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IN THIS ISSUE

"Radio-Carbon Dating" by Elmer Guerri is a discussion and explanation of the carbon-14 method of dating the artifacts of archeological discoveries. The discovery, present uses, and future possibilities of the method are related beginning on page 8.

Chuck Risch's survey dealing with the nonintellectual, nonaptitude, and personality factors that influence the male college student is contained in his article entitled "Self-Evaluation and Academic Achievement." Turn to page 14.

COVER NOTE

This month's cover is by Jeff Brugos, a Junior E.E., and is entitled "The Universal Chronicle."
The Dean's Corner

Radio-Carbon Dating .................................................. Elmer Guerri

Self-Evaluation and Academic Achievement ............... Chuck Risch

* * * *

Editorial

Miss Technic

Library Notes

Sly Droolings

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High School Graduates of 1965

You are cordially invited to visit Rose Polytechnic Institute where you can earn a degree in:

Chemical Engineering
Electrical Engineering
Mechanical Engineering
Civil Engineering
Mathematics
Physics
Chemistry
A technical student, rather completely immersed in scientific pursuits, often develops a definite aversion to any commitment on human values or issues. Well-structured orderliness in the physical universe appeals strongly to young minds first discovering for themselves the logic and precision of fundamental concepts in mathematics, physics and chemistry. Even in a relatively complex problem, once the interrelations of the physical entities are clearly perceived, an intense satisfaction is derived from the absolute “repeatability” and the stark, unyielding simplicity of the “right” answer.

Some men on the Rose campus feel uneasy in the knowledge that no such “unambiguity” pertains to problems requiring value judgements. When scientific principles are applied to develop sound solutions to problems representing real needs of human beings, answers are many and varied. The choice of the “optimum” answer may depend as much on one’s ethical orientation as on the technical factors.

Thus, taking some simple examples from problems which plague larger communities, air pollution presents a dilemma. By governmental edict, should the cost to the individual citizen of his automobile be substantially increased in order to abate the nuisance of smog and fumes? Or, in another instance, should the designer of a large coal-burning electric generating station omit from the smoke stack all specialized equipment for consuming smoke and for removing fly ash? If he does omit it, people in the immediate vicinity of the plant may suffer rather severely—but the price per kilowatt hour to all customers served by the plant can be reduced. Conversely, inclusion of equipment to reduce air pollution can be an expensive way (for a large number of people) to abate an annoyance to just a few of the plant’s neighbors.

Who should decide issues involving such value judgements? Clearly something is demanded beyond the usual competence of the expert technician or the elected official. Our leaders in government and in education are perceiving more clearly that a combination of three elements is required in the education of truly competent “decision makers” for such tasks. The first of these ingredients is a solid grounding in the fundamental principles of mathematics and the sciences—a necessary foundation for precise analytical thinking. The second necessary element is a substantial introduction to design and synthesis—the art of combining or putting together elements to fill a need or to perform a useful function—this is the converse of analysis. The third vital ingredient is a liberal education in the history, literature, philosophy and institutions of our society—a framework to provide a valid scale for ethical judgement.

Dr. R. W. Hamming, Head of the Numerical Methods Research Department, Bell Telephone Laboratories, has stated this problem clearly and compactly. Speaking before the Engineering College Honors Dinner at Syracuse University last March he said, regarding “Science” and “Engineering”:

“Traditionally these were quite distinct kinds of activity. Science was concerned mainly with new results while engineering was concerned mainly with the use of what was already known. An average engineer could master these fields and then expect to apply this knowledge to various situations the rest of his life. True, there were a few engineers who tried fundamentally new things and who did contribute new ideas, but the bulk of engineering was the application of old knowledge.

“At present, of course, there is no such clear difference; engineering treads so closely on the heels of science that sometimes it even leads! If I had to make a distinction applicable these days, I would say that science mainly concerns itself with facts and theories, while engineering includes value judgements. In some respects it is much easier to teach facts and theories than it is to teach the art of weighing conflicting, and often rather intangible, values, and how to decide on a final course of action. Thus, we find today that many engineering schools are teaching science and are evading the somewhat harder topic of the art of making value judgements.”

It is precisely in this latter area that Rose Polytechnic is striving mightily to strengthen its whole educational program. The new Humanities program, now well under way, followed from a determination to face up to the difficult problem of providing every student with his own yardsticks for intangible human values and qualities. He needs this dimension, in addition to the indispensable technical competence, in order to reach good decisions based on sound value judgements.
It gives me pleasure in my last editorial to call to the attention of the staff and students of Rose, the list of new staff heads for the Rose Technic, as posted on the bulletin board. These men will provide for you your monthly issue of the Technic. These men have the experience and creativity to make the forthcoming issues among the best in the magazine’s 73 year history.

The operation of the Technic, year to year, is fascinating to watch. Yearly, and more usually every six months, the Technic is completely reorganized, new policies are advocated, and new management installed. Significantly, the magazine continues in a form that is basically similar to all issues that have preceded it.

A contrast to this situation was painfully evident to me when I first entered the Institute as a freshman. The Institute was at that time without a President. Frankly, it appeared to me that the simple day to day operation of the college was so burdensome, that the enthusiasm I had expected to find in such a small engineering college was nonexistent. Thankfully, I have seen the emergence of a new school spirit. I would list as examples signalling this new spirit the following items: the expansion of enrollment and campus building programs, the publication of the Rose Philosophy, the significant increase in average teacher’s salaries, the tremendous growth rate of the overall school operating budget, the creation of the Board of Associates, the increase in Guidance services, the increased emphasis on athletics and recreation, the remodeling of the main building, and the Faculty’s acceptance of the Student Body Constitution. The list could be extended, but these are just the high points accomplished in five years.

Unfortunately the Faculty and Administration’s spirit is not matched by that of the students. For instance, until the past two weeks, the school newspaper seems to have been unable to survive the removal of only two of its staff members way back in September. Many of the clubs at Rose have members that have shrunk to less than ten. Certainly the Technic does not have enough people to put out as good a magazine as possible. These situations are occurring at a time when enrollment is at a new high.

Judiciously chosen outside activities never hurt anyone and in fact have been the basis for excellent job opportunities and a more profound education for most. Why don’t you start the second semester off right by joining the club or organization you thought about all last semester?
Don’t miss the boat!

The boat is the Navy's Hydroskimmer, powered by four 1100-horsepower gas turbines built by the Solar Division of International Harvester.

More significantly, the skimmer is a symbol of new opportunities at IH—the company that is also developing gas turbine power for tractors and trucks—the company that is already number one in heavy-duty trucks, farm tractors and equipment—that is building new plants on six continents to serve customers in 144 countries of the free world.

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INTERNATIONAL HARVESTER
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The matter of time is of central importance to the sciences of geology, anthropology, and archeology; and it is a significant factor in many others, such as meteorology and oceanography. By knowing the absolute time of specific occurrences, it is possible to calculate the heat flow from the ocean floor, the rate of oil formation, or to define past epochs of mountain building or ore deposition.

The only methods of measuring geological time involve the phenomenon of radioactivity in one way or another. Up to a few years ago, methods were known, such as the decay of uranium into lead, which made it possible to calculate the heat flow from the ocean floor, the rate of oil formation, or to define past epochs of mountain building or ore deposition.

This paper's purpose is to discuss the carbon-14 method of dating and to explain it thoroughly from its discovery to its future possibilities.

**DISCOVERY**

Living things have contained the radioactive isotope carbon-14 for tens of thousands of years, but nobody knew about it until the Atomic Age. It was Dr. Willard F. Libby of the University of Chicago's Institute for Nuclear Studies who worked out the intricate system of radiocarbon dating.

For more than twenty years Dr. Libby had been interested in measuring the radioactivity of certain elements, but until 1946 neither he nor anybody else was able to find a single atom of carbon-14 in nature.

In 1947 Dr. Libby actually estimated how much carbon-14 could be found on the earth. The following year he was proved right. Carbon-14 was found to be a part of every living thing.

With this discovery, Dr. Libby was all set to build his atomic time-clock. After a few tests on ancient charcoal, he was ready to check the system's accuracy by testing something with a known age.

The directors of the Chicago Museum of Natural History had such
Elmer A. Guerri is a senior majoring in chemistry. He is married and commutes from Clinton, Indiana. Elmer is president of both the American Chemical Society Student Affiliate chapter and the S.A.M.E. One of his hobbies is the archaeology of the American Indian—thus his interest in radio-carbon dating. This article was originally written as a paper for presentation before the Chemistry Seminar.

confidence in the professor that they gave him a piece of a priceless Egyptian relic. After dating this sample of a known age he had obtained results with an error of only 129 years. This was very accurate for any system that depended on radioactivity for its basic theory.

This first date by Dr. Libby opened the door for scientists everywhere to a new era in dating things of the past. This meant that men could now tell by modern scientific research when mountains were formed, when caves were occupied by prehistoric man, when the great oil pools were actually formed, and many other dates of specific occurrences.

IMPORTANT

Carbon-14 has been very important to the sciences of archaeology, geology, and oceanography. Many problems have been solved and many explanations have been given concerning the matter of time in man's development, the processes by which our world was formed, and the effects the ocean has had on the evolution of life through the ages.

"Why it is that archaeologists today", to use the words of anthropologist Carleton S. Coon. "collect flecks of charcoal as carefully as if the Queen of England had dropped her pearl necklace in a gutter?" The answer to this question lies in the fact that by collecting these flecks of charcoal scientists can readily determine when they were buried and therefore they can pinpoint the time in history when man appeared on certain parts of the earth.

The following table was taken from dates determined by the Goodman-Thompson Archaeological Survey. This table will illustrate how it would be possible to trace man's existence on the face of the earth.

<table>
<thead>
<tr>
<th>Archaeological Samples</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mayan lintel with carved date</td>
<td>Age (years before present)</td>
</tr>
<tr>
<td>1,470 plus 120</td>
<td>1,920 plus 200</td>
</tr>
<tr>
<td>Isaiah manuscript</td>
<td>Stonehenge, Eng., late Neolithic</td>
</tr>
<tr>
<td>3,800 plus 275</td>
<td>Tunisia, early Neolithic</td>
</tr>
<tr>
<td>8,400 plus 400</td>
<td>Oregon sandals</td>
</tr>
<tr>
<td>9,050 plus 350</td>
<td>Belt Cave, Iran, Mesolithic</td>
</tr>
<tr>
<td>10,560 plus 1,200</td>
<td>France, upper Paleolithic</td>
</tr>
<tr>
<td>13,000 plus 560</td>
<td>Lascaux Cave</td>
</tr>
<tr>
<td>15,400 plus 350</td>
<td>Superbison flesh and hair, Alaska</td>
</tr>
<tr>
<td>Older than 28,000 yrs.</td>
<td></td>
</tr>
</tbody>
</table>

Carbon-14 dating is also of importance to geology in estimating when rocks were formed or when mountains were formed. One of the most important geological problems is the question of the time of the retreat of the last continental ice sheet. The first two samples of extinct forests now overlain by the latest drift show that the last continental glacier was still in Wisconsin 11,000 years ago. Many additional samples are making it possible to understand the absolute time of the advance and retreat of the ice during the last part of the ice age.

The following table will illustrate how the carbon-14 dating method enables the geologist to determine facts necessary for understanding the development of the earth.

<table>
<thead>
<tr>
<th>Geological Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
</tr>
<tr>
<td>Age (years before present)</td>
</tr>
<tr>
<td>Mississippi delta wood, 25'</td>
</tr>
<tr>
<td>2,900 plus 300</td>
</tr>
<tr>
<td>Florida Everglades peat</td>
</tr>
<tr>
<td>4,900 plus 150</td>
</tr>
<tr>
<td>Bermuda peat</td>
</tr>
<tr>
<td>6,900 plus 150</td>
</tr>
<tr>
<td>Mississippi delta shell, 73'</td>
</tr>
<tr>
<td>9,000 plus 200</td>
</tr>
<tr>
<td>Two Greeks spruce wood</td>
</tr>
<tr>
<td>10,880 plus 740</td>
</tr>
<tr>
<td>Two Greeks peat</td>
</tr>
<tr>
<td>11,100 plus 600</td>
</tr>
<tr>
<td>Eagle River, Alaska, peat</td>
</tr>
<tr>
<td>14,300 plus 600</td>
</tr>
<tr>
<td>Rapa Island, Central South</td>
</tr>
<tr>
<td>Pacific, Lignite</td>
</tr>
<tr>
<td>Older than 30,000</td>
</tr>
<tr>
<td>Mississippi delta, weathered surface, 273'</td>
</tr>
<tr>
<td>Older than 30,000</td>
</tr>
<tr>
<td>Southern California, 75', lowest terrace</td>
</tr>
<tr>
<td>Older than 30,000</td>
</tr>
</tbody>
</table>

A perennial problem of geochemistry and geology has been the origin of petroleum. Most theories include a long period of time—e.g., one million years—for the hydrocarbon molecule to be formed. It has further been frequently stated that recent marine sediments contained hydrocarbons. Paul V. Smith of the Esso Laboratories, making use of
modern organic techniques in brilliant fashion, began a new search for such hydrocarbons and discovered them in large quantities. Not only did he find enough hydrocarbon to account for known petroleum reserves, but he found that the spectrum remained as to whether the hydrocarbons form now. Although the extremely small quantities of hydrocarbon available required the development of special techniques, it was possible by carbon-14 determinations to demonstrate that the hydrocarbons were geologically recent, and thus the problem of origin of oil becomes the problem of accumulation only.

Carbon-14 is important to oceanography too. One of the basic problems in oceanography is the rate of turnover of the ocean. It is too slow to measure directly, and speculations on this rate have differed by orders of magnitude. The discovery of carbon-14 in nature made an attack on this problem possible.

Although atmospheric carbon dioxide is in equilibrium with the carbonate in surface ocean water, the submergence of such water cuts it off from its supply of carbon-14, as effectively as does death in the case of a plant or animal. Since ocean water sinks in the polar regions and moves along the bottom toward the equator, the rate and direction of movement can be measured by determining the time since a unit of water left the polar surface.

The future possibilities for carbon-14 dating are at least as exciting as the past results have been. For example, liquid scintillation counting offers a factor to ten to one hundred years in either precision or sensitivity. It seems perfectly feasible, if this technique is developed, to measure back to one hundred thousand years ago, or to an accuracy of plus five years two thousand years ago. This would not only vastly extend the application to geological processes and archaeological detail but would probably permit detailed studies of natural isotopic fractionation processes with carbon. To geochemists the fine structure that would be revealed would probably present the most entrancing problems of all.

Thus, carbon-14 dating faces a bright future if AEC scientists do not get too many "home-grown" carbon-14 atoms into the cycle before the low-level geochemists have a chance to examine it.

SOURCE OF RADIOACTIVE C-14

The discovery of cosmic radiation by V F. Hess in 1911 led to repeated conjectures as to possible permanent effects this radiation might have on the surface of the earth. The energy received by the earth in the form of cosmic radiation is commensurate with that received as starlight. It is therefore really quite small in terms of the solar energy. The specific energy—that is, the energy per constituent particle—is very much higher than for any other type of radiation, averaging several billions of electron volts (1 electron volt is $1.6 \times 10^{-12}$ ergs, which is the average energy of motion of a gas molecule at ten thousand degrees Centigrade.) It is conceivable, therefore, that the cosmic radiation will alter the earth's atmosphere in detectable ways.

Neutrons are present in the higher layers of the atmosphere probably as secondary radiations produced by the primary cosmic rays. Measurements by cosmic ray physicists have clearly established that the population in the atmosphere rises with altitude to a maximum some what above forty thousand feet and then falls. This proves the secondary character of the radiation—that it is an incident on the earth from interstellar space, but it is a product of the impact of the true primary radiation on the earth's atmosphere.

The neutron is truly radioactive with a lifetime of about twelve minutes, which of course removes any possibility of the neutrons having time to travel any considerable distance in interstellar space, though the trip from the sun could be made without complete decay to hydrogen.

This leads us to the question: What would the neutrons produced by the cosmic rays be expected to do to the earth's atmosphere? Through complicated laboratory studies the results are that oxygen is extraordinarily inert but that nitrogen is reactive. It appears certain that of the two nitrogen isotopes, N$^{14}$, of 99.62 per cent abundance, and N$^{15}$, of 0.38 per cent abundance, N$^{14}$ is the more reactive. With neutrons (n) of thermal velocity the reaction is dominant, the cross-section 

(Continued on page 12)
Young Engineers Find Opportunity at Allison

Bob Reinstrom came to Allison Division, General Motors, early in 1962 following his graduation from the University of Minnesota with a BS degree in Mechanical Engineering.

As a research engineer at Allison, he has been associated with the Nuclear Liquid Metal Cell Program, the MCR (Military Compact Reactor) Project, and the Energy Depot Project. In these assignments, he has contributed to these studies:

1. Analysis and design of heat transfer equipment to investigate boiling, condensing, and thermal cycling in closed liquid metal systems.

2. The steady-state parametric optimization and transient behavior analysis of nuclear reactor systems.

3. Thermodynamic analysis of open chemical processes.

Presently, Bob is doing graduate work in engineering at Purdue University-Indianapolis campus . . . one of the many advantages of a job with Allison.

Allison’s broad education and training programs offer unlimited opportunities to the young graduate engineer desiring education beyond the normal four or five years of college training.

If you’re interested in knowing more about Allison’s Graduate Study Program, see our interviewer when he visits your campus. Or, write now for your copy of Allison’s brochure, explaining your opportunities for advancing your professional career at Allison. Send your request to: Allison Division, General Motors Corporation, Indianapolis, Indiana 46206, Att: Professional and Scientific Placement.

An equal opportunity employer
RADIO-CARBON DATING
(Continued from page 10)

\[ \text{Ni}^{14} + n \rightarrow \text{C}^{14} + \text{H}^0 \]

of the \text{N}^{14} for a room temperature thermal neutron being in the vicinity of \(1.7 \times 10^{-24} \text{cm}^2\), whereas the thermal neutron cross-section for reaction with \text{O}^{16} is of the order of 0.1 per cent of this. It is therefore quite certain that thermal neutrons introduced into ordinary air will react according to the above equation to form the radiocarbon isotope of mass fourteen and half-life of 5568±30 years.”

After observing that secondary neutrons reacted with seven \text{N}^{14} nuclei to yield six \text{C}^{14} nuclei, Libby calculated the number of \text{C}^{14} atoms produced per unit time in the upper atmosphere and the reservoir of carbon into which the \text{C}^{14} would be diluted. Then, knowing the half-life of carbon-14, he estimated the steady state concentration of a carbon-14 in the reservoir. That is, carbon dioxide of the air, surface ocean carbonate, and plants that photosynthesize all absorb the same concentration of carbon-14 from the atmosphere. This was an ingenious calculation, but it could not be tested, because apparatus of sufficient sensitivity did not exist. The first part of the scientific theory had been completed; new data had been accumulated and a new theory had been proposed. The next step was experimental confirmation.

WORLD-WIDE DISTRIBUTION

Before any accurate dating could be done, scientists had to know what quantity of the carbon-14 produced in the earth’s atmosphere each part of the earth receives. The amount of carbon-14 present in various sections of the world varies depending on latitude, altitude, and climate. Organic material, principally wood, was collected from various sections of the globe and measurements of the specific radioactivity were made. One group of samples was concentrated near the geomagnetic equator, where the neutron flux is at a minimum; another in high latitudes, where the neutron flux is at a maximum.

Fig. 1 and Fig. 2 illustrate graphically the neutron intensity variation due to altitudinal variation and latitudinal variation.

The carbon in the exchange reservoir is obviously of three principal origins: that dissolved in oceans, the carbon of living organisms, and atmospheric carbon dioxide itself. The latter two sources are so small in comparison with the first source that they can be neglected. The exact amount of carbon present in the ocean can be calculated with the use of two factors: the alkalinity and the pH of the ocean water. The alkalinity is the excess of positive ions over the anions of strong acids. This difference must be made up by neutrality. The total amount of dissolved carbon is not uniquely determined by the alkalinity alone, because of its variable equivalent nature due to the possibility of its existence in the neutral forms.

“The variation of pH throughout the ocean is surprisingly small, and the average value is about 8.0. The small amount of variation found throughout the greater portion of the water does not usually exceed 0.1 pH unit.”

It seems quite likely that the amount of living matter on earth will not seriously affect the specific activity, for the reason that it constitutes such a small fraction of the total inventory in the reservoir and probably has always held this minor position.

The question of constancy of the cosmic radiation intensity is much more difficult to answer. It is not unlikely that the intensity has remained constant in the sense we demand; namely variations in the average intensity over periods commensurate with the lifetime of radiocarbon, since it appears to be a phenomenon originating in the cosmos and therefore probably tied to a time scale similar to that controlling the intensity of solar radiation.

The only way scientists have of actually determining the constancy
rate of radiocarbon intensity is by measuring the abundance of the end materials in proportion to the total amount of radiocarbon that might have been produced under the changing conditions of the earth's atmosphere. For instance, radioactive uranium decays according to the half-life cycle and the end product or stable particle formed as a result of this decomposition is lead. Therefore, by calculating the amount of lead present on earth now in the pure state, scientists can determine the amount of uranium that decayed, since it decays in direct proportion to the amount of lead formed. When the amount of uranium previously existant is known, the rate of production of this element can be figured out allowing for the changes that the earth has undergone during different stages of its development.

During the past few thousand years no change has taken place in the earth's makeup that would change the rate of decay of radioactive carbon. Therefore this method of dating is very accurate since the rate of decay can be measured inversely with the amount of radiocarbon left in the earth.

There is, however, one important change in the atmosphere of the earth that can cause a variation in the counts recorded in scientific measurement. This change is concerned with the amount of carbon-14. Under certain conditions where the possibilities of exchange is low and the isotopic composition of the water in which the animal grew is known. Fresh water aquatic plants are not suitable because they may utilize carbonate carbon from the water, which may have been derived in part from old limestone. Burned bone is normally as suitable as charcoal, but as a rule, unburned bone has lost all its organic content by subsequent bacterial action.

A description of the process of preparing the sample for dating is as follows:

1. The first step in each instance is to carefully examine the sample and to separate out as well as possible by physical methods the material desired. For example, a piece of wood will usually be dirty and is cleaned physically as well as possible. It is well to remove the outer surface by cutting, for the danger of contamination is then greatly reduced. In the case of finely divided charcoal from camp fires, it is necessary to carefully remove intrusive rootlets and other matter which might introduce modern carbon into the material. It has been suggested that future physical separation methods will be developed to the point where rather low carbon-containing soils can be examined.

2. The physically cleaned sample is then tested with hydrochloric acid solution for calcium carbonate which may have been deposited in the cracks and internal fissures by underground waters. If any bubbling of carbon dioxide is observed on this test, the sample is then treated from camp fires, it is necessary to carefully remove intrusive rootlets and other matter which might introduce modern carbon into the material. It has been suggested that future physical separation methods will be developed to the point where rather low carbon-containing soils can be examined.

(Continued on page 20)
Self-Evaluation And Academic Achievement

A Survey of Rose Students

by Chuck Risch, Soph. M.E.

In recent years much has been done to predict the success of a college student. There has been much research done in the field of aptitude tests, such as the Scholastic Aptitude Test, which is the most widely used college entrance exam. The S.A.T. has been found to include approximately one quarter of the variables that determine college success. The various tests seem to be able only to reach a correlation coefficient of about .50. Therefore there is probably an area of research that ought to be investigated. "... a portion of this undefined area is probably 'chance' variation (test unreliability, criterion unreliability, subject variability etc.) but, as McQuarry (1953) has demonstrated, a major portion may also be said to include nonintellectual, nonapptitude, or personality factors."

This survey deals with these non-intellectual, nonapptitude, and personality factors that influence the success of a male college student. It has special emphasis on the correlation between self-evaluation and academic achievement.

The gathering of information for this survey was done by means of a questionnaire. (See Fig. 1.) Visual observation was also made of students that did not follow directions and circled their answers in completing the questionnaire. The subjects for this were 100 students of Rose Polytechnic Institute. All subjects were male undergraduate stu-

Fig. 1. Questionnaire used in the survey.

NO NAME, PLEASE
Underline your answer
1. Your health condition is (above average, average, below average).
2. In your opinion you are an (above average, average, below average) student.
3. Your self-evaluation as a student before entering college was (above average, average, below average).
4. In your opinion your social adjustment is (above average, average, below average).
5. Your self-evaluation as to social adjustment before entering college was (above average, average, below average).
6. Your accumulative grade point is (0-.5, .5-1, 1-1.5, 1.5-2.0, 2-2.5, 2.5-3, 3-3.5, 3.5-4).
7. You (are, are not) satisfied with your academic achievements.
8. You (are, are not) approaching your academic maximum.
9. Your I.Q. rating (see table below) would probably be ...............% Included
   Classification I.Q. Limits % Included
   defective 69-and below 2.2
   borderline 70-79 6.77
   dull-normal 80-89 16.1
   average 90-109 50.0
   bright-normal 110-119 16.1
   superior 120-129 6.7
   very superior 130-and above 2.2
10. Your age is (0-22, 20-22, 22- ).
11. You are presently in your (freshman, sophomore, junior, senior) year.
12. Your high school (was, was not) coeducational.
13. You (are, are not) presently a psychology student.
14. You (have never, have) previously taken psychology.
dents pursuing degrees in the fields of engineering and science. The questionnaires were first distributed to the 36 members of a psychology class. The remainder of the questionnaires were distributed randomly to students as they passed the main bulletin board. No names were entered on the questionnaires.

The questionnaires were first sorted with respect to the answer given on question #2 which states, "In your opinion you are an (above average, average, below average) student." (See Fig. 2.) From this it can be noted that those who rated themselves below average on the second question had a correspondingly low student self-evaluation before entering college (question #3). It can also be seen that social adjustment (question #4 and #5) increased slightly for the self-evaluated above average student, while it was the reverse for those who answered "below average" for question #2. As would be expected, grade points (question #6) were higher for the students who rated themselves higher. This is mainly due to the fact that question #2 was probably answered on the basis of grades. As would be expected, question #7, which states, "You (are, are not) satisfied with your academic achievements?", is also a function of grade points and thus had a positive correlation coefficient. The I.Q. or I.Q. rating was also in agreement with what was expected, i.e. it increased as student evaluation increased. Another interesting fact is that 30% of the below average self-evaluated students and 32% of the above average group did not follow directions and circled their answers. The average self-evaluated students, however, had only 13.8% of their numbers who circled instead of underlined. The fact that some circled instead of underlining is probably due to negative transfer. Very often there are tests given where the students are told to circle. Also many students prefer to circle because it designates the answer more emphatically than underlining does. At any rate this correlation should not be mistaken as causation, especially since the below average and above average groups agree.

The questions not mentioned had results that indicated that they had no relation with a person’s opinion of himself as a student.

Next the questionnaires were rearranged according to question #4 which states, "In your opinion your social adjustment is (above average, average, below average)." (See Fig. 3.) With regard to health conditions (question #1) there seemed to be a slight positive correlation with social adjustment. There was a great deal of agreement between self-evaluation and social adjustment before entering college and to present valuation. This is as would be expected because many people are set in their ways, especially socially, by the time they leave high school. The grade point averages for the above average, average, and below average groups as to social adjustment were 2.48, 2.32, and 2.70 respectively. Here again the results are inconsistent. It does show to a slight extent that the less socially adjusted group might have an edge.
### FIG. 3. ANSWERS ON QUESTION #4

<table>
<thead>
<tr>
<th>Question</th>
<th>Above Average</th>
<th>Average</th>
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<td>Average</td>
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<td>29</td>
<td>6</td>
</tr>
<tr>
<td>Below Average</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2. Above Average</td>
<td>11</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>Average</td>
<td>19</td>
<td>40</td>
<td>6</td>
</tr>
<tr>
<td>Below Average</td>
<td>3</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>3. Above Average</td>
<td>29</td>
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<td>7</td>
</tr>
<tr>
<td>Average</td>
<td>3</td>
<td>16</td>
<td>2</td>
</tr>
<tr>
<td>Below Average</td>
<td>1</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>4. Above Average</td>
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<td>10</td>
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<tr>
<td>5. Above Average</td>
<td>25</td>
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<td>Average</td>
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<td>46</td>
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### FIG. 4. ANSWERS ON QUESTION #6

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<td>0</td>
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<tr>
<td>Are not</td>
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<tr>
<td>Are not</td>
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<td>4</td>
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</tbody>
</table>

### Additional Statistics

- **11. Freshman**
  - 3 | 6 | 6 | 7 | 2 | 1 |
  - 0 | 10 | 5 | 4 | 4 | 1 |
  - 0 | 4 | 14 | 6 | 4 | 2 |
  - 0 | 3 | 10 | 3 | 4 | 1 |
  - 3 | 19 | 35 | 18 | 14 | 3 |
  - 14 | 22 | 13 | 9 | 3 | 1 |
  - 0 | 5 | 9 | 0 | 0 | 0 |
  - 2 | 2 | 6 | 5 | 6 | 0 |
  - 1 | 2 | 6 | 5 | 6 | 0 |
  - 2 | 22 | 29 | 15 | 8 | 5 |
over the others. At any rate, these results indicate that social adjustment is not a major factor in determining college success. Again there are parts of the questionnaire that seem to be unrelated to a person's self-evaluated social adjustment. It tends to be unrelated to satisfaction of academic achievement, nearness to academic maximum, I.Q. rating, age, class, coed or non-coed high school, taking or having taken psychology, or following directions in answering the questionnaire.

The questionnaires were next sorted with respect to grades (question #6). Again it was noted that opinion of self as a student and grade point are positively related. There seemed to be no clear indication as to dependence of grades upon social adjustment either before entering college or at present. As would be expected there was a positive correlation between satisfaction of academic achievement and total grade point averages. The same was true with regard to I.Q. ratings. Class was independent of grade groupings except in the 1.0-1.5 group where it was all freshmen. The other variables in the questionnaire (health, age, coed or non-coed high school, and taking or having taken psychology) showed a tendency to be independent. It might be noted that in this grade grouping a random change of one or two answers per group could change the whole nature of a variable since the groups contain such a small number.

A total was made of the different answers on each question. (See Fig. 4.) It can be seen that most everyone had good health. It is also clear that self-evaluation with respect to social adjustment remained mostly constant with a majority of "average" answers. A graph of the number of people versus I.Q. rating was plotted. (See Fig. 5.) As can be seen, it resembles a bell curve. It is interesting to note that few were satisfied with their academic achievements and that few reached their academic maximums. The graph (See Fig. 6.) of the number of people versus I.Q. rating was plotted. The results indicated a slight bell curve with a median between bright-normal and superior. It can be seen that there was a good division among the classes, thus giving a good representation. It is also interesting to note that 20% of the questionnaires were circled instead of underlined as directed.

The reliability of this survey was tested on several points against previous experiments. The fact that the student evaluations were considerably lower after a time at college where self-evaluation as to social adjustment did not change is in agreement with the results formulated by Borislow (1962). The result of negative correlation between social adjustment and scholastic achievement also agrees with Borislow. If poor social adjustment is considered to mean that the people are introverts then the results are also in agreement with Griffiths (1945). The positive correlation between grades and student evaluation is also in agreement with Borislow.

In view of the fact that the results of this survey agree with other similar studies on the several points compared greatly enhances its probable reliability.

FIGS. 5 and 6

REFERENCES


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RADIO-CARBON DATING
(Continued from page 14)

other than the desired organic substances, the acid treatment frequently works to purify the sample. After the preceding two steps have been taken, the samples should be free from all foreign radioactive substances and should be ready for the first step in the actual reduction line.

ASSUMPTIONS AND CALCULATIONS
In order to use the C-14 method of age determination, we must make three assumptions. They are:
1. The specific activity of living organic material has been constant over a period of time.
2. The biological materials which are to be assayed have retained their true original composition and have ceased exchanging with reservoir carbon at the time of death.
3. The half life of C-14 has been accurately determined.

When these three assumptions have been made and justified, the actual time since death of the organism can be calculated using the relationship

\[ t = \frac{\log I - \log I_0}{\lambda} \]

where \( t \) = the time since death
\( \lambda \) = decay constant of C-14
\( I \) = measured activity of the ancient sample
\( I_0 \) = measured activity of modern organic material

PROCEDURE
Carbon-14 can be measured in principle by the ion chamber Geiger counter, proportional counter, or scintillation counter. All the published results to date have been obtained by counting elemental carbon mounted on the inside of a large volume Geiger tube. It would appear that if the ion chamber method should become fully developed it might compete with the Geiger counter method. The use of a proportional gas counter would lead to higher sensitivity, but the development of such a counter is handicapped by severe electronic requirements. The scintillation counter technique looks most promising of all, and this paper will primarily be concerned with that method of counting.

The dating procedure consists of preparing a sample of pure carbon from the natural carbon-bearing material, mounting this in a special screen-wall Geiger counter, and counting it against background radiation for several days. The key to success is the reduction of the unshielded background of the counter (about 350 counts per minute) to about two counts per minute by the use of elaborate shielding, anticoincidence counters, and appropriate circuitry.

This method will be further explained in the following paragraphs. “After the sample has been cleaned of all impurities, the process of extracting pure carbon-14 begins. The extraction process begins with controlled buring of the specimen.

(Continued on page 24)
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Miss Technic For January

(Photos by Stewart)
Habla Espanol? Our Miss Technic for this month is a Spanish major. She is Miss Barbara Brightmire. Barbara comes from Evansville and attends Indiana State College. After graduation, she plans to make use of her knowledge by going to school in Spain.

Here in Indiana, she finds many other interests to fill her time. Barb, as her friends call her, enjoys such sports as skiing, swimming, and especially horseback riding. She also enjoys music and dancing. She is a member of Delta Gamma Sorority and the Spanish Club.

This eye-catching, green-eyed blond is 5'5" tall and weighs 120 lbs. Her 35-23-35 figure makes her doubly eye-catching.
RADIO-CARBON DATING  
(Continued from page 20)  
A measured quantity of the material to be dated is placed in the center of a tube of high-silica glass, such as Vycor, capable of withstanding two thousand degrees Fahrenheit. The ends of the tube are stuffed with glass wool and closed by stoppers fitted with entrance and exit tubing. The tube is then inserted into an electric furnace made by winding successive layers of Nichrome wire on concentric tubes of asbestos sheeting. The length of the heating unit overhangs the sample by an inch or so. After the furnace has reached a working temperature of about 900°C, oxygen is admitted at a pressure of slightly less than one atmosphere, and the combustion gases are passed through a bubbler. The carbon dioxide reacts with ammonium hydroxide in the bubbler to form ammonium carbonate.

“The remaining gases, mainly carbon monoxide, are then passed to a second furnace identical with the first. In this step the Vycor tube is packed with copper oxide, which usually consists of short lengths of fine blackened wire. When heated to about 900°C, the carbon monoxide reacts with the copper oxide to form carbon dioxide and copper. The carbon dioxide is then absorbed in a second ammonium hydroxide bubbler. At the end of the run the bubbler solution contains not only ammonium carbonate but also the oxides of nitrogen, sulfur, and radon. The set-up of apparatus for the above procedure is shown in Fig. 3.

“Purification is accomplished in two succeeding steps. The ammonium carbonate is transferred from the bubblers to a flask and heated on an electric mantle to a temperature of 95°C. The solution of calcium chloride is then brought to a boil and added. Calcium carbonate precipitates rapidly. The precipitate is next washed completely free of ammonia, the salts, and the radon. The carbon dioxide is then reconstituted by transferring the precipitate to a flask and adding hydrochloric acid. The liberated carbon dioxide is led through a liquid air trap for removing the water and then through a ‘U’ tube packed with a drying agent.

“The dried carbon dioxide is then bubbled through a three-necked flask containing methyl magnesium iodide, with which the gas reacts to form acetic acid. The gas enters through one neck, a stirring rod to agitate the fluid is introduced through a second neck, and unreacted gas escapes through the third neck. The escape neck is fitted with a drying tube to prevent entry of water vapor from the air into the flask. If the chemical steps have been taken with care, the specimen, now in the form of clear acetic acid, is free of all radioactive substances except the original carbon-14. This acetic acid is bottled promptly to prevent contamination. The acid in this form is ready to be transferred to the scintillation cell. The set-up of apparatus for the procedure on this page is shown in Fig. 4.

“The scintillation cell of the counter consists of a pipe nipple
about an inch long and two inches in diameter. The ends are closed by glass windows held in place by a pair of internally threaded bevels. The inner wall of the cell is coated with a special white paint impervious to the scintillation fluid. The fluid itself consists of toluene with four tenths of one per cent of diphenyloxazole and twenty parts per million of diphenyloxazolybenzene, the latter chemical serving to shift the color of the scintillations to the portion of the spectrum to which the cathodes of the phototubes are most sensitive. The cell is filled through a small entrance tube in the side. The scintillation fluid has the property of fluorescing when excited by the emission of radioactive substances as well as by light and other radiations. The scintillation cell is shielded from the background by a tube of lead three inches thick. The shield reduces the effect of background radiation by about eighty per cent. The rest of the background radiation and the 'noise' from the electrical system must be suppressed electronically.

“The scintillation cell is sandwiched between a pair of photoelectric cells of the photomultiplier type, consisting of a photocathode plus a self-contained amplifier. Each scintillation triggers a substantial pulse of current, which appears at the output terminal of each photomultiplier. Electrons dislodged from the cathode by heat cause similar pulses. These are minimized by refrigerating the entire pickup assembly—the scintillation cell, the photomultipliers, the preamplifiers, and the lead shield. The pickup assembly has to be held to about twenty degrees below zero Centigrade.

Since the flashes produced by the carbon-14 atoms are fairly uniform in brightness and since they are more intense than most flashes produced by other radioactive isotopes, a method of reducing background electronically can be devised. A circuit can be designed that favors the pulse size of carbon-14. It employs a set of vacuum tubes controlled by the signals from an auxiliary circuit. The size of each pulse is measured as it enters the device and is then routed into a branch circuit called a delay line—a kind of electrical blind alley. In the meantime the charge on the grids of the vacuum tubes is being adjusted in accordance with the measurement so that the tubes will conduct or not conduct according to the size of the pulse. The control action is timed.
for completion just prior to the instant the pulse returns from its side trip. Only those pulses meeting the specifications get through. A significant number initiated by sources other than carbon-14 must pass here, however.

Most of the remaining background is blocked out by a screening device of a somewhat different sort. The scintillation cell is watched by a pair of photomultipliers. After amplification the current impulses from the two photomultipliers, screened by the previous device to uniform size are presented to a “coincidence” circuit. Essentially this is a pair of electric “check valves”, or diodes, comprising the input circuit of an amplifier designed to ignore pulses of current below a predetermined size. The pulse from a single photomultiplier is not energetic enough to activate the amplifier. Therefore the circuit is activated only when a pair of pulses from the photomultipliers, arrive simultaneously. Thus, only pulses generated by flashes in the scintillation counter where the pair of watching photomultipliers is triggered simultaneously, gain admittance to the electromechanical counter.

“The spurious counts can be reduced to about twenty-five per minute using the above method.

“In dating an archaeological specimen the counting equipment is first calibrated. A measured quantity of standard fluid is mixed with the scintillation fluid and put into the cell. The cell, the shield, the photomultipliers, and the preamplifier assembly are refrigerated overnight. Then the counter is operated for forty-eight hours; the accumulated reading is taken; the reading is reduced to counts per minute; and the efficiency is computed.

“The cell is then removed and cleaned, and then the activity of the actual sample is measured. The difference between the count of modern carbon and that of the specimen provides the basis for computing the unknown date. If the calibration step can be omitted, as is the case when you are working with

(Continued on page 29)

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library
notes

“I write and will keep writing books; they’re not needed; all the same, they do serve some purpose. Culture doesn’t save anything or anyone; it doesn’t justify. But it’s a product of man: he projects himself into it, he recognizes himself in it: that critical mirror alone offers him his image.”

Jean-Paul Sartre.


In the past twenty years, Jean-Paul Sartre has become the best-known and most influential French writer alive. As a philosopher, novelist, playwright, editor, and as a man, he has never hesitated to commit himself to the moral and political as well as literary life of his own times. He is perhaps the greatest man of letters since Voltaire.

Now, at fifty-nine, Sartre has undertaken his autobiography, bringing to his own childhood the same honesty and insight which he has applied so brilliantly in earlier books. In France, where The Words has been a best-seller since its publication earlier this year, it has already been accorded a place beside that other masterpiece of self-analysis, Rousseau’s Confessions.

There have been child prodigies before, but few have been so blissfully happy as Sartre at the age of ten. Born into a gentle, book-loving family and raised by a widowed mother and doting grandparents, his childhood might be described as one long love affair with the printed word. Half a century later, he can write as passionately of his grandfather’s library as Mark Twain could of the Mississippi River.

But ultimately, Sartre is exploring and evaluating the whole use of books and language in human experience. It was the great illusion of his life, he argues, that he grew up loving books, and taking it for granted that a courageous and productive literary career could do something positive on behalf of humanity’s total struggle. If he eventually came to think otherwise, nonetheless his childhood joy in words, and his lifetime’s commitment to their just and purposeful use, have remained powerful enough to sustain him.


This is a classic collection of eight short stories and two full-length novels, all about robots and robotics, which completes the entire library of Asimov’s robot writings begun in I, Robot. At first they were simple, unthinking machines victimized by frightened men suffering from a “Frankenstein complex.” Later, as the technology advanced, they became capable of independent action. Asimov traces the development of positronic robots with brains of platinum-iridium in this set of stories.

(Continued on page 30)
RADIO-CARBON DATING
(Continued from page 26)
a series of specimens, you can date an average of about one specimen per week if everything goes well. It rarely does."

The preceding method of dating by the carbon-14 method was devised by Willard F. Libby of the University of Chicago. The method was reduced to a laboratory scale by Fred Schatzman, an amateur scientist; and the reduced method is suitable for experimental dating.

The development of carbon-14 dating was of such importance to the scientific world that Dr. Willard F. Libby was given the Nobel Prize for his work in this field in 1960.

The field of carbon-14 dating holds many opportunities for young scientists or for people contemplating scientific careers.

SCINTILLATION SPECTROMETER

The scintillation spectrometer (Fig. 5) is used in the final step of the carbon-14 dating method. The scintillation spectrometer consists of two photomultipliers, two preamplifiers, two amplifiers, two pulse analyzers, one scaler, one high voltage supply, a scintillation cell, and coincidence circuits. The coincidence circuits serve two purposes: they reduce the background radiation and 'noise' from the electrical system, and they serve as a converging point for leads from the other parts of the system. The coincidence circuits sort out the counts of carbon-14 radiation and allow them to pass to the scaler. The other pulses from secondary radiation or electrical 'noise' is sent into a relay or sort of an electrical dead end.

The results obtained from the scaler reading are compared to mathematical calculations concerning present day radiation and in the end a date is obtained.

The scintillation cell should be shielded by a lead shield. There have been proposals saying more background would be filtered if the entire assembly were shielded, but it is not necessary to do so.
Sensible, non-mephistophelian robots designed by engineering and not pseudo-men created by blasphemers, Asimov's robots revolutionized the field of science fiction. All the more fascinating because they are not supernatural creatures but precision-engineered machines, the postronic robots react along rational lines that exist in their brains from the moment the last rivet is in place and the last electrical connection has been made. This should be a popular selection.


In this companion volume to his continuing bestseller, The Art of Loving, Dr. Fromm examines those forces in man which show that love of death is pathological while love of life is normal.

With deep psychological penetration The Heart of Man analyzes the nature of evil and of good. It shows how man in losing his capacity for independence, love, and reason, necessarily develops those forces of destructiveness which lead to his dehumanization. Dr. Fromm illustrates his analysis of evil with many concrete examples including Stalin and Hitler. On the basis of his findings the author discusses the individual's freedom to choose between love and hate and examines the forces in human nature which block the creative energies, twisting the instinct for good into fascination with evil.

The Heart of Man opens new approaches to psychoanalytic theory and dynamic social psychology, enhancing the significance of many of Freud's discoveries by putting them in a new and wider frame of reference. Beyond that, it is a most timely contribution to the understanding of the current wave of violence and destructiveness which has become an ever-increasing threat to mankind's capacity for growth. Dr. Fromm shows how man may escape from his greatest prison — the destructive aspect of himself.
Men on the move

at Bethlehem Steel

JIM ANTHONY, I.E., JOHNS HOPKINS '60—An operations research man at our Sparrows Point, Md., Plant, Jim applies techniques such as linear programming, regression analysis, exponential smoothing, CPM, and PERT to complex production problems.

TOM FREE, MET.E., CASE INSTITUTE '60—After experience in both mills and laboratories, Tom became a Lackawanna Plant metallurgical service engineer. His job is to solve problems in customers' plants.

DICK PEOPLES, C.E., NORTHEASTERN '60—Dick helped build our new, $20-million continuous galvanizing mill at the Lackawanna Plant, near Buffalo, N.Y. Now he's foreman of the mill's production line.

JIM BULLOCK, E.E., BROWN '58—Jim is an electrical engineer at our Bethlehem, Pa., Plant. His broad-ranging duties include instructing technicians in the intricacies of electronics.

SAM COLEMAN '62, DOUG HATCHER '61, BOTH M.E., SOUTH CAROLINA—Sam and Doug are salesmen in our Atlanta District. Their technical training is a valuable asset in selling steel products.

JOHN O'BRIEN, CH.E., NOTRE DAME '60, AND DICK HOSTETTER, M.E., PENN STATE '58—Production engineer O'Brien and research engineer Hostetter worked together on an automatic gage-control system for a mill at our Sparrows Point, Md., Plant.

These alert young men are a few of the many recent graduates who joined the Bethlehem Loop Course, one of industry's best-known management development programs. Want more information? We suggest you read our booklet, "Careers with Bethlehem Steel and the Loop Course." Pick up a copy at your Placement Office, or write to our Manager of Personnel, Bethlehem, Pa.

An equal opportunity employer
CHESAPEAKE BRIDGE-TUNNEL NOMINATED AS OUTSTANDING CIVIL ENGINEERING ACHIEVEMENT

The 17.6 mile Chesapeake Bay Bridge-Tunnel, opened in April 1964, has been nominated the “Outstanding Civil Engineering Achievement” of the year.

The American Society of Civil Engineers sponsors the yearly award. This top honor designates the project, “which demonstrates the greatest engineering skills and represents the greatest contribution to civil engineering and mankind.”

Crossing Chesapeake Bay now takes the motorist over and under the open sea, where the Bay meets the Atlantic Ocean—between Norfolk and Delmarva Peninsula. The new facility cuts driving time between New York and Florida by an hour and a half and avoids Washington, D.C. and Baltimore.

The civil engineering achievement combines 12½ miles of low-level trestle, four man-made islands raised from the bottom of the Bay, two tunnels, each over a mile long, a high and medium-level bridge, and several miles of approach roads. The bridge-tunnel project was financed by a $200 million dollar toll-revenue...
bond issue and does not have the benefit of tax money.

Two thirds of the project's length is made up of low-level trestle, consisting of 858 spans of 75-feet with a 25-ft. clearance over mean low level. It, and other bridge structures, are designed for 20-ft. waves and a 10-ft. storm surge. The superstructure for each trestle span consists of precast, prestressed concrete units resting on precast concrete pile caps which are supported by sand-filled 53-inch diameter concrete piles.

The steel superstructure for the high-level bridge was assembled in a harbor to be then floated to the site and lowered onto concrete piers. Fabrication and assembly of the two bridges was accomplished by the American Bridge Division of the U. S. Steel Corporation.

To assure navigation requirements for major naval vessels and commercial shipping, two tunnels were built at channel locations. Entry to the tunnels is through four man-made islands built of sand to 30 feet above the sea in 40 ft. of water. The islands are 1,500 ft. long and 230 ft. wide.

Watertight sections of double-wall steel casing in 300-ft. lengths were fabricated in Texas, towed 1,700 miles to Norfolk and eventually sunk into a leveled trench beneath the sea. These formed the two mile-long tunnels which are ventilated by equipment located on the islands.

The mammoth project was completed through the efforts of six major companies assisted by several hundred subcontractors and suppliers.

Designer of the project was the St. Louis, Mo. consulting engineering firm of Sverdrup & Parcel.

A team of four companies was the General contractor: Tidewater Construction Corporation of Norfolk, Va.; Raymond International, Inc., New York; Peter Kiewitt Sons' Co., Omaha, Neb.; and Merritt-Chapman & Scott Corporation of New York.

Other nominated civil engineering projects contending for the “Outstanding Civil Engineering Achievement” award of the American Society of Civil Engineers are: The Verrazano-Narrows Bridge and approaches in New York City; The District Filtration Plant in Chicago, and the Flood Control & Water Conservation Project of the Los Angeles County Flood Control District.

The winning project will be selected by a jury of editors of engineering magazines. The winner will be announced by the Board of Direction of the American Society of Civil Engineers when it meets in March.

**IOBBM—NEW SPACE-AGE MATERIAL**

A sheet of it will take 1400°F. without wilting. Pound for pound, it's nearly as strong as steel. It can be machined or molded. A piece only 1/32-inch thick will block an electrical surge of 45,000 volts. It's not measurably affected by a radiation attack nearly 2 million times stronger than would kill a man.

It's a new insulating material developed by General Electric: inorganic bonded mica mat (IOBBM).

Mica has long been used as an electrical and thermal insulator, of course, but it's impossible to obtain large enough pieces in nature to fabricate into uniform segments. GE's solution was to reconstruct the mica into wafer-thin sheets and laminate them to uniform thickness using an inorganic bonding material.

The bonding material has effectively added some 900 degrees to the temperature threshold of mica, giving IOBBM significant advantages over ceramics in the 500 to 1400 degree range. One advantage is weight: IOBBM has a specific gravity of only 2.1 compared to ceramics' 3 to 4. And sheets of mica laminate can be drilled, milled, folded, sawed, punched, cut or filed with little or no waste.

Applications of this new material are limited only by the imagination of development engineers. Its unique combination of electrical and thermal properties makes it ideal for key structural components which are subject to severe environments.
An attractive young coed was having difficulty keeping her skirt down about her shapely legs while awaiting a bus on a windy Washington street corner. She was aware of a young man watching her discomfort with considerable interest and she addressed him in an irritated voice:

"It is obvious, sir, that you are no gentleman."

With appreciation in his voice, the man replied, "It’s obvious that you’re not either."

There was a time when the music at the St. Pat’s Dance was so bad that when a waiter dropped a tray, everybody got up and started dancing.

Jack: "I’ll bet you think twice before you leave your wife alone evenings."

Mack: "I’ll say. First I have to think up a reason for going out—then I have to think up why she can’t go with me!"

The stranger walked up to the Las Vegas dice table and laid down a $1000 bet. He shook the dice, but as he threw them, a third cube fell unexpectedly from his sleeve. The house operator was unruffled. He handed back two of the dice and pocketed the third, saying, "Roll again. Your point is 15."

"There are only two kinds of parking left on campus—illegal and no."

Drunk: "Ho, Lady, you got two ver' beautiful legs."

Girl (snapping): “How would you know?”

Drunk: “I counted 'em."

Then there’s the engineer who made his own drink at a party. It’s called a Gin Daddy. It’s made with equal parts of gin, milk, and sugar. It seems that the sugar gives you energy, the milk gives you pep, and gin gives you ideas of what to do with all your pep and energy.

"Do you really love her ”

“Do I love her? Why, I worship the ground her father struck oil on.”

A lobbyist who was opposing a large appropriation for a state college approached a legislator who boasted of his self-education.

“Do you realize,” asked the port-
ly lobbyist gravely, “that up at the university men and women students have to use the same curriculum?”

The legislator looked startled.

“And that men and women often matriculate together?”

“No!”

The lobbyist came closer and whispered, “And a young lady student can be forced to show a male professor her thesis?”

“I won’t vote them a damn cent!” exclaimed the legislator.

First there was nothing. Then came the stone age, followed by the bronze age. Next came the machine age, and now we’re in the space age. Space is nothing, so we’re back where we started.

Slowly, her eyes glowing softly, the beautiful debutante raised a glass on high, exulting: “Port wine to me is the nectar of the gods, the elixir of life. When I imbibe its fluid, my soul begins to throb and glow. The music of a thousand muted violins whispers in my ear, and I am transferred to the make-believe world of magic. On the other hand, beer makes me barf.”

A girdle is an elastic supplement to stern reality.

Science is making so many strides ahead, almost daily, that it gets increasingly difficult for the layman to keep up. Latest invention we’ve heard about is a toothpaste with built-in food particles for people who can’t eat between every brushing.

Then there was the M.E. who thought that steel wool was the fleece from a hydraulic ram.

Two hunters in Africa were caught by cannibals and put into a huge cooking pot. One man laughed hysterically. Annoyed, the other asked: “What’s so funny?” The first one replied, “If they only knew what I was doing in their soup!”
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An equal opportunity employer.
The small white rectangle above represents the approximate size of space required to contain one page of newspaper-size document reduced for storage through NCR's PHOTOCHROMIC MICRO-IMAGE process. The small white dot on the right shows the area that would hold thousands of micro-capsules (cell-like structures containing useful materials) produced through NCR's amazing chemical process of MICRO-ENCAPSULATION.

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AN EQUAL OPPORTUNITY EMPLOYER
Advancement in a Big Company: How it Works

An Interview with General Electric’s C. K. Rieger, Vice President and Group Executive, Electric Utility Group

C. K. Rieger

Charles K. Rieger joined General Electric’s Technical Marketing Program after earning a BSEE at the University of Missouri in 1936. Following sales engineering assignments in motor, defense and home laundry operations, he became manager of the Heating Device and Fan Division in 1947. Other Consumer-industry management positions followed. In 1953 he was elected a vice president, one of the youngest men ever named a Company officer. Mr. Rieger became Vice President, Marketing Services in 1959 and was appointed to his present position in 1961. He is responsible for all the operations of some six divisions composed of 23 product operations oriented primarily toward the Electric Utility market.

Q. How can I be sure of getting the recognition I feel I’m capable of earning in a big company like G.E.?

A. We learned long ago we couldn’t afford to let capable people get lost. That was one of the reasons why G.E. was decentralized into more than a hundred autonomous operating departments. These operations develop, engineer, manufacture and market products much as if they were independent companies. Since each department is responsible for its own success, each man’s share of authority and responsibility is pinpointed. Believe me, outstanding performance is recognized, and rewarded.

Q. Can you tell me what the “promotional ladder” is at General Electric?

A. We regard each man individually. Whether you join us on a training program or are placed in a specific position opening, you’ll first have to prove your ability to handle a job. Once you’ve done that, you’ll be given more responsibility, more difficult projects—work that’s important to the success of your organization and your personal development. Your ability will create a “promotional ladder” of your own.

Q. Will my development be confined to whatever department I start in?

A. Not at all! Here’s where “big company” scope works to broaden your career outlook. Industry, and General Electric particularly, is constantly changing—adapting to market the fruits of research, reorganizing to maintain proper alignment with our customers, creating new operations to handle large projects. All this represents opportunity beyond the limits of any single department.

FOR MORE INFORMATION on careers for engineers and scientists at General Electric, write Personalized Career Planning, General Electric, Section 699-11, Schenectady, N. Y. 12305

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