

Goals for Engineering



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The temperature in Las Vegas in August is 115° with no cooling breeze. Atop Mount Washington in January, the 50-mph winds emphasize the -40° temperature. Yet in both environments, the core of the human body holds its temperature remarkably steady at a normal 98°.

This human control system was first termed a homeostatic system by the

This superb example of automation or feedback control is important to the engineer because, even in this simple human system, we find an extraordinarily complex interconnection of sensors to measure body temperature and actuators to maintain the signal at the desired level or goal. Regulation of traffic flow at a point on the Long Island Expressway is comparatively a simple task.

The example does illustrate, also, a dominant characteristic of modern engineering: the focus on system goals. Greater understanding of the body-temperature control system requires that we investigate why the body temperature rises in a fever, to what extent can the human being be taught to change this goal according to his perceived needs, and how should the goal be changed in the presence of disease or malfunctioning.

In the same way, the engineer is concerned not only with the detailed design of particular mechanical or electrical parts of his system, but also with the goals appropriate to the human uses of the system. If he is developing new techniques for coping with the alarming problem of solid waste disposal, the design of an incinerator or the planning of land-fill processes or the scheduling of collections requires consideration of the detailed system goals and the alternatives available to approach these goals. If economy and cleanliness of disposal are paramount, how much of the refuse can be elim-

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physiologist Walter Cannon — the term "homeostatic" means that the response signal (the core temperature) returns to its normal value even after major disturbances such as sharp changes in the environment. If a man walks abruptly into a cold area, the metabolic rate increases, blood flow to the skin decreases, perspiration and evaporation cease, and his muscles move at random to generate internal heat mechanically (that is, he shivers).

The homeostatic system changes its goal when an animal goes into hibernation. Then the body temperature drops to just above freezing, and the animal's processes slow markedly. In the opposite direction, a fever associated with illness causes the core temperature to rise, with the normal control system either malfunctioning or purposely selecting a goal higher than 98°. (Which it is may be important — if the fever is beneficial, perhaps parents should not be so anxious to feed aspirin to mildly ill children.)

inated at the source, to what extent can people be convinced to generate less rubbish, or how much can be designed at the beginning to be burnable in an energy-generating station? In a nation which is by far history's most efficient producer of rubbish, can we find system goals which at least allow the application of existing technology to control both the depletion of resources and the accretion of waste?

Determination of desirable goals frequently demands that the engineer look well beyond the particular equipment he is designing; he must view a broader system encompassing the people on whom the system impacts. This required breadth of viewpoint is illustrated by a classic story, recently retold in *Technology Review*.

A wealthy sultan had two sons, both more interested in racehorses and frivolity than in ruling. When the sultan died, he willed that each son was to select his fastest horse and they were to race to Mecca. The wealth and

power would go to the son whose horse lost.

The young men dutifully followed the terms of the will and set off for Mecca. After a week of dawdling and backtracking, they were both less than a mile from home. It was apparent that they would spend years on the trip.

They approached a wise man (that is, the sultan's engineer), and promised to follow whatever instructions he might give to solve their problem. He immediately instructed them, whereupon they dashed from his presence, jumped on the horses and took off at full speed for Mecca.

What had the savant said? He had simply looked at the system, had observed that the goal should be to make each son strive for a minimization of the time to Mecca, and hence had ordered each to ride the other's horse. In the same way, the engineer must design today's systems from an understanding of the true, human and social goals. □

State Conservation Dept. Welcomed to Campus

One of the newest additions to the Stony Brook campus is the handsome new regional headquarters of New York State's Department of Environmental Conservation (ENCON). Although it is tucked away by itself on the quiet northeast corner of the University's acreage, it is anticipated that interaction of its staff with University faculty and researchers will prove beneficial to both groups in many ways. The University's department of ecology and evolution and the Marine Sciences Research Center are just two campus offices, for example, which share interests and purposes with the new ENCON office.

Located on the loop road north of H quad, the two-story building contains approximately 60,000 sq. ft. of laboratory and office space. Though not officially connected with the University, the new facility is physically linked to the campus for electricity, steam, sewage and water, with custodial services and police protection provided under contract with the University.

The move to a new building represents a consolidation of the department's regional services. Formerly each division of the department maintained office, library and laboratory space in various locations throughout Nassau and Suffolk counties.

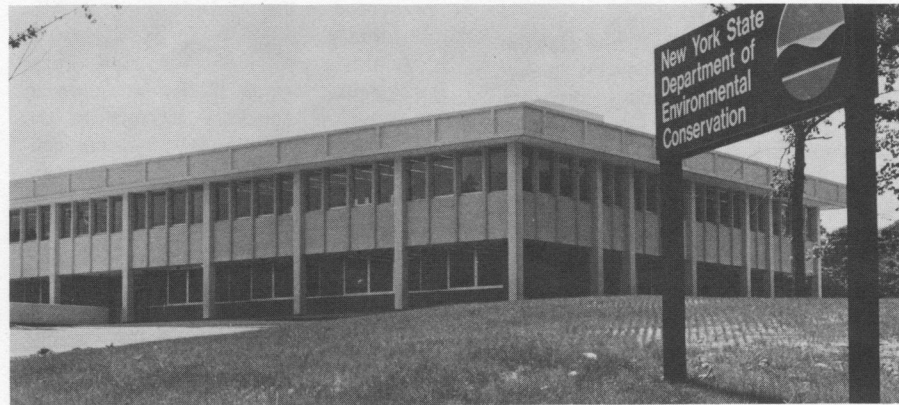
The ENCON office has regulatory, maintenance, and research responsibilities for the Long Island region. But one of its most important functions, according to ENCON Community Relations Director Sam Blecker, is to serve as a depository and source of information for any kind of environmental question, from what the effects of New York City's latest air inversion are for Suffolk residents, to how to get a raccoon out of an attic.

The information and library services aside, most public contact with the local office comes in the form of licensing and regulatory functions. The department's conservation officers regulate Long Island's two wildlife preserves, and the campus office issues permits for, among other things, shell-fishing and well-drilling.

Another function of the department is to run educational centers, conservation camps and summer symposia.

Legislation passed within recent years has opened a new area of involvement for conservation personnel. Environmental impact statements which detail the ecological effects of a proposed land use plan or construction project must be filed with the office before approval is given for the work. The analysis of these statements, released to the public, gives local government and civic groups the information they need to determine whether the proposed project will really be beneficial to a community.

The ENCON department is also engaged in diverse research projects and, by keeping track of various ecological trends, obtains knowledge essential to averting future crisis situations. Banding studies on migrating birds, analysis of the factors of beach erosion and build-up, research on the effects of different pesticides, and study of the patterns of lobster nesting may provide information both vital to the preservation of natural resources and helpful to commercial interests. □



CULTURAL IMPACT

Cultural Events Draw Hundreds of Performers, Thousands of LI'ers

"Stony Brook, when you are together,
you are beautiful."

Statesman editorial 12/12/72

With these words, *Statesman*, the student newspaper, recently took note of the mounting pace of cultural and social activity taking place at the University. On some recent nights, as many as a dozen or more cultural events have been scheduled for the public.

Scheduled activities — including theatre, music, cinema and lectures — are being sponsored by an increasing number of University departments and student organizations, resulting in the full, diverse schedule that prompted *Statesman's* response.

But these offerings have not been restricted to the campus community. Rather, Stony Brook has rapidly emerged as a major cultural center for Suffolk County providing an artistic fare that was previously available to Long Islanders only after a tedious trip to Manhattan.

Through the efforts of the University's Center for Contemporary Arts and Letters, international artists have come to Stony Brook to lecture or perform, supplementing an already extensive campus program. Many of these special offerings have been repeated in the community at area high schools as part of a continuing University effort to share its educational resources.

Review Resumes

Publication of the *Stony Brook Review* resumes with this issue. Due to limitations of staff and financing, the five monthly issues prior to February had to be cancelled. The *Review* is returning on a 5-times-a-year basis, rather than the previous 10-times-a-year schedule.

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A few weeks prior to the January groundbreaking ceremonies for the new Fine Arts Center, a temporary theatre was dedicated to the memory of Salvatore Calderone, an impresario instrumental in bringing theatre to Long Island early in the century. The dedication took place at the theatre arts department's production of "Peer Gynt," a modernized version of Ibsen's classic play staged in the manner of a circus.

During the fall semester, student-produced theatre received a boost with the formation of a new group, Punch and Judy Follies, which produced "The Boy Friend," a nostalgic musical. Another musical, "Jacques Brel is Alive, Well, and Living in Paris," was produced by students at the George Gershwin Music Box. This semester the comedy, "The Owl and the Pussycat," and the musical, "The Last Sweet Days of Isaac," have been produced on campus and "Company," "Twelfth Night," "Evolution," and "A Funny Thing Happened on the Way to the Forum" are scheduled.

The University's orchestra, chamber orchestra, band and chorus have been taking their voices and instruments to unlikely places, presenting concerts in the administration building lobby and the lecture center.

The Theatre Arts Department has been actively involved in extending its productions and services to the community. Assistant Professor Thomas Neumiller, assisted by a number of his students, has presented educational mime performances in various Suffolk County school districts providing elementary students with an introduction to theatre arts. Others in the department work with a variety of community groups and theatre companies. In February a campus theatre production was presented at the South Huntington Public Library.

Author and self-proclaimed male chauvinist Norman Mailer was one of a series of speakers brought to the campus during the fall by the Student Activities Board. Mailer's controversial comments on the sexes attracted a large crowd, as did talks by psychologist R. D. Laing, educator Jonathan Kozel, and Daniel Ellsberg, of Pentagon Papers fame. Other prominent speakers who visited the campus last semester included newscaster Geraldo Rivera, peace activist Sister

Elizabeth McAlister and poet Allen Ginsberg.

The University lecture series, sponsored by the Center for Continuing Education, provides free, public, weekly lectures by faculty members. This semester the University lectures cover some 19 subjects, including talks by Einstein Professor of Physics C. N. Yang, and Distinguished Professor of Biology Bentley Glass.

The Center for Continuing Education also sponsors Cinema 100, a series of films shown each week and open to the public at no charge. Selected on the basis of cinematic technique in form and content, the films represent a spectrum of foreign and domestic work.

A second weekly film series, sponsored by the Stony Brook Union, singles out the work of style-setting directors, and films representative of a particular genre. Also free and open to the public, the "Tuesday Flicks" series is another aspect of the Union's expanded programming. Workshops '73 is another Union program which offers campus and community members 30 mini-courses on subjects as diverse as jazz and needlepoint.

Two additional weekly film series, sponsored by the Committee on Cinematographic Arts showcase recently released popular movies on Friday and Saturday evenings, and screenings of acclaimed foreign and domestic films on Sunday nights.

Cooperation between the Stony Brook Union and the International Art of Jazz Council has made possible a continuing program of jazz concerts with performances by the Clark Terry Quartet, Richard Davis Quintet, and Randy Weston's African Rhythms thus far, with additional programs planned for the spring.

The Student Activities Board has recently presented professional entertainment ranging from the New Shakespeare Company's production of "As You Like It," to concerts by rock groups such as the Steve Miller Band.

Supplementing the plethora of scheduled activities already mentioned are many more films, speakers and concerts sponsored by academic departments, the residential colleges and various student groups. Just the volume of activity alone would seem to justify the *Statesman's* enthusiasm for the current campus cultural scene. □

EVENTS OPEN TO THE PUBLIC



Classical concerts, lecture appearances, theatre productions, rock programs, dance recitals and art exhibits are a few of the cultural attractions which draw Long Islanders to the campus.

**ECONOMIC
IMPACT**



**Annual Monetary Impact
Of University Estimated
To Reach \$101 Million**

A hundred feet from where a young graduate student feeds a complex physics problem into a computer, a programmer pauses for a mid-afternoon snack dropping 15¢ into a vending machine. Technology is at work delivering the complex formula and the simple bag of candies, both ingredients in the daily operation of the modern university. It is far different from those early days of academe when Socrates sat in an Athenian arbor with a handful of students and the main expense was for a few cherished scrolls and an occasional amphora of wine. The technological revolution changed all that, making life more complex and expensive. Today, the modern university needs buildings and laboratories, chalk and microscopes, animal cages and sewage lines, in addition to what has always been its essential requirement—the questing intellect.

It is not surprising then that the impact of the University goes beyond the cultural and intellectual enrichment of its constituency and becomes a major force in the business life of the community, stimulating the economy and opening jobs to area residents. Radiating out from the Three Village area through Brookhaven and Smithtown to all of the Nassau-Suffolk region, the economic impact of Stony Brook is a fact of life, providing jobs for many more than the 5000 people on its payrolls.

A recent comprehensive check puts the direct annual monetary impact of Stony Brook at just over \$100 million, or \$101,290,800, conservatively estimated. This does not include the rippling effect, which some economists say is two to three times the direct impact.

The rippling or multiplier effect is based on the simple fact that money spent on goods and services results in the employment of other people who in turn buy goods and services which results in the employment of still more people. Thus the employees and students at Stony Brook, through their buying power, help to create additional employment in retail establishments, supply houses and the trucking industry. These employees in turn, through their buying power, create

additional demands for services and goods leading to more employees being hired. The cumulative effect of this economic impact is hidden and indirect. It becomes obvious to the general public only in a reverse situation, such as when prolonged strikes or lay-offs reduce the buying power of a community, creating a rippling effect of unemployment. The negative economic impact created at such times reaches beyond the affected industry, and, if it is prolonged, can create a local depression. This negative impact also affects government services, which must be reduced as tax revenues decrease and the need for public assistance funds increases.

The University with a personnel roster of 5000 persons is the largest employer in Suffolk County and one of the five largest on Long Island. Budgeted payroll for the 1972-73 fiscal year totals \$37,000,000 and includes personnel on state, research, Faculty-Student Association and Stony Brook Foundation payrolls. At least \$33 million of this is paid to Nassau-Suffolk residents. According to statistics obtained from the Long Island Lighting Company, Grumman is the largest employer on Long Island with 23,000 workers, the Telephone Company is second with 9000, LILCO is third with 5500 employees. Stony Brook with 5000 ranks fourth, followed by the Sperry Corporation with 4600 workers.

In the ten years since the University began operations at Stony Brook, its academic programs have grown rapidly. From a new college training science and math teachers for secondary schools, it has developed into a major university with a current offering of 36 undergraduate majors and 26 doctoral programs. New facilities to house these programs have been built, others are under construction or on the drawing board.

Stony Brook Director of Facilities Charles Wagner says current construction, not counting the recently started modern Fine Arts Building, includes 11 projects having a total value of \$131,450,000 — of which \$52,580,000 will be expended during the 1972-73 fiscal year. Of this amount, approximately \$26,240,000 will be spent in direct costs for on-site labor, exclusive of employer contributions to fringe benefits. An additional \$10,566,000 is expected to go to non-site labor employed to make deliveries of materials,

to work in lumber and cement processing plants and similar outlets for the construction industry. The total labor cost, direct and indirect, comes to an estimated \$36,806,000, and almost all of the workers reside in the Nassau-Suffolk region. The bulk of the remaining \$15.7 million goes for materials, of which at least \$7 million worth is purchased from or through Long Island outlets.

The purchase of supplies and services is one area where the direct monetary impact of the University is most easily seen. Charles Gullo, Director of Purchasing, estimates that at least \$4,500,000 will be expended this year on Long Island out of a state allocation of \$10,500,000. Stony Brook's electric bill paid to LILCO this year will be a flat \$1,000,000 and the telephone bill will total \$700,000. A garbage removal contract comes to \$50,000 and bus rentals in addition to the campus' own bus service will total \$20,000. Fuel oil costs projected for the fiscal year total \$650,000 and the water bill will be \$100,000. Pro-rated sewer charges paid to Port Jefferson are expected to be \$46,000 with an additional \$123,000 being paid as the University's part of the redevelopment costs for the sewage treatment plant.

These are the major bills. In addition there are thousands of smaller orders placed each year for items such

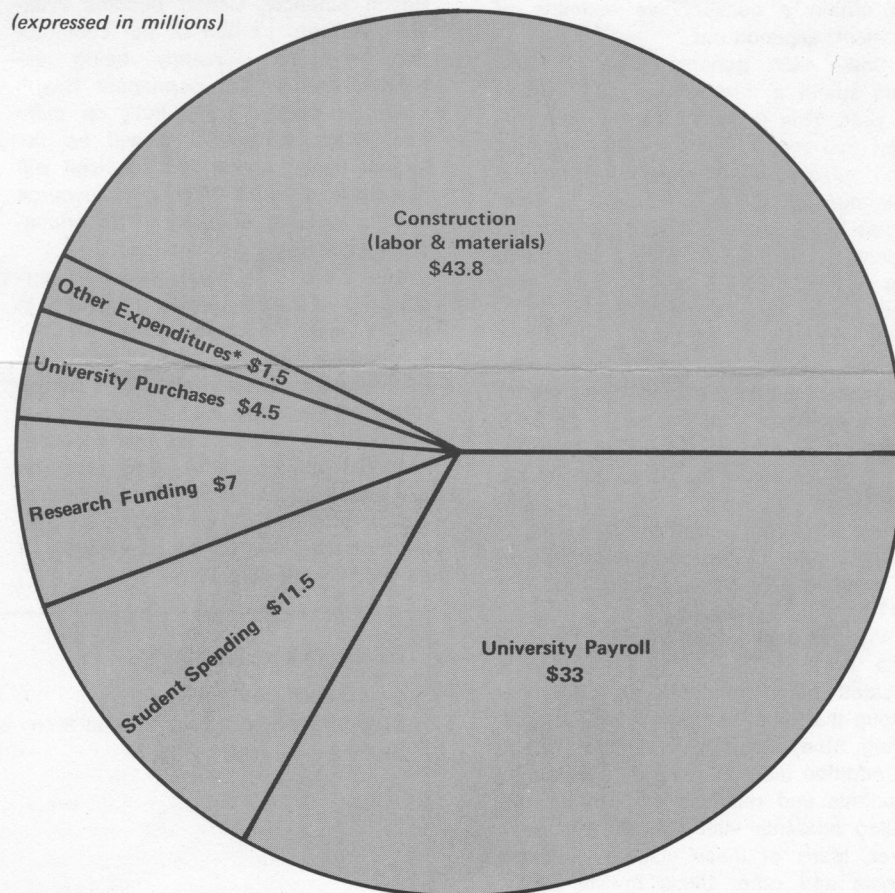
as guinea pigs, tongue depressors and camera film. A few recent small orders included papercups purchased from a dealer in Medford, rabbits from Yaphank and computer ribbons from a firm in Port Jefferson. The procurement of such items, required during the course of a year by the various departments of the University, keep six staff members of the Purchasing Office busy on the phone placing small orders. It is the policy of the University, Mr. Gullo notes, to give priority to vendors in the Nassau-Suffolk region and then to the rest of New York State in making purchases.

Research projects at the University sponsored by federal agencies and private foundations have a current total value of \$17 million, of which about \$9 million will be expended during the current fiscal year. About \$6 million of this non-state funding will be expended in salaries and student stipends, and \$2.5 million will be spent in purchases of supplies and equipment needed in research projects. As is the case in purchases made with state funds, supplies bought with research money are normally purchased from Long Island outlets whenever possible.

The Faculty-Student Association (FSA) at Stony Brook, which operates a variety of services from the University Bookstore to vending machines,

**DOLLARS SPENT
ON LONG ISLAND**

(expressed in millions)



*by Faculty Student Association, Student Polity, Alumni Association and campus visitors. Over \$100 million is annually tunneled from the campus to the community in the ways shown on this chart.

spends \$802,000 — over half of its budgeted \$1,539,000 — on Long Island. Ernest Christensen, Director of the FSA and the Stony Brook Union, says that almost all expenditures, other than the purchase of books, are made on Long Island. Food service accounts for \$176,000 with an additional \$27,000 being spent through two general stores and a pub operated on campus. Salaries account for \$321,000, vending machines for \$89,000 and tobacco, candies, and newspaper sales at the Union's Main Desk total \$74,000. All of these supplies are purchased through Long Island wholesalers. The University Bookstore purchases are almost entirely made outside the Long Island region from publishers and wholesalers in New York City or elsewhere.

Polity, the undergraduate student organization, has a total budget for the year of \$487,000 generated from student activities fees. Of this total, an estimated \$368,800 goes into the Long Island economy with expenditures ranging from \$37,778 for the printing and production of the student newspaper in Smithtown to \$100 earmarked for the fall reception of the Women's Recreation Association.

A major factor in the University's economic impact on Long Island is the buying power of the 12,058 students enrolled at Stony Brook. Using a list of probable expenses provided prospective students, and subtracting those fees such as tuition and on-campus housing which do not enter the Long Island economy directly, it is possible to obtain a conservative estimate of student expenditures.

Some 4450 students living off campus spend a minimum of \$8.2 million a year. This is based on the assumption that meals, room, books, supplies and miscellaneous expenses reach a minimum of \$1800 a year per student. Some 5000 students living on campus spend a minimum of \$900 a year each for a total of \$4.5 million. And there are about 2500 students taking part-time courses in continuing education while working at regular jobs. The minimal university related expenses of these students is estimated to be \$120 each or a total of \$30,000 a year for all of these students. These figures are all based on very conservative estimates of expenses and the actual monetary impact of the student population is undoubtedly much higher than the \$11.5 million estimate.

Visitors and salesmen who travel to this area because the University is located here constitute an additional group that must be considered in measuring Stony Brook's economic impact. In addition many parents of prospective students and relatives of currently enrolled students visit the campus each year. Many of these visitors purchase meals and other items in the immediate area of the campus adding to the economic impact generated by the University's presence. The Stony Brook Alumni Association, which spends a

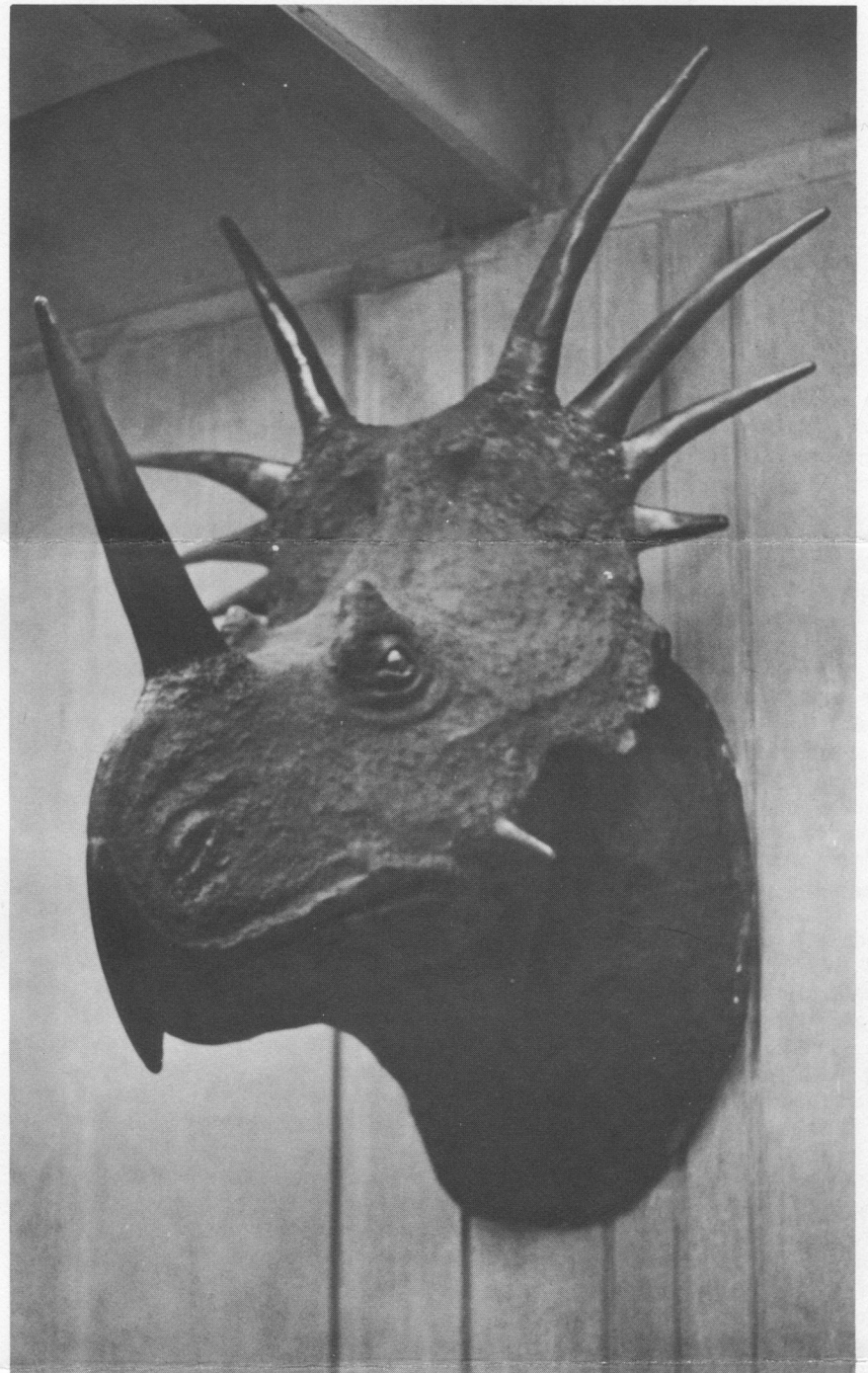
few thousand dollars in the area for miscellaneous administrative expenses during the year, accounts for a much larger impact during the fall and spring when hundreds of former students and their families attend reunions at the campus. The actual amount of funds expended by these various visitors during the year is difficult to estimate with any degree of accuracy. Two years ago it was estimated that some 50,000 persons visited the campus during the year spending a minimum of \$280,000 in the area.

The various services performed by the University for local government agencies and offices at minimal costs results in a direct savings of several hundred thousand dollars a year for county and town taxpayers. These services are provided by faculty and graduate students working in special study and internship programs conducted by the University's Health Sciences Center, Economic Research Bureau, Urban and Policy Sciences Program, Marine Sciences Research Center, and various academic departments. Local government officials have publicly stated that without these special programs the County and towns would have had to pay large fees for needed studies or would simply not have been able to obtain crucial data for planning and administration.

Large as the current economic impact of the University is at present, it can be expected to increase even more rapidly in the next few years as the special programs and services of the Health Sciences Center become available. A large portion of the construction revenues presently being expended are for the permanent Health Sciences Center being built on campus. When completed it will be the largest in the nation and by itself will constitute a major economic resource for the area in addition to its educational and medical services.

The more than \$100 million generated by the University's presence is not its most important value. As University President John S. Toll has noted in the past, "The University's major effect on the Long Island region is not its monetary impact, but the contributions of its graduates, the research discoveries of its faculty and students, and its intellectual and cultural involvement in the life of the community it serves." — Patrick Hunt □

Dinosaurs Seen Hanging Around



Sty and Tri, Styracosaurus and Triceratops to be precise, are North American dinosaurs which lived about 70 million years ago. Life-sized, reconstructed heads of these two prehistoric creatures have been donated to the University by the American Museum of Natural History. The two massive reconstructions — each about eight feet high — are on display in the lecture hall of the earth and space sciences building and may be seen there on any weekday between noon and 1 p.m.

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