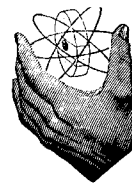




—Wide World.

SR / Research

SCIENCE & HUMANITY



DEPARTMENTS: Research in America • Science in Journals • Personality Portrait—CIII • Letters to the Science Editor

ARTICLE: The Lonely Tunesmiths of Nature—Men and The Birds

RESEARCH IN AMERICA

THE NIGHT THEY UNPLUGGED SOCIETY

WHEN the lights in the offices of *Saturday Review* flickered, dimmed, and gradually died out just before the doors were due to close at 5:30 P.M. last November 9th, our first reaction was that electrical circuits powering the place had become overloaded and had blown their protective fuses. Just across Madison Avenue, a vertical shaft of brightness glowed bold reassurance in the Union Carbide Building. But as our eyes jumped over the nineteenth-story terrace railing onto the Manhattan skyline roundabout, we could see other neighboring buildings pallid gray in the deepening twilight. Brave yellow teardrops—breaking from new-struck matches, obviously—began to patter in the windows of the Pan American Building and the Grand Central Tower. Swinging my chair around, I watched shadowy shapes of secretaries and editorial assistants float noiselessly past my office door. Out of the subdued feminine chatter beyond boomed the big bass voice of associate publisher “Pat” Patterson two doors north of me:

“How is SR’s science editor going to explain this one?”

In another moment his secretary, Nancy Gruber, was standing before my chair.

“You heard him,” she said gently. “He wants to know how you explain it.”

Already enough time had passed (though only a matter of minutes) for publisher Jack Cominsky to discover that the TV and radio hookups that normally inform his office of emergencies were as dead as the lights. A small transistor radio was speaking from the desk of Mrs. Ivy Dodd, outside Jack’s door. From it we knew that the blackout enveloping us extended over most of New York State, most of New England, and part of southern Canada. The announcers had also told us that the darkness reached west to Pittsburgh and

south to the edges of Philadelphia, which wasn’t true. They had given us a vague realization that an ultra-high-voltage power channel from Buffalo to Boston was somehow involved in the trouble.

“Stay where you are,” the voices from the loudspeaker advised. “A spokesman for Consolidated Edison has promised us that the restoration of power will begin within an hour.”

So most of us stayed where we were, ate a boxful of crackers Mrs. Dodd kept in a drawer of her desk, ate what was left of a can of macaroons that treasurer Nat Cohn’s hustling sons had sold to someone in the advertising department on the other side of the building, and waited for the hour to pass.

“Seriously, John,” said Patterson, “How do you explain it?”

To explain the situation at that point would have been equivalent to duplicating the magician’s trick of pulling a rabbit out of a hat without opportunity to first duplicate the magician’s preparations and stage props. As an old newsman, Patterson knew that as well as I did. But I thought it might be fun to see how much scientific background could be sketched in without running into misleading extrapolations.

“Well,” I said, “you’ve got to start with the fact that you can’t store very large amounts of electric power. You’ve got to use the power as soon as you generate it. And you’ve got to keep generating enough of it to meet the peak demand for it. If the people in the town where it is being generated are asleep, or out on the highways in their automobiles, or at the movies, their use of power is going to fall, and the economical procedure is to move the power they don’t want into another town where power is wanted. Given the right connections, it is possible to shift power back and forth as the earth turns one part of the country into the sunlight,

other parts into twilight, and still others into darkness. That’s why the ultra-high-voltage power lines run from Buffalo to Boston and down here to New York.”

“Oh, Mr. Lear,” said Roberta Hauke, Cominsky’s secretary, “I was listening to the radio for a minute there. Did you tell us why you can’t store big chunks of electricity?”

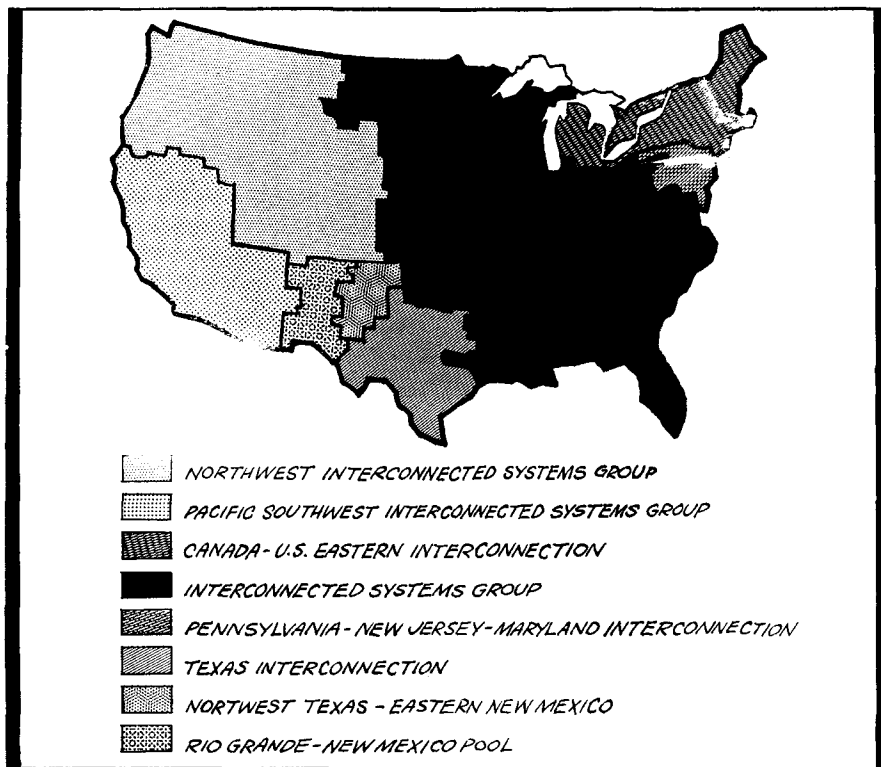
“Have another macaroon,” said ad salesman Dick Morton. “Have two,” said Marion Army, our personnel director.

I took a macaroon and glanced into the long corridor between the office of the publisher and the office of SR’s editor. There I could follow the restless pacing of secretary Jane Dozier by the pendulum-like sweep of the dull red burning of a cigar she had found in a box while hunting in vain for a flashlight. “I’m not really smoking it,” she had explained. “I’m just puffing on it to get a sense of direction.”

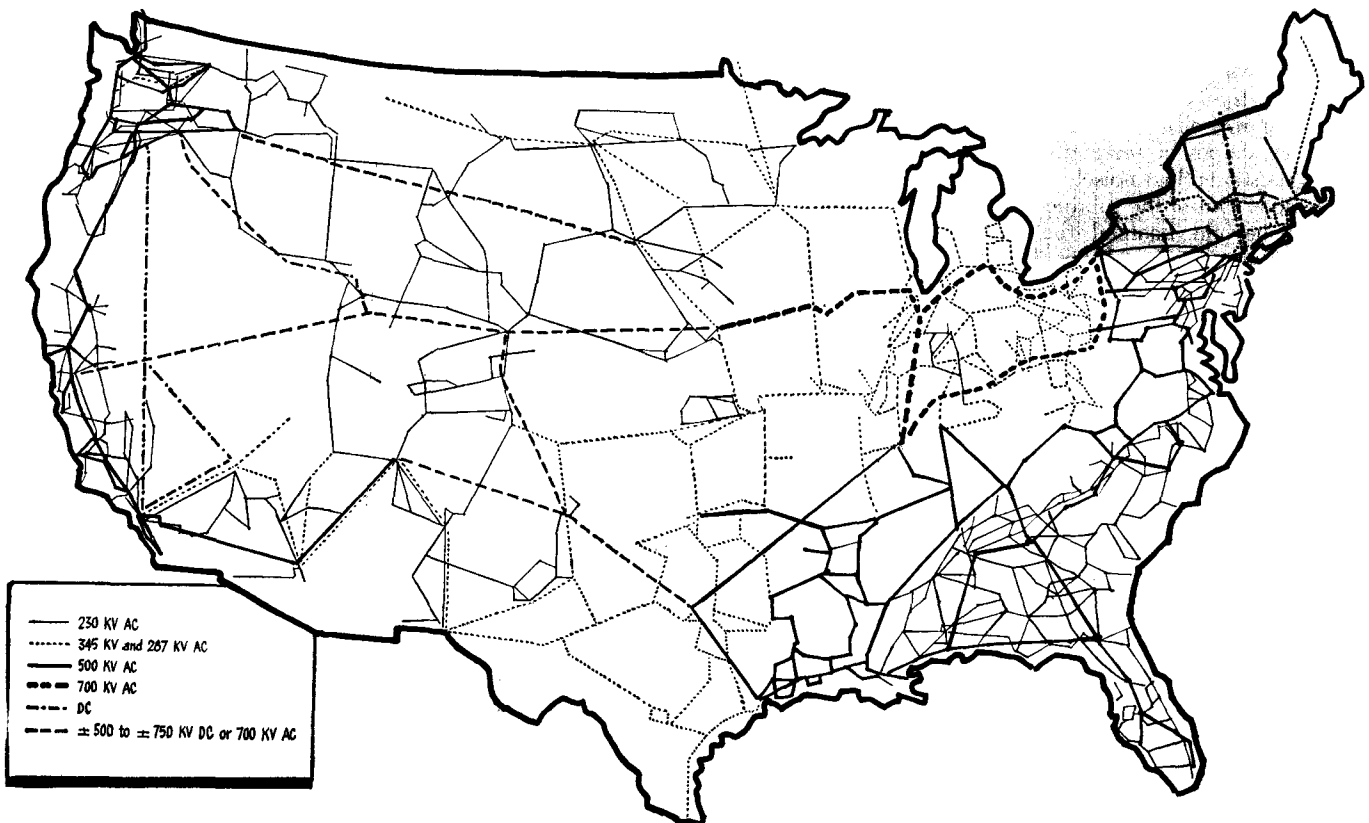
“That explanation of yours starts awfully slow,” Patterson said. “I don’t think you’re holding your readers.”

I could see my own assistant, Jean Corwith, smiling in the light of the enormous torch Roberta uses to fire her cigarettes. Jean was accustomed to long, complicated explanations. Science is full of them.

Someone turned up the radio to catch Con Ed’s latest apology for not returning the power on the promised schedule. I was being excused, by common understanding. We sat there together in long stretches of silence until almost 9 P.M., watching the full moon rise, and finally decided to brave the cold streets below. Lighting drinking straws from the Coca-Cola machine in the mailroom to show ourselves the way, we trudged in a long queue down nineteen flights of narrow, winding, pitch-dark stairs to the sidewalk, there broke into groups and walked homeward through streets filled with people friendlier than any of us



Border of color on map above marks region of northeastern United States and southeastern Canada blacked out by the electric power failure of last November 9. One of many mysteries of that night is why the blackout did not extend to western edge of black area, for every place east of that line is hooked into the northeastern network that did go out. Especially why did Staten Island and parts of Brooklyn, powered by Consolidated Edison of New York's generators, break away at the Flushing interconnection and remain alight in company with New Jersey, Pennsylvania, and Maryland? Whereas map above shows eight groupings of interconnections, map below is Federal Power Commission concept (explicitly not a blueprint) of single nation-wide power hookup for the future.



—Maps by Doug Anderson, following Federal Power Commission 1964 National Power Survey.

could remember seeing in this vast city ever before.

Unknown to us, a photographer just about that time aimed his camera from a Manhattan rooftop toward the Statue of Liberty (which remained alight) and the New Jersey shore of the Hudson River (where the lights also were unaffected), capturing the scene reproduced in miniature at the Science and Humanity masthead on page 81.

Fortunately for our aching muscles, Norman Cousins had left a few minutes before the blackout to speak at a public dinner in the grand ballroom of the Waldorf Astoria—a dinner that did not, of course, take place. Had he been among us, he would have had us all out sampling the experiences and opinions of the crowd until dawn. As it turned out, we had an excellent sample right there in the office.

Jim Fixx was in the street when the traffic lights went off. He walked uptown to the 59th Street Bridge, heading for his home in Queens, when a passing motorist picked him up. Pearl Sullivan and her husband Paul, starting in the same direction hours later, despaired of reaching their own apartment and accepted an invitation to bed in adwoman Lyn White's living room. Dick Tobin slept in a New Haven Railroad train that stopped just short of the tunnel exit from Grand Central Station. Typist Mary Busa had got as far as the subway station before the lights went out; she started to walk at 6 P.M., walked across the 59th Street Bridge and on across

Queens to Forest Hills; it was 10 o'clock when she reached home. Hal Bowser worked out an itinerary sixty blocks long in order to see others safely home before arriving at his own place at half past midnight.

None of us stumbled or fell in the darkness, or suffered any hurt, or came upon the bodies of those lonely unfortunates who here and there plunged downstairs to death or succumbed to heart attacks at the top of unaccustomed climbs. One of us endured entrapment in a suspended elevator. A few shared the fate of thousands who had to walk from stalled trains through rat-infested subway tunnels to the streets and then to sleep on the floors and stairs of railroad and bus stations, hotel lobbies, and club vestibules. Mrs. Cousins climbed twenty-three floors to make dinner for her husband in their Manhattan apartment. Many of us were victimized by profiteering taxi drivers; at least as many were beneficiaries of unexpected courtesy and thoughtfulness. A neighbor I had never seen before preceded me with his flashlight up seven of the nine flights of steps to my apartment, and another neighbor who heard my keys rattling in the front door lock gave me a candle to light my way within. I had no water to drink until morning because the electric pumps were stilled, nor any to wash my grimed face and body, or to flush the toilet. Food stored in the refrigerator spoiled, and defrosting that occurred during the night flooded the kitchen floor. However, considering the potential tragedy among air travelers alone if the moon had not been full and the sky clear, inconveniences like mine and the multi-billion-dollar losses suffered by city businessmen were a cheap price to pay for a sharp and timely warning.

THE night of November 9, 1965, must be recognized for what it was—the night when America's great mechanized society became unplugged.

Roughly a sixth of the nation's people were trussed in one swoop of a snare of their own devising.

The whole country east of the Rockies is tied into the same network of wires and cables that powers the northeast with electricity (see top map, page 82). The entire hookup could have blown. Why didn't it?

Other segments of the network had gone out previously, on at least two occasions. On June 25, 1962, a 300,000 square mile swath of eight midwestern states went dark—an area almost four times that darkened on November 9, but populated by a small fraction of the northeast's 30,000,000 inhabitants. Again, on January 28 last, a small connecting wire parted near Pickstown, South Dakota, and the whole of Nebraska and Iowa were blacked out along

with parts of Missouri, Illinois, Wisconsin, Minnesota, and South Dakota. The city of Omaha was powerless for three hours, Des Moines for two.

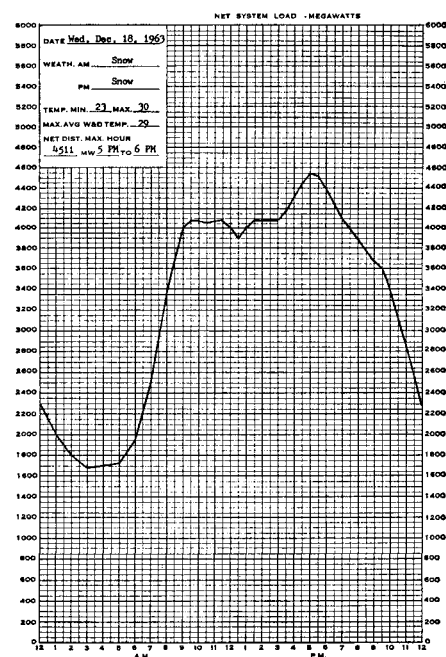
A sample of what might have happened on November 9 was reported by the U.S. Weather Bureau in Suitland, Maryland, outside Washington, D.C. There some of the electronic computers that work on weather maps quit work.

On a still broader perimeter, the weather information normally exchanged in recent months between Washington and Moscow was suddenly stopped. Suppose those messages had concerned matters more urgent than routine weather observations?

VULNERABILITY to attack from the outside is obviously serious. Far more to be feared is the danger of erosion of the hard core of American civilization. Within the next half century, the population of the United States is expected to double, to a total of 400,000,000 citizens. During that time, the rich store of natural resources from which national greatness has been fashioned will be diminished. Veins of high-grade ore will become exhausted, and lower grade stuff will be dug into. As the ratio of metal in the rock goes down, the workload required for extraction rises. More electric power will be needed. A Federal Power Commission survey published late last year estimates that the 1964 power output of 1.1 trillion kilowatts will have to be stepped up to 2.8 trillion kilowatts by 1980. If the national economy is to remain stable, that added energy will have to be produced more cheaply than power is produced today. Whereas the average retail price for power was 2.2 cents per kilowatt in 1940 and 1.7 cents in 1962, FPC says the price ought to be down to 1.2 cents per kilowatt in 1980. This can happen only if everybody uses more electricity. The average consumer's quota will have to go up from today's 5,400 kilowatts to 10,600 kilowatts by 1980.

The fundamental scientific principles governing electricity in nature are known. The seemingly magical flow of power can be induced in wires that are spun across a magnetic field. Once generated, the current (made up of electrons) moves at the speed of light—186,000 miles per second. If it isn't used immediately, it escapes from the wires and disappears.

Because of this leakage, the early technology of electric power (it started with a water-driven wheel in Rochester, New York, in 1880, and progressed to steam-driven turbines in 1882 in Thomas A. Edison's famous Pearl Street station in New York City) limited transmission of power to areas close by the generators. So the next logical step was to increase the size of the generators. Since the loss of current (number of electrons



—Con Ed, N.Y.

Fluctuating demand for electric power in New York City on a typical winter day is graphed above.

passing a given point in a given time interval) was inversely proportional to the square of the voltage, the main engineering problem after that was to step up voltage. The stepping up process has gradually occurred, 345 kilowatt lines are commonplace, 500 kilowatt lines are being experimented with, and 750 kilowatt lines are talked about.

Ultimately, it is these ultra-high-voltage power transmission cables that are being looked to as carriers of very cheap electricity. Half the price the consumer pays goes into those wires. The more satisfactorily they perform, the more power can be switched over increasingly greater distances. The assumption is that ultimately the whole country will be linked in one enormous hookup (see lower map, page 82).

Precisely at this point lies the significance of the November 9 blackout (its dimensions are marked in color on both maps on page 82). One of the ultra-high-voltage power lines on which the future of American civilization depends broke down. More accurately, it was thrown out of use by an automatic switch about the size of a breadloaf, setting on an island not far from Niagara Falls.

There could hardly have been a more illustrative lesson in fundamentals of modern electric power system operation. For the cheapest, as well as the most flexible and hence most easily manageable, means of power generation is the force of falling water. No preliminary heat-up is required, as steam boilers in oil- or gas- or coal-fueled generating plants must be heated in advance. The water simply drops into the turbine

blades. When demand for power rises suddenly, the flow of water is increased; if demand falls, water is shunted away.

The Niagara operation is, indeed, so flexible that it takes tourists into account daily. The United States and Canada have agreed to a minimum waterfall of 100,000 cubic feet per second during daylight hours. At night, half the fall is diverted into canals above the falls. Since the greatest demand for power is in the daytime, water diverted during the night is pumped into a man-made basin from which it falls during the day.

Many private power companies, including Consolidated Edison of New York, buy power from the Niagara store because it is cheaper than they can generate with steam.

About four miles north of Niagara Falls, on the Canadian side of the river at a hamlet called Queenston, six ultra-high-voltage cables were carrying 1,100,000 kilowatts of power into Ontario on the afternoon of last November 9. At 5 P.M., the schedule was changed to accommodate two new orders for power. Toronto wanted 300,000 kilowatts more for maintenance purposes. Power companies south of the border wanted 200,000 kilowatts moved through Cornwall, Ontario, and Massena, New York. That made a total of 1,600,000 kilowatts, well within the capacity of the six cables.

At 5:15 P.M., Syracuse asked for 200,000 kilowatts.

At that moment, disaster struck.

What happened and why is masked by a technological blur. The Queenston

circuit had been so designed that if one of the six cables had become overloaded, that cable would be isolated, as cables are regularly isolated when struck by lightning. Although none of these six cables was carrying an overload, the automatic sensor on one cable acted as though an overload had occurred and took the cable out of service. Instead of isolating the load, however, the automation threw it onto the other five cables, knocking them all out.

The surge of electricity thus freed raced back and forth seeking an outlet.

Con Ed's energy control had ten minutes warning time in which to break clear; but belief in the pooling concept was too deep-rooted. No one acted until the Syracuse controller said, on the telephone: "I must go now. I think we're falling apart." As a result, Con Ed generator bearings were burned out and the city's power had to be restored piecemeal from outside. It took twelve hours.

At least two major reforms are suggested by events. First is installation of emergency power sources, independent generators like those that lighted New York's Union Carbide Building and kept Boston's subways running on November 9. Second is a broader licensing system. The Federal Power Commission now holds no licensing authority over the building of steam-driven generators or the manner of their linkage with each other. Yet 81 per cent of the power produced in America is steam-generated.

—JOHN LEAR,
Science Editor.

There is also, I believe, confusion about the individual physician's role in his community. At one time his local citizenship was very special, with equivalent responsibility for community leadership shared by only a few others—the town lawyer, the schoolteacher, and the minister, priest, or rabbi. Today many educated citizens are able to share the burden of special citizenship. A physician, unless he has a special interest in community affairs, need not feel any special obligation for any community affairs except those dealing with health.

In those areas of community life dealing with health, the physician, as an individual, must not take a back seat to anyone. We must excel in the organization of medical care at all levels, as well as in medical care itself. We must recognize what we alone can do—and do it.

This means leadership in many aspects of hospital affairs, recently left to administrators; special attention to welfare medical programs, usually left to politicians; and involvement in voluntary health organizations and community health planning, so often left to business leaders.

First and most important, we must care for all of our patients as we have in the past, no matter who the third party may be, even if the third party is our government itself.

Of course we should work to make third-party arrangements ideal for the best of medical care. I suggest the following as ideal circumstances under which even government might serve as a third party:

Usual, reasonable, and customary fees produce satisfied physicians. They should be approached.

Secondly, comprehensive coverage interferes least with the availability and the decisions of medical care, providing satisfied physicians and patients. Insured medical care should be broad in scope.

And finally, only review by practicing physicians of the quality of care and the use of facilities is effective and acceptable. Professional review committees of physicians are here to stay.

When these conditions are satisfactorily met, the identity of the third party handling the medical bills does not matter.

We can, I believe, take good care of patients under government programs, and ASIM and our component societies will work to create the necessary conditions. Your personal public image as a physician, the only image which really matters, demands it.

—ROBERT E. WESTLAKE, M.D.
in *The Internist*.

Dr. Robert E. Westlake is president of the American Society of Internal Medicine. *The Internist* is a popular publication of ASIM.

SCIENCE IN JOURNALS

THE PHYSICIAN'S IMAGE

WE all know the argument that patients respect their own doctors but the public (*i.e.*, the same patients) is losing its respect for "doctors." Presumably, the image in trouble is that of organized medicine. But do we, and should we, as individual physicians, really place any organization's image above our own? I think not. Therefore, although I would like organized medicine, especially the American Society of Internal Medicine, to be respected by all our publics, general and specific, I am really concerned about individual, not collective, medical images.

Public relations for medicine is, therefore, personal doctor-patient relationships. We should, I believe, re-examine this relationship, not as public relations image-makers, nor ad men, nor public health experts, but as physicians.

Somehow, in the last twenty-five years, physicians seem to have become

confused about their role. For instance, in the patient-doctor relation "Who is really in charge?" (Don't answer "the doctor, of course" too quickly.) Our profession, like the unfortunate bankers in the great Depression of thirty years ago, has been caught in a social dilemma created by the times. The bankers reacted by hiring the Madison Avenue ad men who have created the current image of "your friendly banker." Physicians, as individuals, have, I believe, been persuaded that they, too, should woo their clients' favor rather than their respect. We must remember that a profession serves needs, not wants. The situation reminds me of parents trying to be "pals" to their children, then wondering why parental influence has diminished. Who is in charge, indeed?

I suggest, therefore, that internists lead the way in reasserting authority as a necessary corollary to responsibility.