

Population Problems

The following two articles—by Alan Gregg and Curt Stern—are based on papers given by the authors in the symposium on "Population problems," held in Berkeley, California, on 28 Dec. 1954, which comprised the second part of the general symposium on Science and Society. The other two parts of the general symposium were devoted to "Natural resources: power, metals, food" and "Science in human thought and action." Articles based on the papers presented in these sessions will appear in subsequent issues.

A Medical Aspect of the Population Problem

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THE medical aspects of what is called the population problem defy condensation into a brief paper. Even the relatively few factors we know something about are too numerous and too intricately involved with one another and with external circumstances to lend themselves to summary exposition. For this reason I propose to offer only one idea regarding the population problem. It hardly deserves to be called a medical aspect: it is rather the view of one who has had a medical training—a single idea around which subordinate reflections of a rather general sort present themselves.

In exposing this one idea I recall the Spartan custom of exposing infants to the rigors of the weather, in the conviction that such a practice weeds out the weaklings. To expose an infant idea to the rigors of a scientific atmosphere before providing the poor little thing with the support of experimental evidence or with the power of demonstrated predictive value may seem like Spartan treatment. But if the idea dies of exposure, its exit will be at least more dignified and permanent under AAAS auspices than under any other I could invite or invent. I should therefore witness its death with a very fair semblance of Spartan parental fortitude.

The way in which physicians estimate, by a sampling procedure, the number of white blood cells in the blood of a patient is generally known. In essence, it involves diluting a carefully measured amount of blood in a carefully measured amount of water, counting the number of cells found in a defined cubic volume of the blood thus diluted, and then computing the number of cells per cubic millimeter of blood. A similar method is applied to counting the red cells of the blood. Although such cell counts vary somewhat among individuals and in any one individual under varying conditions of activity, any variation of the order of 400 percent or more would usually justify the suspicion of being pathological. If, for example, a patient's white-cell count moved up within a month from 5000 to 23,000, a physician would think of the possibility that he was witnessing an early stage of

leukemia—an uncontrolled growth in the numbers of white blood cells.

Now new growths of any kind (popularly called cancer) involve an increase in the number of some one kind of cell and, hence, a corresponding increase in the size of the organ or tissue involved. However, not all increases in the size of organs are the result of new growths: the heart hypertrophies—that is, grows larger—to make up for leaky valves and its lost efficiency as a pump; the uterus grows in volume remarkably during pregnancy; the organs and tissues of the growing child also present obvious increases in cellular numbers. But in these increases there appears to be a limit at which further cell reduplication stops or is in some way inhibited. Indeed, one has the mystified impression that there is a process involved that in its effect resembles self-restraint or self-limitation. One cannot, of course, attribute a sense of decorum to cells, even though we can give no better answer than ignorance to the question of why organs show a relative uniformity of size and shape in the normal state. But the fact remains that, in all but one instance, organs and tissues in their growth seem to "know" when to stop.

The exception, of course, is the whole category of new growths, or neoplasms (popularly called cancer), of which there are two main sorts—the benign and the malignant. Fibroids of the uterus furnish a good example of benign tumors; cancer of the stomach, of the malignant. I shall return to some of the more important characteristics of new growths, but now I would like, at this point, to introduce another set of considerations more apparently related to the population problem.

If we regard the different forms of plant and animal life in the world as being so closely related to and dependent on one another that they resemble different types of cells in a total organism, then we may, for the sake of a hypothesis, consider the living world as an organism. I would not merely admit that this is a hypothesis—I would insist that it is only a hypothesis. Perhaps more cautiously one would say that such

a hypothesis is no more than a scaffolding. For a scaffolding may serve, but does not enter into, the final structure of established fact.

Let us look, then, at the different forms of life on this planet as a physician regards the federation or community of interdependent organs and tissues that go to make up his patient. What would we think if it became evident that within a very brief period in the history of the world some one type of its forms of life had increased greatly in number and obviously at the expense of other kinds of life? In short, I suggest, as a way of looking at the population problem, that there are some interesting analogies between the growth of the human population of the world and the increase of cells observable in neoplasms. To say that the world has cancer, and that the cancer cell is man, has neither experimental proof nor the validation of predictive accuracy; but I see no reason that instantly forbids such a speculation. If such a concept has any value at the outset, we should quite naturally incline to go further by comparing the other characteristics of new growths with the observable phenomena related to the extraordinary increase now noted in the world's population. An estimated 500 million in A.D. 1500 has grown, in 450 years, to an estimated population of 2 billion today. And the end is not in sight—especially in the Western Hemisphere.

What are some of the characteristics of new growths? One of the simplest is that they commonly exert pressure on adjacent structures and, hence, displace them. New growths within closed cavities, like the skull, exert pressures that kill, because any considerable displacement is impossible. Pressure develops, usually destroying first the function and later the substance of the normal cells thus pressed upon. For a comparison with a closed cavity, think of an island sheltering a unique form of animal life that is hunted to extinction by man. The limited space of the island resembles the cranial cavity whose normal contents cannot escape the murderous invader. Border warfare, mass migrations, and those wars that are described as being the result of population pressures resemble the pressures exerted by new growths. We actually borrow not only the word *pressure* but also the word *invasion* to describe the way in which new growths by direct extension preempt the space occupied by other cells or types of life. The destruction of forests, the annihilation or near extinction of various animals, and the soil erosion consequent to overgrazing illustrate the cancerlike effect that man—in mounting numbers and heedless arrogance—has had on other forms of life on what we call “our” planet.

Metastasis is the word used to describe another phenomenon of malignant growth in which detached neoplastic cells carried by the lymphatics or the blood vessels lodge at a distance from the primary focus or point of origin and proceed to multiply without direct contact with the tissue or organ from which they came. It is actually difficult to avoid using the

word *colony* in describing this thing physicians call metastasis. Conversely, to what degree can colonization of the Western Hemisphere be thought of as metastasis of the white race?

Cancerous growths demand food; but, so far as I know, they have never been cured by getting it. Furthermore, although their blood supply is commonly so disordered that persistent bleeding from any body orifice suggests that a new growth is its cause, the organism as a whole often experiences a loss of weight and strength and suggests either poisoning or the existence of an inordinate nutritional demand by neoplastic cells—perhaps both. The analogies can be found in “our plundered planet”—in man's effect on other forms of life. These hardly need elaboration—certainly the ecologists would be prepared to supply examples in plenty of man's inroads upon other forms of life. Our rivers run silt—although we could better think of them as running the telltale blood of cancer.

At the center of a new growth, and apparently partly as a result of its inadequate circulation, necrosis often sets in—the death and liquidation of the cells that have, as it were, dispensed with order and self-control in their passion to reproduce out of all proportion to their usual number in the organism. How nearly the slums of our great cities resemble the necrosis of tumors raises the whimsical query: Which is the more offensive to decency and beauty, slums or the fetid detritus of a growing tumor?

One further analogy deserves attention. The individual cells of new growths often show marked variations of size, shape, and chemical behavior. This may be compared with the marked inequalities of health, wealth, and function so conspicuous among the human beings in overpopulated countries. Possibly man's invention of caste and social stratification may be viewed in part as a device to rationalize and control these same distressing discrepancies of health, wealth, and status that increase as the population increases.

By now the main posts and planks of my scaffolding must be obvious. In the history of science there have been hypotheses that, although not true, have led to truth. I could hope that this somewhat bizarre comment on the population problem may point to a new concept of human self-restraint. Besides ennobling human life, it would, I think, be applauded by most other forms of life—if they had hands to clap with. Or are we deaf to such applause?

And finally, I submit that if some of the more thoughtful cells in, say, a rapidly growing cancer of the stomach could converse with one another, they might, quite possibly, reserve some afternoon to hold what they would call “a discussion of the population problem.”

If Copernicus helped astronomy by challenging the geocentric interpretation of the universe, might it not help biology to challenge the anthropocentric interpretation of nature?