The facts with which I shall deal are mainly old and familiar. If there is any novelty in my remarks, it is in the mode of presenting the facts, and the inferences and observations following from them. I have long been concerned with psychopathology, but since I am not an epidemiologist by training, I can claim originality in that field only for my mistakes.

Introduction

Psychopathology is usually regarded as the science dealing with the behavior both overt and covert of the mentally ill, including the changes in such behavior induced or associated with management and treatment. Whether we are witnessing a revolution in psychopathology itself is debatable. That we are undergoing a revolution in our attitudes towards research in, and treatment of, the mentally ill, is beyond any shadow of a doubt.

But this is not the first revolution in psychopathology. If we regard modern psychopathology as beginning with Pinel, Rush and William Tuke, the first revolution was the introduction of moral therapy in the middle of the 19th century.

Just why moral therapy failed is difficult to fathom unless we invoke such a general factor as industrialization, which brought with it urbanization, overcrowding, and immigration, overturning our economy as well as our mental hospitals. Apparently the unsympathetic attitude of the Yankee doctor to the Irish immigrant was also a factor in the elimination of moral therapy as an effective agent. Moral therapy having been abandoned, the patients remained stagnant residents of the hospital, and the resultant overcrowding in turn reduced the chances of remission even further.

Moral therapy presumably assumed a psychogenic cause for mental disorders. Its apparent failure strengthened the hand of the somatogenecists, and the pendulum began to swing the other way. The advances in medicine in the conquest of infectious diseases, in pathology and similar areas, and finally the discovery of the cause of general paresis in the early decades of the 20th century increased the attention paid by psychopathologists to the somatogenic factors in the mental disorders. The seesaw between somatogenic and psychogenic considerations has characterized the history of psychiatry throughout the ages, and only now is a synthesis of the two viewpoints beginning to be made.

The impact of somatogenic models on psychopathology is best illustrated by the conquest of such illnesses as general paresis and pellagra with psychosis. Perhaps the history of the discovery of the causes of general paresis, well known to many of the older members of this audience, nevertheless bears repetition for our younger colleagues.

The early guesses about the causes of general paresis ran the entire gamut from psychogenesis to somatogenesis as revealed by the following aetiological claims.

1. Heredity
2. Excessive mental or emotional upheaval.
   a. Excessive mental activity (a reason why men had higher frequency of attack than women).
b. Exhaustion from overwork.
c. Napoleon's defeat and terror of war (a reason why Napoleon's officers were so frequently affected).
d. Violent love and jealousy.
e. Frightening experience.
f. Privations.

3. Physical and Somatic Factors
   a. Head traumas.
   b. Faulty menstruation or menopause or masturbation.
   c. Alcoholic and venereal excess.
   d. Heart and abdominal diseases, hemorrhoids.
   e. Misuse of mercury.
   f. Excessive heat or cold.

4. Occupation
   a. Night workers
   b. Actors (because of emotional upheaval with different roles).
   c. Prostitutes.

5. Personality
   a. Patient's conviction of his own greatness, power and wealth in contrast with the sordid reality in which he lives.

This congeries of causes is quite reminiscent of the claims made today for diseases whose etiology is still unknown. The first breakthrough came through the observation of a Danish physician that all of the 8 general paretics in a neighboring hospital had formerly been his patients for syphilis. The next step was carried out by one of Krafft-Ebing's students who inoculated 9 moribund general paretics with syphilitic matter and demonstrated that they were immune, thus proving that they had all previously been infected with syphilis. Finally Noguchi and Moore demonstrated the presence of the spirochete in the brain tissues of general paretics.

Despite the tremendous impact of the somatotherapies, initiated by Wagner von Jaurregg with malarial treatment, the decade of the 20's was a relatively static one for psychiatry. (Story of Wagner von Jaurregg). The abortive focal infection theory of Henry Cotton, which gave rise to the first controlled experiment in psychopathology, interrupted the silence, and some attempts at sleep therapy and a variety of other undistinguished methods were tried. The inefficacious nature of these therapies, the overcrowded conditions of the hospitals and the popular approval of psychoanalysis tended to deter the somatic therapies. They nevertheless broke through in the 30's.

The next decade could be described as the heroic period in modern psychopathology. After the discovery of malarial treatment for general paresis, a whole series of somatic therapies were introduced, beginning with insulin therapy, metrazol, electric shock, carbon dioxide, psychosurgery, and finally, drug-therapy. These new therapies brought about the revolution in psychopathology which is still in progress. This further revolution has gone on under the surface. It is rather more like the building of Grand Central Station in New York at the turn of the century, when no interference with ongoing traffic was permitted. The evidence for it is to be found in the following: the diagnostic nomenclature sacrosanct in the 30's has undergone a serious face-lifting; whether the operation was a success is still debatable. Our hospital doors have been thrown open. Our release rates have been doubled. The geriatric problem hardly noticed in the 30's and the childhood problem, practically unknown then, have become the primary sources of concern. The separation of mind and brain, a firm tenet of the 30's, is no longer regarded as a stumbling block in integrated attacks on the mental disorders. Fields like clinical psychology, sociology, anthropology, biometrics, biochemistry, pharmacology, microbiology,
hardly mentioned in the halls of psychopathology in the 30's have now, if not entrenched themselves, at least put their foot in the doorway. Funds for research, very scarce in the 30's, are now at least available, if not ample. The vast armamentarium of different therapies, the struggle against the tendency to build bigger hospitals, etc., are all earmarks of a revolution which has not yet spent itself.

The current revolution has been brought about by two types of breakthrough: (1) in management, and (2) in scientific research.

Let us first look at the breakthrough in management. England has anticipated our own revolution by about a decade, as shown in the two recent studies of Michael Shepherd and Vera Norris.

In the Shepherd study covering the period prior to the introduction of the National Health Act, no increase in facilities, but a marked increase in admissions and in releases is reported. This could only have happened as a result of shortening the stay of the average patient. Whether this change in release rate was occasioned by the new therapies, by change in attitudes on the part of the community or by change in type of admission is difficult to fathom. The new therapies could not explain the change, because the most frequently used new therapy was continued narcosis, a technique which has not been found to be highly efficacious. There is evidence of a change in the character of the hospitalized population. During the second period the population was older, included a higher proportion of females, of married and of voluntary patients and of readmissions. Diagnostically, there was an increase in the functional psychoses, and particularly in the affective disorders. All of these changes characterize a patient population having a somewhat better prognosis, and it is likely, therefore, that the changes in release rate may be at least in part due to the better prognosis of the newly incoming patients. But why did this new influx of patients occur? It probably reflected a change in attitude towards hospitalization for mental illness. It is interesting to note that remarkably little change in release rate occurred in the schizophrenic group.

One of the most surprising findings is the reduction in absolute numbers as well as in rate of first admissions for schizophrenia in the second period. Whether this represents a change in diagnosis, a change in the type of facility to which the schizophrenic comes at first, or some statistical artifact such as variability due to small numbers, is difficult to fathom. It is clear, however, that the number of readmissions per schizophrenic patient has risen and the total duration of residence in the hospital during the follow-up period has declined.

In the U.S., the trends observed in England are only now beginning to be felt. The downward trend in the resident population of our state hospitals, the upward trend in hospitalization of the young, the stabilization of the rates of hospitalization for the old-age group, the shifting of mental hospitals to urban centers, the trend towards smaller hospitals, all indicate the revolution in management and treatment. Are these long-term or short-term trends? One question plaguing the statisticians is: what has brought about these changes -- the drugs, the change in attitude, or the interaction between these two factors? It is likely that some of our research with double blind methods may come a cropper because of this interaction effect. If drugs alone won't do the trick, and attitudinal changes alone won't do it, then, double blind methods can not succeed because they eliminate the interaction! This may explain why drugs work in some hospitals and not in others.

There is one possibility that may lead us to the conclusion that the reduction of the resident hospital population occurring in several of the more advanced states of our country may be only temporary in nature.
As everyone knows, there is a shortage of individuals in the age-range 20-30 because of the drop in the birthrate during the depression years. The teacher shortage, the general professional and man-power shortage is attributable at least in part to this factor. Yet the hospitalization of schizophrenics is on the increase. My tentative hypothesis is that our hospitals will always fill up as long as there are vacancies, and since there is a "shortage" of schizophrenics in the population, the less severe cases are entering our hospitals; and less severe cases leave hospitals earlier.

It may be that the original cause of the revolution in management was this very decline in population. Doctors, finding that they have milder cases to treat, are encouraged to release their patients from the hospital; and the community, seeing that mental patients do return and make a fairly good adjustment, loses some of its fear of hospitalization, which once again increases the number of mild cases applying for care.

In addition to the open door policy which is, in fact, a revolving door policy since 70% are released but 40% returned in the next revolution of the door and the eventual reduction in overcrowding and understaffing, the revival of such older methods as ergo-or work-therapy has come in the wake of change in attitude. Unfortunately work therapy seems to be tied to the economic cycle. In countries where there is a shortage of labor, work therapy for mental patients under contract to industrial firms seems to be quite acceptable and successful. In countries where unemployment exists, as is the case in our country, no great enthusiasm exists for the method.

New mechanisms for treatment and maintenance of mental health are developing through clinics, day hospitals, half-way houses, sheltered work shops such as Alto, and the finding of jobs in industry. This brings with it certain dangers. Since there are now twice as many former mental patients as there were ten years ago, the question arises of how this return of the mental patient to his old occupation will affect the community. How many of us, however enlightened, would have wished, ten years ago, to see a woman who had been diagnosed as schizophrenic return to teaching school or even to taking care of her own children? We must provide prognostic criteria for determining which of these returnees will make good and which may either fail or even cause harm.

The cost of the care of the mentally ill is gradually being transferred from the state budget to the local community and the immediate family. Social security payments as well as insurance payments are also helping families to bear the burden. New mental hospitals are being built close to university centers and other community facilities to the end that the isolation of the mental hospital staff and of the mental patient is becoming a thing of the past. So much for the breakthrough in management.

The scientific breakthrough can be viewed best when examined from the vantage point of the scientific models now burgeoning in this field. One might question the need for models and ask what they indeed signify. Let me hasten to assure you that scientific progress can be made only if we recognize that science is the offspring of the interaction between schematization and observation. We shall not raise the question of which comes first, but merely point out that schematization or conceptualization without observation leads to scholasticism, while observation without schemas leads to confusion. What is a scientific model? It consists of specific definitions and assumptions, from which certain hypotheses are derived, and are then subjected to verification through experimental observation.
"A model sets out the relationship between a limited number of variables -- selected for their supposed importance in the explanation of particular phenomena,..."(Bauer, P.T. and Yamez, B.S. Underdeveloped Economics, Science 1959, 130 1383-.)

"The blindest of all blind are those who are unable to examine their own presuppositions and blithely imagine, therefore, that they do not possess any."-(Butterfield)

So let's put our models on the table.

It is perhaps permissible to inquire whether psychopathology is ready for such models. As Jerome Cornfield has pointed out, fields differ in their degree of articulation, that is, the extent to which their phenomena are capable of being explained or predicted in terms of a small number of fundamental concepts and constants. Once the inverse square law was schematized and the earth's radius and gravitational constants determined, any school boy could figure out the escape velocity. It was not necessary to resort to trial and error by examining a wide range of propulsion thrusts -- although the goings-on at Cape Canaveral often lead one to wonder! On the other end of the scale is the discovery of the American continent. No amount of schematization could have enabled the pioneers to predict the streams, valleys, mountain ranges and flora and fauna of the interior. Every valley and mountain peak had to be discovered by sheer might and main. This is a field of low articulation, although our ability to predict the geography of the planets and the other side of the moon may present a somewhat higher degree of articulation. Where does psychopathology stand on this scale?

Although we cannot answer this question in general, we can point out the degree of development of psychopathology in its various aspects. There are at the present time the following scientific models in our field: 1) cultural-social, 2) developmental, 3) learning, 4) hereditary, 5) internal environment, 6) neurophysiological or brain model and, lastly, 7) the epidemiological model.

To analyze each of these in turn would take more ability and more time than I possess. All we have time for is a brief survey.

1. The cultural-social model.

It has been claimed that the stress and strain of modern society is responsible for the increase in mental disorders. This is debatable: it is not even clear that an increase has taken place; evidence for it comes largely from hospital statistics, which reflect hospitalization rather than true incidence. Furthermore, while it is true that modern society has been characterized by a reduction in the effectiveness of such anxiety-reducing agencies as home, marriage, church, etc., and has not been able to develop adequate substitutes for them, we cannot be sure that such conditions tend to increase psychosis or even neurosis. Perhaps the most satisfactory scientific model for social-cultural factors is one in which they play the role of occluding or eliciting factors but not of causal factors. (examples of frigidity and pseudo-cyosis).

The recent finding, for example, that schizophrenia is largely drawn from the lowest socio-economic levels, has been brought into question by the finding in England by Morrison in Jerry Morris' Research Unit that the distribution of occupations of the fathers of schizophrenics is no different from the distribution of the rest of the country, but the occupations of the schizophrenics themselves is definitely skewed toward the lower classes. Apparently, schizophrenia produces low socio-economic status rather than vice versa. In our own studies, contrasting two ethnic groups -- Jews and Negroes -- with regard to hospitalization, the role of ethnic mores in determining hospitalization is far greater than any biological differential that may exist. (role of violence in hospitalization).
The developmental model, which was largely in the hands of Freudian -- and Meyerian -- inspired workers, has now taken a turn into more objective areas. Ethologists have entered with investigations of the instinctual behavior of animals and experimental psychologists with the investigation of early life experience of animals. Both of these types of studies tend to indicate that the early hunches regarding the influence of early experience on subsequent personality were essentially correct but, thus far, no evidence of their role in producing psychopathology is evident. "Maternal behavior" especially has taken a beating, ranging from the demonstration by Birch and Schneirla that mothering requires the cooperation of both mother and offspring and maladaptive behavior or rejection can result from defects in either one, to Harlow's dethroning of filial love into love for soft terry cloth. Perhaps the most striking recent development has been in the paranatal field, where deviant gestation events seem to underlie a good many subsequent deviations such as mental deficiency, reading retardation, and other neurological sequelae even when no apparent lesions are demonstrable in later life (as shown by Pasamanick and Lilienfeld). We have actually pushed back some of the causes of psychopathology into the uterine environment or to congenital conditions. Apparently, the moment when the deprivation or trauma occurs seems to be an important determinant of subsequent psychopathology.

The learning model focuses essentially on the role of previous experience on subsequent behavior regardless of when the experience occurs. This is a fast developing field in which the analogue to neuroses and psychoses is sought in animals through such techniques as conditioned emotional responses, avoidance conditioning, etc. These analogues have already demonstrated a similarity to human conditions which is too close for comfort for those who believe that man's diseases cannot be understood through animal work. Joe Brady in David Riech's group has demonstrated the production of ulcers in monkeys through techniques not unlike these which produce ulcers in executives, and the disruptive effect of high anxiety on learning has also been demonstrated. Recently, the Reta hypothesis of Dunlap has been revived at the Maudsley Hospital and by Wolpe. This technique has its paradigm in Dunlap's famous demonstration that typing tests for the can be eliminated by wilfully practicing the nurse and thus extinguishing it. It can be used effectively in the reduction of tics, enuresis, and to some extent stuttering, without the introduction of substitute symptoms.

The genetic model is well known through the work of Rüdin and his school and the work of his colleague and collaborator Franz Kalimann in this country. There is no longer any question of the importance of genetic components in such diseases as the functional psychoses, and even in some of the neuroses; but this does not mean that heredity is enough. Men do not inherit diseases as they inherit money, they merely inherit a predisposition. The big question now is, how does this predisposition work to produce the illness? Some recent developments have enabled geneticists to count the number of chromosomes in the human cell, and though we have as a consequence lost two chromosomes -- we now have only 46 instead of the former claim of 48, mongolian idiots seem to have 47 chromosomes and this extra chromosome may be an important feature in their illness. Beadle's work in finding out the biochemistry of genic action also opens up the possibility of supplying missing substance needed for health but not produced by the deviant gene. Genetics has stopped begging for admission into psychiatry; instead it becomes necessary to demonstrate not that it works, but how it works.

The internal environment as a basis for a scientific model has recently come in for a good deal of attention. Almost everything secreted or synthesized by the body has been offered at one time or another as the cause of schizophrenia. In fact, the biochemists have become so active that they have won first place over psychology as
the science with the richest repertoire of negative findings. Apparently, before
body fluids can be compared in normals and abnormals, it is necessary that their
intake be equivalent or their N intake be in balance. In several painstaking
studies significant differences were found between schizophrenics and normals only
to discover that they reflected not schizophrenia but excessive coffee drinking on
the part of schizophrenics and tooth-paste use on the part of the normals. Psycholo-
gists have for a long time known that motivation influences test performance. Now
the biochemists are finding out that nutrition affects body fluids. Such work has
recently been dubbed "Pure drug and food psychiatry." At all events, the biochemists
have the easier job -- they can circumvent differences in nutrition much more readi-
ly than psychologists can overcome differences in motivation.

The scientific model for psychopathology which has made great strides forward
in recent years has been the neurophysiological model, which involves study of brain
centers, blood-brain barriers and neural conductivity. Perhaps the most exciting
findings are on the one hand, the eliciting of sensory, perceptual and conceptual
behavior through direct brain stimulation à la Penfield and on the other hand, the
evocation of behavior through implanted electrodes. If the brain is truly the seat
of the mind, increase in knowledge of brain function is bound to be reflected in
increased understanding of the mind. Hess's pioneer work in implanted electrodes
picked up by Hebb, Olds and Milner has now been reported successfully in human beings
in Scandinavia. Semmes Jacobson is reportedly finding that pleasurable and unplea-
surable feeling tones can be induced through stimulation with implanted electrodes
and that some of the patients report sexual stimulation as one of the accompaniments.

The final scientific model is the epidemiological model, which seems to be a
super-model including each of the above models as partial factors in the explanation
of the mental disorders but requiring careful field studies to determine the relative
role of each of them. Mental disorder is conceived as the end result of a series of
probabilistic events, each of which must occur in interaction with others to produce
the disorder, although the threshold value for each factor may differ from person to
person. Thus, two people may have inherited the same predisposition, but because of
differential stress or nutritional or deprivalional factors will not both develop
the illness. The virtue of epidemiology is that it takes in all possible factors
ranging from radiation, paranatal existence, genetics, social-cultural environment,
etc. Thus, the epidemiological model both permits and requires the weighing of each
of the submodels in the total picture of causation; the difficulties of assessing
their relative importance, and of devising studies which will not overlook some of
the factors, are too well known to need re-emphasizing here.

Summary
The revolution in psychopathology has been brought about on the one hand by
improvement in management of the mentally ill, and on the other hand, by scientific
breakthroughs in such widely separated areas as sociology and genetics, paranatal
factor and learning theory, anthropology and brain function. An inclusive model to
include each of these areas as potential contributors to knowledge in mental health
and disease is provided by the epidemiological model. With such a model in mind,
the work in the various areas can be integrated for the benefit of the patient as
well as of scientific progress. The implications of this revolution for epidemiology
are manifold. One of the most essential next steps is the training of a new type of
epidemiologist who, though specializing in a particular field, has sufficient acqaint-
tance with the adjacent fields to enable him to keep up with developments. The fields
involved are the focal field and cultural anthropology, sociology, ethology, genetics
developmental sciences, physiology, psychology, psychiatry, social work, biochemistry
and pharmacology. How to prepare for a career in psychopathology is indeed difficult
to know.

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