heavy pressure to succeed, with the result that he accomplishes more per unit of intelligence than do children of any other racial stock.

Significant differences between the groups were found in the childhood data on emotional stability, social adjustments and various traits of personality. The case histories and trait ratings obtained from parents and teachers in 1922 reflect these differences clearly. All the 1922 trait ratings except those for health averaged lower for the C group. That is, fifteen or more years prior to the classification of these subjects on the basis of adult achievement, teachers and parents had been able to discern personality differences that would later characterize the two groups.

The A-C differences are further evidenced in the marital records. The incidence of marriage is higher in the A group and the age of marriage is lower. Moreover, the A's marry better than the C's; the A spouses score higher in intelligence tests and include nearly twice as large a proportion of college graduates. Especially significant is the contrast in marital adjustments, for the incidence of separation or divorce is only a third as high in the A group as in the C group. This difference extends even to the parents of the two groups, the incidence of separation or divorce being only half as great for A parents as for C parents.

The A-C differences in marital adjustments appear to be symptomatic of more basic differences in emotional stability and integration of personality. With the aid of funds from the National Research Council a special study is being made of marital adjustments in the entire gifted population. This has shown that the A group scores higher than the C group not only in present marital happiness, but also higher in a test designed to measure general happiness of temperament, or what might be called aptitude for happiness.

The facts just reported appear to be in direct opposition to the Lange-Eichbaum theory that great achievement is associated with emotional tensions which border on the abnormal. In my gifted group success is associated with emotional stability rather than instability, with absence rather than presence of disturbing conflicts, with happiness of temperament and with freedom from excessive frustration. This does not necessarily mean that the Lange-Eichbaum theory has been disproved. It is conceivable that the personality factors which make for ordinary achievement under ordinary conditions are different from those which make for eminence of a superlative order. The two approaches agree in the conclusion that beyond a certain high level of intellectual ability success is largely determined by non-intellectual factors and that the number of persons who are endowed with abilities equal to great achievement is immensely greater than the number who will attain eminence.

Looking forward to the future, I regard it as unlikely that more than a few score of my 1,300 subjects will attain to a national reputation or that more than a dozen or so will become really eminent. It would be surprising if even one of them a hundred years hence should be found among the thousand most eminent persons of history. In sheer intellectual ability, however, I am sure that my group overlaps Cattell's thousand most eminent persons of history. Although the group certainly contains no intellect at all comparable with that of a Newton or Shakespeare, I believe it contains many who are intellectual equals of Washington, the nineteenth most eminent in Cattell's list, and perhaps some who are not intellectually inferior to Napoleon, the most eminent man of all time.

These specific estimates are of course not amenable to objective proof. They are offered merely as illustrations of a larger truth that no one can doubt who has studied either a group of historical persons or a group of living gifted subjects: namely, that genius and eminence are far from perfectly correlated. Why they are so poorly correlated, what circumstances affect the fruition of human talent, are questions of such transcendent importance that they should be investigated by every method that promises the slightest reduction of our present ignorance. So little do we know about our available supply of potential genius; the environmental factors that favor or hinder its expression; the emotional compulsions that give it dynamic quality; or the personality distortions that make it dangerous! And viewing the present crisis in world affairs who can doubt that these things may decide the fate of a civilization?

THE TIME CAPSULE[1]

By DAVID S. YOUNGHOLM

VICE-PRESIDENT OF THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY

WE are gathered here together to-day to take part in a ceremony that, so far as I know, is unique in history. We are the people who will be the last of our time to see the 800-pound letter to the future, which was posted at this point two years ago and which will now be sealed and sent on its journey into the ages to come.

[1] Address on the occasion of the sealing-in of the Time Capsule of the Westinghouse Electric and Manufacturing Company on the grounds of the World's Fair, September 23, 1940.

In a few minutes we expect to complete the sealing-in ceremony, which will be the last act of our generation in preparing the Time Capsule as a message for historians of the future.

At the bottom of this "Immortal Well," which goes 50 feet into the earth beneath the walls of the Westinghouse Building at the New York World's Fair, the world's first Time Capsule is about to begin its long journey into the future—a journey which, it is hoped, will extend through 5,000 years of time.

The Time Capsule is something like the imaginary "time machine" described for us by H. G. Wells, except that the Time Capsule can not hasten forward through time—it can only wait. For this purpose we have fashioned it with care, and we believe it is amply protected to remain safely in the soil—not 5,000 years, but perhaps as long as 15,000—if need be.

The Time Capsule represents months of careful planning and the combined efforts of hundreds of persons. Archeologists, historians, engineers, librarians, scholars and many others were consulted at every step so that the project might be as nearly successful as all our present-day arts and sciences could make it.

Leaving a message from our time to so distant a future presented three distinct problems: First, how to build a vessel capable of preserving the record; second, the selection and preservation of the objects to be included; and third, how to leave word of its whereabouts for future historians.

The capsule, as finally constructed, consists of a one-inch outer shell of cupaloy (chosen because of its electrical qualities and resistance to corrosion). It was cast in sections; each section threaded and screwed into the next and sealed in with asphalt.

The contents of the torpedo-shaped capsule were packed securely in an inner envelope of Pyrex glass, which was then sealed, evacuated, filled with nitrogen and set into the shell in waterproof mastic. The inner crypt is about six and a half inches in diameter and seven feet long.

More than 40 articles of common use are included. Among them are a fountain pen and mechanical pencil, a watch, an electric lamp, a tobacco pouch with zipper, tobacco, pipe, cigarettes, cosmetics, a woman's hat, eyeglasses, toothbrush and powder, a miniature camera and film, a razor, a can opener, specimens of our money, and so on. There are samples of the major metals and alloys; textiles, including wool, cotton, silk, linen, rayon, glass fabrics, rubber fabrics, asbestos cloth; materials such as Portland cement, asbestos, synthetic and natural rubber, synthetic plastics; also samples of coal (which may be rare in 5,000 years), seeds of staple food crops and many other items.

Most important is a carefully prepared microfilm "essay" on our times, taken from books, almanacs, pictures, arranged in logical order to cover all the major activities of human life. Multi-lingual texts, a dictionary and an idiomatic lexicon will enable future historians readily to translate the texts of the microfilm. All film in the capsule is cellulose acetate especially prepared for permanence. The microfilm contains a total of more than 23,000 ordinary book pages, reproducing more than 10,000,000 words, and many hundreds of pictures. A microscope is enclosed to enable "futurians" to read the text. Complete directions in text and picture are given for the construction of a larger reading machine and a motion picture projection machine.

For use with the latter, a newsreel is enclosed, specially prepared for the people of A.D. 6939. This contains nearly a score of historic, typical or significant scenes of our day, with sound.

Word has been left for future archeologists in the form of a Book of Record, printed with specially compounded permanent inks, on 100 per cent. rag permanent book paper. Copies have been sent to libraries, museums and other repositories throughout the world. Some will surely survive, either in the original form or translated into new languages that arise. In this respect we have the example of the Egyptian papyrus, a paper-like material that has lasted, without special protection, for many hundreds of years.

In order that futurians may know when the year 6939 has come, the equivalent of this date is given in the book not only in our own calendar, but also in the Chinese, Jewish, Mohammedan and Shinto calendars. If none of these kinds of calendars survives, futurians may still calculate the years elapsed by reckoning from astronomical data supplied by the United States Naval Observatory. These include the number and dates of eclipses of the sun and moon in 1939, the positions of the planets and the angle of the earth's pole relative to the north star.

The U. S. Coast and Geodetic Survey has provided a description of the survey's network of stations across the United States, astronomical and geodetic locations of nearby permanent stations, and the exact latitude and longitude of the Time Capsule, determined by a special survey. Given to the third decimal point in seconds, these geodetic coordinates are sufficiently accurate to locate the spot with an error of less than an inch. They are: Latitude 40° 44′ 34″ .089 north of the Equator; Longitude 73° 50′ 43″ .842 west of Greenwich.

If other guides fail, the futurians can still find the capsule. Minute directions have been prepared for constructing and using electromagnetic instruments to locate it by the methods widely used to-day.

Finally, that our language may not be lost, the book contains a simple but ingenious key to English which will permit readers to translate our tongue and to pro-

nounce it, 1938 style, as well. This was prepared by Dr. John T. Harrington, of the Smithsonian Institution, and has caused much comment and interest among students of our language.

It is impossible, of course, to detail here all the studies and reasoning which led to the construction of the Time Capsule and selection of its contents. We have undertaken with humility the enormous task of leaving this message to the future, realizing well that no selection of ideas and materials, no matter how large, could really do justice to the astonishing variety and vigor of our age. Whether, in the end, the project can achieve its purpose depends on ourselves and our posterity. The engineering difficulties of removing the Time Capsule from its resting place can probably be counted upon to protect the capsule from vandalism. We feel that the good instincts of the human race may be relied upon to preserve word of its whereabouts for the generation to whom it is addressed.

We are often asked whether the Time Capsule will not be beneath the ocean when 5,000 years have elapsed. This question is raised because there is a general belief that the eastern coast of the United States is slowly sinking, and that as a result the ocean will rise higher and higher, finally covering these parts. The best answer to that comes from the U. S. Coast and Geodetic Survey, which has repeatedly surveyed bench marks along the Atlantic coast. They tell us that no evidence can be found that the coast is either rising or sinking. If it should be sinking, the rate of motion must be as slow as an inch a century, or else the sensitive instruments would long ago have detected it. At the rate of an inch a century, 5,000 years would see a sinking of only about four and a half feet. Since we are at this point 25 or more feet above sea level, we feel that the capsule will be safe from the ocean during its appointed time.

In addition to all the other protections that have been thrown around the Time Capsule, we are now about to place one more. The capsule rests at the bottom of a well which was made by driving a twelve-inch pipe into the soil until it reached solid ground at the bottom. Inside that pipe a ten-inch steel pipe has been welded. The second pipe was inserted in order that the well might remain dry. At the bottom of the inner pipe has been placed a three-foot plug of waterproof concrete and two feet of sand mixed with tar. The Time Capsule, at present, rests upon this base. Last night, in preparation for this ceremony, the capsule was straightened up and a small layer of our sealing material was poured around the bottom to hold it upright in the pipe. We shall presently pour in upon the Time Capsule 500 pounds more of this material, a substance consisting of 58 per cent. petroleum pitch, 17 per cent. chlorinated diphenyl, and 25 per cent. mineral oil. This material has been specially chosen because of its resistance to electrolysis and other characteristics. Our engineers tell us that this compound alone should last for thousands of years. All the materials used have been made from coal or oil products which were in the earth for millions of years before they were put to work.

Thus, when this sealing-in is performed, the Time Capsule will be protected from the earth and elements by two thicknesses of steel pipe and an inch layer of highly resistant plastic. Even without these protections, our engineers believe that the Time Capsule would be quite capable of lasting more than 5,000 years safely. With this additional protection, its potential life will be greatly prolonged.

SCIENTIFIC EVENTS

THE SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION

THE fifth annual "Progress Report" of the Society for the Promotion of Engineering Education was released by Professor C. F. Scott, chairman of the committee, prior to the Berkeley meeting in June. The report is based on about sixty letters from officers and chairmen of the society. Items indicating progress were selected, condensed and epitomized.

The report states that increase in enrolment is significant, undergraduate students in approximately 150 engineering schools in the United States and Canada now numbering about 106,000, an increase of nearly 30 per cent. in three years. There were in 1939 4,700 candidates for the master's degree and for the doctor's degree 850, both having more than doubled in three years. The report states that this "undergraduate increase is presumably due partly to the employment situation, but mainly to the growing regard for engineering training as a preparation for careers in industry, business and public service." Mechanical engineering enrolment, which shows the greatest increase during this period, 89 per cent., "may be traced to the character of this curriculum and to the recent publicity given to aeronautics, Diesel engines and air-conditioning. Most mechanical engineering curricula stress management and labor problems, which may be an added explanation."

It is pointed out that "a notable trend in engineering education has been in the field of chemical engineering, which is maturing rapidly, and becoming more and more a mathematical, quantitative kind of