POPULATION GROWTH AND HUMAN PROGRESS

By Paulo C. Campos, M.D., Academician

It is obvious that the population in the world is in a period of explosive growth, geometric in pattern (Figure 1). Whereas, it took a millenium before the earth could have the first billion population; the second billion took only a hundred years; the third bil-

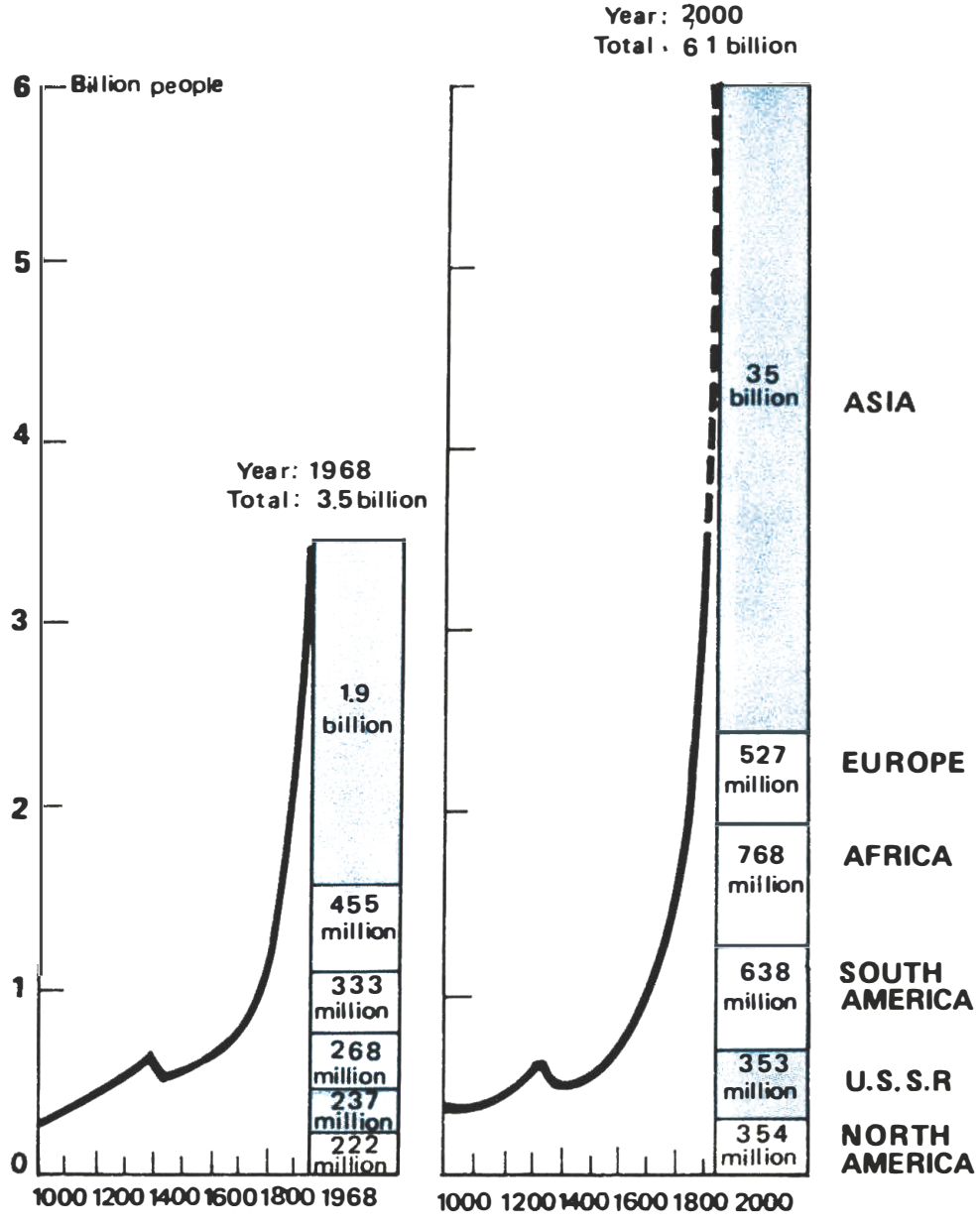

Figure 1. Population by world areas A.D. 1000-2000.

*Excerpt of address delivered by Dr. Paulo C. Campos, President of the National Academy of Science & Technology during the 2nd annual presentation of papers held on July 15, 1980 at the Philippine International Convention Center.

lion, 50 years; the 4th billion, 15 years; the 5th billion, only 9 years; the 6th million will only take 5 years, etc. (Figures 2 and 3). So one begins to wonder and worry about the future as the available food and resources on earth become scarce. At this juncture, we have to fall back on our observations on living systems we encounter in nature.

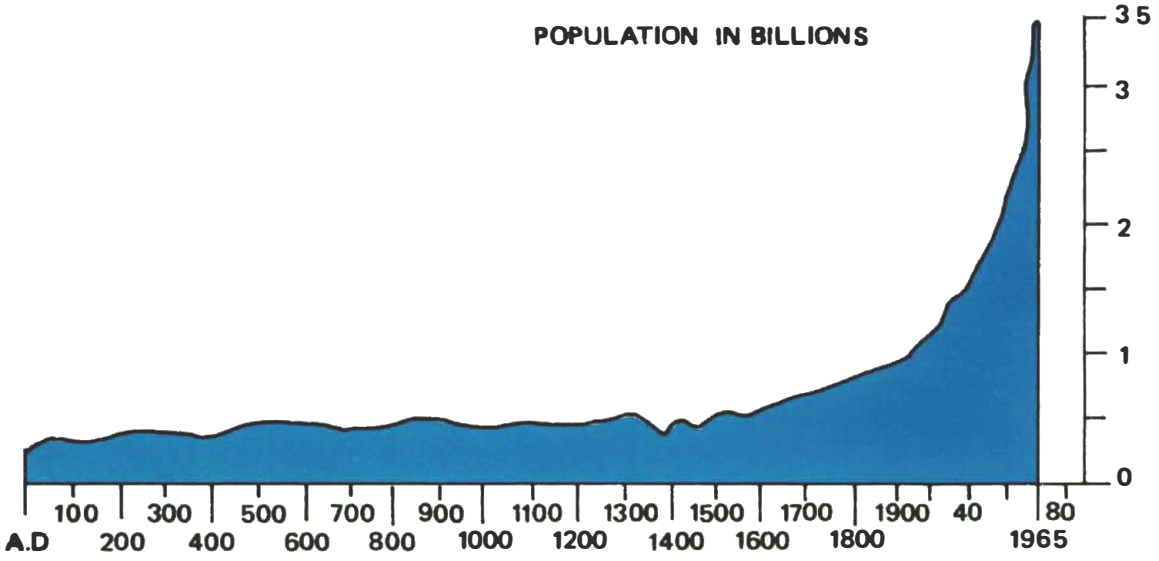

Figure 2. World population estimated A.D. 0-1965.

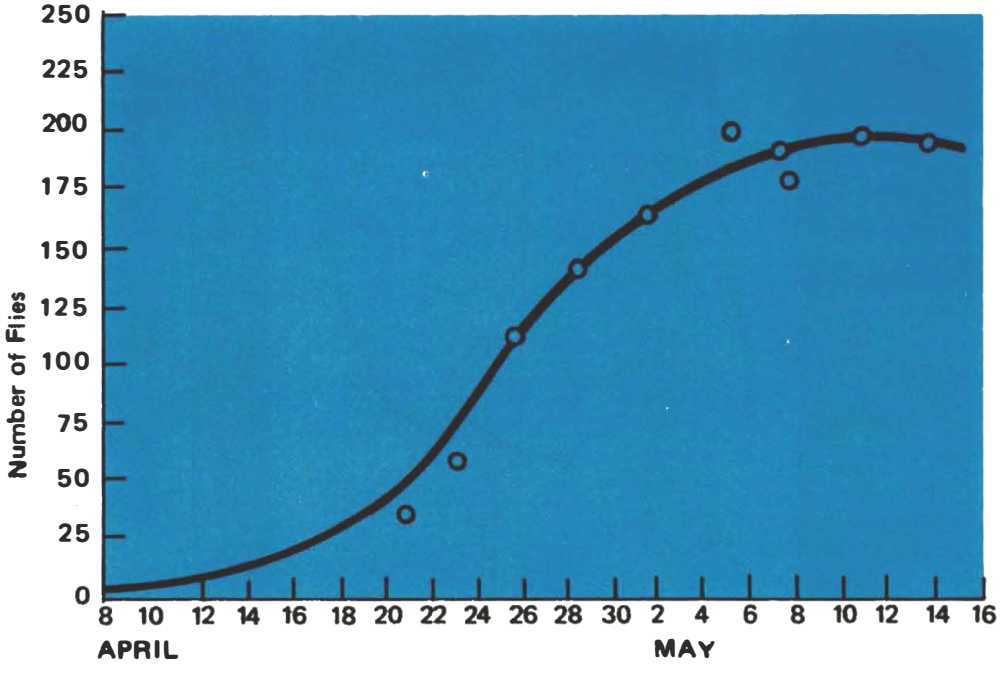

Figure 3. Growth of fruit-fly population.

A valid model is the growth curve of the fruitfly (Figure 4). It starts with a slow growth rate, then slowly accelerates into a more explosive growth rate. However, at some point, the growth rate starts to decelerate until it levels off in a plateau. In other words, it is an S-shape or sigmoid curve.

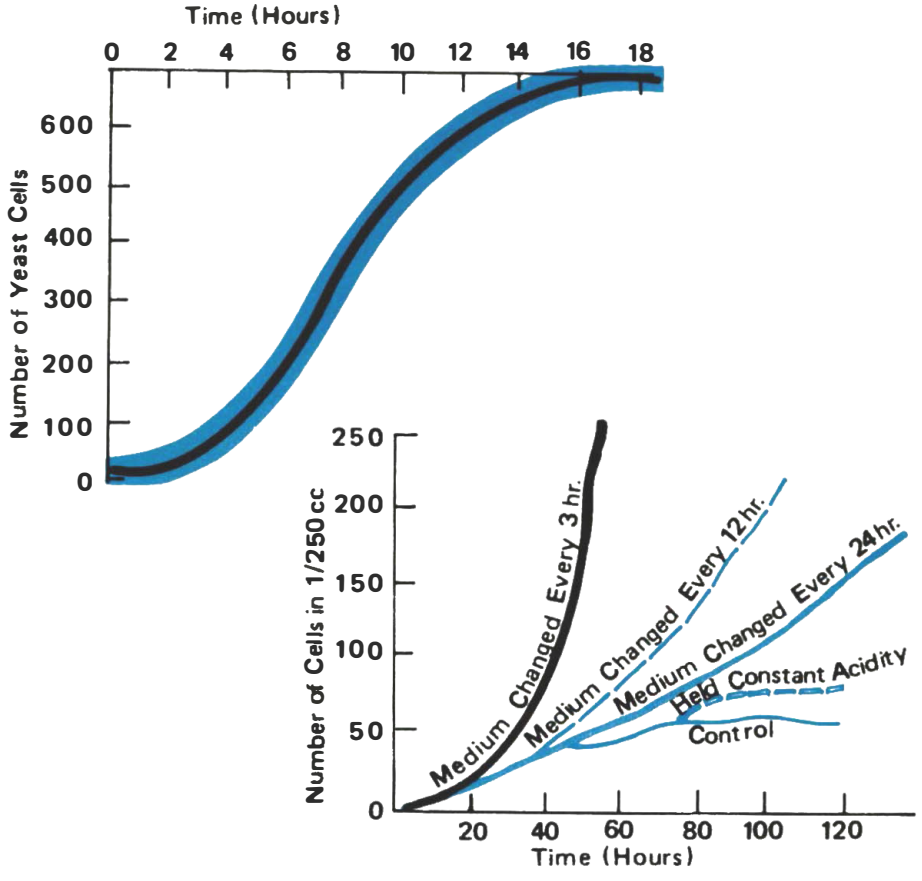

Figure 4. The upper graph depicts the growth curve of yeast cell grown in a laboratory culture and refers to the table immediately above. The lower graph shows the growth curves of yeast cells grown under varying environmental conditions.

This is the same observation in other living systems like the yeast (Figure 5). It has further been demonstrated that the growth of yeast cells in culture can be altered by changing the ph and the frequency with which the medium is changed.

Antibody responses follow a sigmoid curve but can be modified with the introduction of reinforcing substances (Figures 6 and 7).

The growth curve of the sheep population in Australia followed an initial sigmoid pattern followed by an equilitratory state (Figure 8).

If we are to project a possible trajectory for the human population growth curve, the sigmoid or "S" curve is one strong possibility.

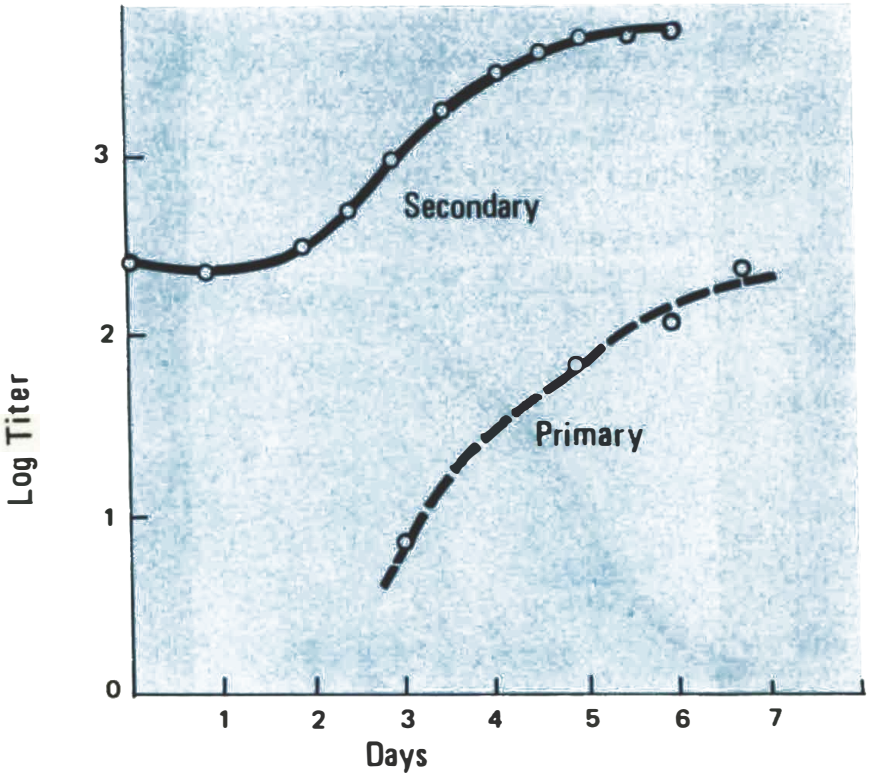

Figure 5. The primary and secondary antibody responses of two rabbits to intravenous injections of a "vaccine".

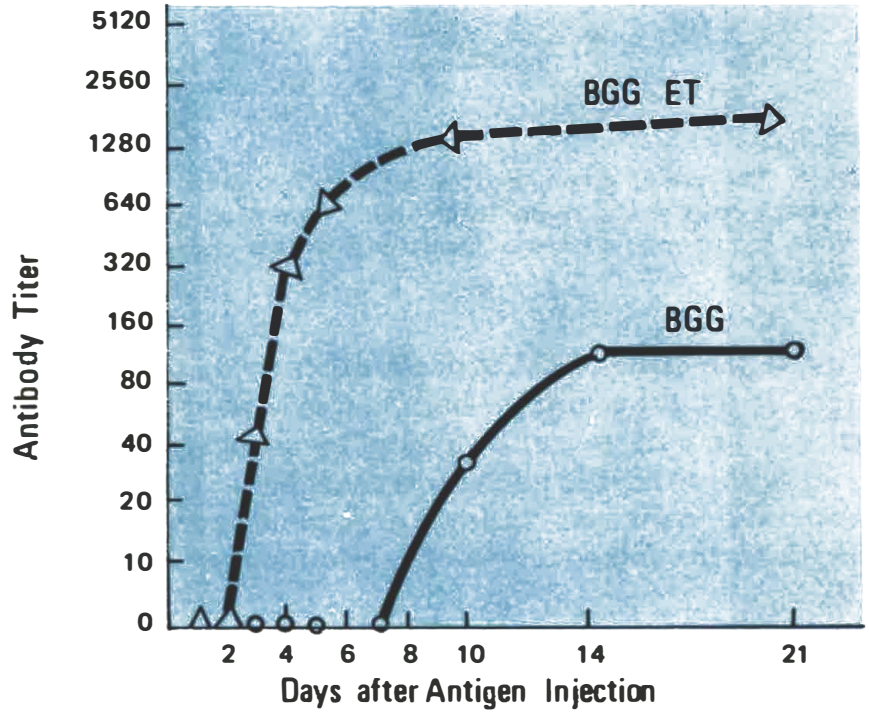

Figure 6. The primary and secondary antibody response in mice injected with bovine gemma globulin (BGG) with and without the reinforcing effect of another substance, endotoxin (ET).

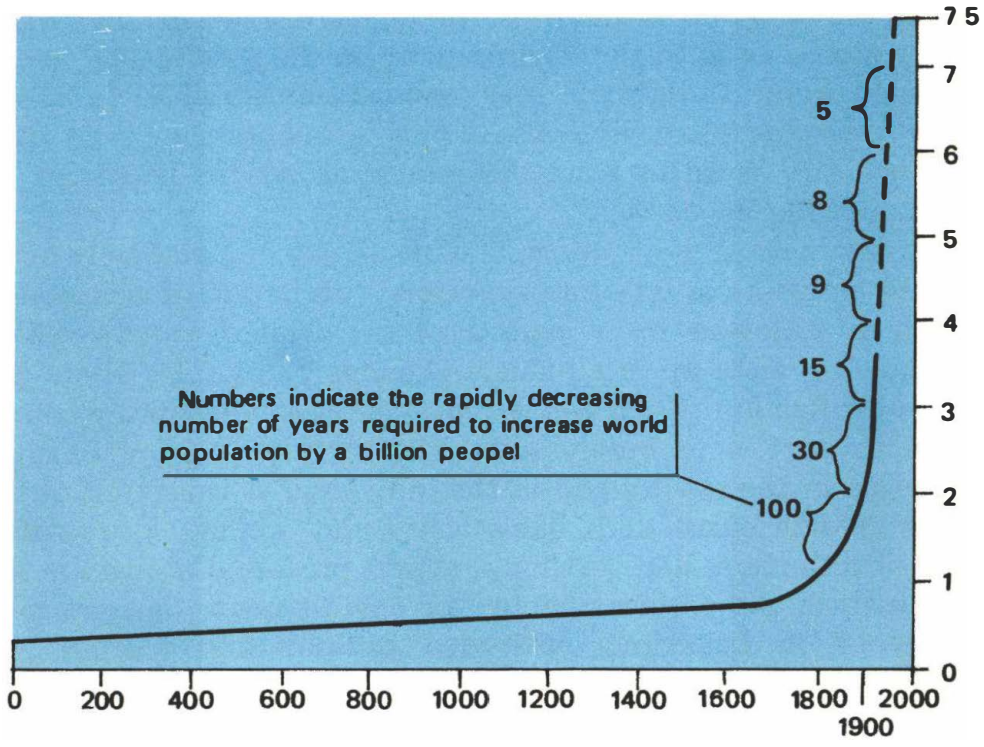

Figure 7. Adapted from "The Population Bomb".

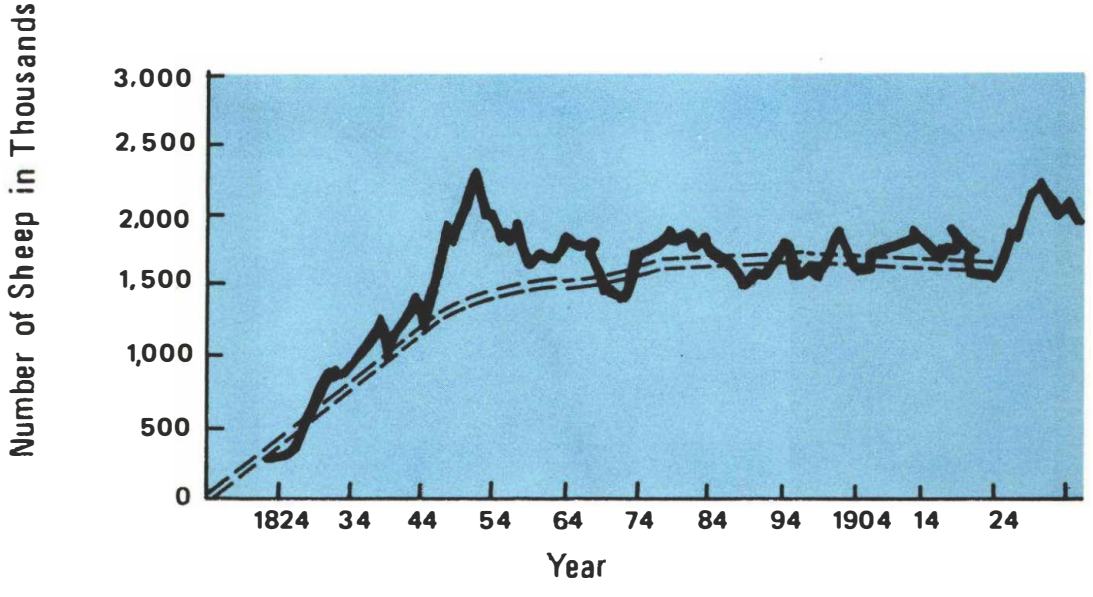

Figure 8. Growth curve of sheep following their introduction to an area. Note initial sigmoid pattern followed by approximate equilibrium.

The implication is that there are regulatory mechanisms in all living systems, both in the environment, in the species, and in the individual itself. These regulatory mechanisms are possibly coded in the germplasm but it is also highly probable that they have some intuitive sense to react differently at various points of its evolution along the curve.

If we look at the S curve, it starts slowly and gradually picks up then enters a period of acceleration. This period of accelerated growth is followed by a period of decelerated growth which subsequently ends up in a plateau (Figures 9, 10, 11). There is a point of inflection which we can imagine as a break in the course of evolutionary time. Surely and most certainly profound changes take place in the species and in the individual at this point of the human growth curve. It is likely that today we are close to that point of inflection; and we should expect profound changes in the individual, in the species and in our environment. Changes may initially be in behaviour, attitudes, outlook and reactions to stimuli, influences, and events.

What makes man a little more complex and difficult to understand, is that man is attributed with the capacity of ***learned behavior*** and ***individual will*** which is absent in lower animals. The point of greatest concern is how we (man) would and should exercise these attributes. In the past, the struggle is between man and his environment. Now, the battle is between man and his species. We are moving into the era when the struggle will have to be in the individual himself.

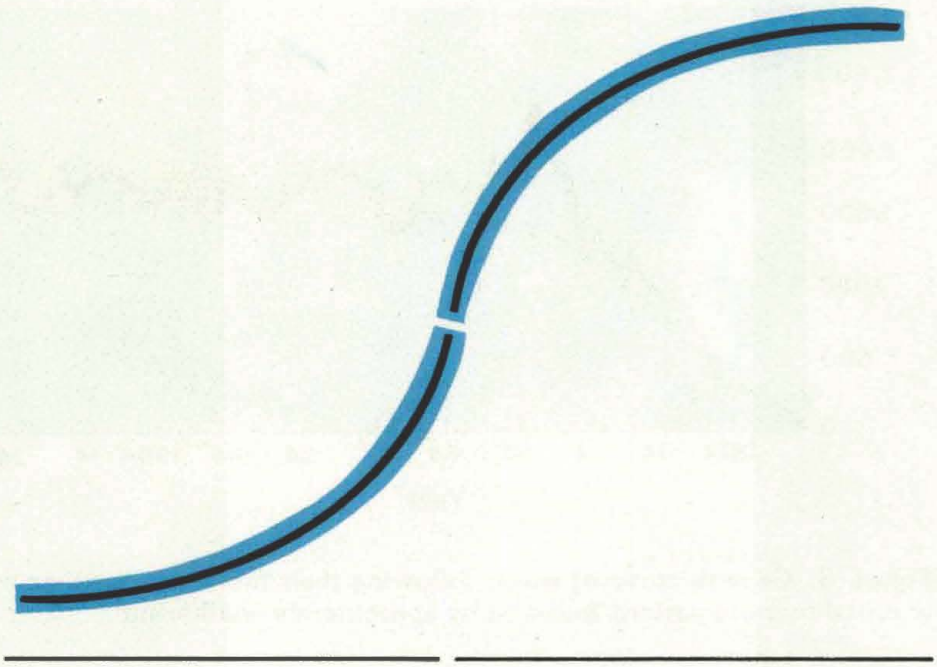

Figure 9.

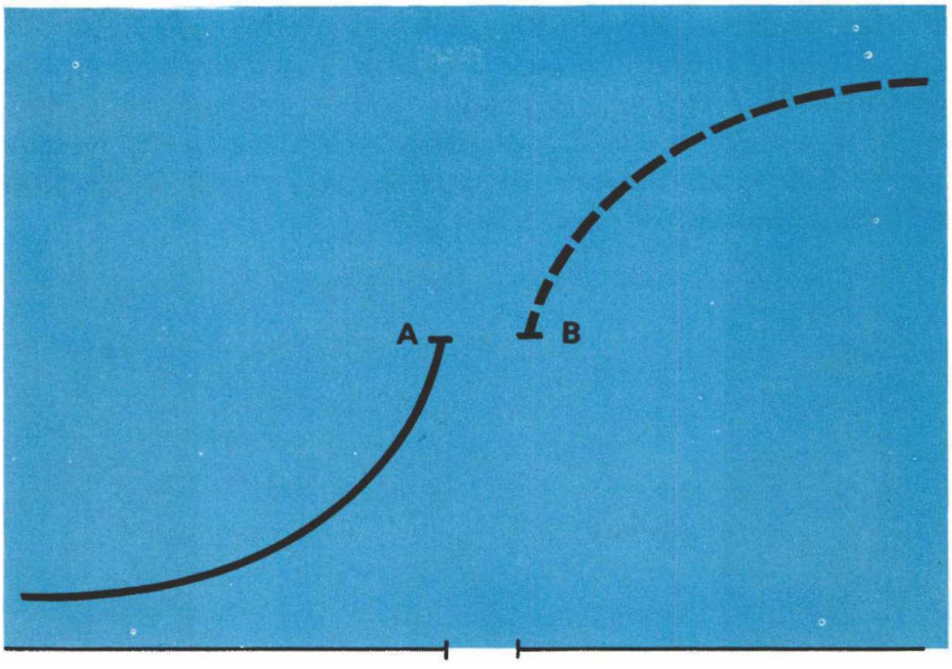

Figure 10.

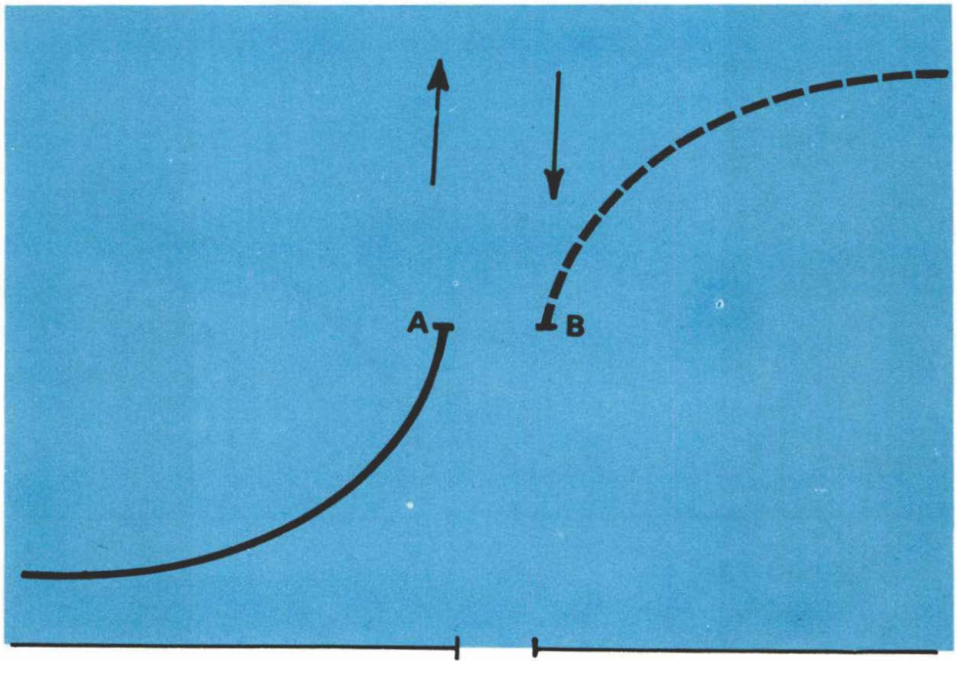

Figure 11.

Many of us are lost or confused, because each individual seem to be imbued with two patterns of behavioral development (Figure 12). It follows a dualistic pattern characterized by features and attributes similar to those in Figure A and another set of attributes similar to those found in Figure B (Figure 13). They tend to come into conflict in man, in his species, and in the individual itself. Man, however, by exercising judgement and his capacity to select, need not follow the patterns of unrestrained growth which would lead to his extinction.

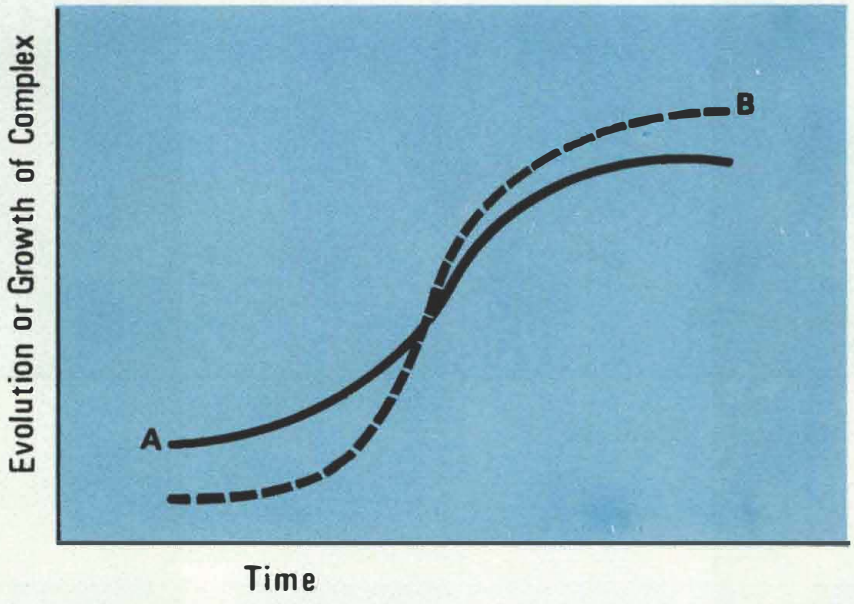

Figure 12.

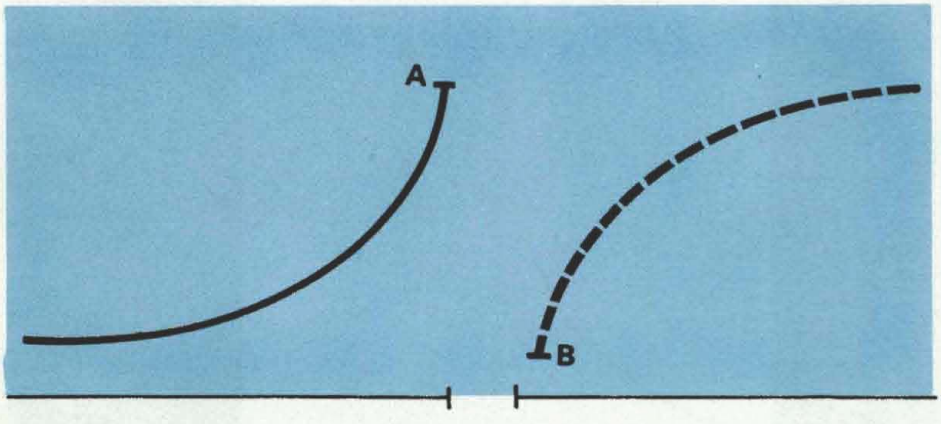

Figure 13.

We need not follow the pattern of the lemmings either (Figure 14) as was originally advocated by Malthus — war, famine, and pestilence — will keep population with the limits of earth's resources. We need not follow the sigmoid curve of living systems, as presented by the fruitfly model but we can follow a growth

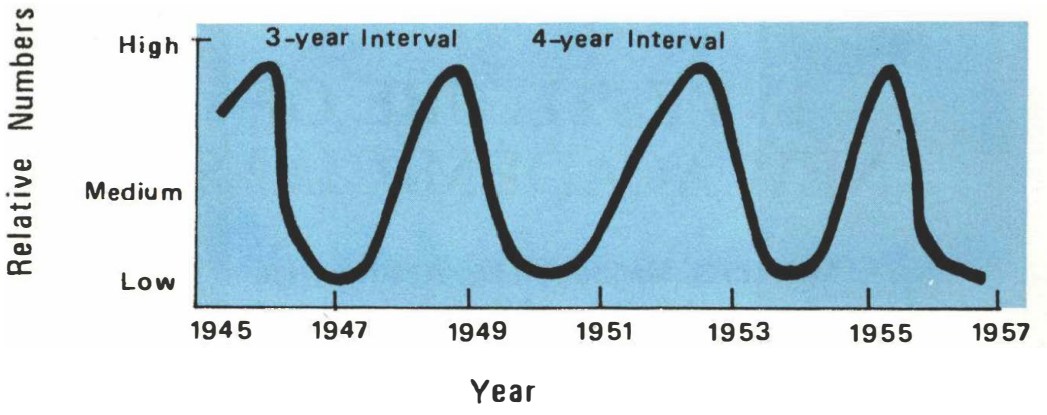

Figure 14. Generalized curve of the three-to-four year cycle of the brown lemming population.

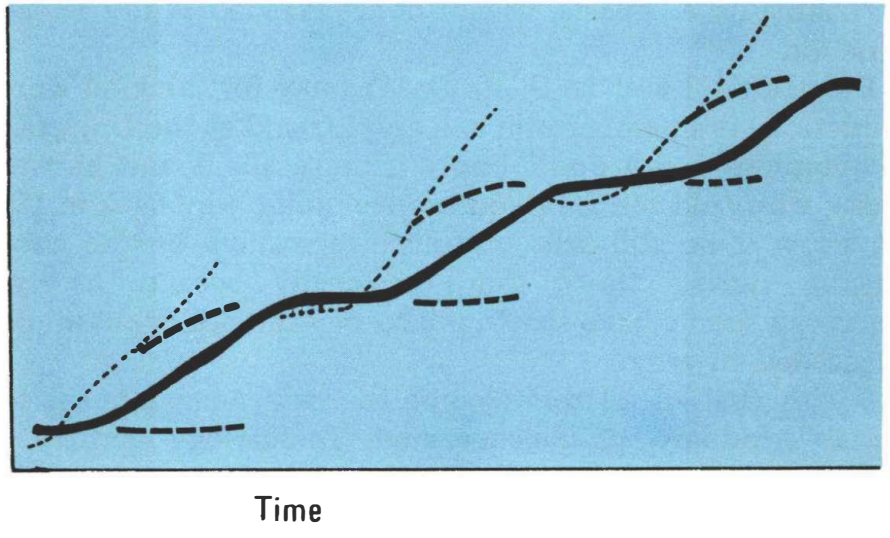

Figure 15.

curve where man can harness the environment, exercise control over his species and tame his dualistic nature. In resume, man has more than an alternative for his choice. We can observe three or four patterns of curves for human progress vis-a-vis population growth:

The first is one of unrestrained growth which, of course could only lead to extinction;

The second is the catastrophic growth curve as exemplified by the lemmings (Figure 14);

The third is the S or sigmoid curve; and,

The fourth is the curve where adjustments and adaptations play significant roles specially in species like *Homo sapiens* where judgement and the power to select is an attribute. Such a curve is Figure 15.