A Westinghouse reactor in this biggest atomic power plant in continental Europe now helps light Milan and power Italy's industrial boom

Westinghouse has supplied the world's biggest atomic reactor of its kind to Societa Elettronucleare Italiana (SELNI). Located at Trino, near Milan, this plant makes Italy the third largest nuclear producer of electricity in the world and the biggest in continental Europe. The whole countryside around Milan is in the midst of an industrial boom. The grain-rich Po river valley is now pouring out autos, machine tools, steel and pharmaceuticals. This enormous growth is a strain on the power resources of the country, because Italy has an almost total lack of domestic fuel. Atomic power... which uses nuclear fuel... promises an economic solution for Italy and other power-short areas of the world.

You can be sure if it's Westinghouse

For information on a career at Westinghouse, an equal opportunity employer, write L. H. Noggle, Westinghouse Educational Department, Pittsburgh, Pa. 15221.
Arm yourself with facts about DuPont

These booklets helped influence some 863 new technical graduates of all degree levels to join us in 1964.

For example, if you want to start your career in a certain section of the country, you'll find that Du Pont—with facilities in 28 states—will try to accommodate you.

If you're interested in growth for what it can mean to you personally, you'll be interested to know that our sales have increased more than 750% since 1937. You've probably heard that R&D expenditures are a good indicator of a company's future success. We spend $90 million a year on it, $60 million of which goes straight into "pioneering research"—the discovery of new scientific truths and new materials.

Our booklets will answer most of your preliminary questions. Later—or even now if you wish—we can talk specifics by letter, or face to face. Why not write us or send our coupon? We'd like to know about you.

Technical men we'll especially need from the Class of '66

Chemists
Chemical Engineers
Mechanical Engineers
Industrial Engineers

E. I. du Pont de Nemours & Co. (Inc.)
2531 Nemours Building,
Wilmington, Delaware 19898

Please send me the facts about Du Pont.

Name______________________________
Class________Major________Degree expected________
College_______________________________
My address___________________________
City____________________________Zone____State________

An equal opportunity employer
IN THIS ISSUE

On the occasion of the dedication of the Krannert School of Industrial Administration at Purdue University, Herman C. Krannert, Chairman of the Board of Inland Container Corporation, spoke on the subject of “Entrepreneurs.” His thought-provoking remarks are reprinted starting on page 8.

Few people realize how important standardized weights and measures are to everyday life. Jeff Keeler’s report on his visit to the National Bureau of Standards begins on page 10.

COVER NOTE

This month’s cover is by Freshman Alan Espenlaub. It expresses well the lonely beauty of the autumn season.
From the President ............................................. Dr. John A. Logan
Entrepreneurs .................................................. Herman C. Krannert
National Bureau of Standards ............................... Jeff Keeler
So You Want An Education ................................. Prof. Alfred R. Schmidt
Thin Film Chromotography ................................. Kenneth E. Rich

Editorial

Miss Technic

Sports Unillustrated

R & D

Sly Droolings

PRINTED BY MOORE-LANGEN PRINTING AND PUBLISHING CO.
140 North Sixth Street, Terre Haute, Ind.

Published monthly except June, July, August, September and January by the Students of Rose Polytechnic Institute. Subscriptions obtainable by a $3.00 donation to the Student Activities Fund of Rose Polytechnic Institute. Address all communications to the ROSE TECHNIC, Rose Polytechnic Institute, Terre Haute, Indiana.

Entered in the Post-office at Terre Haute as second-class matter, as a monthly during the school year, under the act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized December 13, 1918. This magazine does not necessarily agree with the opinions expressed by its contributors.
ROSE POLYTECHNIC INSTITUTE
Terre Haute, Indiana

HIGH SCHOOL GRADUATES OF 1966
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
System Analysis As An Educational Aid

The inherent value of Systems Analysis as a logical approach to engineering problems has impressed me in four widely different activities with which I have been associated during the past year; a re-evaluation of environmental-health education by the World Health Organization in Geneva; a critique of the Aerojet general study of waste-disposal problems in California (one of four state-sponsored studies being carried out by space-oriented consulting firms in an attempt to find new solutions for nagging community problems; The American Academy of Science review of the Corps of Engineers military construction research program; and finally, the preliminary design of Rose's new Learning-Resources Center.

What is Systems Analysis, and what is its particular relevance in 1965? With the risk of oversimplification, Systems Analysis is the study of "systems" (such as for example urban transportation or communications systems as opposed to the study of system "components". While it is true that Systems Analysis has always been an integral part of the practice of engineering, engineering education has traditionally been component rather than system oriented. As a result, engineers have emphasized the detailed design of individual components rather than the characteristics, performance, and objectives of systems as a whole.

Systems Analysis, both as a philosophy and as a tool, has been gaining increasing support for the past fifty years (it was first identified by the brilliant English engineer Lanchester early in the Century as a unique approach to problem solving); however, it received its greatest impetus with the availability of high-speed computers and the simultaneous development of the mathematics of Operations Research.

While Rose has not yet adopted a systems approach to engineering education, the idea is under review. In the meantime, Dean Herman Moench and his Learning Center Committee are studying Center design from a systems point of view. Their charge is to develop the required characteristics of this new facility—to define its unique role as the vital new element in our educational and research program. In embarking on our agreed objective of National recognition as the outstanding undergraduate college of science and engineering in the nation, the Learning Center is essential. If we are to take advantage of the new understanding of learning and of the learning process, Systems Analysis is, in turn, equally essential.

JOHN A. LOGAN, President
To haze or not to haze,
That is the Question!

THE END IS NEAR

The October eighth issue of the Institute Inklings brought up that ever reoccurring question, "Is there value in Freshmen Hazing?"

As an attempt to answer this question there were published, for all to read and I hope you did, two very good articles on hazing, written by two of our better known faculty members. These articles gave a history of past hazing policies and pointed out basic feelings of both students and faculty. One article presented a "plea for moderation." The other, after discussing the pros and cons, ended with a "take your choice," but did not necessarily mean that you will get it.

That, it seems to me is the whole point. We don't really have a choice. As has been pointed out, most colleges are following the policy of hazing abolition, which results directly from the situation of "bigness" present on most campuses. By this I mean these institutions are so large that there are no efficient means of indoctrinating the freshman class as a whole, and unless hazing is done on a mass basis, I must agree, it has little value.

Therefore, initiation goes undone or is excited by small groups and has no over-all affect of stimulating any class unity or school spirit. In fact the actions of small groups with radical hazing ideas actually destroy spirit and are the very cause of such strict rules against any type of hazing on most campuses.

This is where a policy of moderation might be acceptable. Yet moderation breeds complacency in such activities where enthusiasm is basic. It is like ruling out loud cheering at a ball game. If you can't cheer you lose interest and eventually give up ball games. Another way of saying it is, if we can't do it right, why do it?

It is therefore inevitable that as Rose attains "bigness" as she is doing many things other than old landmarks will fall. Among these is hazing whether we like it or not.

B.J.S.
Another of your future's many facets at Monsanto

With a company growing as fast as Monsanto (annual sales quadrupled to a hefty $1.2 billion in little more than a decade), design of new plants, equipment and systems has never been so important. Engineers are needed to apply their skills and knowledge . . . in known and unknown areas . . . to help us manufacture the new and improved products that move Monsanto ahead—500 new products in the last 10 years.

We can show you what this means in terms of increased professional opportunity . . . how Monsanto's continuing expansion affords more and interesting growing room for you.

See your Placement Director to arrange for an interview when we visit your campus soon. Or write today for our brochure, "Your Future and Monsanto," to Manager, Professional Recruiting, Dept. CM 64, Monsanto, St. Louis, Missouri 63166.

An Equal Opportunity Employer
Entrepreneurs

by HERMAN C. KRANNERT
Chairman, Inland Container Corp.

Text of a speech delivered on the occasion of the dedication of the Krannert School of Industrial Administration Purdue University.

Thank you for that generous introduction. After three quarters of a century, President Hovde, I have learned not to take such praise too seriously. But, I certainly appreciate the spirit in which those words were expressed.

In the long run, the greatest tribute you can pay Mrs. Krannert and me is to make this venture a rousing success. It already is quite a success, of course. But, as one of the "centers of excellence" which we have been establishing in the great universities of the Middle West, the school carries the challenge to excel.

Today I want to talk to you briefly about my hopes—and, I must admit, my fears—for the Krannert Graduate School of Industrial Administration.

My hope is that the school will lead the whole nation in the preparation of talented young entrepreneurs for the American economic system. The dictionary defines an entrepreneur as the person who assumes the risk and management of business. Entrepreneurship is a million dollar name for a kind of magic which turns capital and people into success. But, perhaps the word ought to carry a big price tag because the quality of entrepreneurship is in short supply.

As I look back on fifty years of business experience, I am convinced that it is the entrepreneur who has built American industry—with all of its might and its capacity to produce a high standard of living. I sincerely hope that this school will turn out entrepreneurs who will function as risk takers—whether as foremen, superintendents, sales engineers, plant managers, or chief executive officers.

And, I would be less than candid if I didn't tell you that I have some fears. Too many people who have gone to graduate school of business want to be sure before they act. Before they take on a new responsibility, or install a machine, or launch a new sales program, they spend weeks and weeks assembling information. They insist on having such complete data that they never get to the point where they do something.

Now I believe that staff work can be valuable—and that somebody must keep the books and prepare the reports. And, I hope that the faculty in our graduate school will always be in the forefront of research on how to assemble and use information to make the best decisions. But, I have some fears that we can have too much respect for staff work. There is a place for thinking and a place for acting. And a man who can only think, but doesn't have the courage to act, will probably not succeed in this fast-moving world of business. My main fear is that we will over-emphasize the role of the intellect. People have to be smart and well-trained to be risk-taking managers nowadays, but they have to be something more. And it is this something more that I want to underline.

Sometimes this something more is called character. Well, it's true that integrity and courage are necessary to be an entrepreneur. But there are many men of character who are not entrepreneurs. And so, if you will permit me to look back in my life, I would like to tell you what it means to be an entrepreneur and chief executive officer of a company.

I hesitate a little because you might say "what has this to do with education?" My answer to this is that, if our school is to educate entrepreneurs, we should know just what an entrepreneur does. I am sure you will understand if I do not include many of my activities which really belongs in sales, production, or finance. When I was building Inland Container Corporation, I did a great deal of the selling. I always talked not only with purchasing agents, but with the owners of the business and the boys in the shipping department and the production plant. I wasn't just selling a product, but a method of service to customers that would help them to reduce their own costs of operation. I also got out into my plant with my fellows. And when I wanted to know what was happening in the economy, I talked to the bankers. And I would say to you—never get so far from the guts of the business that you can't take over one of these operating jobs when necessary. You have to know how they function before you can manage them. You don't step from the campus into leadership. You are really just beginning your post-graduate education.

But, apart from these stand-by jobs, what does a chief executive officer do? Is there a separate job for the man who carries the big
risk-taking function in a business? And, if there is, what is it? If everybody in a company did his job superbly well, would the chief executive have anything left to do? The answer, as I am sure you will agree, is YES.

Perhaps my first and most important job has been to weave the larger dreams which hold the organization together. All of us have dreams of what we would like to get done. When I was working in Chicago for six dollars a week, my dream was to support my mother and get enough money saved to pay for part of my first year at the University of Illinois. Our corrugator operators, our sweepers, our salesmen in Inland Container all have career hopes. And the job of the chief executive officer is to tie all these hopes together into a strong rope of company goals which every man can grab for support and strength.

Let me elaborate from my own past. Back in 1932, business was hard to come by, but dreams were just as big as they are today. The only way that Inland and its people could continue to grow during the depression was to get into big container business. It wouldn't happen immediately, however. There would be a time when money was shorter as we tooled up for large volume customers. I decided that the risk had to be taken so I went out and signed up our first volume customer—Postum. When I brought the news back to my associates, I found that my faith in their faith was well justified. As a matter of fact, all of them offered to take a salary cut, if necessary, to tide us over.

Nowadays as I watch professional managers develop job descriptions, salary brackets, five-year sales projections, personnel-manning tables, and all of the other traveling baggage of scientific management, the more concerned I become. If we send our men from Purdue with their herds full of figures and facts, suitcases full of techniques and computer tape—but without deep respect for the ambitions of people in the soul and a lively dream-making ingredient in the spirit—we won't be developing entrepreneurs.

It was said that an army doesn't march on its stomach, and I would say to you that scientific gadgets will not produce the loyalty and enthusiasm which make an organization move forward. Every business marches on its dreams.

Let me be more specific. When the dreams are too detailed, they don't allow enough room for the individual imagination of the people who get things done. And if the imagination runs wild, there are people who will say that the goals are impossible and they won't join in supporting the program. Some place between these two extremes there is always a dream which will capture the imagination of the people in a company who want to work and to advance. The dream must be big enough to serve as an umbrella over the individual dreams of many people and yet specific enough to serve as the basis for rewarding successful performance.

Lest you think that dreaming at the top level is a soft, a feet on the desk job, let me tell you that there is plenty of hard work in this kind of industrial leadership. I am always puzzling about how I can communicate my dreams to my people. Just telling them is not enough. They must feel the urgency of these goals. I want them to join me in tackling the future with enthusiasm. This means that I must be prepared to reward the ones who are succeeding and to penalize those who are failing. One of my hardest assignments is to penalize the "status quo" people. Many are real friends and I hate to see them disappointed. But people who are not reaching cannot be rewarded if the organization is to stretch.

I have frequently heard it said: "Have no small dreams for they have no magic to stir men's souls." As I think about forty years of running my own company, I would say that this task of "effective dreaming" is my most important activity. It is one I cannot delegate. And I doubt that companies which entrust it to some long-range planning department will succeed. It is the unique role of every chief executive officer to cast the long shadow over his organization. In some degree, every company is the reflection of the chief executive's hopes and dreams. Scientific management, computers, mathematical models and all of the other gimmicks which are so fashionable these days will never, in my estimation, reduce the importance of the effective dreamer. Nor substitute for him.

Now, in the second place, the chief executive must be a master treacher. I have done a lot of thinking about what it is that makes for what we call a "solid" business. We know, of course, that good people are essential—but this is not enough. Something else is needed. And I have concluded that this something else is the unique fund of knowledge which the organization has accumulated. If all of Inland's managers were suddenly to be transferred to the moon so that we would have to replace all of our earthly crew with fresh talent which, for the sake of argument, are as smart as the old ones—we would still lose something very important for our organization. And what we would lose is the knowledge that we have accumulated over forty years of facing problems together.

The knowledge I am talking about is made up of the unwritten practices of the machine operators in our plants, of the contacts of our sales engineers, of the technical findings of our research people, and so on. There is a separate pool of knowledge which could be identified as Inland Container. Indeed, I suspect that every business organization is a unique pool of knowledge.

No person, least of all the chief executive officer, can have all the information in his company's pool of knowledge. But it is he who must constantly be asking—Is it adequate? Is there enough knowledge to handle the problems of the future? How much information in the pool (Continued on Page 22)
The National Bureau of Standards is a United States government institution established in 1901 whose principal function was to provide technical assistance to educational institutions, private and public industry, and individuals. This assistance takes six forms:

1. Development and maintenance of the national standards of measurement and the provision of methods for making measurements consistent with these standards;
2. Determination of physical constants and properties of materials;
3. Development of methods and instruments for testing materials, devices, and structures;
4. Advisory services to government agencies on scientific and technical problems;
5. Invention and development of devices to serve the special needs of the government;

To carry out these six functions in the many fields in which the NBS is involved, the Bureau is organized into four basic institutes:

1. The Institute for Basic Standards;
2. The Institute for Materials Research;
3. The Institute for Applied Technology;
4. The Central Radio Propagation Laboratory.

This organization was designated by the Secretary of Commerce in January, 1964, in order that the NBS could serve as a local point in the Federal Government for assuring optimum application of research in the physical and engineering sciences to technological advancements in industry and commerce. The programs of these four institutes intentionally cover broad areas of research and services.

The Institute for Basic Standards provides for a complete and consistent system of physical measurement and coordinates the United States system with systems of other nations. This institute measures and disseminates fundamental properties of matter. The Offices of Standard Reference Data coordinates the National Standard Reference Data Program (NSRDP) and keeps a central national file of critically evaluated data from the physical sciences. This institute is composed of several divisions covering such classical areas of science and engineering as electricity, optics, heat, mechanics, radio physics, astrophysics, metrology, applied mathematics, etc.

The Institute for Materials Research strives to improve the understanding of the basic properties of matter. It contributes to NSRDP by developing data on the bulk properties of materials and developing methods of measuring these properties. The divisions of this institute are organized by technical field for which each is solely responsible. Such divisions are cryogenics, polymers, metallurgy, analytical chemistry, etc.

The Institute for Applied Technology develops criteria for the evaluation of performance of commercial and industrial products and services and provides a specialized information service to meet the needs of specific industries. Divisions of this institute include Building Research Division, Textile and Apparel Technology Division, etc. The Institute also maintains the clearing-house for Federal scientific and technical information which makes available to industry and technical communities classified unclassified technical reports and information about present government sponsored technical work. The Office of Engineering Standards strives to coordinate all national standardizing

(Continued on Page 23)
Graduation was only the beginning of Jim Brown's education because he joined Western Electric.

Jim Brown, Northwestern University, '62, came with Western Electric because he had heard about the Company's concern for the continued development of its engineers after college graduation. Jim has his degree in industrial engineering and is continuing to learn and grow in professional stature through Western Electric's Graduate Engineering Training Program. The objectives and educational philosophy of this Program are in the best of academic traditions, designed for both experienced and new engineers.

Like other Western Electric engineers, Jim started out in this Program with a six-week course to help in the transition from the classroom to industry. Since then, Jim Brown has continued to take courses that will help him keep up with the newest engineering techniques in communications.

This training, together with formal college engineering studies, has given Jim the ability to develop his talents to the fullest extent. His present responsibilities include the solution of engineering problems in the manufacture of moly-permalloy core rings, a component used to improve the quality of voice transmission.

If you set the highest standards for yourself, enjoy a challenge, and have the qualifications we're looking for — we want to talk to you! Opportunities exist now for electrical, mechanical and industrial engineers, and for physical science, liberal arts and business majors. For more information, get your copy of the Western Electric Career Opportunities booklet from your Placement Officer. And be sure to arrange for an interview when the Bell System recruiting team visits your campus.

Western Electric
MANUFACTURING AND SUPPLY UNIT OF THE BELL SYSTEM

AN EQUAL OPPORTUNITY EMPLOYER

Principal manufacturing locations in 13 cities
□ Operating centers in many of these same cities plus 36 others throughout the U.S.
So you want an education? That’s great! Except perhaps for democracy, motherhood, and in some circles medicare, there’s hardly a nobler cause around these days. But what are you really saying when you say you want an education? Sometime back, the Indianapolis Star had on its front page the quotation, “There is nothing the U.S. public is so willing to pay for and not get as an education.” Aside from being a barbed comment, this is also a very astute observation. There was a time when one person would ask of another “Where did you pursue your education?” We have now shortened this, or made the question less formal, so that it comes out as “Where did you get your education,” or, simply, “Where did you get your degree?” Notice the change in the action — from “pursuing” to “getting?” Certainly one might suppose that with the expense of attending college being as high as it is, the “pursuit” comes in raising the money and after that exhausting race there should be little else required but to lean back for four years and “get educated.” But, gentlemen, it won’t work—if you don’t!

Since this is a college dedicated to science and engineering, your automatic response to such a dogmatic statement as “it won’t work” ought to be “Why won’t it work?” There are two general ways for investigating this proposition: one is to find all you can that is already known about “leaning back and getting educated,” then determine what else, if anything, needs experimentation; and the second way is to start from scratch yourself. Some of you, I realize, will do your own independent research on this question and, certainly, we wouldn’t want to stifle curiosity. But be fore-warned that this kind of research is called a destructive experiment—you may succeed in proving “it won’t work” but flunk out in the process!

So why do I say “it won’t work”? How many people do you know who became good ball-handlers by just watching basketball. Is there something more involved than just bouncing it every-so-often and tossing it to someone else or through an iron ring, Take running the two-mile for example—an extremely simple performance where you just put one foot in front of the other and from there on it’s repetition for two miles, along with some arm-waving and anguished facial expressions. I’ve watched lots of these and that’s the way it looks.

Or take one of the newer hobbies — assembling your own hi-fi kit. According to the instructions, all you have to do is be old enough to hold the necessary tools, be able to read the directions to solder wire no. 27 to pin no. 102, and so on for thirty or so pages. Then presto! You plug it in—and it won’t work; or perhaps it “works” but in addition to the melodic stereo tones of the Rolling Stones, you get a hum which exceeds human tolerance.

Or consider the fundamentals of playing a piano—all you do is push down a collection of keys and what could be simpler for any ten-digitated person?

In exactly the same way, what could be complicated about any course you will take? You simply take the plugs out of your ears, listen to and watch the instructor in class (while you are seated comfortably in an air-conditioned carpeted room), then go to your dorm room and simply read a book and write some stuff now and then. You know where your next meal is coming from and no-one is shooting at you. Pretty soft, this “getting educated.”

Seriously, gentlemen, you know from experience that no skill can be yours without considerable practice. And you also know from experience that after you have developed a skill you will become “rusty” without continual practice and soon the skill is gone—and all that remains is an appreciation for what it takes to develop and maintain that skill. This is equally true of any facet of what we call “education.”

Let’s consider now the question of what constitutes this “education” you have chosen to pursue.

A recent newspaper editorial contained this paragraph:

Choosing a vocation does not mean the student should shut out the world of knowledge beyond his narrow perimeters. The
Successful men of any vocation are those whose interests are broad, who can relate their endeavor to the work of others, and who are quick to recognize a potential application to their work from another field.

Dr. Elliott, Vice-President of I.I.T., said recently that education is not training. It is the equipping of an individual with the tools, the capability, and the desire to continue in his personal and professional development as long as he lives. It is an attitude of mind; not a terminal degree.

And Dr. Karl Compton observed that the ultimate value of an undergraduate education depends far more on the quality of intellectual and moral discipline and inspiration than it does on the particular course of study which is the vehicle through which this discipline and inspiration are imparted.

And to help us keep our sense of perspective, there is the comment of Charles Carter. He said education is not an act of salvation, after which one is safe for eternity... The present generation of students will still be employed in the year 2000; but long before then their degrees and diplomas—at any rate, in science, technology, and the social sciences—will have become obsolete... Measures to combat obsolescence, therefore, become of prime importance.

President Logan described the attributes of an educated scientist or engineer by saying they should be highly competent in reading, writing, perception, concentration, organization of material, objectivity, problem-solving, decision-making, and creativity.

Each of these attributes is itself a skill and is not available by merely wishing for it. Rather, it takes much patience and practice—even more than just the four years of undergraduate school.

One other area must also be recognized. We are human beings in a world of human beings, and our work is with other human beings. We work for others and often others work for us. To a large measure, gentlemen, your present and your future is strongly affected by all people with whom you associate or meet. And at the same time you are influencing them in some measure, great or small. Each of us must be concerned with the personality we present to others, with our character, our dignity, our integrity—in short, we must consider what we are as human beings and what we stand for. We must be responsible citizens.

Let's consider for a minute this business of our association with, our impressions of, and even our prejudices toward others. Do you form an opinion of an instructor, a classmate, or other person based on first impressions? Suppose you get sick and someone calls a doctor about whom you know nothing. A while later, the door opens and in walks this cool cat in his bermudas, bare feet in dirty white sneakers, a long hairdo reminiscent of an English sheep dog, and an air about him that resembles more the underside of the saddle than an English Leather.

Chances are that your ailment moves to second place behind the hope for mere survival.

Or suppose you get hauled into court on a charge of which you are innocent. The bailiff intones “All rise!”, the side door opens and in swaggers this ape in his dirty jeans, black leather jacket, cigar, and a coiffure done by the same barber that doctor goes to. What do you suppose would happen to your confidence in seeing any justice in that court?

Okay, now suppose that next Spring, you take a job interview for summer employment. The interviewer will spend just a few minutes with you; he will get very little more than a first impression—of your appearance, your manners, your speech, your integrity, your self-confidence, and so on. And based on this, together with comments he can get from faculty members, he will decide whether to buy your services.

Want to try it dressed in a dirty T-shirt, scraggly beard, and Japanese thongs?

(Continued on Page 34)
What do you really know about Caterpillar?

You think of Caterpillar as a yellow machine, crawling along a muddy road. That’s all? Think again.

Put 49,000 skilled people on that machine. Add 16 manufacturing plants, in both hemispheres, to your image.

Still not close enough.


Not one yellow machine. Thousands. Not one Cat representative. An army of them. And a world-wide network of parts suppliers.

You’ve got to think of design. Manufacturing. Sales. And research—an average of $40 million a year, spent on research. (In 1964 it was $45 million). Big testing ground facilities. Technical centers, among the most modern in the world.

You’ve got to imagine engineers, too. Mechanical, chemical, industrial, metallurgical, agricultural, electrical, civil… every kind of engineer good schools produce. Caterpillar has an important position for all of them.

You might check into Caterpillar leadership in the world’s business community. We stood 48th on the latest list of “500 largest manufacturers,” and we’re one of the top five exporters in the United States.

Ask your placement office for information on Caterpillar. Find out about some of the many contributions Cat research engineers have made in many more fields than earthmoving.

Got it? There’s a scope of operations here that makes Caterpillar a good place to put your life. If you agree, get in touch. We certainly need what you have to offer!
Detroit Edison and Consumers Power Company are jointly sponsoring research at the University of Michigan, devoted to advanced mathematical methods for power system stability analysis and generator field control. Shown are Professor Anthony J. Pennington (left), director of the project, and James Bennett, a graduate student.

Campus research is important to Detroit Edison

Detroit Edison supports research activities at many engineering universities and receives valuable information from these joint programs. Here are some of the projects now under way at University of Michigan, Iowa State University, Kansas State University and Rose Polytechnic Institute.

- Power System Stability Analysis and Generator Field Control
- Analysis of Conductor Vibration
- Modern Solutions for Power Networks
- Mathematical Models for Peak Load Forecasting
- Block Diagram Representation of a Power Generating Unit—a first step in stability analysis
- Thermionic Conversion

Research projects such as these provide a challenge for both professors and students alike. This challenge continues after graduation in our research laboratories and engineering departments because interesting things are happening at Detroit Edison.

If you're graduating this year and want to put your ideas and energies to work—write to Mr. George Sold, The Detroit Edison Company, Detroit, Michigan 48226. And look for the Edison personnel representative when he visits your campus.

Detroit Edison
SERVING SOUTHEASTERN MICHIGAN
THIN LAYER CHROMATOGRAPHY

By KENNETH RICH

Ken Rich is a senior Chemistry major from Wood River, Ill. He is treasurer of the ACSSA, secretary of the SAME, and president of the Rose Film Society.

Chromatography is a method of analysis in which the flow of solvent or gas promotes the separation of a substance by differential migration from a narrow initial zone in a porous medium.

"All techniques of chromatography are based on the simple principle. They all involve a moving system of some type which is in equilibrium with a stationary phase. These phases are so designed that the mixture to be separated will be distributed between the two. When the stationary phase is a solid and the forces acting between it and the mixture are absorptive in nature, the technique is called absorption chromatography. When the stationary phase is a simple liquid or a liquid held on some type of support, the chromatography is considered to be partition chromatography."

In general, absorption chromatography involves a relatively non-polar phase and works best when the substances to be separated are not very polar. The major advantages of partition chromatography are that larger quantities of a mixture can be separated and that a controlled temperature is not necessary.

Partition chromatography generally polar solvents and mixtures of very polar compounds. Since it is basically dependent upon the distribution coefficients of the substances in question, which are, in turn, highly sensitive to temperature and other conditions, a carefully controlled atmosphere is necessary.

It is difficult to sort out the various originators of some concept or technique because any such development is the result of contributions and ideas from many people and laboratories.

The historical development of thin layer chromatography is best divided into two phases. The first phase is the conception and initial development of equipment and techniques followed by their slow but steady adoption. The second phase is an extensive and rapid development following the invention of new equipment, the standardization of the method, and particularly, the commercial availability of apparatus and absorbents.

In 1938 Izmailov and Shraiber described the use of a thin layer of absorbent on glass plates for the separation of galenicals.

In 1941 Crowe described the use of thin layers of unbound absorbent to help predict the best solvents for column chromatography.

In a book published in 1947 Williams reported the use of thin layers of absorbent held between horizontal glass plates.

The use of a binding agent (starch) to hold the layers in place was introduced by Meinhard and Hall in 1949.

The next and the most extensive and comprehensive contributions to the development of thin layer chromatography were made by J. G. Kirchner, J. M. Miller and their co-workers at the United States Department of Agriculture Laboratory in Pasadena, California. In an extensive series of papers during the years 1951
to 1957 this group investigated various absorbents and binding agents. They designed equipment for the preparation of plates and used the technique for the investigation of the terpenoids.

Starting a little later, Mottier and Potterat worked out a method for analyzing food dyes on layers of nonbonded alumina and even separated amino acids by this technique. The major reason for the slow development and adoption of the technique during the time for 1951 to 1958 was the fact that equipment and chemicals were not commercially available. This was made possible by Egon Stahl in Germany. Stahl, working with C. Desaga in Heidelberg, devised a system involving standard size glass plates 5 by 20 cm. and 20 by 20 cm., a new apparatus for preparation of layers, and a standard absorbent, silica gel-plaster of Paris. The apparatus became commercially available from Desaga and the absorbent from E. Merck. Stahl and his co-workers studied the variables of the technique in a thorough manner and applied it to many new types of organic compounds and pioneered the use of new absorbents. Stahl called the method Thin Layer Chromatography and the name was widely accepted.

Applications of the thin layer technique mushroomed after 1958. Today it is used almost routinely in natural product, pharmaceutical and lipid laboratories.

The importance of chromatography lies primarily in its use as an analytical tool. It serves as a means for the resolution of mixtures and for the isolation and partial description of the separated substances. It is an indispensable exploratory method in all sciences dealing with chemical substances and their reactions. It is among the most selective and the most widely applicable separatory technique yet devised.

Some of the advantages of thin layer chromatography are, the smallness of the amounts of materials involved, the speed with which results are obtained, the fine resolution of closely similar substances and the permitting of sensitive and specific qualitative analysis of the mixtures.

Thin Layer Chromatography suffers from the short-comings of paper chromatography, namely tailing, and limited load capacity. But the major disadvantage of thin layer chromatography is that the Rf values of substances are not exactly reproducible. This is probably traceable to the complexity of surface adsorption.

To help in further understanding of Thin Layer Chromatography a few definitions are useful.

1. Adsorbent is the finely divided powder which makes up the stationary phase in adsorption chromatography or holds the stationary liquid in partition chromatography.
2. Layer refers to a thin layer of adsorbent, bound or unbound deposited on a glass plate.
3. Spotting refers to the application of the substance to be separated to the thin layer.
4. The development is the passing of a liquid through the layer to affect a separation.
5. The developer is the liquid itself.
6. Visualization refers to the rendering visible of the results of a developed chromatogram.
7. The Rf value is the distance traveled by a given substance divided by the distance traveled by the solvent front. Both are measured from the origin.

Thin Layer Chromatography can be applied to column chromatography in that it can predict in a short time the ideal solvent and absorbent to be used. One needs only to find a system in which the product moves and the contaminant stays at the origin and to transpose this to a short column. Thin Layer Chromatography can also be used effectively in analyzing the effluent from column chromatography for completeness of separation.

Thin Layer Chromatography is used in clinical chemistry for quantitative assay where speed is important although there is the limitation of an error of from three to five percent.

There are many types of adsorbents, in fact, almost anything can be used. The four most widely used are: silica-gel, alumina, kieselguhr earth, and cellulose.

Silica-gel is acidic in nature making it equally suited for either adsorption or partition chromatography of non-polar acidic, non-polar neutral, and polar compounds. Alumina is basic and is best suited for adsorption chromatography of non-polar basic or neutral compounds. Kieselguhr earth is neutral and is best suited to partition chromatography of polar compounds. Cellulose is neutral and is best suited to partition chromatography of polar compounds.

Additives are often added to the adsorbents to change their properties, either physical or chemical. The most common are binders, acids, bases, buffers, reagents and complexing agents.

Binders are added to the adsorbent to make it more cohesive and to make it stick to the plates better. This makes the layers easier to handle and makes it possible, for them to be sprayed or dipped into other reagents. The most common binder is Plaster of Paris. Others are starch and polyvinyl alcohol.

Acids, bases, and buffers are added to the adsorbent to help in the separation of acids and bases. The additives accomplish this by keeping the compounds which are being separated in their non-ionic form, thus preventing tailing or a blur.

(Continued on Page 29)
To Continue To Learn And Grow . . .

. . . is a basic management philosophy at Delco Radio Division, General Motors Corporation. Since its inception in 1936, Delco Radio has continually expanded and improved its managerial skills, research facilities, and scientific and engineering team.

At Delco Radio, the college graduate is encouraged to maintain and broaden his knowledge and skills through continued education. Toward this purpose, Delco maintains a Tuition Refund Program. Designed to fit the individual, the plan makes it possible for an eligible employee to be reimbursed for tuition costs of spare time courses studied at the university or college level. Both Indiana University and Purdue University offer educational programs in Kokomo. In-plant graduate training programs are maintained through the off-campus facilities of Purdue University and available to employees through the popular Tuition Refund Program.

College graduates will find exciting and challenging programs in the development of germanium and silicon devices, ferrites, solid state diffusion, creative packaging of semiconductor products, development of laboratory equipment, reliability techniques, and applications and manufacturing engineering.

If your interests and qualifications lie in any of these areas, you're invited to write for our brochure detailing the opportunities to share in forging the future of electronics with this outstanding Delco-GM team. Watch for Delco interview dates on your campus, or write to Mr. C. D. Longshore, Dept. 135A, Delco Radio Division, General Motors Corporation, Kokomo, Indiana.

An equal opportunity employer

solid state electronics

Delco Radio Division of General Motors
Kokomo, Indiana
Who makes the bucket seat for the world's youngest drivers?

Here's an entirely new kind of baby car seat.
It's designed to keep children safe and just as comfortable as grown ups. There's soft vinyl foam padding all around. And special legs make it a real convertible seat for use inside the home as well as outside.

We're making many new things at Union Carbide. For the electronics industry, our plants are now producing components for computers and electronic equipment used in satellites and other space equipment. We've just built a new plant to make transistors and we're expanding another facility for producing capacitors, including a new type that's one-fifth the usual size. It uses a unique new Union Carbide plastic film just five millionths of an inch thick.

To keep bringing you these and many other new and improved products, we'll be spending half a billion dollars on new plant construction during the next two years.
October's Miss Technic is Jeanne Ann Forbes, an ideal date for all fall festivities. This 19-year-old blonde is a graduate of Terre Haute's Wiley High School and now works as a salesgirl in a downtown store.

Jeanne prefers outdoor activities, with water-skiing, swimming, and horseback riding heading her list of favorite sports. She also enjoys the more sedate pleasures of sewing and listening to records, especially those of Peter, Paul, and Mary.

For those interested in statistics, hers are of more passing interest: Height 5'4", weight 118 lb., perimeter at three random locations 35-24-36. The editors hasten to add that these dimensions are reported only as quoted, and have not been verified experimentally.
MISS TECHNIC
FOR
OCTOBER

(Photos by Stewart)
ENTREPRENEURS

(Continued from Page 9)

of knowledge is wrong information? How can he get people to be skeptical without being negative? How can he blend the knowledge of the men on the line with the knowledge highly-trained college graduates bring to the organization?

These are the problems of teaching I have been facing for forty years. I am convinced that the companies with the most up-to-date and usable pools of knowledge can earn the larger profits and better satisfy the needs of customers. My challenge has been (and yours will be if you become a risk-taking manager) to use the world of activity to teach people the knowledge they must have to succeed.

Many times this means watching people make mistakes while they are learning—even though I know, or think I know, a better way to do it. I encourage people to make some mistakes because it is much healthier for the company than paralysis. It gives a man more confidence when he gets himself off dead center than if you give him a push. However, I can tell you that teaching takes a lot of patience so I have real sympathy with the teachers in this audience.

I feel that a substantial part of my life has been spent in another kind of classroom. Every business organization is partly an educational institution. The main subject which must be taught by the chief executive is what you faculty people might call history—but, in industry, it is known as experience. Some young people don't want to wait long enough to accumulate experience. They won't go very far without it, and they would miss most of the adventure of business if they did.

It is not enough for a company to develop a recruiting program and to hire training directors. Both of these certainly make a real contribution. But the chief executive officer must himself be vitally involved in the process of knowledge accumulation if his company is to grow and prosper.

Not only is a company a pool of knowledge, it is also a communications system. Unfortunately, communications systems tend to destroy themselves in a number of ways. People gossip, and this puts static in the system. Personal ambitions lead to the withholding of information. And people get to thinking that if they write long reports, they can get promoted, and this leads to the clogging the pipeline with a lot of useless knowledge.

Left to itself, every organization runs down. It gets choked with its own words and destroys itself. And nobody but the chief executive officer can really keep the communications channels open and clear. As long as he keeps the big picture clearly in front of people and insists that they live up to the challenge of change, they will talk to each other about things which are significant.

My problem is to keep talking—but not too much—about the right things. And let me say right now that the committee—which, as I see it, is another gadget of scientific management—is not the way to do it. Mostly, the committee is a way to waste time. It would be a great contribution to society if our administrative sciences department could originate a better way of getting people to communicate with each other without fear. And a better way of generating ideas than the typical committee meeting.

I am now going to turn to the most important task of every entrepreneur-manager. However, you are going to have to think this through with me because it is a difficult thing to convey in words. I am talking about the chief executive's responsibility to bear risks.

When any man looks at the world today, he has every reason to be scared. Changes are forever sweeping through our economy. No technical process can be expected to last very long. New products replace old ones while the old ones are still new. Even the concept of private property is being threatened. The odds against any single project succeeding in a world so full of change are pretty slim.

And then I will throw in another complication—and that's the role of pure accident. It's a world of chance we live in as well as change. The best paper machine may blow up or the strongest overseas market may have a revolution. Putting all these things together, I tell you right here that the world is a risky place and the chance of succeeding on any project is not very high.

The chief executive officer of any company must be honest in appraising these risks. He can't fool himself about their magnitude. At the same time, he must face the fact that most of the people who work for him don't take risk in such big doses. If they are asked to, they worry so much about it that they get nothing done. So the chief executive's job is to give more security to his people than he gets from the world. He is like a banker who gives his depositors easier access to money than he gets.

Let me state it another way: every business consists of many ventures. Some of them are going to succeed and some of them will fail. The business, as a whole, must have enough success to finance its failures. And the people who do the job of producing, selling, and financing each of these ventures must know that, after they have done their best, the organization will reward them regardless of the immediate outcome of that particular venture. It is the chief executive's job to choose that collection of ventures which, on the average, will succeed. It is his job to give the employees involved in each venture the assurance that, despite the uncertainties of the world, their contributions will be appraised. In a sense, the chief executive officer is an anchor to the windward in the storm his organization is always facing.

The chief executive is always breaking high-risk ventures into lower-risk projects for his men. He is absorbing risk because this is the only way big things can be done by

(Continued on Page 28)
(Continued from Page 10) organizations in the field of science and engineering.

The Central Radio Propagation Laboratory, in Boulder, Colorado, is responsible for collecting, analyzing, and disseminating information on the propagation of electromagnetic waves and associated events. This institute develops data useful in much communication work.

NBS maintains a calibrations service open to science and industry. As science and technology continue their rapid advances, measurements are required on new materials and older fields require more accurate measurements over greater ranges. The Bureau anticipates the need of these measurements and has them available when called up by industry. Accelerating calibration procedures through use of digital computers and automation is required if this data is to be kept up-to-date. Last year the Bureau developed a technique of calibrating a length in fifteen minutes, whereas by old methods this calibration would have required fifteen hours. The device used an automatic fringe counter with a standard interferometer.

Large weights are becoming more useful in devices used to measure thrust in rocket engines. When these weights are sent to the laboratory in Washington, D.C. to be calibrated, the testing equipment of the customer is out of service. A new technique was devised which allows any laboratory to use at-hand materials to calibrate 10,000 lb. weights at a precision of 5 parts per million. This should save the government several millions of tax dollars in the next few years.

The NBS is in a position to coordinate the standardization data of recognized standardizing bodies such as ASA and ASTM. Members of the Bureau hold active positions on the staffs of such associations.

NBS operates and maintains WWV at Greenbelt, Maryland; WWVH at Maui, Hawaii; and WWVB and WWVL at Ft. Collins, Colorado. These stations operate at frequencies from 20 Kc. to 25 Mc. provide anyone with a suitable radio standard radio frequencies, standard audio frequencies, standard musical pitch, time signals, propagation forecasts, geophysical alerts, and astronomical time corrections. The entire standard reference system is based on a basic frequency reference (USFS) of a cesium beam, the heart of an atomic clock. The stability of WWV standard frequencies are within 5 parts in 100 billion. And the accuracy is within 1 part in 100 billion.

Other activities NBS engages in include planning and executing programs for the International Quiet Years Of The Sun (IQSY) through 1965. The sunspot cycle is at a minimum of activity at present and solar disturbances are least likely to affect the ionosphere and hence affect radio propagation. NBS assisted the Defense Communication Agency in developing a computer program to simulate our Defense Communication System. They have done research for the Naval Training Device

(Continued on Page 34)

CIVIL ENGINEERS:

Prepare now for your future in highway engineering...get the facts on The Asphalt Institute's new computer-derived method for determining structural design of Asphalt pavements for roads and streets

Today, as more and more states turn to modern Deep-Strength* Asphalt pavement for their heavy-duty highways, county and local roads, there is a growing demand for engineers with a solid background in the fundamentals of Asphalt technology and construction.

Help to prepare yourself now for this challenging future by getting the latest information on the new Thickness Design Method developed by The Asphalt Institute. Based on extensive statistical evaluations performed on the IBM 1620 and the mammoth IBM 7090 computers, accurate procedures for determining road and street structural requirements have been developed.

All the facts on this new method are contained in The Asphalt Institute's Thickness Design manual (MS-1). This helpful manual and much other valuable information are included in the free student library on Asphalt construction and technology now offered by The Asphalt Institute. Write us today.

*Asphalt Surface on Asphalt Base

THE ASPHALT INSTITUTE
College Park, Maryland

(Continued on Page 34)
The football team is off to a great start this year following victories over Indiana Central and Illinois College. It would have been hard to forecast these victories because of the team's lack of experience. Of the 46 members out for this year's team there are no Junior and only 5 seniors. One of these Seniors was quarterback Gib Bosworth who was magnificent in his first outing of the year. Bosworth clicked on 11 passes in 27 attempts for 163 yards against Indiana Central. For the two games, Bosworth is 18-45, a 36.5%. Gib had a bad start in the first quarter of the I.C. game but his passes were right on target. Led by Mike Mefford, sophomore halfback, the receivers got hot hands. Mefford scored two touchdowns on passes from Bosworth. Freshmen John Ward and senior Joe Tyan also got into the act.

The offensive front wall should be praised for the fine job of providing protection for Bosworth and thus giving him time to get rid of the ball. Led by senior Bill Lewis (Most valuable player for two straight years) who, it seems, covers the whole field from his middle line backer spot, the defense has held its opponents to 6 points in two games. On a defensive point system devised by Coach Martin, Lewis has 79 defensive points for the two games. From the middle linebacker Lewis has 18 unassisted tackles. Other defensive points, Tom Vetters, 36; and Ben Bradburn with 35. These helped Rose twice stop Illinois College within the 20 yard line. Against Illinois College 8 passes were intercepted raising the total for two games to 13 intercepted passes. Vetters intercepted 3 passes and Bradburn intercepted two passes and ran one back for a touchdown.

The cross country team, with everyone back from last year and with a good turnout from the freshmen class, started off the season with a bang—a 15-48 victory over Marian. However in the very next meet the tables were turned as Wabash defeated Rose 15-42. All is not black, if the team keeps up its steady improvement Rose will have a winning season. The team is looking forward to an encounter with DePauw University cross country team on Oct. 9, 1965. DePauw was a late arrival on the schedule to replace St. Joseph, which will not field a team this year.

The season outlook is brightened by the return of senior MVP John Lynn, and his freshmen brother, Larry. John and Larry tied for first place in the Marian meet, but Larry placed ahead of John against Wabash. With these two fighting each other for first place, the rest of the teams on the schedule better be prepared to forfeit first and second place. Freshmen Don Gregurich and two year letterman Larry Sachs have been doing a fine job. Tom Foltz, Jack Braun, Len Duszynski and Larry Olson have been doing a fine job lately.

It is nice to see a change in the sports achievemests of "Dear Old Rose." Last year's basketball team's record was 10-11—their most satisfying win came over Wabash. Besides the cross country's team 4-2 record two seasons ago, the baseball team was the first team to have a winning season since '58. Their 8-5 record included wins over Wabash, Franklin, Principia, and a tie for the Prairie Conference. The football and cross country have a fine start this year. It all goes to show that: fine athletic teams can go hand in hand with academic excellence.

Do You Want To:

1. Develop Leadership?
2. Have A Good Excuse for Not Studying?
3. Learn a Useful Trade?
4. Have an Activity to put on Your Job Application Form?

If so, Then Join The ROSE TECHNIC TODAY!
The hidden enemy is vapor in automobile fuel lines. Causes vapor-lock that stalls cars on warm days.

Our special agent is Dr. John O. Becker, University of Illinois, '64. Here he plots a temperature-pressure-fuel relationship as he specializes in fuel volatility at our Whiting, Ind., Research & Development lab. One of his theories has already been proven. The next step—a practical application useful in re-blending gasoline. To make it less prone to vapor-lock.

In his spare time, Dr. Becker is boning-up on car engines of the future. Maybe someday he'll help us formulate a new kind of fuel for a yet-unknown engine.

How about you? Looking for a challenge—and a chance to contribute to the exciting new technologies shaping tomorrow's world? Your opportunity may be here at American Oil. Whether you're a mechanical engineer, as Dr. Becker is, or a chemist, metallurgist, mathematician or physicist.

For more information, write J. H. Strange, American Oil Company, P.O. Box 431, Whiting, Indiana.
A National Aeronautics and Space Administration scientist has synthesized the five chemical building blocks of DNA and RNA in a simple laboratory model which duplicates conditions on the primitive Earth.

The two nucleic acids, DNA and RNA, form the core of and are the "prime movers" of all living cells in plants, animals, and man. The five DNA-RNA building blocks, known as nucleotides, are made up of a nitrogenous base, sugar, and a phosphate. The synthesis of the five nucleotides under laboratory conditions like those believed to have existed on Earth from three to four and one-half billion years ago, appears to be a major advance toward explaining the origin of life on Earth.

It is believed to retrace a critical phase in the chemical evolution of organic material which had to occur before the appearance of life itself. Synthesis of nucleotides has been done before but always by long, complex laboratory procedures.

Dr. Cyril Ponnamperuma, of the Exobiology Division of NASA's Ames Research Center near Mountain View, Calif., accomplished the synthesis assisted by Ruth Mack, Ames research scientist. Especially significant, according to Dr. Richard S. Young, Exobiology Division Chief at Ames, is the fact that all five of the nucleotides have been synthesized in "good yield."

The chemical evolution process used to accomplish the synthesis refers to the way in which the organic molecules necessary for life are believed to have appeared on the primitive Earth through the interplay of existing energy sources and chemical material. These organic staples had to be on hand before one or more first living unit(s) could be "assembled."

The primeval conditions which the Ames scientists duplicated in the laboratory are those which many scientists believe prevailed on Earth long before the appearance of living things. The principal ingredients in the Earth's atmosphere at that time were ammonia, methane, and water. There were also ingredients in the ancient seas and the surface of the Earth.

This atmosphere contained no protective layer of ozone (probably formed later from oxygen produced by green plants). Hence these basic ingredients in the so-called "primordial soup" were continually bombarded with massive amounts of highly energetic ultraviolet radiation from the Sun. Other energy sources affecting the process and the products were: lightning, heat from volcanic action, and radiation from radioactive elements.

Later, this combination of solar radiation and other energy sources, highly reactive chemicals, and conditions such as wetting and drying on the shores of the ancient bodies of water is believed to have caused the formation of even more complex organic molecules. The process going on for hundreds of millions of years culminated not only in the nucleotides but eventually in the formation of an organized molecular complex which behaved as a living cell, including reproduction.

The nucleotide containing the nitrogenous base, uracil, is not present in DNA; and the nucleotide containing the base, thyamine, is not present in RNA. Hence each of the two nucleic acids contain four of the nucleotides arranged in a near-infinite range of combinations and sequences which specify in precise detail the characteristics of the organisms of which the cell is a part.

These building block molecules fit together like pieces in a puzzle to make on section of the nucleic acid chain. Perhaps a hundred thousand of these "puzzle pieces" must join to make the DNA chain for the nucleus of a very primitive living organism. Human cell DNA chains may have billions of such pieces.

Like the electronics in a magnetic recorder tape, scientists believe, these nucleotides in the double spiral chain of the DNA molecule arrange themselves in common combinations to "remember" the specifications of the center of each frog cell is a blue-print of an entire frog, and human DNA carries the specifications for a complete human.

The RNA molecule chain is the second critical part of this process. RNA forms on the DNA chain. It is
almost identical to DNA except it is usually a single spiral and can "persuade" other organic molecules to arrange themselves in the same pattern as itself.

That is, the RNA molecule serves as a template for making new living cell material, and eventually new cells, from the existing "chemical soup" of organic material in the cell.

In earlier research, starting with the basic methane, ammonia, and water of the primitive Earth environment, the Ames scientists added energy to form two of the five bases (adenine and guanine) needed to make nucleic acids, plus both sugars (ribose for RNA and deoxyribose for DNA). They have induced these bases and sugars to combine under primitive Earth conditions. With the sugar and base combination, only the addition of phosphate was needed to make a DNA "building block," a nucleotide.

In their current experiments, by merely adding heat and a variety of inorganic phosphates, they have found that they get the needed phosphate component. The variety of phosphate salts which can supply the missing phosphate for DNA building blocks, and the low temperatures needed (about 108°F) elated the researchers. The reaction turned out to be "astonishingly simple."

It is the ability of life to reproduce which points up the significance of the nucleotide synthesis at Ames, since it is the linkage of such nucleotides which forms the long spiral chains typical of DNA and RNA in living cells.

In tracing further the path of chemical evolution leading up to the origin of life, Dr. Ponnamperuma will investigate the possibility of joining the nucleotide building blocks together to "evolve" such a DNA chain.

In his current experiments, he has found preliminary evidence of two and perhaps three nucleotides joining together. He would like to generate long molecular chains from DNA building blocks under laboratory conditions like those on the primitive Earth. In living systems, this is done by catalysts known as enzymes.

Dr. Ponnamperuma will seek out chemical catalysts already present in the chemical soup of the primitive Earth environment as duplicated in the laboratory. If an effective catalyst is found and DNA chains can be made, it may be possible to show how life got started, by inducing DNA and RNA chains to evolve themselves chemically, and then to duplicate themselves.

In another field, researchers at the Lewis Research Center, Cleveland, Ohio, have successfully operated a high field strength cryomagnet having a volume many times larger than any previously known.

William D. Coles, Lewis engineer, said that this cryogenic (extremely low-temperature) magnet will provide research facilities for magnetics, solid state physics and plasma physics.

The effects of high strength magnetic fields on life can also be examined in the cryomagnet. Plant life, fruit flies and small animals placed in the field may provide information on biological effects and perhaps even mutations.

The Lewis cryomagnet creates an intense magnetic field over a volume 4-1/2 inches in diameter. Researchers have run cautious tests on the new magnet facility, pumping more current into it each day. And each day they set a new record in magnetic energy storage — the amount of useful energy that can be stored in and retrieved from the magnet.

Running the magnet with eight coils and a power input of one million watts they obtained a continuous magnetic field of 200 kilogauss, at least 20 to 50 times stronger than the magnets used in junk yards to hoist autos and scrap materials.

According to Coles, the Lewis research magnet is the first "really high-field cryogenic magnet." The coils are made of high purity aluminum in a stainless steel channel. They are submerged in liquid neon at 410 degrees below zero. At such extremely low temperatures the electrical resistance in aluminum is about 500 times less than at room temperatures. Thus, much stronger magnetic fields can be induced with much less power.

NASA has also been studying the landing approach characteristics of supersonic transports using a Boeing 707 simulator. As an essential part of the instrumentation needed to make a 707 into a flying simulator, a 15-foot, needle-like nose extension has been added to the airplane. It contains a response sensing mechanism to detect and report airplane motions which occur when the pilot moves a control or alters engine thrusts.

Even though the 707 flying simulator is a fixed sweep-wing subsonic jet, it can be made to respond to a pilot as though he were actually flying a supersonic transport of the future. The changed responses are provided by an analog computer system and other electronic equipment which make the 707 an accurate inflight dynamic simulator.

For example, wind tunnel evaluation of various supersonic transport concepts have indicated that, partly due to their size, they will not respond as quickly as present jets to a pilot control input. In the 707 simulator, he computer will provide a time delay between a control action by the pilot and a response by the airplane carefully calculated to match the predicted responses of a supersonic transport.

The research program will assess simulated landing approaches with both the fixed wing and variable sweep concepts, including conditions such as emergency use of cruise sweepback during a landing.

For the experimental program, the 707 has been fitted with a separate control system. The standard 707 control system has been left intact for the safety pilot who will occupy the left seat on all flights. The system will provide a wide selection of flight variables for research purposes without in any way compromising the safety of the crew or aircraft.
like, man ....

for shoes it's

Hornung & Hahn
at Meadows Center

Experience
is a great teacher
but...
you can learn more
from books
cheaper and faster

Order your books through
Rose Polytechnic
Book Store

ENTREPRENEURS
(Continued from Page 22)
people who have less capacity to take
risks than he has. Let me tell you,
this is no easy job. And it is some-
thing I have never found a way to
delegate. It goes on all the time. It
is exhausting. The risk-taker is al-
ways at work, mentally at least—
whether he's in the office, driving
home from work, or on vacation.
And I want also to say that the
man who is bearing risks has no time
or energy for doing the jobs of his
subordinates. In fact, it is my obser-
vation that the manager who insists
on doing his subordinate's work is
really trying to escape this awe-
some task of assuming risk. In many
cases, he is magnifying the worry
about risk for the other fellow rather
than diminishing it. The person who
looks for the escape hatch on risk
is really a non-entrepreneur. He
robs people of their effectiveness.
Instead of adding, he subtracts.
Well, there you have my four ma-
jor jobs as a chief executive officer.
Now, what's the big unsolved prob-
lem of the entrepreneur today? In
mathematical terms, it's how to
multiply himself. Once we had
rather simple businesses and one
man could do most of the leading.
Nowadays business is complex and
we need new risk-taking managers
at every level.
In this connection, I want to share
a problem with you. Over the last
forty years, I have noticed that most
improvements in our company occur
despite the established pattern of
things. We think that once a routine
is working, we can rest. Bureau-
cracy and complacency take over. I
have noticed that the improvements
which occur are usually because
someone has broken a rule or be-
cause we are facing a crisis and
something has to be invented fast.
This is not right. There should be a
better way to infuse the spirit of
entrepreneurship in a company than
to wait for the next crisis to develop.
The chief executive officer must
find ways to create an environment
in which people dare to upset suc-

(Continued on Page 30)
CHROMATOGRAPHY
(Continued from Page 17)
ring of the spots.
Reagents are also added to the adsorbent to aid in the visualization of the spots. Phosphors and fluorescent compounds are added, so that unsaturated compounds can be seen under ultraviolet light.
Complexing agents are sometimes added to increase the resolution of products.
The layer is very important and must be prepared in the same manner each time. The thickness of the layer is unimportant with respect to Rf values and the degree of separation. The thickness is determined by the type of information sought. For diagnostic or qualitative work, very thin layers are best because the spray reagents are sensitive. For preparative work the use of a thick layer is best in order that the maximum amount of material can be separated at one time. The minimum thickness is about 0.15 millimeters and the maximum is about one to three millimeters or the thickness at which cracking of the layer starts.
The glass plates on which the layer is placed should be heat resistant and should be as clean as possible. It should be particularly free of grease.
In the preparation of the slurry the major problem is obtaining a viscosity suitable for the type of spreading device. There are many ways of applying the slurry of adsorbent of which the liquid portion is usually water, although, it may contain an additive. One type of spreading device is the Kirchner, which has a stationary reservoir. The plates are moved under it. In the Stahl type spreader the slurry reservoir moves over stationary plates. The slurry may also be sprayed on fairly uniformly, however the thickness of the layer is unknown. Microscope slides are often used and can be coated by slipping them into the slurry.
The sample that is to be separated is dissolved in a solvent. This solvent should dissolve the sample to at least one percent and should have a boiling point between fifty and one hundred degrees Centigrade. It should be as non-polar as possible so that the sample concentrates at the center of the spot.
The amount of sample that is placed on the layer is best determined by experimentation, and should be investigated at several concentrations. The amount that is chosen should be big enough to be visualized yet small enough to give distinct spots. The sample is applied to the layer by touching the tip of a capillary, micropipette, or microburette to the layer about two centimeters from one edge.
Many types of chemical reactions may be carried out on the layer itself. Some of them are: The regeneration of bases is carried out by spotting the amine as the hydrochloride and then developing the layer with a developer containing one to two percent base. Bromination is done by using a developer containing 0.5% bromine. Oxidation can be accomplished by either
(Continued on Page 32)
ENTREPRENEURS

(Continued from Page 28)

cessful procedures if there's a chance to make them better. We need more people who will stick their necks out above the old level of performance, people who would rather play it smarter than to play it safe. This kind of spirit must penetrate an organization from the apprentice to the president if the company is going to successfully meet the challenges of the market place. And I must confess to you that I can't tell you how to do this in every organization. It seems so natural for an organization to keep doing efficiently what has been done in the past, to trade on past successes. But, many times, the road to future success is to do something entirely different. It is better to do the right thing inefficiently than to do the wrong thing efficiently.

I think we have a lot to learn about how to encourage entrepreneurship at all levels in our businesses. Every man bosses something and every man leads somebody. He should be practicing entrepreneurship every day on his job. He should recognize ways to get results easier, quicker, and more profitably. I hope that the Krannert Graduate School is studying entrepreneurship as a process for solving problems.

So let me summarize, President Hovde—I have real hopes that the Krannert Graduate School will excel in educating young men for modern entrepreneurship. It will not be enough to develop better computer routines and better staff procedures. In the future, I am convinced, we will have to have more young men who are willing to take responsibility—who can dream big dreams—who are master teachers in the classroom of activity—who can generate effective communications systems—who can absorb risks—and who can encourage others to be venturesome.

These are my hopes, President Hovde. I invest these hopes with you as I give you these keys to our new building. Use the keys to unlock the door to education in modern entrepreneurship—and opportunity for the young men of tomorrow.

November Schedule of Interviews

Monday, 1st
AMSTED INDUSTRIES
DIAMOND CHAIN
MEAD CORPORATION

Tuesday, 2nd
CUMMINS ENGINE
NASA

Wednesday, 3rd
B. F. GOODRICH
MOTOROLA
SURFACE COMBUSTION

Thursday, 4th
HOOKER CHEMICAL
JOHN DEERE
WALKER MFG.

Friday, 5th
UNIVERSITY OF ROCHESTER
SCHOOL OF BUSINESS ADM.
3-5:30 PM ONLY

Monday, 8th
IBM
DOW CHEMICAL

Tuesday, 9th
DOW CHEMICAL
CORN PRODUCTS
OSBORN MFG.

Wednesday, 10th
DETROIT EDISON
CATERPILLAR TRACTOR
SUNBEAM ELECTRIC

Thursday, 11th
INDIANAPOLIS POWER & LIGHT
MOBIL OIL
MARATHON-DIVISION OF AMERICAN CAN

Friday, 12th
GULF RESEARCH
CITY OF MILWAUKEE
LINK BELT
MARATHON OIL

Monday, 15th
NAVAL ORDNANCE LAB
NEW YORK CENTRAL R. R.
OLIN
BAILEY METER

Tuesday, 16th
LOUISVILLE CEMENT
DAYTON POWER & LIGHT
LIBBEY-OWENS - FORD

Wednesday, 17th
FIRESTONE TIRE & RUBBER
NATIONAL STARCH & CHEM.
HAMILTON STANDARD
AMERICAN OPTICAL

Thursday, 18th
FORD MOTOR CO.
HAMILTON STANDARD
U.S. STEEL

Friday, 19th
CONSUMER PRODUCTS —
DIVISION OF UNION CARBIDE
ILLINOIS POWER
CITIES SERVICE

Monday, 22nd
MONSANTO
WHIRLPOOL

Tuesday, 23rd
INLAND STEEL
INTERNATIONAL NICKEL

Monday, 29th
HUMBLE OIL - MARKETING DIV.
HUMBLE OIL - PRODUCTION DIV.
ILLINOIS TOOL WORKS

Tuesday, 30th
PRATT & WHITNEY
NALCO CHEMICAL CO.
To build a rectangular color TV tube with more of a picture than the earlier round tube type, and then squeeze it into a dimensionally attractive cabinet—you face almost insurmountable challenges.

Just to build a conventional color tube, you must . . .

1.— with absolute precision, lay more than a million red, blue, and green phosphor dots in a perfect triad pattern over the entire surface of the picture screen. Why so tough?—because the light source for the dots is a single ray coming through a pinhole. And it must be bent by a correction lens with precise mathematical calculation (different for each dot) to pass through over a third-of-a-million pinholes and fall exactly at a given spot on the screen.

2.— Once you’ve figured out the phosphor dots, you must then bend the electron beam broadcast by the TV station so that it too passes through the third-of-a-million pinholes.

These are just some of the feats you must perform. But after going through all this, you wind up with a tube with a neck so long it requires a cabinet nearly a yard deep to hold it. To shorten the neck requires mathematical calculations and engineering techniques so demanding they fall beyond any brief description.

The complexity of the 23-inch rectangular color tube development is considered by some of our consumer products engineers even more of a technological challenge than designing some of the sophisticated command systems required for space flights.

Motorola military engineers tend to disagree.

But now that we’ve brought it up, Motorola has accomplished both.
CHROMATOGRAPHY

(Continued from Page 29)
adding an oxidizing agent to the developer or by placing it over the sample spot. Many other types of reactions can be carried out in the same manner.

In choosing a developer for Thin Layer Chromatography the type of chromatography must first be determined. For adsorption chromatography the developer is best found by experimentation. This is accomplished by developing the sample in various pure solvents of different polarities. Some key solvents are hexane, benzene, ether, and methanol. By comparing the Rf values in the various solvents the correct solvent or combination of solvents can be found for a developer. In partition chromatography the separation is performed by the distribution of substances between a polar stationary phase such as water, acetic acid, phenol, or formamide on the layer and a moving non-polar phase. Because this developer usually contains three solvents it is easier to start by looking in literature for information than to start by experimentation.

There are several methods of developing the chromatography. The most common being the ascending method Figure #1. In this method the plate is placed in a tank saturated with the developer and containing about one centimeter of developer in the bottom. The developer is allowed to ascend to about 10 to 15 centimeters and the plate removed, dried, and visualized. The descending method is very similar to the ascending method except the developer is placed in a reservoir at the top of the saturated tank and allowed to descend through the layer.

In two dimensional Thin Layer Chromatography the sample is spotted in one corner of the plate and allowed to develop in one direction. It is then removed, dried and again placed in the developer so that the spot now develops in a direction at right angles to the first.

Often the sample that is being developed is not colored and therefore must be visualized in some manner. Figure #2. Some of the universal reagents used are strong dehydrating agents, oxidizing agents, and iodine. There are, of course, many specific indicators which only visualize one type of compound.

After the chromatograph has been visualized it must be preserved in some way because many of the color formed in visualization will fade. The layer is often photographed to preserve the results.

Quantitative measurement on Thin Layer Chromatography is performed by one or several of the following ways: by estimating the spot area and/or the density of the spot on the layer itself or by photostats or photographs. The spot may be removed from the plate by scraping the layer off the glass plate and eluting the sample from the adsorbent scraped off. It then can be analyzed by spectrophotometry or colorimetry.

Thin Layer Chromatography has many applications in both organic and inorganic chemistry. It is especially useful in Bio-chemistry and medical science where very complicated mixtures must be separated. Thin Layer Chromatography is one of the many new and rapidly growing fields in Chemistry.

Footnotes
2. Ibid P. 4
3. Ibid P. 5
4. Ibid P. 6
5. Ibid P. 2

BIBLIOGRAPHY
Behersky, Analytical Chemistry, 35, 261, (1963)
They’re members of Bethlehem Steel’s 1965 Loop Course — graduates of colleges and universities from coast to coast.

What is the Loop Course? Since 1922, Bethlehem has conducted this Course for training college graduates for careers in Bethlehem’s management. Hundreds of men at all levels of Bethlehem management, including our Chairman, started their careers as loopers.

The ‘65 Loop convened at our general offices in Bethlehem, Pa., early in July. After five weeks of thorough indoctrination, many of these men were assigned to facilities throughout the country for further brief training at the operations before undertaking their first job assignments. Others, such as sales and accounting trainees, may remain at the general offices for some months before being assigned.

Most Loopers Have Technical Degrees

Our primary need is for engineering and other technical graduates. Such men have many fine opportunities in all phases of steelmaking, as well as in research, sales, mining, fabricated steel construction, and shipbuilding. Also, both technical and non-technical graduates are needed for other important activities including accounting, sales, purchasing, traffic, finance and law, industrial and public relations, and general services.

You’ll find a great deal more information in our booklet, “Careers with Bethlehem Steel and the Loop Course.” You can obtain a copy at your Placement Office, or drop a postcard to Personnel Division, Industrial and Public Relations Department, Bethlehem, Pa. 18016.

BETHLEHEM STEEL
An equal opportunity employer in the Plans for Progress Program
EDUCATION

(Continued from Page 13)

Of more immediate concern, suppose you establish the pattern of usually arriving late to class and shuffling your feet as you drift toward your sleeping position in the back of the room so that everyone is aware of your grand entrance, and the pattern of always having some alibi to explain why your homework isn’t finished or your reports turned in on time. Now suppose you really have had trouble getting a needed reference from the library so that your theme is late and you tell that to the instructor. He won’t need more than one Kleenex for his tears of sympathy!

If you visited the campus last year, did the appearance and behavior of students whom you saw contribute to your decision to come to Rose? Each student is a representative of Rose, on or off campus, whenever it is known that he attends Rose. So you, by your appearance and your actions, are affecting the reputation of Rose and its students; for good or for bad.

The college years are a time for formation or further development of good habits. Habitual proper courtesy is the result of continual effort just as are good study habits, and cannot be acquired suddenly but is aware of being needed and of having no-one around to whom we can “pass the buck.” So we try; and, perhaps to our own surprise, we find we have more courage, stamina, and endurance than we even suspected.

During these next weeks, months, and maybe years, there will be times when you will feel very discouraged, worried, or just plain alone. This is a common disease and is par for the course. And in spite of this your class will be at least as successful as those which have preceded you.

There is a tale about an old professor in a German university who had the habit of bowing to his class at the end of his lecture. This was a breach of protocol in that the faculty are held in high esteem there and the students normally bowed to the professor. One day he was asked why he bowed to a class of young people and he replied “Many of these students will become burgomeisters, members of the government, clergymen, and business leaders. I will bow to them then, so why not now?”

Many of you will in fifteen or twenty years—or perhaps sooner—be leaders in many different fields. You will bring credit to yourselves, your families, and to your Alma Mater. So in the spirit of the German professor, gentlemen, I salute you for your future accomplishments. Thank you.

National Bureau of Standards
(Continued from Page 23)

Center on techniques for producing three dimensional terrain information from stereoscopic information. Recently certain semiconductors, such as strontium titanate, were shown to exhibit properties of superconductivity at very low temperatures. Several metals are superconducting at very low temperatures also, but their crystalline structure is quite complex; whereas semiconductors have relatively simple structures which the Bureau can more easily treat theoretically.

The Bureau has been located at Washington, D.C., for years and has outgrown its present buildings. Within a few months the entire facility will be located about thirty miles north of Washington at Gaithersburg, Maryland. A new NBS linear accelerator, LINAC, capable of generating electron beams up to 100 million electron volts is being constructed at Gaithersburg.

The Bureau currently employs about a 4000 full-time permanent staff about 70% of which are located at Washington.

The activities of the NBS is financed from three sources: congressional appropriations, payment for research and development (R&D), and payments for calibration and testing.

In 1964 the approximate financing was as follows.

Appropriations .......... $73 million
R&D payments .......... 18 million
Calibration testing ....... 8 million

TOTAL $99 million

The functions of the NBS are many and are very important to the advancement of science and technology in this nation. The Bureau assures that new scientific information from research and development is readily available to private industry through its extensive publications. With this constant outflux of data and technical information, much laborious duplication of research is saved and hence much money and effort is saved. The NBS was designed to serve the public.
"Are there any East Coast labs doing Organic Research?"

"What's available in R & D around New York?"

"DO YOU have any MANUFACTURING FACILITIES IN THE SOUTH?"

"Could I start at a location with nearby graduate schools?"

"Any chance of moving around the country?"

ASK Allied Chemical

IF LOCATION is important to you in choosing your first job, why not talk to the company that has 130 plants and research centers throughout the U.S.A., as well as scores of sales offices from coast to coast? Your placement office can tell you when our interviewer will be on campus.

AN EQUAL OPPORTUNITY EMPLOYER

DIVISIONS: BARRETT • FIBERS • GENERAL CHEMICAL • INTERNATIONAL • NATIONAL ANILINE • NITROGEN • PLASTICS • SEMET-SOLVAY • SOLVAY PROCESS • UNION TEXAS PETROLEUM
Engineer on telephone: “Doctor come quick! My little boy just swallowed my slide rule.”

Doctor: “Good heavens man, I will be right there. What are you doing in the meantime?”

Engineer: “Using log log tables.”

Then there is the forlorn engineer who, on seeing a pigeon flying overhead, exclaimed, “Go ahead, everybody else does.”

The human brain is wonderful. It starts working when you get up in the morning and doesn’t stop until you get called on in class.

Prof: “Will the gentlemen in the back of the room stop passing notes?”

Student: “We’re not passing notes, sir. We’re playing bridge.”

Prof: “Oh, I beg your pardon.”

We understand the fire department in Terre Haute has, as its only equipment, one fire truck and two dogs. The dogs, of course, are used for finding the hydrants....

The deans who think our jokes are rough
Would quickly change their views
If they could compare the ones we print
With the ones we’re scared to use.

Know the difference between the mambo and pea green paint?
Anybody can mambo.

If all freshmen in the world were placed in a line holding hands, they would reach more than half way across the ocean.

A lot of seniors would be in favor of this scheme.

Papa stork: “I surely had a busy day. I delivered 152 babies.”

Mama stork: “Yeah, me too. I delivered 145 babies.”

Kid stork: “Well, I can’t deliver babies like you grownups can, but I did have fun today scaring the hell out of a couple of college kids.”

A man caught in a snowdrift looked and saw a St. Bernard coming toward him with a keg under his chin. “Oh, look,” exclaimed the man, “Here comes man’s best friend—and look at that big dog too.”

John was being given his test to get out of the insane asylum. He had answered all the questions well and had just one more to answer.

“John, what are you going to do when you leave here?” the psychiatrist asked.

“Well,” said John thoughtfully, “I figured I would finish my studies to become an E.E., or I thought possibly I would go into my father’s business, and then again I thought I might become a teapot.”

Freshman: “What does ‘fantasy’ mean?”

Senior: “A story in which the characters are ghosts, goblins, virgins, or other supernatural beings.”

Every store has its absent minded salesgirl. The boyfriend was kissing her goodnight when she turned a sweet smile on him.

“Will that be all, sir?”

M.E.: “Know how many students they have at L.S.U.?”

E.E.: “No, I don’t.”

M.E.: “About one out of ten.”

Since we call professors “profs”, it is easy to figure out what we should call assistants.

A woman drove me to drink, and I’ll be a son-of-a-gun, but I never wrote to thank her.

C.E.: “The trouble with youth is they waste it on the young punks.”

M.E.: “Yeah, and what is worse is they aren’t old enough to appreciate it.”

Judge: “Have you ever earned a dollar in your life?”

Prisoner: “Yes, your honor, I voted for you in the last election.”

Florist: “So you want to say it with flowers. How about a dozen roses?”

Suitor: “How about a half dozen. I’m a man of few words.”

Dean of Students: “I have a report here that coke, soda, and whiskey were found in your room. What do you make of that?”

Student: “Highballs, sir.”

Men are as honest and truthful as women—that’s why women are so suspicious of them.
By solving problems in astronautics, U.S. Air Force scientists expand man’s knowledge of the universe. Lt. Howard McKinley, M.A., tells about research careers on the Aerospace Team.

(Lt. McKinley holds degrees in electronics and electrical engineering from the Georgia Institute of Technology and the Armed Forces Institute of Technology. He received the 1963 Air Force Research & Development Award for his work with inertial guidance components. Here he answers some frequently-asked questions about the place of college-trained men and women in the U.S. Air Force.)

Is Air Force research really advanced, compared to what others are doing?

It certainly is. As a matter of fact, much of the work being done right now in universities and industry had its beginnings in Air Force research and development projects. After all, when you're involved in the development of guidance systems for space vehicles—a current Air Force project in America's space program—you're working on the frontiers of knowledge.

What areas do Air Force scientists get involved in?

Practically any you can name. Of course the principal aim of Air Force research is to expand our aerospace capability. But in carrying out this general purpose, individual projects explore an extremely wide range of topics. "Side effects" of Air Force research are often as important, scientifically, as the main thrust.

How important is the work a recent graduate can expect to do?

It's just as important and exciting as his own knowledge and skill can make it. From my own experience, I can say that right from the start I was doing vital, absorbing research. That's one of the things that's so good about an Air Force career—it gives young people the chance to do meaningful work in the areas that really interest them.

What non-scientific jobs does the Air Force offer?

Of course the Air Force has a continuing need for rated officers—pilots and navigators. There are also many varied and challenging administrative-managerial positions. Remember, the Air Force is a vast and complex organization. It takes a great many different kinds of people to keep it running. But there are two uniform criteria: you've got to be intelligent, and you've got to be willing to work hard.

What sort of future do I have in the Air Force?

Just as big as you want to make it. In the Air Force, talent has a way of coming to the top. It has to be that way, if we're going to have the best people in the right places, keeping America strong and free.

What's the best way to start an Air Force career?

An excellent way—the way I started—is through Air Force Officer Training School. OTS is a three-month course, given at Lackland Air Force Base, near San Antonio, Texas, that's open to both men and women. You can apply when you're within 210 days of graduation, or after you've received your degree.

How long will I be committed to serve?

Four years from the time you graduate from OTS and receive your commission. If you go on to pilot or navigator training, the four years starts when you're awarded your wings.

Are there other ways to become an Air Force officer?

There's Air Force ROTC, active at many colleges and universities, and the Air Force Academy, where admission is by examination and Congressional appointment. If you'd like more information on any Air Force program, you can get it from the Professor of Aerospace Studies (if there's one on your campus) or from an Air Force recruiter.

United States Air Force
Automating a Complete Steel Mill

The automation of Bethlehem Steel Corporation's new Burns Harbor, Indiana, cold rolled and plate mills is another giant step toward meeting the demands for stepped-up steel production. General Electric is uniquely equipped to supply all the bits and pieces of automation, and to call on and integrate the skills of more than 120 business departments—skills that run the gamut of specialized and systems engineering, manufacturing and technical marketing. Whatever the projects at General Electric, and they are legion, a small-company atmosphere is maintained, so that individual contributions are quickly recognized. And, these become starting points to new discoveries and opportunities. Write us now—or talk with your placement officer—to define your career interest with General Electric. Section 699-14, Schenectady, N. Y. (An Equal Opportunity Employer)

Progress is Our Most Important Product