de Jouvenel, leader of the Futuribles Project in France, have brought together a mixture of simple, extrapolatory projections, methods from operations research, Delphic "scenarios" of multifold trends, sociologic diffusion models, and some straightforward evaluative prejudices to produce quasi-scientific techniques which supposedly allow us to examine the possible, alternative world futures resulting from our present actions. By these methods, we are given, at least, the impression that we can exercise some willful control over our destiny and thus retain some degree of personal stability and integrity in a world of frantic change. Whether any of these various methods actually will predict the future is yet to be seen, but there can be no doubt that they do provide the reader (and the predictor) a feeling of psychological security by establishing a methodology which purports to determine the long-range consequences of our actions in a nonstatic environment. In a sense, these dynamic techniques have replaced the Utopian concepts of the past which emphasized stable societal institutions. We now seek societal stability by institutionalizing the process of change itself.

"The *Method* is the thing to catch the fancy of
the *Scientist-King*"
(With apologies
to Shakespeare
W.O.E.)

Personal stability is gained by placing our faith in a method which analyzes change itself. Differential equations of rate change have replaced the static rituals of past institutions, and stochastic models have replaced sacrifices to appease the modern "computor" gods. We are forced to make the process of change orderly in order to insure our own psychological well-being. For generations historical and sociological theorists sought a model of social change without success. Yet, now our need has produced a faith in prediction validity of these untested methods.

Unfortunately, such esoteric models of change are only of use as "tranquilizers" or "pacifiers" to a few, highly educated members of our society. These few, however, are in a position to produce a self-fulfilling prophecy by their ability to implement changes in governmental funding policies and to attract public notoriety to help validate the prophecy. It is interesting, and somewhat frightening, to conceive of an age of orderly, programmed change in which random creativity becomes a threat to "The Plan." We can imagine the reverent, servile dedication with which clerks will input the latest social survey data to be displayed after analysis on a master PERT board to indicate the progress of "The Plan"; the sincerity with which "The Plan's" implementors will pronounce Galbraithian dictums of a neo-post-industrial economy, and the horror and chastisement that might greet any layman so bold as to challenge the accuracy, the necessity, or the desirability of the particular future expressed by "The Plan." Orthodoxy may come to be the humble acceptance of an approved social change equation. Certainly no drug effect, no matter how "mind-expanding," can begin to approach in scope or folly the boundless, righteous ego of a man who has accepted a "doctrine" to justify himself with a sense of purpose and meaning.

Psychotropic drugs do have something in common with the new Utopian thought—both may provide a sense of stability and certainty, whether realistic or not, and reduce the feeling of chaos generated by a perceived social flux. Social planners well might consider the description of long-range forecasting as a "tranquilizer" for reformers. Tranquility is not always a state with a high survival potential, nor is orthodoxy adaptable in a world of changing problems.

Psychotropic drugs have become of concern to our society because of their sudden popularization. Chemicals which could alter the state of mind or mood have been administered by physicians, witch doctors, priests, medicine men, or by self-medication throughout history and in almost every culture. As far back as the Vedas of ancient India we find reference to the drug Soma as having both mystical and palliative properties. Alcohol was described by the Egyptians as being given to men by Osiris to relieve the troubles of their lives. Kava Kava has been used by the natives in the Samoan Island group for its mental effects, and the Indians of South America have been relatively fortunate in the multitude of alkaloid bearing plants which they can take to induce a change in their mental functioning. However, the explosion of mind or mood altering drugs in this country started in the year 1955, when a small group of dedicated, radical thinking young psychiatrists introduced tranquilizing drugs into the state mental hospitals of our country. This was accomplished almost without the knowledge of the predominantly psychoanalytically-oriented psychiatric establishment. The results of the introduction of these drugs were so dramatic that only the most fervent disbelievers could hold out against the onslaught of data. The use of these chemicals has reversed the curve of ever-increasing numbers of mental patients in our state hospitals. At this time, the curve is on a rapid downward path.

Due to the realization of the medicinal benefits of chemicals for the relief of certain types of mental illness, major efforts were initiated by the pharmaceutical industry to look for new chemical substances which would have mind-altering properties. Further, the military-industrial *symbiants* began to sponsor projects to produce chemicals which could disrupt the will of an enemy to fight without damaging his body. This latter effort was designed both to wage more humanitarian wars and, also, for use in situations in which the hostile elements of a population were intermingled with neutral and friendly elements—the situation most usually found in conditions of insurgency. Also, intense investigation of the use of natural products by various peoples all over the world was instituted in the hope of discovering new products.

The munificent results of these intensive research efforts are now seen in our pill-taking culture with a drug of choice for all ages: antidepressants for the elderly, tranquilizers for the middle aged, alcohol and pep pills for the young adult, and "mind-expanders" for the youth. From morning until night there are advertisements from the mass media, attention arousing condemnations from local police, prescriptions from family physicians, and word of mouth advice from peers emphasizing that "such-and-such" a chemical will help with whatever problem a person might have, such as pain, insomnia, boredom, lethargia, anxiety, etc. Psychomedication is an accepted way of life and the search for the "just right" pill has become the existential goal for many people and a habitual consideration for the rest of us.

The present volume can be regarded as a "tranquilizer" for psychopharmacologists, that is, people who discover and study mind-altering drugs. Those of us who work in this field see a developing potential for nearly a total control of human emotional status, mental functioning, and will to act. These human phenomena can be started, stopped or eliminated by the use of various types of chemical substances. What we can produce with our science now will affect the entire society. In a sense, we are in the same ethical and moral dilemma as the physicists in the days prior to the Manhattan Project. Our tradition and allegiance to the ethos of science and technology makes us feel the responsibility to explore every lead which may produce new chemicals which can help, or control, man. On the other hand, we obviously see the possibilities for social stagnation or repression when such agents are perfected. Along with the geneticists, with their near ability to modify human genetic potential, we are participating in the development of what can be called a "biological atom bomb." For this reason a group of us have come together to inform the intelligent, lay public of the kinds of drugs we are capable of producing. Although this disclosure may not result in a wise use of psychochemicals in the future, at least we will feel that we can share part of our concern and guilt with the general public. If drugs are invented and used in ways which are not beneficial to mankind, psychopharmacologists will not be

exempted from the disaster. Therefore, we ask you, the intelligent public, to help us answer the following questions.

1. What drugs should be invented and when?
2. Who should control drug production and use? What control means should be used?
3. How free should people be allowed to be in regard to drug use?
4. How can effective education about drug use be implemented?
5. What limits must be placed on governmental use of drugs to control individuals?
6. *Where does freedom of research end and public responsibility begin?*

WAYNE O. EVANS, PH.D.

CONTENTS

PSYCHOTROPIC DRUGS IN THE YEAR 2000

Use By Normal Humans

1

THE ETIOLOGY OF BEHAVIOR IN THE YEAR 2,000

JOSEPH ZUBIN

I HAVE CHOSEN AS my topic the etiology or general underlying causes of behavior in the year 2,000 in order to provide an introduction to the papers that will follow which deal with the specific impact of drugs on behavior. In a sense I am to provide the baselines on which drugs will be superimposed.

Had I foreseen the task in September as fully as I see it now, I would probably not have undertaken it. As a matter of fact, psychology, the science of behavior, has only recently begun to consider causes. Most of its last one hundred years have been spent in studying and classifying the effect of these causes—behavior itself, i.e. the response side of the problem rather than the stimulus. Indeed, the search for the stimulus, or cause of behavior, is one of the major unsolved problems facing psychology. *Cherchez la cause* is the chief concern of most students of behavior today.

Why should the search for the cause be so important? Why not study the more palpable response per se, and note how it is altered by drugs and leave cause to philosophy? The reason for studying cause is that the number of ways in which behavioral responses may vary is rather limited, while the number of causes that may bring them about it manifold. Whether this is basically true or is only apparently true, because we have already developed a taxonomy of responses but do not yet have a good taxonomy of causes, remains an open question. Perhaps the bewildering array of causes may some day yield as neat a pattern of categories as we have found for the responses. But that day is not yet here.

In looking for the sources of behavior, we are faced with a tremendous number of bewildering options. We could look for physical, physiological, instinctual (play, curiosity, etc.), social, cultural, or philosophical causes, to name only a few.

Since we do not have any basic knowledge of the causes of behavior, all we can do now is develop ideal etiologies in the form of scientific models which would give us the structures from which to draw our hypotheses concerning underlying causes.

There is no need for a defense of scientific models; nevertheless, the imaginative schemas, built first on fantasy, which underlie the structure of models and which are either vindicated or rejected by actual observation, are most succinctly illustrated in the following episode.

> When Robert Boyle died in 1691, Christian Huygens and Gottfried Wilhelm von Leibnitz commiserated that he had wasted his talents trying to prove by *experiments* what they knew to be true in the light of *reason*—that he was more interested in *observation* than in *reasoning* and had left no unified body of thought. (Hall, 1967.)

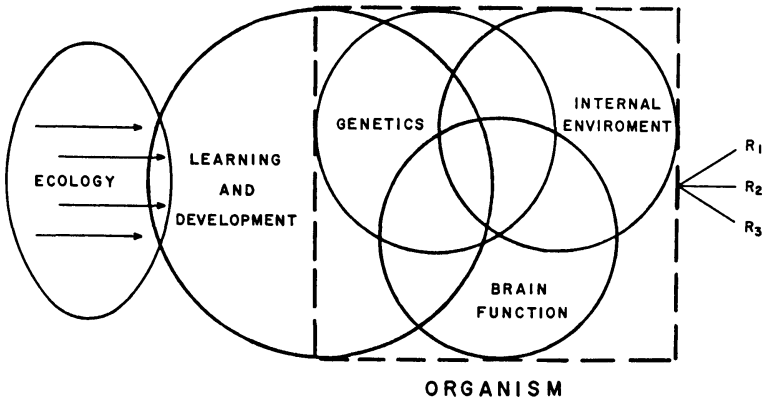
This conflict between schemas based on mere speculative reasoning and crass empiricism based on a plethora of observations is resolved through the scientific model, which combines schematization with the built-in mechanism for testing the hypotheses arising from the schema through observation and experiment.

In searching for a group of scientific models that might be useful in explaining human behavior, the following come to mind: (a) the ecological model, according to which the sources of man's behavior are to be found in the social-cultural or ecological niche which he occupies; (b) the developmental model, according to which the source of man's behavior can be attributed to the variety of the developmental crises (critical periods) through which he passes and the proper or improper satisfaction of needs at these junctures that may lead him in the direction of good or poor development; (c) the learning and conditioning model, which stipulates that man's behavior is primarily the resultant of the particular kinds and schedules of reinforcement which he has been subjected to; (d) the genetic model, which stipulates

that man's behavior is primarily reducible to the genetic endowment with which he comes into the world; (e) the internal environment model, which stipulates that the body fluids and body chemistry are the chief bases of man's behavior; and (f) the neurophysiological model, which stipulates that the etiology of man's behavior is to be sought in his neurophysiological equipment, especially the central nervous system. I have elsewhere (Zubin, 1966) applied these scientific models to the explanation of etiology of mental disorders, but it is high time that a similar system of models be applied to normal development.

There is one difficulty in all of this classification, and that arises from the essential fact that the classification of ignorance is always very difficult! But where our knowledge ends, our freedom to speculate or roam in the explanatory area is, of course, unlimited. Speculation is all that we can engage in at this point; nevertheless, controlled speculation may show the way for the type of research required for producing a classificatory system of causes of behavior that would be of value. Besides, the speculation or fantasy of today is the reality of tomorrow, and the reality of today is nothing more than the legend of the day after tomorrow.

While these models are conceived of as independent for heuristic purposes, they are in reality interdependent to a greater or lesser degree. This interrelationship is indicated in the diagram. The ecological model and the learning model refer primarily to the exogeneous factors impinging on the individual. The develop-



mental model is partly exogeneous, influenced by ecological and learning factors and partly endogeneous, reflecting maturation. The genetic, internal environment and the neurophysiological models operate entirely within the skin, but they are mutually interrelated as well as influenced by the ecological forces by learning and development.

We shall now take up each of the models in turn, describing its assumptions, and the causal agent presumably salient to it.

For heuristic purposes we deal one at a time with causal factors of the model under discussion, assuming that the factors assigned to the other models are not also involved in the behavior under examination. Thus, when we deal with the ecological model we will assume that it alone is responsible for the particular behavior and that the basic capacity involved in development, learning, genetic expression, internal environment and neurophysiology is essentially intact or normal and not contributing to the deviant behavior. This is a simplifying assumption, which of course will be corrected later.

The human ecology model is built on the assumption that human behavior is directly attributable to the particular factors operating in the ecological niche in which the individual finds himself. The evidence for social-cultural, environmental pressures as etiological agents in behavior comes largely from studies of socioeconomic status, isolation, educational and social deprivation, and social-cultural change due to migration or rapid acculturation which affect behavior adversely through some such general factor as stress and stratification of society. The evidence for more benign factors affecting behavior positively is not as available nor as convincing. However, even the most sanguine environmentalist will not be satisfied with merely indicating the above mentioned factors as causal agents and will try to determine just how these forces bring about salutary or deleterious effects.

To cope with the stimuli assumed to operate under this model, we need techniques and methods that will delineate the various environmental forces that underlie the production of behavior. Our handicap here is tremendous because even preliminary descriptive work is yet to be done. We do not have a taxonomy of ecological factors that is suitable for the exploration of be-

havior, nor do we know the links between these global forces and the proximate forms by which they may bring about a given type of behavior. It is of course true that social science has developed a number of sophisticated taxonomies in what I am calling the "human ecology" realm. We have classification systems for economic modes, social organization, kinship, cultural complexity and so on. But in relating behavior to these we generate a rather frightening plethora of "intervening variables"; conspicuously we lack parametric control. For example, in face of the often demonstrated fact that the prevalence rates of major psychiatric disorders are quite constant across cultures, we find ourselves invoking such constructs as "individual stress" or "personality" to explain differences between the subgroups that constitute a given culture. These may be just the right middle level construct—they may pay off. But we will not know until they can be anchored objectively and measured either in the casual or consequential realm. If indeed such constructs can be objectified, we may find that the more molar taxonomy will no longer serve our purpose.

Recent work by Richard Wolf (1965) illustrated how the correlation between social status and intelligence, which is usually found to be between 0.20 and 0.40, can be boosted to as high as 0.69 if the parameters of the socioeconomic environment that have a bearing on intellectual potential are measured and included in the multiple correlation. Similarly, the correlation between social status and achievement, which is usually found to be 0.50, can rise to 0.80 if the parameters of social status pertinent to achievement are identified and measured. How the factors presumably underlying low socioeconomic status will relate to the occurrence of psychopathology when their parameters are explicated and measured no one can tell, but arguments such as those provided by Bruce P. Dohrenwend (1965) lead one to suppose that at least transient, if not permanent, psychopathology is highly related to the stresses and strains of the environment. Perhaps persistent noxious stress can even lead to permanent psychopathology.

The developmental model of etiology of behavior is built on the assumption that mental disease develops as a result of some

specific deprivation or interference during a critical period in development when that specific deficit or interference is crucial. A general underlying factor in this model is the aging process itself with the growth and decline of function that it entails. Identification of the critical periods of development is still moot, with research covering the entire ontogenetic range: fetal, neonatal, childhood, adolescence, adulthood, middle-age and old-age. Moreover, the values of the variables that may affect behavior at the critical junctures are still to be specified. At present, such obvious factors as absence of toxemia during the gestation period, rich early experience, sufficient interaction with peers during early childhood and adolescence, good psychosexual development and good vocational adjustment patterns, satisfactory role development in family, vocation and society, and social interaction in old-age can be tabulated as important causal agents in the direction of good development. How to measure the degree of well-being during pregnancy, the extent of peer relationship, the pattern of friendship, and so forth, is still beyond us. Even the categorization of family interaction in terms of degree of relationship between its members shows no universal agreement. But it is interesting to note that there is far more done in the area of deviant behavior in these respects than in the area of normative behavior.

As an example of the study of one of the developmental parameters we might examine peer relationships during early development. Harlow (1962) has demonstrated that macaque monkeys raised without peer interaction tend to develop rather poorly, especially with reference to psychosexual development. Investigation of the adolescent friendship patterns of preschizophrenic adolescents (Kreisman, 1967) indicates that compared to normals their adolescent friendship pattern is quite deviant. Whether this represents an etiological factor in schizophrenia, or, whether it indicates subclinical schizophrenia is, of course, difficult to determine.

Here again, we must have independent measures of parameters of the environment that are still unidentified. Meantime, we can point to some of the behaviors that seem to be direct reflections of good or poor development: linguistic or verbal

behavior, comprehensibility of speech, greeting, eating, sleeping, and other types of daily behavior accompanying socialization.

One of the more exciting developmental studies is that of Papoušek in Prague, Czechoslovakia at the Institute for the Care of Mother and Child. (Papoušek, 1968). Here the neonates are placed under more or less similar social environments from birth on, so that social-cultural determinants as a source of individual differences are largely eliminated. Care is taken to include only healthy infants without any evidence of pathology in pregnancy or in delivery, and they are reared in a special unit under relatively standard conditions with the assistance of mothers and specially trained nurses who can substitute for mothers if necessary. Despite this uniformity of environmental conditions striking differences in conditionability emerge. Whether this is to be attributed to primarily genetic factors or developmental-learning factors is still an open issue.

Finally, it should be pointed out that certain kinds of developmental models may be considered as special cases of the ecological model. In a model, for example, which postulates family structure, e.g. broken homes, as crucial for the development of psychopathology, what is really being suggested is that childhood is an optimal period for *transmitting* certain effects from the social-cultural environment to the individual. Such a conceptualization may lead one to consider the role of learning in relation to psychopathology.

The learning or conditioning model postulates that the source of the normal or deviant behavior of the patient is to be sought in his reinforcement history and the current behavior-reinforcement contingencies.

The learning model has one underlying component viz.—reinforcement—which may serve the function of selecting for survival those behaviors in the inborn repertoire of the neonate which are most essential for his continued development. In this way, reinforcement may serve the same function for selective survival of behaviors and their shaping that evolution serves in selection for survival of species and their adaptation. Because learning is dependent on innate mechanisms like sensory analyzers and unconditioned responses, it is difficult to separate the learn-

ing process from them, but for heuristic purposes we shall assume these underlying mechanisms not to be deviant to begin with and discuss only the normative development or maldevelopment due to the learning process itself.

It seems reasonable to assume that many behavior deviations, especially in the neuroses and other nonorganic conditions, must be acquired in accordance with known learning principles or with those which are still to be discovered. The learning procedures, intentional or unintentional, that our culture utilizes in shaping behavior are gradually becoming known. Some of the basic principles (such as schedules of reinforcement) have been studied extensively in animals and are beginning to be applied to human beings, especially in the area of verbal and other social behavior. The acquisition of adaptive emotional responses, however, is still largely to be investigated in humans. In general, the parameters of the learning process itself are slowly revealing themselves, since the products of such learning, whatever the process may consist of, are easily observable and often measurable.

The physical basis of learning also may cast light on normative as well as deviational possibilities. The identification of biochemical processes involved in consolidation, and the finding that certain stimulants injected after a learning episode can exert a retrograde facilitation effect that shows up after the drug has worn off, has potentialities for perhaps reducing the difference between learning by retardates and by normals. Similarly, the role of attention (perhaps conceived of as involving nervous-system "efficiency") in learning of both retardates and schizophrenics has been investigated; according to Zeaman and House (1963), one reason why retardates of certain levels fail to learn quickly is the long trial-and-error period before they select the proper stimulus to attend to.

Further illustrating the possibility of interaction between models, a study by Salzinger and colleagues (1961) demonstrated that the administration of chlorpromazine affected only that class of behavior that was being reinforced. When verbal behavior in general was being reinforced it was emitted at a lower rate than when no drug was administered. On the other hand, when

self-referred affect statements were being reinforced only these showed a lower rate of emission, speech level remaining the same. Finally, when movement in the subject's chair was measured (another response class not under the reinforcement contingency), it showed, if anything, a higher rate owing to the administration of the tranquilizer. It was therefore concluded based on a couple of subjects that the effect of the drug was not directly upon the behavior, but was indirect, perhaps through some aspect of the reinforcement process.

Another consideration in the etiology of deviant behavior is the status of the original stimulus in producing the deviant behavior—the role of traumatic events, for example, as distinct from the factors maintaining the behavior long after the effect of the initial stimulus has disappeared. The contingencies of reinforcement for specific deviant behavior may serve to maintain it, whether the reinforcement is intended or not. Similar contingencies are to be sought in the maintenance of normal behavior.

With regard to measuring the deviation in behavior referrable to learning, the entire gamut of patient behavior is involved; much of it can be observed in the clinic and hospital, and some of it measured under laboratory situations. Here, observational techniques and interviewing under individual or group conditions are available, but standard procedures for the assessment of degree of psychopathology in relation to learning principles are only beginning to be provided on a practical basis (Kanfer and Saslow, 1965).

It might be pointed out here that learned behavior, as a basis for causation, detection, diagnosis, and elimination of psychopathology has received a new impetus from some of the successes reported for behavior therapy. No one can deny that, at least at the present time, there is no other way to detect the presence of functional psychopathology except through overt behavior, verbal or nonverbal. But it must also be realized that the same behavior may receive positive reinforcement in one culture, negative in another, and be completely ignored in a third. This fact may lead us to adopt either a purely relativistic view on mental disorders or to search for other indicators which may

accompany or underlie the pathology. The learning theorists for the most part object to this, saying that the behavior and its functional relationship to the environment is the psychopathology and nothing else is needed. Yet, if we discover that a neonate is incapable of some metabolic process (say metabolism of phenylalanine) and neglect it, because the neonate is not demonstrating any pathological behavior, we may lose the opportunity of saving him from mental retardation later. It is in this sense that we should be critical of the statement that we need to pay attention only to current behavior, unless we wish to include all activity of the organism, even the cellular or segmental, as behavior. In this way, a thorough survey of the various response systems of patients, besides their overt behavior, may permit the detection and diagnosis of even latent conditions that have not yet come to function in addition to providing a more objective indicator of the presence of the illness.

The genetic model postulates that, as far as psychopathology is concerned, the basic origin of mental deviation is an inherited propensity. The investigation of the parameters of normal heredity is hardly begun, though those underlying deviant heredity are gradually becoming known. The genetic origins of some types of mental disorders can be demonstrated in the form of certain inborn errors of metabolism, as in PKU or galactosemia, or can be associated with specific chromosome anomalies, as in mongolism, or can be inferred from studies of consanguinity ranging from absence of any blood relatedness to monozygocity. Comparing hereditary factors with social-cultural factors, it is clear that we have today a better measure of hereditary similarity in the degree of consanguinity than we have of environmental similarity. The relationship between degree of consanguinity and resemblance in IQ is quite linear and positive. The relationship between resemblance in environmental factors and resemblance in IQ is practically zero (Jarvik and Erlenmeyer-Kimling, 1967). But this may be a reflection of the fact that we have good measures of hereditary resemblance but few good measures of environmental resemblance. Indeed, the genetic stimuli that give rise to deviant behavior have been detected and described in much better fashion than the environmental factors or the

factors underlying any of the other models that may account for deviation. Among the genetic factors leading to mental deviation are some identifiable genetic anomalies, such as translocation and nondisjunction as evidence in Down's Syndrome, mosaics, and specific alleles or combination of alleles that because of their enzymatic activity interfere with normal cell development and functioning. Some of the other genetic principles that have been employed in etiological considerations are polymorphism (or the balance maintained between alternative genic structures in given internal or external environments), penetrance and expressivity of genes.

There has been a recent flurry of interest in the potential evolutionary survival value of such disorders as schizophrenia. One recent suggestion is that the genetic element in schizophrenia has something to do with the unpredictability of schizophrenic behavior when viewed from the standpoint of normative expectancy. This unpredictable behavior may be valued highly if it meets with social acceptance and is rewarded by society, or may be rejected and classified as illness (Hammer and Zubin, 1968).

Genetics may be viewed in terms of biochemical mechanisms by which the genes serve as precursors for the production of certain enzymes whose absence (or excess) prevents the organism from prospering. There is, therefore, considerable hope that an investigation of the internal environment of the body may reveal the particular metabolic deficiency or excess that characterizes the patient. A particular error of metabolism may, of course, be inherited or acquired. A considerable amount of effort has been spent in the attempt to relate schizophrenia to metabolic error. Certain fractions of schizophrenic blood have produced metabolic alterations as well as changes in such behaviors as rope-climbing in rats, as well as transitory changes in the psychomotor behavior of normal human subjects. Presumably similar fractions from the blood of normals do not produce such changes. The parametric studies of serology, chromosomal counts, etc., may turn out to be important bases for classification either with or without immediate behavioral correlates.

The specific aspects of the internal environment, such as

homeostasis, endocrine balance, acid-base balance, electrolyte metabolism (Coppen, 1967) and other internal mechanisms and circulating fluids are too many to mention, but there is again a need for classifying them into stimulus class that may be useful in relating them to behavior. Considerable advances have been made in the analysis of serum protein and hemaglobin, enzymes, bile salts, antigens, etc., which may prove useful in classification. Similarly, Hamburg *et al.* (Hamburg, 1967) have reviewed thyroid function in relation to genetics and the rest of the internal environment with special reference to behavior and pointed out many new leads. Here again the mediation of factors operating in other models, such as the genetic or the neurophysiological, is important.

The final model, the neurophysiological or brain-function model, postulates that human behavior depends basically on neurophysiological control especially through the central nervous system, and that the function of the brain is to organize and control behavior in all its aspects from the physiological to the conceptual levels. Some years ago I developed a table in which the various aspects of behavior—physiological, sensory, perceptual, psychomotor and conceptual were classified against the various methods for eliciting them under laboratory conditions: idling state, energy stimuli and signal stimuli (Burdock, Sutton, and Zubin, 1958). This constituted a sort of Mendelejeff Table for psychological experimentation.

Not only normal but also abnormal behavior is dependent upon the functioning or malfunctioning of the organ that most directly controls behavior—the brain. The nature of this malfunctioning can only be guessed at, but certain behavioral characteristics have been found in some types of mental disorder that differentiate patients from normals in a way that seems to be independent of ecological factors and that presumably reflects brain function (either innately, by endowment, or in the course of ontogeny). For example, slower recovery of evoked potentials to rapidly succeeding stimuli, and slower reaction time when a stimulus modality shift occurs, have been found. The actual brain substrates or processes underlying these deviations are still to be discovered. Except for certain "textbook" neuro-

logical syndromes, we probably know less about neurophysiological factors for the production of deviant behavior than we know about factors or stimuli in any of the other models (except, perhaps, for the internal-environment model).

Nevertheless, some of the aspects of brain structure and function that have been implicated in the production of deviant behavior are amount of endogeneous neural noise, general level of arousal, reticular activating system, limbic lobe, temporal lobe, hippocampus and amygdala, peripheral gating mechanisms for dealing with excessive or diminished inputs, reverberating circuits, and the general integrative capacities of the cortex.

So much for the current scene. Now, what about the year 2,000? What will be the basic causes of behavior and how will the parameters of the causal factors underlying each of the models be altered?

The future of psychopathology was delineated in a symposium of the American Psychopathological Association some seven years ago (Hoch and Zubin, 1962). With the more limited scope of psychopathology it was somewhat easier to look ahead and focus on such issues as the future of each of the etiological models, but even here the editors took refuge in their preface in the following:

> The experience of other disciplines indicates that even unsuccessful predictions can be of use. Why a prediction went wrong and where it went wrong and under what circumstances may be illuminating. Attempts at explaining unanticipated unsuccessful therapeutic outcomes or unanticipated successes can throw more light on the therapeutic process than can demonstrations of expected successful therapeutic effort . . . we hope that the next generation will find these predictions entertaining as well as instructive—regardless of whether or not our prediction will prove right or wrong.

Our attempts to predict the future of the sources of behavior is even more hazardous, but in the light of the above comments our venture into prophecy may be forgiven.

In the matter of prediction, to paraphrase Goethe, who can say something clever or something stupid that has not been said before? If there is any virtue in what I am about to say, it inheres not in the novelty of my ideas but in the new organization I