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## BOOK REVIEW

Gordon R. Taylor, *The Biological Time-Bomb*, pp. 230 (The hard-cover edition from the World Publishing Company, is \$5.50; the New American Library paper back version is 95¢.)

by Arthur Pedoe

The explosion inferred in the title is that of our advance in biological knowledge—man's probe into nature: the origin of life, the deferment of death, tinkering with heredity, the transplantation of organs, etc. While the book was in the press several of the achievements forecast to be accomplished "within the next five or ten years" became accomplished facts—here is a list of those forecasts:

1. Extensive transplantation of limbs and organs.
2. Test-tube fertilization of human eggs.
3. Implantation of fertilized eggs in womb.
4. Indefinite storage of eggs and spermatozoa.
5. Choice of sex of offspring.
6. Extensive power to postpone clinical death.
7. Mind-modifying drugs: regulation of desire.
8. Memory erasure.
9. Imperfect artificial placenta.
10. Artificial viruses.

These items give an idea of a few of the matters discussed in the text. An account is given of research taking place on matters of the greatest interest and practical importance to actuaries in underwriting, mortality trends and longevity. One chapter is headed "Is Death Necessary?" In case it is inferred that the book is another of those popular science texts where fact and fiction are inextricably mixed, with emphasis on the latter—it makes better headlines—the author's background should be outlined.

Mr. G. R. Taylor has written other biological texts including "The Science of Life" (McGraw Hill, 1963) which has a foreword by the Professor of History of Science at Harvard. Until recently he was editor of the B.B.C.'s science program which involved extensive travel in the United States and other countries to contact leaders in the biological field. Full credit is given to the leadership of the U.S. in biological research. A biologist with extensive experience in journalism and in close touch with biological

developments has a unique background for a work of this nature.

Dwelling on the future the author gives what in his opinion will be accomplished after 1975 and before the year 2000. Among the twelve items named are: enhancement of intelligence in men and animals, prolongation of youthful vigour and organ regeneration. Note the last item refers to *regeneration* not *transplantation* which has already been accomplished. In the final phase which covers accomplishments after the year 2,000 he refers, among other items, to "control of ageing: extension of life span; gene insertion and deletion; indefinite postponement of death."

The author refers to a recent objective study held in the U.S. of current trends by 82 experts and records that these experts expect to see primitive forms of life created in the laboratory in the next twenty years and the control of hereditary defects by the year 2,000. Referring to these experts the author states "like me they don't expect extension of life until the same date (year 2,000) when they foresee fifty years being added to the expectancy." There is nothing in the text to justify this statement. The reviewer may express his personal doubts on this point. Perhaps the thought is that so much has been accomplished in the last thirty years that anything and everything can be done in the next thirty. So actuaries with billions of dollars of liabilities in pensions need not take fright—at least, not just yet!

In the October 1967 issue of *The Actuary* the present reviewer stated:

"There is so much nonsense being uttered, by those who should know better, on the extension of man's life to one hundred and fifty years due to current medical discoveries and an increase in the expectation of life at birth to 85 by the end of the century . . ."

Part II of a paper presented to the Institute of Actuaries by Frank M. Redington, M.A., F.I.A., last February, deals with this very subject and refers to an article by Professor Leonard Hayflick on "Human Cells and Aging" in *Scientific American* for March 1968. Redington's paper should be of great interest to actuaries.

In a brief review one cannot refer to the multitude of items covered in this

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ACTUARIES CLUB OF NEW YORK  
JUNIOR BRANCH

by Anna Maria Rappaport

The program at the June 3 meeting provided an introduction to a new and important topic for all business men. Many actuaries have worked with management science, but to others the field is completely new. Dr. Michael Shegda, Director, Research and Development for the Management Consulting Services Division of Lybrand, Ross Bros. & Montgomery spoke on Decision Theory and its Application to the Solution of Business Problems.

In his talk, Dr. Shegda showed how to lay out clearly and qualify alternative results of business decisions. The expected return resulting from an action is the sum of the return for each possible result multiplied by the probability of that result. Taking no action is an alternative with an expected return of zero.

A complex set of alternatives can be precisely spelled out using a decision tree. In the decision tree, each decision point is explicitly stated, and from there each possible outcome is looked at. The various outcomes of one decision are then followed by a new set of decisions.

The probability distribution of the expected profit or rate of return provides management with greater insights than the single point estimate. Single point estimates of the volume of sales, amount of expenses, etc. are being replaced by estimates of the distribution of these items. These are developed from the most likely value, smallest reasonable value, largest reasonable value, etc. Such estimates are usually subjective.

These estimates are used together with corporate planning models using simulation techniques to develop probability distribution of projected operating results. These models allow the executive to play the "What-If" game. Computers with time-sharing facilities are very useful in allowing a rapid turn around to the executive who is asking "What-If" questions. Sensitivity analysis allows the executive to measure on which variables the results are most dependent. This enables a company to see what it should try to control first. □

**Book Review***(Continued from page 3)*

book and the thoughts they stir up. Imagine the consequences of this statement; "It is estimated that in the U.S.A. 1,500 transplant operations *a day* may eventually be called for." The author appears to justify a possible expenditure of hundreds of millions of dollars a year of public funds for few more years of life to those with severe kidney disease.

The question of restricting biological research and the need for legislation to do this is discussed. The fears raised are justified. However, he quotes the eminent English neurologist, the late Lord Brain: "To argue that knowledge can be a bad thing is a waste of time, since the impulse to know is an inherent part of human nature."

At least one development mentioned should be dealt with by legislation — the "deep freeze" for human corpses. In the U.S. a number of people have paid sums to ensure that, at death, their bodies will be preserved by freezing in the belief that in due course techniques will be discovered whereby they can be revived and the disease which caused their death be overcome. It is true that if a person died of pneumonia in 1920, say, and had been preserved until today, he could, almost certainly, have been cured. But consider having several generations of one's family in a "freezatorium" with the cost of the expert attention which the bodies would require and the responsibility of deciding when to revive them.

Any means of deferring "final" death, presents particular problems when the brain is concerned for the brain cells have not the faculty of renewing themselves. Thus the prospect arises of a population of physically fit people with senile minds. Then Regius Professor of Medicine at Oxford is quoted: "I find this a terrifying prospect and I am glad I shall be dead and will have ceased to make my own contributions to this catastrophe before it happens."

A final set of quotations is from the chapter headed "New Minds for Old": "The last twenty years have seen the emergence of three important groups of drugs acting on the mind . . . We may actually be on the way to banishing insanity . . . The way things are going, it looks as if soon we shall be able not only to drive men mad with drugs, but also to drive them sane." □

**COMMENTS ON MORTALITY STUDIES***by A. C. Webster*

In the 1968 Reports of the Committee on Mortality Under Ordinary Insurances and Annuities, there are two special studies in addition to the regular Annual Report on Mortality under Standard Ordinary Issues for the 1966-67 year of exposure. These special studies cover the experience on Term Conversions and Guaranteed Insurability Options between the 1961 and 1966 policy anniversaries. One study treats of mortality and the other of lapses. All business is standard and for all the studies expected deaths are based on the 1955-60 Basic Tables.

Vietnam war deaths, as might be expected, are of greater weight in the 1966-67 study than previously and the major effect is on non-medical issues. The inclusion of war deaths in the select non-medical experience (over \$9,000,000 of the total deaths of \$86,000,000) raised the actual to expected ratio from 107% to practically 120%. On medically examined business the effect of war deaths was minimal for the total experience.

At the young entry ages (roughly 5-34) where the effect of war deaths was at a maximum, the increases in the ratio due to Vietnam war deaths were as follows:

Non-medical from 107% to 124%

Medical from 97% to 100%

Non-medical business is still about the same proportion of the total select exposure—36%. In the aggregate, the non-medical mortality is still higher, 107%, compared with 93.2% for the medical business but if the mortality is compared at the more important non-medical ages (say under issue age 35) the difference between medical and non-medical does not seem to be of major consequence.

Female mortality continues favorable, being still around 60% of the male (56% for medically examined business and 62% for non-medical business).

**Options and Conversions**

This was the first attempt to get mortality experience for elections under the Guaranteed Insurability Option rider and the results are not meaningful because of a paucity of data. One interesting figure—based on 37 deaths—is the mortality ratio in the first year after election—335%.

If there is to be anti-selection on term conversions this should show up in the mortality figures for the years immediately succeeding conversion. Here are the figures by age groups for the first three years immediately succeeding conversion by number of policies (the results by amount are not significantly different) with expected deaths reflecting select mortality from date of conversion:

Age at Conversion	25-34	35-44	45-54	55-64	65 & over
Duration from Conversion					
1	174%	185%	220%	285%	292%
2	146	191	196	221	268
3	144	148	161	209	316

Mortality ratios vary by type of term insurance. Decreasing term seems to show the highest ratios. The above are figures for all types of term conversion.

These figures which refer to duration from date of conversion may be questioned as being the true measure of anti-selection. For this reason mortality by duration from original issue was also studied. Theoretically the results might be expected to show a mortality ratio increasing with duration from original issue with emphasis on the later durations. The experience figures do not bear this out although there is considerable variation among the age groups, and at ages 55 and over the experience was very favorable at all durations.

The Committee was able to get additional data from the contributing companies on the comparative mortality of term insurance and permanent insurance and on the proportion of business sold on convertible term coverage. The report remarks that ". . . at least among those companies contributing to this portion of the study, there is relatively little difference between term and permanent mortality, although there is considerable variation among companies." This is an interesting result be-

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