12 June 1959, Volume 129, Number 3363 SCIENCE

# Economic Implications of Urban Growth

This country lacks a public policy to meet the growing problems of dispersed urban settlement.

Coleman Woodbury

In what terms and by what means is urban growth most effectively measured and described? This would seem to be a question basic to any consideration of the topic of this paper. Answering it adequately, however, would require another paper at least as long as this one. Perhaps, therefore, the wise thing to do is to answer it inadequately but quickly and firmly. In this paper, urban growth is indicated largely by population growth. Of course, it has other dimensions such as economic activity, land area, governmental status and services, and the character and complexity of social relationships and interaction. Population growth, however, has obvious advantages for our purposes. We have more data on it than on any other characteristic of urban growth. It is the most commonly used measure. And, as I hope some of the later parts of this paper will make clear, it is unmistakably related to most if not all the other major dimensions of our expanding urban society.

A second fundamental question is—what urban growth? To this the short answer is: current urban growth—the phenomenon largely of the post-World War II years, which in significant respects differs from earlier urban increase, plus whatever modifications we may reasonably anticipate in the short-range future.

The author is professor of political science and director of urban research, University of Wisconsin, Madison.

## Current Urban Growth

One of the most striking characteristics of current urban growth is that it is predominantly metropolitan growth. According to estimates of the Bureau of the Census, for the six-year period 1950 to 1956 nearly 85 percent of the very substantial population growth of the United States (14.7 million) was accounted for by the 168 Standard Metropolitan Areas recognized by the Census of 1950 (*1*). Only 9.5 percent was in independent, that is, nonmetropolitan, urban areas. As to the metropolitan increase, I should emphasize that by no means all of the 85 percent (in fact only slightly more than one-half) was in territory that in 1950 was urban by the principal Census criteria of legal incorporation and density of development. The remainder was largely in parts of metropolitan areas that the Census designated in 1950 as rural nonfarm areas.

On what grounds, then, am I justified in saying that current urban growth is predominantly metropolitan? There are three grounds. First, as the Bureau itself, referring to the rural nonfarm increase in metropolitan areas, has pointed out, "Undoubtedly, much of this increase was in newly developed suburban areas which will be classified as urban in the 1960 Census" (*1*, p. 1). And I feel sure that the Bureau would agree that if the urban and rural nonfarm parts of metropolitan areas had been marked out in 1956 using the 1950 definitions, the urban area would have much more than half of the six-year metropolitan increase. Second, I suggest that for many purposes the present definition of urban and rural nonfarm territory within metropolitan areas is unfortunate or, perhaps, even misleading. Of course, this is not an unfriendly criticism of the Bureau's terms or work. Its staff members are at least as aware of the difficulties here as anyone else. Certainly, however, many families living within metropolitan areas but in territory now classified as rural are much more like urban families in employment, in their places of shopping, recreation, religious observance, and schooling, and probably in their attitudes, standards, and habits of life than they are like most families in small, relatively independent villages, which are the other major component of the rural nonfarm population. It may be that what is needed is another category for the present rural nonfarm metropolite. And third, if we hold strictly to the current Census definition, the proportion of urban to total population increase is much less, but of the urban increase, about 82 percent is found in metropolitan areas.

It seems to me fair, then, to characterize current urban growth as predominantly metropolitan growth. And in the remainder of this paper I shall be concerned primarily with metropolitan growth.

For purposes of study and discussion, metropolitan areas are often subdivided into the central cities, the suburbs (in Census' terms, the urban territory outside the central cities), and the rural-urban fringe areas (that is, the rural areas—largely rural nonfarm in Census' terms). Population growth from 1950 to 1956 for this breakdown shows another notable fact. Of the six-year *national* increase,

the central cities accounted for 15.6 percent; the suburbs for 27.2 percent; and the fringe areas for 41.5 percent. For these same classes of areas the rates of increase for this period were: central cities, 4.7 percent; suburbs, 17.0 percent; and the fringe areas, 55.8 percent. Here is evidence of what many thoughtful observers think is a significant redistribution of population, the early stage of a "new pattern of settlement" that, if continued, may prove to be a phenomenon comparable in its economic, political, and social consequences to the great urbanization movement of the latter part of the 19th and the first part of the 20th centuries.

It would be a serious mistake, however, to assume that this redistribution or dispersal of population is a relatively simple phenomenon. It often varies materially from one metropolitan area to another. Furthermore, the broad outlines of it that are indicated by the Census data cited are the net result of a number of other movements or shifts. Although information on these component shifts is not nearly as abundant or as reliable as it should be, a few of them should be examined here.

The large increases in suburban and fringe area populations are, in important part, made up of out-migration from the central cities. Contrary to a fairly common impression, most of this out-migration is not directly from the badly blighted districts of the central cities. It is more than offset by some natural increase plus a substantial in-migration of population—most of it from nonmetropolitan areas and largely composed of Negroes and Puerto Ricans and other whites well down the income scale. Thus, the economically selective character of these shifts in central city populations is bringing them closer and closer to the description applied some years ago by the Regional Plan Association to New York City—the home of the rich, the poor, and the childless.

Suburban newcomers quite clearly include more than their proportionate share of families with young children. In two respects, however, the old image of the suburban community is now false. That image, I believe, was of a dormitory town predominantly of wealthy or very well-to-do people. Suburban communities fitting this description still exist, of course, but more and more suburban in-migrants are in the middle income and some in the lower-middle income ranges. And a recent study of 398 suburban communities of 10,000 or more showed that only about 46 percent of them, by one standard of measurement, were essentially dormitory towns (*2*).

About the rural-urban fringes, our knowledge is shamefully weak. Quite probably, however, their inhabitants and current arrivals are a very heterogeneous lot as to income, employment, place of former residence, and standards and ways of life. During the recent house-building boom, apparently more than one-quarter of the national total of nonfarm units produced were built principally by their owners (as distinguished from speculative builders and general contractors), who also became their occupants (*3*). In large part, this type of house-building is the poor man's response to high construction costs in housing. Quite surely a large proportion of it is taking place in the fringe areas where land is cheap and code standards are low. At or near the other economic extreme is estate-type development, both in the form of new building and, in some areas, rebuilding of older properties. A very few and widely scattered studies indicate that fringe populations are made up not only of migrants from central cities and suburbs plus some indigenous families, many of whose members may now be industrial employees, but also in considerable part of in-migrant families from nonmetropolitan areas, rural and urban.

In short, then, the growth we are considering makes up a very large part of the current population increase of this country. It is predominantly metropolitan in character. It is forming a new, much more widely dispersed pattern of settlement than was characteristic of earlier urbanization. The process by which this is being done is a complex phenomenon. We know relatively little about it, but quite surely its component parts are concentrating relatively more persons of low income status in central cities, more of middle income in the suburbs, and in the fringe areas, very heterogeneous groupings, whether they be described in economic or cultural terms.

## Contributing Factors

Before we can look at the economic implications of current urban growth with any prospects of accomplishment, at least one other question must be considered: Is the current pattern of urbanization likely to continue, with or without material change, or is it a temporary phenomenon resulting from conditions peculiar to the immediate post-World War II period?

I suggest that this question can be answered today only by listing the factors or forces that we have some reason to believe are contributing to current urbanization (that is, to its volume, character, or both) and then asking two more questions: (i) On balance, do these factors seem likely, in the years just ahead, to become stronger, weaker, or to remain about the same? (ii) Can we foresee new forces that might either counteract existing factors or supplement them, either in their present or future form? Here, again, our knowledge of the factors and, particularly, of their relative strength is insufficient for a definitive analysis. And again, space limitations require a truncated discussion of the questions. In brief outline, however, I suggest we can identify at least several factors and groups of factors in current urbanization.

High agricultural production and its necessary concomitant, efficient means of transporting food and fiber to urban centers and distributing them there, are so elementary that they need no comment. In all probability both will increase in the future. A high level of general economic activity, particularly in urban-located manufacturing, distribution, and service trades, is a generally recognized condition of urban growth. Its immediate future is not too clear—at least not to me. Over the longer run, perhaps we are justified in assuming that, by and large, it will be maintained.

Other factors are certain technological developments including widespread ownership and use of the automobile, availability of electric power in nearly all parts of metropolitan areas, the lowly septic tank, the telephone, radio and television, and, perhaps, even the power lawn-mower. All of these and other items in our much-advertised, mechanically-oriented civilization have contributed strongly to the dispersed character of recent urban growth. In all probability, there will be no diminution in them or in their effects on urban patterns.

Certain public policies make suburban and fringe area living either possible for or more attractive to many people. In this category fall state and federal grants-in-aid, particularly for schools and highways, and federally encouraged practices in small house financing, particularly the high percentage, long-term, amortized mortgage. Not

many people, I believe, know that roughly one-quarter of the aggregate revenues of local governments in this country are now in the form of grants from state governments. A large proportion of these grants are for schools and highways. Although highway grants usually are limited to certain classes or kinds of roads, they enable local governments to build and maintain substantially more all-weather roads than they otherwise would. Forecasting the probable future of such measures may be risky, but I see no likelihood that these aids will be curtailed. Quite surely some of them will be strengthened. Others may well be added. In these circumstances, their byproduct effects on the new pattern of urban settlement seem likely to continue.

Another factor in current urbanization is that characteristic of many intergroup relations that is becoming known as *exclusionism*. This refers to the misunderstandings, animosities, dislikes, and antipathies among many members of racial, national origin, economic, and other groups that make them uneasy neighbors and lead to various degrees and kinds of residential segregation. I would like to believe, of course, that as our urban culture grows more mature these divisive and essentially undemocratic factors will decline. Maybe they will, maybe not. These factors, however, seem to me somewhat different from most of the others we can identify. Although they clearly are influencing the *character* of current urban dispersal, I doubt that they are very significant in the degree or extent of it.

In nearly all of the few studies of people's reasons, or what they think or say are their reasons, for preferring suburban and fringe area living, space turns up very frequently and prominently. The ways it is expressed to the interviewers vary widely, but it cannot be mistaken. Many people, quite possibly an increasing number of them, want and seem determined to get space or spaciousness for themselves and their families. It means less congestion and tension, more play space and safety for the children, more privacy, escape from the clamor, dirt, and confusion of high density districts, more greenery and beauty in their surroundings, chance for a wider variety of hobbies and avocations, and usually easier access to the open countryside. Too much of the discussion of this aspect of current urbanization has been shrill and subjective. Some commentators who do not share this value spend considerable time belittling it and deriding those who recognize it and are trying to understand it. There is no evidence, however, that any appreciable number of urbanites pay serious attention to these outcries.

Some students of the urban scene think they see evidence of a backflow from the less densely to the more densely built parts of metropolitan areas. This may well be taking place. With some 10 million persons—many of them adults—coming into suburban and fringe areas in six years, some reshifting certainly is to be expected. No evidence I have seen so far indicates this backflow is more than minor. I look for this factor of space or spaciousness as a value to continue strong in the changing urban scene.

Although the connection between leisure time and dispersed metropolitan development is quite obvious, in my opinion this is the most generally underestimated of all the major factors influencing urbanization. More leisure time for more people means more opportunity and more energy for the activities and ways of living common to suburban and fringe areas. To some degree, it probably lessens the drag of long journeys to and from work. It seems likely to be an even more powerful force in the future than it is today, regardless of how the probable increase in leisure time affects the length of the work day, week, year, or lifetime.

In the various combinations or mixes in which these influences operate, they amount to formidable forces in our economy and society. Also, although from time to time and place to place some of these combinations of forces may lessen temporarily, over the next generation or so they seem likely to increase, rather than to decline, in their effect on metropolitan growth patterns.

In broad terms, I see also two main dangers or threats to urban growth and change in something like the forms they have taken in recent years. The first of these would be a substantial and long-sustained lowering in the level of general economic activity. Although this is by no means inevitable, it seems quite possible. The other is the performance of construction costs, particularly of house-building costs, in the post-World War II period. The best information available shows that from 1946 to 1955 the median dollar income of urban and rural nonfarm families increased by 58 percent (*4*). For the same period, the Bureau of Labor Statistics estimated that the average construction cost of privately owned, nonfarm dwelling units started went up by 96 percent. For single-family houses the increase was 105 percent (*5*). Also, for August 1957, the Boeckh index of residential construction costs was at an all-time high, despite the fact that the seasonally adjusted monthly index of nonfarm dwelling unit starts (privately owned) had been moving generally downward for more than two years and in that month was more than 25 percent below the level of January 1955 (*6*). Clearly, this, if continued, can become a threat to vigorous metropolitan growth in the current patterns. Over the past few years its effects have been largely offset by easier financing terms, so-called (that is, smaller down payments and longer term mortgages), particularly on FHA insured and GI loans. But we are about at the end of that road, unless, of course, interest rates on small house mortgages decrease substantially.

## Some Implications

From our admittedly poor knowledge of current metropolitan growth and our even poorer understanding of what lies behind it, no one can see, clearly and unmistakably, all or nearly all of its economic implications. Let me, however, list what seem to me the principal ones.

Future urban growth will call for many types of capital investment, both private and public—all on a large scale, some of them on an unprecedented scale. Thus, it could be a major stimulant to the economy and, in some circumstances, a contributor to inflation. Because of the low birth rates during the 1930's, the current rate of household formation in this country, a crucial factor in over-all housing need, has fallen off somewhat. In the early 1960's, however, it probably will pick up rapidly and may well surpass materially past rates, except those of the first few years after World War II (*7*). To some degree, postwar urban growth has been using up excess capacity in public facilities of various kinds. By and large, however, this process is now over. Evidence of this is in the rise of public investment in such facilities over the past few years. Outstanding local government debt in the United States went up by more than 92 percent from 1950 to 1956 (*8*). From now on, investment for these purposes may be expected to move up more sharply or shortages in some of the essential facilities of urban living—

schools, hospitals, highways, water, and sewer works—will become very serious.

Unless fairly drastic remedies are applied soon, the financial plight of many local governments in metropolitan areas will be aggravated to the point of crisis. The basic troubles here seem to be three: (i) the regressive, inflexible character of the principal sources of local tax revenue; (ii) antiquated, unrealistic debt limitations; and (iii) the Balkanization of local government jurisdictions that results in many local areas that are uneconomic for the provision of at least some services and also often results in great disparities in tax paying and borrowing capacity from local jurisdiction to local jurisdiction. To these are now added substantially higher costs of money to local governments. The yield on municipal bonds in late 1957 ranged from almost 4 percent to about 3.50 percent. For comparison, the average yield in 1950, on the same index (Standard and Poor's), was slightly under 2 percent (*9*).

The headlong growth and dispersal of metropolitan populations is bringing more and more into the spotlight of thoughtful discussion the concept of the physical plant of metropolitan areas. By *plant* in this context is meant the size, location, and relation to each other of the major land-use districts, the densities of their development, the transit and transport facilities by means of which people and goods are moved around and among them, and the utility facilities that serve them with power, light, communication, and water. An analogy, of course, is to a manufacturing plant—the amount and layout of floor space; its arrangement—whether on one or two floors or on several; the location and relation to each other of various departments in which raw materials or component parts are shaped, treated, and assembled; and the transport system by which materials and products move into, out of, and within the buildings and grounds of the establishment. But whereas many, perhaps most, industrial plant managers know about what size and kind of plant will approach the optimum for turning out the products of their companies, who knows what sizes and patterns of metropolitan plant will make possible the most efficient provision of public services and contribute most to the effective prosecution of the chief human activities—of individuals, families, and of business and industrial enterprises—that are carried on within it?

The pressures of urban growth in the near future may well sharpen this question to the point at which it can no longer be ignored. Once it is faced, responsible officials and other citizens may see, much more clearly than many of them now do, a substantial part of the case for metropolitan planning—financed and prosecuted at a substantially higher level than obtains in any metropolitan area today. And it should be only a short step further for these persons to realize that metropolitan planning can be truly effective only if the planning process is an integral part of a local government with metropolitan-area wide jurisdiction for certain purposes and services.

Lest I be misunderstood on this point, let me add three short comments. I do not believe that a metropolitan plant conducive to efficiency in public services and private activities is the only or even the highest objective of metropolitan planning and development. It is, however, an important one. Neither do I suggest that planning and guidance of metropolitan growth can or should be as close or as detailed as planning for an industrial plant. No one pattern of growth will be found best for all metropolitan areas, and, for any one, our present techniques and knowledge will often indicate more than one acceptable possibility. Finally, I believe that two of the most troublesome problems of metropolitan development—the money and the real costs of the journey to work and the plight of transit and transport services—are properly seen not as discrete or separable questions but as integral and important parts of this more inclusive issue.

Future urban growth seems almost certain to aggravate the already formidable problems of central business districts in central cities. It also may well hasten the onset of similar difficulties in the older and larger suburbs.

The current ills of central business districts are largely attributable to three conditions. Blight, largely in the form of obsolete, overly dense residential development in near-in parts of central cities, has hastened the outward movement of many well-to-do and middle income families on whose aggregate purchasing power stores, shops, and some other central business district operations have depended heavily. Much of this purchasing power is now being spent in other districts, including, but not limited to, the major outlying shopping centers, which have sprung up so rapidly in recent years, and which are more conveniently located for many of these customers. Secondly, most central districts, particularly those in the larger cities, have sought and encouraged a fairly high degree of congestion. Over the years transit facilities and major street systems have poured more and more customers and workers into these areas. Property values reflect this concentration of business activities. Employees and customers endured the resultant crowding and inconvenience as long as they had, or felt that they had, no feasible alternative. Both, but particularly the retail customers, now feel otherwise and are acting accordingly. But attempts to redress the competitive position of central business districts in respect to many businesses are severely hampered by the huge investment in and high asking prices for central district properties. Finally, transit and traffic congestion for many people going to and from the central business districts has been worsened by a smaller but still considerable volume of bus, subway, and car riders whose destinations are in the areas immediately around the business district. Some of these latter travelers are engaged in businesses, industries, and services that can operate most efficiently only in such locations—that is, near at hand to the central district. Quite as clearly, however, some undetermined but substantial proportion of them are adding to the congestion in the central areas largely because only in their peripheries, more specifically in the old, largely obsolete buildings typical of such locations, can their employers find the combination of a sizable, easily tapped labor pool and cheap rents.

Even such a quick and incomplete analysis suggests the seriousness of the present plight of many central business districts. In my opinion, the nature of the current and prospective urban growth as well as their rate or speed indicate that this plight will become worse before it becomes less severe. It is one of the most difficult problems among the by-products of recent and prospective urban growth. My task here is to point up implications of growth, not to propose or to discuss remedies for all urban ills. Maybe, however, I should say that I do not share the view that central business districts in metropolitan areas are doomed to wither and fade away. Neither do I subscribe to the firm assertions, for which no evidence seems to be forthcoming, that unless these districts are maintained, at whatever costs to public and private purses, at their present size, pattern, and character, dire consequences for the economic and social

health of their metropolitan areas are certain to ensue. Rather, I would expect that, over the next generation or more of urban development, many central districts will become more specialized functionally and will change substantially in their physical character and density. The principal questions of public policy, then, are how these changes are to be brought about more rapidly and orderly and in ways that will maximize the benefits, direct and indirect, over the costs, also direct and indirect.

Finally, I think we can expect that with continuing urbanization the blighting process in the older parts of metropolitan areas, particularly in the central cities, will continue and may even accelerate in the near future. It may well show up in the older suburbs on a considerable scale. In my opinion it is at least a potential threat in many outlying areas built up since World War II. Unfortunately, many of them have at least some of the seeds of deterioration and blight: construction of not too high quality; inadequate open space and space for public activities, institutions, and services; a high proportion of small units that make for overcrowding and high rates of turnover; a shortage, to put it mildly, of those amenities important in residential quality and character that make for stability of occupancy and pride in one's house and its neighborhood.

Although, under the label of urban redevelopment or renewal, many municipalities are experimenting with attacks on blight in many of its various forms, I doubt that any sizable community has actually reduced its blighted area or materially slowed down the blighting process within its boundaries. This should not astonish anyone who will consider for a moment the obstacles confronting these new, complex, and difficult programs.

Beyond the usual obstacles—financial, administrative, physical and social—to redevelopment programs, I think I see two very disquieting omens for the future of urban renewal and blight prevention. One is the almost total absence of any clear recognition by most central city planners and redevelopment officials of the implications for their programs of this new pattern of settlement that is characteristic of current urbanization. To be sure, not every present and prospective resident of central cities wants open, spacious low-density living areas. Quite as surely, however, many, probably most of them, do not want the kind of quarters and ways of life that go with the so-called high-rise apartment structures that are becoming the hallmark of redevelopment, even in many cities in which very few, if any, building of this kind had been built until recent years. How big is this market? What should be done with the other blocks or square miles of badly blighted area that cannot be absorbed by such structures? I find disturbingly little serious discussion of such questions, and most of it seems to reflect either ignorance of what is happening to urban patterns in this country and why, or else the curious notion that central city rebuilding can safely proceed without regard to these changing patterns.

The other disquieting aspect of current urbanization is the failure to acquire in advance substantial areas for parks, playgrounds, forest preserves, beaches, schools, libraries, parking lots, and other public and quasi-public uses in the rapidly growing suburban and fringe areas. To be sure, many of these areas now seem spacious and open enough, but most of them will fill in fast. As they do, land prices will rise—often sharply. Almost before the need is appreciated, the opportunity to do this crucial job adequately and imaginatively may be gone. And this is just another way of saying that we will have produced $x$ thousands of square miles of urban residential development that almost from its beginning, certainly from its early maturity, will fail to meet the needs of most of its residents. Once such a statement can fairly be made about residential districts, the handwriting of eventual blight is on the wall for nearly all of them.

As one looks back over my observations on the probable and possible consequences of urban growth in the near future, he might conclude that, with few exceptions, the implications are gloomy indeed. Growth, so it seems, is going to produce some new problems and aggravate many others, possibly to a degree that will make them almost new difficulties for a healthly urban economy. Of course I would defend my conclusions as realism; to others they may seem the fears of a tired and weak mind. Be that as it may, it seems likely (although not much direct evidence is at hand) that scores of thousands of families whose decisions and actions, in the aggregate, have made the current pattern of urban development over the past few years have added to the sum total of their satisfactions and utilities. If economics is concerned with the allocation of scarce resources to meet human needs, this accomplishment is a notable economic implication in its own right. Unless, however, the problems I have tried to sketch are dealt with intelligently, the degree of utility found in living in these newer areas may well decline; the costs, real and monetary, will surely rise, both for residents of these districts and for those in other parts of metropolitan areas, often miles away, who will have to pay, in one way or another, for some of the by-products of urban growth.

## The Time Element

At several points in this paper I have adverted to the time element or the actual and the probable future rate of urban growth. Now I wish to emphasize briefly this aspect of the matter because it is a significant factor, both in a true picture of urban increase and in the problems of public policy that urban growth and its economic implications raise. Only a very few indicators of this element can be cited.

According to the latest projections of the Bureau of the Census, the population of the United States in 1975 may be between 216 million and 244 million people (*10*). For our purposes we may take 220 million as a round and not improbable figure. This would mean an increase of roughly 70 million over 1950. If metropolitan areas should continue to get 85 percent of the national population growth (the proportion they are thought to have received over the first 6 years of this 25-year period), their increase would be about 59.5 million. (On the same basis of estimate, the nonmetropolitan urban areas would increase by slightly less than 7 million.)

An increase of 59.5 million in metropolitan populations in 25 years may seem offhand a substantial volume of growth. Two comparisons may give it more meaning. In 1950 the officially designated metropolitan areas had an aggregate population of 83.8 million. Thus, the increase projected for 25 years is approximately 71 percent of the total metropolitan population at the beginning of the period. Also, of the 168 Standard Metropolitan Areas in 1950, 14 had populations of more than 1 million. Their aggregate population was 44.4 million. The projected metropolitan population growth for 25 years, therefore, is roughly equal to the 1950 populations of the metropolitan areas (not of their central cities alone) of New York-Northeastern New Jersey, Chicago, Los Angeles,

Philadelphia, Detroit, Boston, San Francisco-Oakland, Pittsburgh, St. Louis, Cleveland, Washington, Baltimore, Minneapolis-St. Paul, and Buffalo, plus 15 million persons more.

For me, these are sobering if not staggering figures. When against this backdrop one reviews the problem, implications that I have tried to outline as well as others, both economic and noneconomic in character, that might be added, and considers how ill prepared we in this predominantly urban nation are to deal with them intelligently and in time, he may be pardoned if he concludes that this country has a few things to worry about besides the Sputniks. The metropolitan outlook is grave, in my opinion, not because its problems are impregnable, but because our poor preparation for dealing with them is found on so many fronts—in basic understanding of the problems themselves, in governmental and private institutional means for deciding on policies and pressing forward with them, and in public appreciation of the scale and seriousness of the issues.

In the lifetimes of most of us, not only the face but also the physique of urban America is going to be changed —radically changed. In my opinion we simply cannot afford to muddle along as we are now doing—building a parking garage here or there, transferring a bankrupt transit company to public ownership, tearing down a few blocks of old houses, hiring another junior planner or two when we can find them, nursing our petty, parochial prejudices, whether in central city or suburb, trying to decide if we should not raise the dog license fee a dollar to keep our local government out of the clutches of that evil foreign octopus that is headquartered in Washington, and tentatively suggesting that maybe it is about time to begin to think about setting up a metropolitan planning body or a special authority responsible for *both* water supply *and* sewage disposal. If we continue in this vein, well before 1975 we will have lost one of the finest opportunities any generation of Americans ever had: the opportunity to make our rapidly growing urban localities into things of economy, beauty, and livability, appropriate settings for metropolitan communities that we and our children can live in and take part in with pride.

### References and Notes


1. "Civilian population of the United States, by type of residence, March 1956 and April 1950," *U.S. Bur. Census, Ser. P-20, No. 71 (1956)*. This report is the source of other figures cited in this article.
2. V. Jones, "Economic classification of cities and metropolitan areas," in *Municipal Year Book* (International City Managers' Assoc., Chicago, 1953), pp. 49–57.
3. *Housing in the United States* (U.S. Housing and Home Finance Agency, 1956), pp. 54, 75. The study here reported was made by the Bureau of Labor Statistics.
4. "Family income in the United States: 1955," *U.S. Bur. Census, Ser. P-60, No. 24 (1957)*, p. 21.
5. *Housing in the Economy, 1955* (U.S. Housing and Home Finance Agency, 1956), p. 18.
6. *Housing Statistics* (U.S. Housing and Home Finance Agency, Oct. 1957), pp. 5, 21.
7. "Projections of the number of households and families: 1960 to 1975," *U.S. Bur. Census, Ser. P-20, No. 69 (1956)*, p. 1.
8. "Statistical abstract of the United States, 1957," *U.S. Bur. Census,* Table No. 486, p. 406, and "Summary of governmental finances in 1956," *U.S. Bur. Census,* Table No. 17, p. 33.
9. "Statistical abstract of the United States, 1957," *U.S. Bur. Census,* Table No. 562, p. 466.
10. "Illustrative projections of the popluation of the United States, by age and sex: 1960 to 1980," *U.S. Bur. Census, Ser. P-25, No. 187 (1958)*, p. 2.


# Biochemical Theories of Schizophrenia

## Part II of a two-part critical review of current theories and of the evidence used to support them.


Seymour S. Kety


In part I of this article [*Science,* **129,** 1528 (1959)], an attempt was made to discuss the possible sources of error peculiar to biological research in schizophrenia, including the possible heterogeneity of that symptom complex and the presence of certain biological features—such as adventitious disease, nutritional deficiencies, disturbances associated with abnormal motor or emotional states, and changes brought about by treatment, all of which may be said to result from the disease or from its current management rather than to be factors in its genesis. The difficulty of avoiding subjective bias was emphasized. Some of the hypotheses relating to oxygen, carbohydrate, and energy metabolism, to amino acid metabolism, and to epinephrine were presented, and the existing evidence relevant to them was discussed. Among the recent or current concepts there remain to be discussed those concerned with ceruloplasmin, with serotonin, and with the general genetic aspects of schizophrenic disorders.

### Ceruloplasmin and Taraxein

The rise and fall of interest in ceruloplasmin as a biochemical factor significantly related to schizophrenia is one of the briefest, if not one of the most enlightening, chapters in the history of biological psychiatry. The upsurge of interest can be ascribed to a report that a young Swedish biochemist had discovered a new test for schizophrenia. The test depended upon the oxidation of N,N-dimethyl-*p*-phenylenediamine by ceruloplasmin (*1, 2*). It is difficult to understand the exaggerated interest which this report aroused, since Holmberg and Laurell (*3*) had demonstrated previously that ceruloplasmin was capable of oxidizing a number of substances, including phenylenediamine and epinephrine, and Leach and Heath (*4*) had already published a procedure based on epinephrine oxidation which was equally valid as a means of distinguishing schizophrenics from normal subjects and had identified the oxidizing substance as


The author is chief of the Laboratory of Clinical Science, National Institute of Mental Health, National Institutes of Health, Bethesda, Md.

This article is based on the Eastman Memorial Lecture, delivered at the University of Rochester, December 1957, and on a paper presented at the Third International Neurochemical Symposium, Strasbourg, August 1958.