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noise and dust from continued movement of trucks on the mining road and from blasting at the site for the next 20 years. The road would be cut through the virgin rain forest of the Susitna River valley at the foot of the Glacier Peak itself. A conservative estimate of the area which will be affected by the sights and sounds of this operation for another generation is at least 22,000 acres. Our estimate is that this operation, with all its ap- putenberg, will upset and damage at least 26,000 acres of the wilderness during the course of the operation. When it is over, the scars will remain for centuries. The allegation has been made that nature will soon reclaim this area. Yet the Holden copper mine, 10 miles away, was abandoned 10 years ago, and the huge tailing piles are still there. Nothing is growing on them. And it seems likely that it will be hundreds of years before anything can. How long is long?

Peugnet implies that the area could be made accessible to the public by virtue of the mining road. Last year, over 10,000 people spent 45,000 man days visiting the Glacier Peak Wilderness, doubling its use in the last 4 years. It is already accessible and it is used to view an unmatched panorama of incredible beauty unmarred by any works of man. It is true that the nation needs minerals. But we are some-day going to run short whether we mine every available site or not. The copper ore produced at this particular site would supply about 2 days’ worth of U.S. consumption. This operation will tear out the heart of a great wilderness area forever. I think the appropriate question to ask is whether we want to permit such an operation in such a place. Indeed, it might be said, “Never would so little be gained by so few at the expense of so many.”

M. BROCK EVANS
North Cascades Conservation Council,
4534-1/2 University Way,
Seattle, Washington 98105

Peugnet displays no understanding of the wilderness concept or of the relevant acts of Congress. According to federal law, the National Wilderness Areas are intended to remain in their original state, so as to perpetuate the “values of solitude, physical and mental challenge, scientific study, inspiration, and primitive recreation” (Wilderness Act, Title 36, Chapter II, Part 251—Land Uses). On mining claims validly established prior to inclusion of the land within the National Wilderness Preservation System, claimants are required by law to remove any “improvements” no longer needed for mining purposes, restore the original con-tour of the surface of the land, and promote its revegetation by natural means.

Peugnet’s suggestion that Kenne-cott should leave a road open to the public and a “potentially beautiful lake” is not only incompatible with the wilderness concept but also against the law. . . . The suggestion that an artificial lake would improve Miner’s Ridge is certain to outrage anyone who has visited the area. Equally outrageous is the suggestion that a road would be desirable. Tiny Image Lake, although it is 14 miles from the nearest road, is already so heavily used that the vegetation and terrain are in danger. The appearance of a public road, with parking lot, gasoline pumps, and other “improvements” would provide the coup de grace for another of our fragile wilderness areas.

RONALD W. ANGEL
Division of Neurology,
Stanford University School of Medicine,
Palo Alto, California 94304

The 450-acre open pit that Kenne-cott proposes to gouge out of the top of Plummer Mountain may be a “mere flyspeck in the 458,000-acre Glacier Peak Wilderness Area,” but it would be a festering eyesore visible from the entire Susitna valley, an area a hun-dred times as large as the pit itself. The blasting could be heard over the rest of the wilderness area and clouds of dust would settle on a lake two miles away which is not just “po-tentially beautiful,” but is already the most beautiful mountain lake in the United States.

Image Lake is a morning-glory pool with gently shelving white sand bottom around the edge and indigo-blue depths in the middle. It is set in a basin of alpine meadows spotted with clumps of fir trees and over the low side of the basin, 6 or 7 miles away and 4000 feet above, the white mass of Glacier Peak looms against the sky, the only one of the Cascade volcanoes which cannot be seen from a paved highway.

Apart from esthetic considerations, there are compelling practical objections to this “development.” The possibility of water pollution is not just a matter of speculation; we can be guided by recent, nearby experience. Tailings from the Holden Mine on the
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other side of Cloudy Pass did pollute streams and destroy fish. Even now, years after the operation was abandoned, a vast mound of inert, lifeless, brown dirt, loaded with sulfuric acid, fills half the valley of Railroad Creek, waiting for the spring floods from rain and melting snow to carry more of it down to Lake Chelan.

It may be “obvious that the excavation from which both ore and waste are derived could ultimately contain the tailings”; nevertheless, the concentration plant will be 1500 feet below the pit and it is unlikely that Kennecott will hoist the tailings back to their original level as a public service. They are likely to remain precariously perched on a steep mountainside where the spring runoff will have a much greater erosive effect than in the relatively level valley of Railroad Creek.

There are many other undeveloped ore deposits in the United States. One in the Twin Buttes area of Arizona between Tucson and Nogales is being prepared for mining by Anaconda Copper and they are currently running full-page advertisements (see the inside back cover of Saturday Review, 28 Oct.) to show how their strip operation is being camouflaged by plantings of indigenuous shrubbery. In a flat cactus desert of Arizona this is hardly necessary; the pit is not an offensive contrast to the dry, bare landscape. I would like to invite Kennecott to publish a similar color photograph of Miner’s Ridge and show by photo-montage what their pit would look like.

ROBERT F. JACKSON
Department of Mathematics,
University of Toledo, Toledo, Ohio

Masquerade of Undirected Research

For almost a year Project Hindsight has been under discussion (18 Nov. 1966, p. 872; 2 Dec. 1966, p. 1123; 23 June, p. 1571; 29 Sept., p. 1512), and in all that time a point of fundamental importance has been ignored. “Undirected” research is not equivalent to pure or basic research.

Basic scientific research is concerned with new ideas, new concepts, new principles. It is not concerned with practical applications or development of things, but with the development of ideas fundamental to nature. For this reason it requires a very special scientific competence, even genius, as well as a highly developed sense of purpose and direction.

The hard fact is that the overwhelming majority of scientists are not capable of performing basic research to any significant extent, just as there are many well-trained musical arrangers but there are very few really good composers.

Unfortunately, few scientists are willing to admit to an incapability of accomplishing basic and fundamental research, particularly if they are in academic life. Hence there has arisen that form of self-deception in which the scientist reasons that if his work is “undirected”—not directed toward a specific goal—then it must be basic research. This may be one of the greatest non sequiturs of all time, but that does not prevent one afflicted with the delusion from fighting with astounding ferocity for funds for “undirected research.” In a sense he is fighting to maintain status, face, and self-respect.

The main conclusion of Project Hindsight (and I support it) is that the usual scientist is more productive when he is given specific goals. To equate this to an attack on the value of basic research is ridiculous. The conclusion may be unpalatable to some, but still the evidence is there that a great deal of undirected research is mere timeserving and scientific busywork masquerading as basic research. The large body of scientists supported by public and corporate funds and allegedly engaged in basic research had best recognize this unhealthy situation and come to grips with it, rather than denounce those who have uncovered it.

ROBERT M. LUKES
223 Bramton Road,
Louisville, Kentucky 40207

Liberties with Language

Richards’ analysis (Letters, 20 Oct.) has enabled me to identify, retrospectively, an oddity I encountered some years ago in a manuscript. The text announced that, to allow for some variable or another, values in a table had been “adjusted.” This clearly represents the third term in the series: “to adjust; to make an adjustment; to adjustment.” One hopes that no additional terms will make an appearance to be classificationed.

PHILIP S. CORBET
Canada Department of Agriculture,
Belleville, Ontario
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tion of students' overall records and scholastic aptitude tests have not pro-
gressed very far.

Comprehensive organization is rep-
resented as an alternative to selection.
Evidence is available to show that a
number of well-established comprehen-
sive schools are successful in holding
more young people in school and pre-
paring a greater percentage of them
for university entrance than would have
been the case under the old binary
system. And comprehensive have un-
derlined a point by turning 11-plus
"failures" into university material.

The comprehensive principle seems
to have gained wide acceptance; most
opposition takes the form of rear-
guard actions. One significant trend is
the conversion to state education of in-
creasing numbers of the middle class,
a conversion brought about both by
conviction and financial pressure. To
provide equal opportunity it is agreed
that the comprehensive school should
be socially as well as educationally
nonselective. In achieving the first goal
the comprehensive faces a stiff test.

Comprehensive schools in Britain
have been conceived from the first as
"neighborhood" schools. There are
fears that, particularly in big cities
where there are huge and growing con-
centrations of publicly subsidized "coun-
cili" housing, comprehensives will be-
come one-class schools attended by
working-class children exclusively. De-
spite many forces intended to make
British young people classless, Britain
remains in many ways a "2-nation"
society, split among class lines as the
United States is split along racial lines.
In the working-class culture there is
a very strong tradition enforced by
home and neighborhood that school
is to be left behind at the earliest pos-
sible moment, and that earning, not
learning, is the real concern.

Selectivity dies hard. Grammar
schools survive in many school sys-
tems, and where they do, comprehen-
sive schools have problems in attrac-
ting their share of the academically
talented students. It is not only the
middle class which defends the status
quo. For all classes, the grammar
school has been the portal for the
bright child to higher economic and so-
cial status. The British education sys-
tem has been dedicated to producing
a meritocracy and the habit is deeply
ingrained. The comprehensive school
with its doctrine of nonselection is
counted on by its partisans to main-
tain the standards of the old system
but to overcome its social wastefulness.
But schools do reflect the society and
the British are still literally divided
by class and tolerant of elitism. In
some of the best comprehensive schools,
observers have noted that a pecking
order develops with the academically
talented at the top. Much the same
thing happens, of course, in the United
States, but it would be ironic if the
British made the great effort of re-
organization only to see the old sys-
tem remerge inside the comprehensive
schools.—JOHN WALSH

APPOINTMENTS

John M. De Noyel, deputy director for
nuclear test detection, Office of the
Secretary of Defense, Advanced Re-
search Projects Agency, to assistant
director for research of the Geological
Survey. . . . Louis M. Rousselet, di-
crator, department of surgery, St. Vi-
cent's Hospital and Medical Center,
and professor of clinical surgery, New
York University School of Medicine,
deputy assistant secretary of defense
(manpower) health and medical . . .
W. Lewis Hyde, director of the Insti-
tute of Optics, University of Rochester,
to provost of the University Heights
campus of New York University . . .
S. David Freeman, partner in the
private law firm of Swidler and Freeman,
to director of the newly established
energy policy staff, Office of Science
and Technology. L. E. Roth, professor
of cell biology and assistant dean of
the Graduate School, Iowa State Uni-
versity, to director of the newly estab-
lished division of biology, which com-
bines the former departments of bot-
any, bacteriology, zoology, and bi-
ophysics, at Kansas State University.
. . . James M. Sprague, professor of
anatomy, Institute of Neurological Sci-
ences, University of Pennsylvania
School of Medicine, to chairman of
the department of anatomy at the uni-
versity's School of Medicine . . .
Harvey J. Stiffler, assistant professor
of microbiology, School of Medicine,
Western Reserve University, to profes-
sor and chairman, department of micro-
biology, Ohio College of Podiatry. . .
John M. Richardson, chief of the Radio
Standards Laboratory, National Bureau
of Standards, Boulder, to director of the
newly established Office of Standards
Review, NBS . . . Edgar L. Piret,
scientific attaché, U.S. Embassy, Paris,
to counselor of embassy for scientific
affairs. . . . Paul C. Cross, trustee
and vice president for research, Car-
negie-Mellon University, to director-
at-large, American Chemical Society.
. . . J. D. Ives, chief of the Canadian
Geographical Branch, to director of
the Institute of Arctic and Alpine Re-
search, University of Colorado. He
succeeds John W. Marr, who will re-
turn to research and teaching at the
university . . . Harvey J. Brudner, di-
crator of research and development,
Westinghouse Learning Corporation,
to vice president of the corporation. . .
William L. Haney, head of the Data
Systems Section, Radio and Electrical
Engineering Division, National Re-
search Council, Canada, to liaison offi-
cer, in charge of the London, England
office of the National Research Coun-
cil. He succeeds Harry Williamson,
who has returned to Canada to assume
the position of manager of the Cana-
dian Journals of Research, published
by NRC . . . Stephen Williams, profes-
sor of anthropology, Harvard, to acting
director of the Peabody Museum of
Archaeology and Ethnology, Harvard.
He succeeds John O. Brew, who will
devote his time to research. . .
Clair L. Gardner, program planning
officer for the National Institute of
Dental Research, to associate director
for special programs, NIDR. He suc-
ceds F. Earle Lyman who recently
retired. . . . F. Merlin Bumpus, sci-
centific director of the cardiovascular
research program, Division of Research,
Cleveland Clinic Foundation, to an ad-
ditional post of chairman of the Dis-
division of Research at the foundation.
. . . Charles R. Greene, clinical instruc-
tor in medicine, Downstate Medical
Center, to local program coordinator
for the Regional Medical Program at
Downstate. . . . Peter L. Auer, profes-
sor of aerospace engineering, Cornell
University, to director of the newly
established Laboratory of Plasma
Studies, Cornell.
vented us from constructing an acceptable history of medieval science. Goldstein provides us with a remarkably well-cut stone for the task, but we are still in need of someone to erect the temple.

HARRY WOOLF
Department of the History of Science, Johns Hopkins University, Baltimore, Maryland

Sun and Earth


This book contains the ten invited review papers given at the Inter-Union symposium on solar-terrestrial physics in Belgrade. Five topics were discussed at the symposium, and there were two review papers pertaining to each topic.

The first paper (by Lüst) gives a good description of the observed properties of the interplanetary gas and magnetic field and of the ways in which the observations are made. Together with the next paper (by Parker) it deals with the solar aspects of the solar-terrestrial relationship. These two chapters of the book may be recommended as an appropriate introduction for anyone who wants to familiarize himself with the solar-wind phenomenon.

The next two papers treat the observations (Ness) and the theory (Dungey) of the earth's magnetosphere under quiet solar conditions. There is some overlap with the subjects treated by Lüst and by Ness, but this hardly detracts from the book.

One of the longest chapters (by Oba-yashi, 60 pages) is devoted to the magnetosphere and its response to increased solar activity. Parts of what is discussed in the first section of the article have already been treated by Lüst in his chapter. The other two sections, on disturbances in the earth's upper atmosphere and on disturbances in the magnetosphere, give a comprehensive description of the phenomena. They also furnish a discussion of origins of the disturbances, including treatments of particle precipitation and of ionospheric current systems.

The very worthwhile task of trying to arrive at "an understanding and a coherent summary" of the interrelations of all the observed charged particles in the magnetosphere has been well coped with (by O'Brien) in the next chapter of the book. The characteristics of auroral radiations, Van Allen belts, the magnetosheath, and the solar wind are here related. The following long chapter (by Troitskaya, 60 pages) treats micropulsations of the earth's magnetic field, and shows how investigations of this subject can also give information about the phenomena caused by the interaction of the solar wind with the magnetosphere. In a short, well-conceived article Krassovsky discusses auroras. He distinguishes between ordinary auroras, caused by the injection of low-energy particles, and red auroras, associated with intense heating of the atmosphere by hydromagnetic waves.

The final chapters consist of an article (by Evans) on ground-based measurements and one (by Gringauz) on rocket and satellite measurements of the temperature of the particles in the ionosphere and in other parts of the atmosphere. It is of interest to have the two methods juxtaposed, and it shows to some extent the inherent strengths and weaknesses of both.

A book written by a number of authors will necessarily omit aspects that other scientists in the field would like to see included. Similarly, some repetition and overlap can hardly be avoided. The present book suffers from both of these drawbacks, but—in the reviewer's judgment—not to such a degree that its value is significantly diminished. It can be recommended to all who want to delve into this fascinating inter-field that has so often been ignored—particularly by astronomers.

EINAR TANDBERG-HANSSEN
High Altitude Observatory, Boulder, Colorado

Books Received


American Space Exploration. The First Decade. William Shelton. Little, Brown, Boston, 1967. xii + 367 pp., illus. $5.95.


(Continued on page 124)