

REPORT FROM KANPUR

A Caltech professor of history sums up his experiences and impressions after two years on the faculty of the Indian Institute of Technology at Kanpur.

by Peter W. Fay

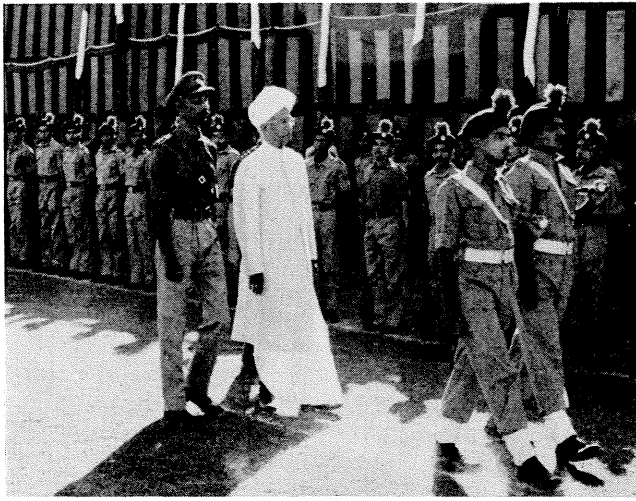
The Indian Institute of Technology at Kanpur, the old Cawnpore on the Ganges in the state of Uttar Pradesh, received its first 100 undergraduates in July, 1960, and graduated 66 of them in May, 1965. It is therefore the youngest of the Indian Institutes of Technology, following IIT/Kharagpur (near Calcutta) by almost ten years, and IIT's/Bombay, Madras, even Delhi (newer in name only), by several. Kanpur also differs considerably from the older four, though the difference is limited in some directions by the uniform framework imposed on all five by Acts of Parliament and by the necessity of admitting students on the basis of an examination common to all. The difference is nevertheless substantial. It has been made possible by, though it certainly is not simply the work of, nine American universities, which in 1962 began to send some of their faculty and a great deal of Uncle Sam's money to Kanpur.

The nine are MIT, Ohio State, Purdue, the University of California (which has meant Berkeley), Princeton, Case, Carnegie Tech, the University of Michigan, and Caltech. I do not know how Caltech happened to join. Perhaps it was in a fit of absent-mindedness. Only a few of our people—notably Donald Hudson, our first representative on the steering committee of the consortium (since succeeded by Marc-Aurele Nicolet)—seemed to take an interest in the Kanpur Indo-American Program (KIAP) during its first two years. Victor Neher, Robert Huttenback, and perhaps one or two others, made brief visits to Kanpur. But no one came for long; and had you stopped almost anyone along the

Olive Walk and asked where Kanpur was, you would have drawn a blank.

Then in 1964 six Caltech people were encouraged to join KIAP. The six were Jon Mathews of physics, David Welch and Peter Mason of engineering, Mason's graduate student John Trenholme, Mason's technician Richard Carrouche, and myself from humanities. The Institute eyed us, blessed us with reservations, and off we went. That was almost two years ago. At this writing only I remain of the six. But Taras Kiceniuk of engineering has just arrived, and Ernest Hugg of Physical Plant soon will. So the ice is broken, and Caltech is as involved as any of the nine institutions in the work of assisting IIT/Kanpur.

That assistance takes a number of forms. Money for the program comes from the Agency for International Development, which early in 1962 contracted with the nine universities through their agent, Educational Services Incorporated, to finance the operation. This arrangement has made all of us at Kanpur AID people. We get our flour and sugar and Scotch from the Commissary in New Delhi. Our mail moves by APO if we wish it to. Our children ride to school and we to work or to the Cawnpore Club in green AID jeeps supplemented by decrepit black AID Ramblers and a few locally rented Indian Ambassadors with transmission trouble. We travel on AID vouchers, take paid leave within AID limits (26 days a year), bring our cars in duty-free under AID diplomatic privilege, receive our furniture and air-conditioners from the Delhi AID warehouse, and live in houses which are rented for us by the



Dr. S. Radhakrishnan, President of India, reviews the cadet corps at the first convocation of the Indian Institute of Technology at Kanpur.

program according to the AID housing allowances.

But at the same time we remain members on detached service of the nine universities from which we come. They pay us our normal salaries in dollars (to which AID adds certain increments in dollars and rupees), and Washington reimburses them so that they may engage people to take our places while we are gone. We are contract, not direct-hire, AID personnel. And though the program is in almost daily contact with AID-Delhi, and though Program Leader Robert Green, a civil engineer from Ohio State and one of the founders of the program, works closely with John Lewis, the economist who heads AID in India, KIAP remains essentially the organ of the nine American universities. It is the steering committee, composed of representatives from each of the nine and chaired by Paul Chenea of Purdue, and Bob Green and the program members actually at Kanpur, who decide what to do and how to do it—not Dr. Lewis. And since the doing of it often requires more PL 480 rupees than Lewis, with his many other commitments, is anxious to argue for, the program manages to be both the brightest jewel in AID's Indian crown (the metaphor is Lewis's) and the greatest thorn in its side (mine).

This condition of belonging and yet not belonging to the foreign aid program is repeated within IIT/Kanpur itself with respect to our belonging and yet not belonging to the faculty. At the other IIT's the foreigners either run the show or do not. The Russians at Bombay and the Germans at Madras do not. They are for the most part simply members of the faculty, on a par with their Indian colleagues. In the normal Indian academic setting this means that they do as they are told by the director and by

the departmental chairmen. No doubt they have good ideas. No doubt they have influence too, particularly when the school has just begun and the power of the purse still makes itself felt. But neither carries them very far, though they probably do not realize it for a while. For they are treated with such tact, such politeness and such indirection, that they perceive nothing until the day they discover that they have been bemused and beguiled and that the path to fundamental change lies blocked and shrouded by the gentle impenetrability of Indian manners and Indian English. Then, I think, they either withdraw into their teaching and their labs, or are content simply to enjoy India.

At Delhi the Britishers, as English people are usually called, do things quite differently. They do not have difficulty with departmental chairmen because they themselves fill the chairs. Few in number, coming to India for terms of at least five years, recruited from the ranks of what might be called the professional overseas educational services, they take charge of a department and build it up as they think best. But if this spares them the frustrations of insufficient authority, it probably also spares IIT/Delhi the services of many able Indian faculty. For in proportion as the English call the tune, the Indians are likely to find the situation unbearable.

Neither servants nor masters

What is attempted at Kanpur is something in between. Thirty in number at our peak a year ago, twenty now and still declining, we are neither servants nor masters, but associates. We bring to the Institute professional ability, experience, and dollars for equipment and books. We advise and assist. Usually connected to particular departments, we are in, but not of them. We may teach, but we do not have to. Indeed, it is generally understood among us, though not among all our Indian colleagues, that we ought not to teach unless doing so will have a larger consequence—introducing a new technique or a new subject—than simply filling a teaching slot. We sit on departmental and Institute committees, and cast our votes on those rare occasions when matters are forced to so shockingly emphatic and final a thing for India as a vote. We are all by courtesy members of the Senate, that organ of Institute government which we have tried to make into something resembling a normal American faculty meeting—with only partial success, since our Indian colleagues have insisted that, except for us, no one below the rank of associate professor shall attend.

In rented hoods we paraded with our Indian col-

leagues in the first convocation, as commencement is called here. In short, we are encouraged to feel like full members of the Institute.

But though we sit on the selection committees which make faculty appointments, on these, significantly, we do not have the vote. In matters of promotion, a thing of the greatest importance for the future growth of the school, we are often not even consulted. Except in cases where no Indian faculty as yet exists (for example in aeronautical engineering when it began under an MIT man two years ago), we are never ourselves heads of departments, not even if age and experience would naturally make us so.

There are people, it is true, who suppose that we pull the strings from backstage. Chowkidars (watchmen) and peons salute us (awful habit) more earnestly, perhaps, than they do our Indian colleagues. A first-year student from Delhi explained to me once that he came to Kanpur instead of to the sister IIT near home because "you Americans run this one." I said I sometimes wished we did. For the fact is we have influence; we do not have power.

A year or so ago a visiting mathematician from Berkeley, appalled by a department whose chief glory was the churning out of papers appropriate to 19th century British applied mathematics, tried to introduce a little modern analysis and algebra into the system by arranging the appointment of some able young Indians with those interests. By every standard except, as it turned out, the prevailing one, the visitor outranked the departmental chairman. But the chairman outmaneuvered the visitor. At the crucial meeting of the selection committee he managed to get his own applied mathematics people appointed or promoted in place of the Berkeley man's pure mathematicians. Today the math department remains as comparatively innocent of pure mathematics as it ever was.

There is another side to the coin, however. When our man from Berkeley saw he had been beaten, he cleared out his desk, retired to his house, and spent the rest of his stay in India writing a book. To this the departmental chairman could say nothing. For our responsibility lies to the program leader, not to the Institute.

We have our own administrative offices. We hold periodic morning meetings to which our Indian colleagues are not invited. Passing by on the open-air walk outside, they can glance through the windows and observe us seated around the long oval table, looking in our whites like a bunch of barbers, and they sometimes wonder (one said to me once) what we are plotting. Not much, I told

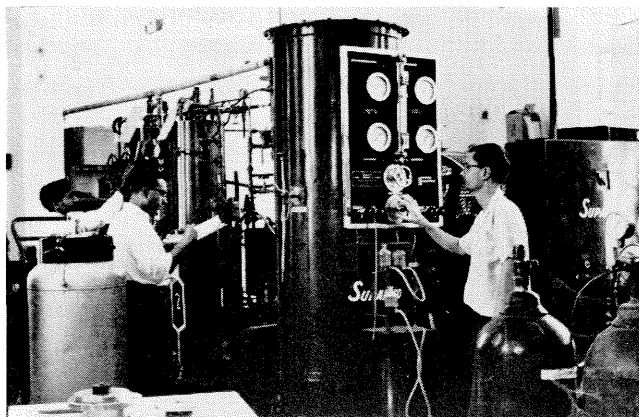
him. Maybe what to do about equipment lying in the rain at Delhi airport waiting for customs. Or maybe how to get out of Kanpur in a hurry—this during the fighting last September, when the city was blacked out and Americans in the Punjab were all ordered to Delhi—without abandoning (in my case) a four-foot Benares brass tray. If at the worst we do not accomplish what we want to accomplish, at least we can curse in privacy.

The Institute of the future

If the Institute becomes what it has set out to become, it will be a residential university with a strong engineering bias, a fair amount of science and mathematics, and enough humanities and social sciences (the Institute has preceded Caltech in naming both barrels) to be quite startling for India. It will confer five-year Bachelor of Technology degrees (five years because entering students are a year or two younger than they are in the U.S.) in aeronautical, chemical, civil, electrical, mechanical, and metallurgical engineering. It may also give, in fewer years as befits the lower importance attached to them in India, BS degrees in mathematics, physics, and chemistry. There will be MS and PhD degrees in all these fields, plus philosophy, sociology, English, and perhaps psychology and economics. There will be no astronomy or geology or biology; probably no Hindi because of the language problem; probably no history because it came at the end of the line; and no leather or glass or textile technology, which is quite a relief in a country abounding in "institutes" for such things.

Fifteen hundred undergraduates living in five hostels will take in their first three years a common "core" including English, some social science, rather more math and physics and chemistry, a considerable amount of engineering science (such as mechanics of solids, rate processes, electrical science), and a nearly equal quantity of "technical arts" (graphics, measurements, shop). The last two years will be devoted to professional training in the branch of engineering—or science, if it is included—which the boy or the boy's father has chosen, with a little compulsory humanities and social science still thrown in. Candidates for MS and PhD degrees will have to take courses, pass comprehensive exams, and satisfy a residence requirement, besides doing their research and writing their theses.

A faculty of about 250, distributed among the ranks familiar to Americans, will teach, do research, consult, and to a large extent administer the Institute. Instruction will be by courses, progress judged by the accumulation of course grades based



Caltech's Peter Mason (right) adjusts a liquefier in the low temperature lab he set up at Kanpur.

in part on quizzes and midterms. Soon there will be a structures lab, a low temperature lab, a magnetic resonance lab, and a number of other central labs. There will be several small wind tunnels and a flight-test facility with gliders and light power planes operating off a 2,900-foot asphalt runway. There will be a 40-booth language lab and a television studio broadcasting films and live shows by closed circuit; there will be an air-conditioned IBM 1620 for instructional and other ancillary purposes, an air-conditioned IBM 7044 for research (Phase 1 has just arrived), and a library, also air-conditioned, of roughly 130,000 books and periodicals—about the number Caltech had four years ago. And there will be a faculty building, an administration building, an auditorium, lecture halls, teaching and research labs, and workshops.

The 1,100 acres of flat, arable, and waste land which the Institute occupies six miles northwest of Kanpur on the Grand Trunk Road will contain a community of about 4,000 people exclusive of students, each household in the Institute house or apartment to which its rank exactly entitles it. There will be a guest house, a post office, a bank, a telephone exchange, a shopping center, an infirmary, two schools, miles of paved roads and thousands of young trees protected by wire or low circular brick walls against nonexistent cattle. There will be shops selling pan (betel nut and other spices wrapped in a leaf and chewed), watchmen with short spears, barefooted gardeners flooding parched lawns from heavy rubber hoses, and dozens and dozens of ragged attendants called peons making tea and reading cheap paperback Hindi novels behind the almira (storage cabinet) in the corner of every lab and office.

It will be quite a place. But how American will it be?

To resemble an American school—that is of course the idea entertained openly by the visiting

Americans, more discreetly and with reservations by many of the Indians. The five IIT's were set up in the first place because the government of India did not think it could develop adequate engineering schools out of what it already had in the established universities. If, for example, it tried to do something with the engineering departments at an established university, it would encounter an old and entrenched faculty teaching engineering exactly as it had taught it 40 years ago, and hardly interested in research. Moreover it would find that any extra money it gave to the university it would also have to give, by the logic of democratic politics, to dozens of other places. By creating new schools, Delhi made possible a new approach with younger and better faculty at a much higher level of expenditure. And it chose to do this with foreign assistance. To expect, then, that American-aided IIT/Kanpur would not grow to resemble an American school would have been silly.

There are certainly some very American things about the Institute. Having humanities and social sciences through all five undergraduate years is American. Postponing professional training until after a common core is American. Proceeding by courses, each an end in itself with a grade to itself, instead of preparing for distant "papers," is American. Giving letter grades is trivial American, and basing them in part on quizzes and midterms is important American. Problem-solving is American, at least if the end in view is that the student acquire, not a stock of solutions, but a habit of mind. Fewer hours in class, more spent on homework, is American. Having lots of equipment and books is American. Putting air-conditioning into the library is American—but so far we have only the ducts. The computers and the language lab are American, and the television system is way-out American. Requiring course work, preliminary exams, and a minimum residence of PhD candidates is American. So is the system of having several full professors in each department, and the habit of using senior faculty to administer the school.

The caliber of the faculty is also, if not American, at least due in part to the Americans. Of the 75 or so who at this moment are assistant professors or better, all but four are under 40 years of age. All have PhD's or equivalent degrees—a dozen from the United Kingdom or elsewhere in Europe, over half from the U.S. and Canada, the rest from India. No other IIT has anything like this concentration of higher degrees. In the mechanical engineering department at Delhi only one man out of fifteen, I am told, has a PhD. In our same department only four out of twelve do not. And ours is the only IIT whose

director is an academic and not a civil service engineer.

There are respects, however, in which the Institute does not really live up to its American appearance. Humanities and social science courses for undergraduates are indeed there, but many of my Indian colleagues are so little interested in them, and so much more interested in the status graduate work confers, that they will begin a PhD program with as little in their discipline as three faculty and fifty feet of books. Most departments do, in fact, have a number of full or associate professors instead of a single professor presiding over readers and lecturers like an oak among the saplings or a guru in the middle of his flock. But though these senior men are theoretically equals, like Orwell's pigs, some are more equal than others. After months of effort the Institute has, at last, two deans drawn from the senior faculty. Yet it needs to create and fill half a dozen administrative posts. And the people at the top have yet to acquire the habit of delegating responsibility and of then refusing to listen when, as so often happens, someone comes running to appeal a decision or to ask for a pencil sharpener. On paper, PhD standards are high. But that paper has only just been written, six years after the Institute's birth and several years after the first candidates for higher degrees appeared; and when you set the number of candidates already enrolled ad hoc (math and physics each have over 50) against the faculty members themselves sufficiently involved in research to be in a position to supervise any, you begin to wonder how much some of these candidates are really doing.

And there is one area in which the Institute's American appearance is downright deceptive. That is the area of language. Like the four other IIT's and all other central schools, IIT/Kanpur operates in the English language. Lectures are given, labs conducted, reading assigned, memoranda written, and most books bought in English. It is a great convenience for us visiting Americans. We have no language problem—but that does not mean the Institute escapes one.

English is a language in which only a fraction of the students feel thoroughly comfortable. It is included in the common entrance exam, but the passing mark is set deliberately low for fear of excluding promising engineers on the grounds of English alone, a thing politically and morally indefensible. As a consequence, most entering students have difficulty with English, and some are literally crippled in it. The first-year course has therefore been made into what is predominantly an English language course; and it was to improve it that some of

us requisitioned—on too large a scale and without sufficient preparation, it is turning out—a language lab.

But the first-year course does not cure, it does not even substantially relieve, the language deficiencies of many students. It probably never will. And so the Institute will continue to operate in what is, for a part of the student body, a semi-foreign language. This may be tolerable for engineers and scientists, for they have math and the blackboard. It is intolerable in the humanities and most of the social sciences, where language is central to thought. As for the supporting staff, clerks, and foremen, their English runs from poor to nonexistent. Entangled in it like flies in a web, they move slowly and sometimes with a seeming stupidity.

But what is the Institute to do? National politics prevents shifting into Hindi, which contains no respectable technical literature anyway. And if the shift should even so occur, that half of the faculty from Bengal, Gujerat, and the south, including eight of ten departmental chairmen, would, in time, probably leave.

The little things add up

To continue with the Institute's shortcomings and problems—there are so many little things wrong. The washroom I use has soap dispensers, but in 20 months I have yet to see any soap. Broken windows are rarely mended and sound windows almost never washed. An internal mail service does not exist. Examination arrangements are extremely complicated, regularly require the personal attention of the deputy director, yet often break down. Senate meetings have been going on for several years, but the seating arrangements are such that when the overhead fans are turning, as they must during the hot weather, one end of the table is reduced to lip reading what the other end says.

It is not easy to lay your finger on why these things are as they are, and it is dangerous to draw large conclusions. Do soap containers without soap reflect a national inclination to promise more than can be performed, or does someone pinch the stuff? A few general observations are, however, possible. The windows are dirty, not because the work force is too small, but because it is fragmented, unenterprising, almost totally unsupervised, and much too big. There are plenty of peons (the term is Indian and in daily use; it is not an American wisecrack) and plenty of sweepers. But peons make tea, carry messages (hence no internal mail service), and read cheap Hindi novels. Sweepers just sweep. Neither washes windows. Faculty do not wash windows

either. They do not worry about dirty windows. I am not even sure they *see* the dirt. As for the building superintendent, if there is such a person, he has achieved the dignity of a desk somewhere, with perhaps an almira and a phone and, of course, his own peon. He is not about to leave them for more windows.

Fire some to encourage the others, you may say. But that is impossible! By law or by custom they have tenure and cannot be dismissed unless there is obvious dereliction of duty, as in the case of the chowkidar found sleeping on my desk one morning. (When I arrived, I discovered that the door was bolted from the inside, got suspicious, and used my shoulder to break in.)

And tenure, while we are on the subject, also threatens the future quality of the faculty. It is normal at the IIT's for an associate lecturer, lowest in the faculty ranks, to receive tenure after one year. So do research and teaching assistants, unless specifically appointed on a recurring temporary basis; and since many graduate students hold these positions they often have tenure too. It is also usual, one might say only decent, for a man to look out for his community and his friends. The consequence of premature tenure may bring about the gradual replacement of the present first-rate staff, recruited at American insistence on the basis of ability only, by persons of the second or third rank, who will gradually be pushed up the ladder by the inertia, kindheartedness, and the good offices of the senior men who brought them to the Institute. Though the new deans are trying to check this development by seeing that graduate students at least do not get tenure, it will be difficult to stop it altogether; and indeed some of it has already occurred.

Meanwhile windows do not get washed, and much else of more importance is done sloppily or not at all. There are exceptions, of course. Convocation last October (it was held then because May, when the academic year ends, is too hot) was brilliantly done. There were lots of flowers in pots, policemen in immaculate whites, bagpipes; the student cadet corps looked very smart for its inspection by the President of India. The ceremony itself was held inside a multicolored tent the size of half a football field, and the gowns worn by the VIP's were of black velvet set off by absolute rivers of gold braid. But for the rest of the year there is no braid at all. Because good technicians are hard to find at the pay the Institute can offer, equipment is often wretchedly maintained. Stockrooms tend to be disorderly and their contents incomplete. If you want a particular screw, it will have to be turned for you; if a particular test tube, it will probably be

blown. And almost nowhere do you find at the middle support level the kind of competence and energy we take for granted at home. What the Institute needs most, perhaps, is people like Tom Harvey and Gerry Fling, like Frances Humphries and Ruth Toy and Virginia Kotkin; and it does not have them.

Not all the defects are Indian

Not all the defects of IIT/Kanpur are Indian, however, and not all its virtues ours. Some of the features that we are trying to introduce we do not practice ourselves. Looking back at Pasadena from this side of the world, I am occasionally startled and a little pleased by how Indian Caltech seems. Some problems at this Institute, moreover, are compounded by our presence. Its tendency to compose itself into autonomous parts, each tugging against the others—something that characterizes, I am told, Kanpur industry, and certainly is true of political India—is perhaps encouraged by the presence of the program, autonomous certainly and tugging too. And we have undoubtedly created a special problem by bringing to the Institute so much so quickly.

As of last November more than \$4,000,000 worth of equipment and books had been requisitioned from the U.S. A great deal of it has reached Kanpur, often late, sometimes battered, but nevertheless in such quantities that the Institute is already the best equipped engineering and science school in India. And that has had a lot to do with its success in attracting able faculty.

In theory all of it was asked for by Indians, and in practice most of it has been. Part of an American's job is to make his colleagues justify requisitions before he signs them and passes them on to the program leader. But some of the stuff, though ordered with the concurrence of the Indians, began as an idea in an American's head. The 1620 computer, operating since the summer of 1963 and a very great success, falls in this category. So do the low temperature lab, the television system, and in a sense the entire library. For we have always been in a hurry. The program is to run for only ten years, and individuals never stay for more than two. We come, we look around, we see what we think is needed, and we induce an Indian colleague to order it. This has often seemed to us not only the best use of our experience but also the only way to make sure that we leave something concrete behind us.

This requisitioning exuberance has had, however, two unfortunate consequences. It has encouraged a natural inclination not to improvise or even to maintain equipment; and because, until recently,

the supply of dollars and of rupees seemed inexhaustible, it was easier and even quicker to order than to build. And if something broke down, you could usually cannibalize from the extras. Ordering on American initiative, while it has endowed the Institute with a number of things of great use, has also left it with some of very little. The supersonic wind tunnel has yet to be installed, the smoke tunnels are toys operated to please visiting firemen, and the electrolytic plotting tank sits idle, because the four Indian aeronautical engineers do not happen to be interested in the things the Americans who founded the department two years ago thought they should be interested in. Question marks hang over optical spectroscopy, an image processing lab, the television studio (Indian participation is adequate on the technical side, but who is to do the programming?), and the language lab.

It is a pity, though in the circumstances not an easily avoidable one, that this sort of thing should occur at IIT/Kanpur. The first thing the Indian faculty members—I am tempted to say Indians in general—need is advice. This they rarely ask for and as rarely accept. Equipment they need less, and we deluge them with it.

Some Caltech accomplishments

What have the six of us from Caltech accomplished? Peter Mason brought over the low temperature lab. It has survived him and will continue, because at least one Indian physicist is determined it shall. Dick Carrouche, surely Old Sceptic himself, has been gone eight months now. But the nitrogen liquefier he nursed into action still fills dewars for the labs that ask for them, and the helium liquefier will be used when a piping system is complete. John Trenholme never did get down to his own research (the idea was for him and Mason to provide a working example of graduate student-supervisor relations), and he developed reservations about the ability of the Indian PhD candidates to do independent work. But he taught undergraduates, came to know a number well, and departed last August quite encouraged by their competence and attitude. Dave Welch worked very hard to improve several of the technical arts courses, with encouraging results, I believe. Both the first-year physics course and that department's graduate programs are the better for Jon Mathews. The language lab is at a standstill, and there is no more history now outside of books than when I came. The first-year English course, in which I spent most of my time, is still inadequate, but the department has more books and more of an interest in the library than it would

have if I had not come. So one has some effect.

In April, as I write, a hot wind from the west has begun to blow; the overhead fans are turning, and paperweights litter every desk. In the TV studio an electrical engineer from MIT watches with an expression of intense pain as a sweeper, swinging his cloth in the classic Indian manner, slaps dust all over delicate equipment. Our children go to school very early, come home at noon, and cannot be allowed out of doors until almost sundown. The winter crop is in, and the fields are bare. Over the vast Ganges plain on which this overgrown village of 1,000,000 sits, with its 19th century factories, there is, except for the trees, no color but the sun-tan color of the parched earth.

In May, when anyone who can afford it goes south or to the hills, the thermometer will pass 100 by noon. Blowing dust will deaden the sky and at times obscure the sun. June will be simply more so, with temperatures as high as 115 and occasional wind and lightning storms that bring a little relief. The rains do not come until July. So now is the most trying season of the year in what is by common consent the poorest, laziest, most God-forsaken part of India; and now is the time when Americans, including myself, are likely to be a little testy.

Yet we know that we do not have to live for long with the Institute's blemishes and with Kanpur's squalor and heat, because we will all go home. What is really surprising is that the Indians on the faculty do not grow discouraged. It is true that this is their country; and that the things I know I shall miss are presumably the things which brought them back to India or kept them here. But Kanpur is not India, it is only a piece of India—probably the worst piece. Except for the few who "belong to" the town, as the phrase goes, there is hardly a man on the faculty who would not prefer to live somewhere else. So why do they stay, living on salaries one-fourth what they would receive if they took jobs in the U.S. (as quite a number could), on a half-built campus with very poor schools and almost no amenities? If you go back to the labs in the evening, you will find a number still there, working at something or other—a thing I am told you will not see at other schools in India.

It is because of them that I think IIT/Kanpur is a success. I do not suppose it can become an institute of the very first rank in ten years, and it may not become one in fifty. But I think it will achieve international standing. And in India it is already at the top among the schools of engineering and science. Coming as I do from an institution with so long and proud a tradition of immodesty as Caltech, I can hardly claim less.