dolph Hassler, a Swiss mathematician and surveyor, whose insistence on the highest possible accuracy of measurement set standards which have ever guided the survey, now called the U.S. Coast and Geodetic Survey (Fig. 6). After issuing some charts it discontinued its activities until 1832. The same lack of interest which characterized the Congress in matters of geodetic surveying can be seen in the frustration of attempts by Joel Barlow and others to found a national university and of John Quincy Adams to found a national observatory. His proposed "light houses in the sky" even became a butt for the wits of those days.

Perhaps I should not leave the subject on this note of anticlimax and should redirect attention to the pioneer naturalists and inventors of those days. We must first of all remember the period as the time of the great explorations and of the great start in industrialization—the time of Jefferson, of Lewis and Clark, of Maclure, Audubon, and Nuttall, of Eli Whitney, and of Robert Fulton. These men laid a lasting foundation for the future—notably for the astonishing 'thirties and 'forties, the Jacksonian period, the time of the geological surveys, the time of the railroads and other technological advances, the time of the professional scientists, as well as the time of the great causes and of the great debates.

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1. Another important event was Alexander von Humboldt's expedition to the Orinoco and Andes regions, which ended in Mexico and in Humboldt's return to Europe in 1804, via Philadelphia and Washington, where he met many learned Americans, including President Jefferson.
2. David Thompson had done better in 1798, when he located the source of the Mississippi in Turtle Lake beyond Cass; see Thompson's narrative of his explorations in Western America, 1784–1812, J. B. Tyrrell, ed. (Toronto, Canada, 1916).
3. To this period also belongs the Russian expedition under Ferdinand Wrangel which, between 1820 and 1824, carefully studied the Siberian coast from the mouth of the Indigirka to Kolyuchin Bay and thus finally established that there is no land connection between Asia and America. Another Russian expedition under Fabian G. von Bellingshausen made geographical discoveries in the antarctic between 1819 and 1821. Here it met with Yankee sealers, among them Nathaniel Brown Palmer, the discoverer of Palmer (Graham) Land (1820).
4. *Am. Ornithol.* 1B, 376–386 (1832).
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Geology, Geologists, and the AAAS

The inclusive association has an important role to play in a time of increasing specialization in science.

Kirtley F. Mather

Herman L. Fairchild, in his history of the American Association for the Advancement of Science (*1*) recorded the fact that on an old residence in Albany, New York, there was a bronze tablet bearing an inscription which told of the organization of the Association of American Geologists, the "parent body" (Fig. 1).

The decade of the 1830's was marked by an extraordinary burgeoning of interest in the newly developing science of geology in eastern North America. Water power was proving inadequate for the rapidly expanding industries. Exploitation of the coal of the Appalachian coal fields was moving ahead with increasing momentum. Mineral resources in great variety were insistently demanded to meet the needs for raw materials in the many new manufacturing plants. The survey of the four "Geological Districts of the State of New York" was getting well under way. The office of state geologist was inaugurated in Massachusetts and Virginia, and before the end of the decade, 17 states had made some sort of provision for geological surveys. Sound bases for geological thinking and for the interpretation of field observations had been established in Great Britain by William "Strata" Smith, Sir Roderick Murchison, Sir Charles Lyell, and others. Such knowledge was infiltrating what was then still the New World. Many professors of natural history or of natural philosophy in 20 or more institutions of higher learning, scattered from New England to Virginia, were concentrating their work upon the

small segment of their broad fields to which the designation *geology* could appropriately be applied.

The "Parent Body"

Ebenezer Emmons was professor of natural history at Williams College, but in addition he was responsible for the geological survey of the "second district" in New York state. This accounts for the fact that he had a "home" in Albany, where he later was professor of obstetrics in the Medical College. One can well imagine how eager was this scientist, trained in medicine and chemistry but essentially self-taught in geology, to secure advice from, and share ideas with, his colleagues in charge of the other three districts, or indeed with any of the small number of his contemporaries who were trying to unravel the complex structure of the rocks in New England and New York. Thus it was natural that from the bull sessions in his home should sprout "the first formal efforts . . . toward the organization of the Association of American Geologists." That association was actually organized in Philadelphia in 1840, with Edward Hitchcock as its chairman.

At its third meeting, in 1842, the Association of American Geologists was broadened in scope and became the Association of American Geologists and Naturalists. Hitchcock at the time was professor of chemistry and natural history at Amherst College. Not only he and Emmons but many others in the association were well aware of the dependence of geology upon the principles of physics and chemistry. Every stratigrapher in those days was a paleontologist, and the intimate relation between paleontology and biology was obvious. The association was therefore enlarged to include the workers in those fundamental and related fields, whose counsel the geologists very much needed.

This expansion in membership and member interests was a long step toward establishment of a national association broadly inclusive of all the sciences, and the model of such an association was at least sketchily known in America at that time. The British Association for the Advancement of Science had been founded in 1831 and was flourishing, along with the Royal Society of London,

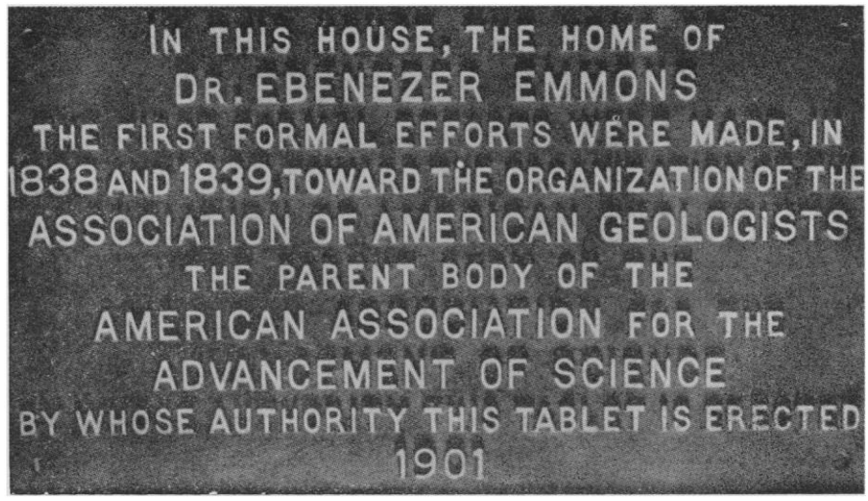

Fig. 1. Bronze tablet from the home of Ebenezer Emmons, Albany, N.Y. [Courtesy New York State Museum of Natural History]

in the 1840's. John C. Warren, a leading physician of Boston, had read a paper at the meeting of the British Association in 1837. After he returned to the United States a year later he actively campaigned for the organization of a similar society here. In his campaign he sought the support of the "American Philosophical Society Held at Philadelphia for Promoting Useful Knowledge," which had been founded by Benjamin Franklin in 1743.

The Philosophical Society, however, passed a resolution in 1839 declaring that in its opinion it was inexpedient for it to undertake the organization of the proposed association. It is quite likely that Warren also sought similar support from the American Academy of Arts and Sciences, chartered in 1780, of which he was a fellow, although I have found no record to prove that he did so. Both the Philosophical Society and the American Academy, then as now, were limited in membership to the few persons who were considered to be the intellectual elite of their time, whereas the proposed Association for the Advancement of Science, like its British model, was to be open to anyone who had any interest, no matter how peripheral, in improving the effectiveness of science in the promotion of human welfare.

Agassiz and the New Association

Louis Agassiz, famous for his studies of glaciers and glaciation, arrived in the United States from England in 1846, and in 1847 the Association of American Geologists and Naturalists decided to widen further its membership and become what was, to all intents and purposes, the American counterpart of the British Association. Agassiz undoubtedly had a great influence in effecting this change. When the transition was completed and the American Association for the Advancement of Science actually came into existence, in Philadelphia in 1848, he was chairman of the section of "Natural History, Geology, etc."

At that first meeting of the AAAS, the geologist William B. Rogers (Fig. 2) presided until the constitution and rules of order had been adopted. He then installed another geologist, William C. Redfield (Fig. 3) as the first president elected by the new organization. Thus Rogers' name is carried on the "Roll of AAAS Presidents" in the number one position—a tribute all the more justified by the fact that the program of the "general session" of that meeting indicates that he delivered an "annual address," thus setting the precedent for the "address of the retiring president" which has become an outstanding feature of subsequent annual meetings. It should be noted also that the list of 461 "original members" of the AAAS includes practically all of the fellows of the Philosophical Society and of the American Academy who were engaged in scientific pursuits, as well as many other leading scientists of the time. Evidently the fellows of those two learned societies had by this time developed the same attitude toward the broadly inclusive association as that long displayed by the fellows of the Royal Society toward the British Association.

The "Roll of AAAS Presidents," as carried in the current Program-Directory, lists 112 names, including that of Paul E. Klopsteg, who is serving as president in 1959. This happens to come

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out even—one per year for the 112 years of the life of the association (1848–1959, inclusive). This is mere chance, however. There were no meetings and no presidents during the war years 1861–65. The 1852 meeting was postponed for a year because of "the prevalence of cholera along the approaches to Cleveland from the south," and there were two meetings and two presidents in 1902. Moreover, four presidents died in office and were succeeded by others in the same year.

Geologist Presidents

Six of the first nine presidents in this list were geologists. I include Agassiz in the six, even though his field is given as zoology, inasmuch as he was elected president in 1851, at a time when his eminence was due to his glacial studies rather than to his work in ichthyology, which came later. I also include Bache, whose field is indicated as geography, because he was, in modern terms, an oceanographer. Incidentally, it was at the first meeting of the association held in Washington, D.C., in 1854, that Bache, then superintendent of the Coast Survey, announced the results of the measurements of ocean temperatures in and near the Gulf Stream, made under his direction.

This preponderance of geologists in the administration of the AAAS—there was no "permanent secretary" or "executive officer" in those days—was in part a carry-over from the "parent body," but it was even more a result of the great responsibility that many geologists had accepted for ensuring the success of the broadly inclusive organization, which seemed to them essential for the welfare of both science and nation. Geologists continued to play this leading role for another 40 or 50 years. (Some of these men are shown in Figs. 2 to 5.) Divide the list of 112 presidents into two equal parts. Among the first 56 there are 21 geologists; among the second 56 there are only five (or six if Isaiah Bowman is considered to be a geologist rather than a geographer).

I have counted as geologists not only Agassiz, as explained above, but also Edward D. Cope and O. C. Marsh; the former is listed as a zoologist rather than as a paleontologist like the latter, his bitter rival in the discovery and naming of fossil vertebrates. I have also counted two others, in addition to Bache, whose fields are indicated as geography. J. W. Foster was for a time associated with J. D. Whitney in the study of the Precambrian system in the Lake Superior region, and his address as retiring president indicated his later concentration upon paleoclimatology; Julius E. Hilgard was a geodesist and cartographer. It should be noted, moreover, that the "21 geologists" in my statistics are in reality only 20, inasmuch as William B. Rogers is listed twice, having been elected as the 26th president in 1875, after serving as "acting president" for the first meeting in 1848.

Even so, the contrast between the two halves of the list of presidents is great enough to have real significance and to call for explanation. It is undoubtedly related to the establishment in 1888 of the Geological Society of America, one of the first completely autonomous national societies of specialists in a single scientific discipline to be organized in the United States. It was not that geologists had suddenly become clannish and no longer wanted to rub shoulders with their colleagues in other fields of science, nor that they had lost interest in the aims and objectives of the association in general. The fact that for many years the meetings of section E (geology and geography) of the association have consistently been listed as joint sessions of the section and of the Geological Society of America and that abstracts of section E papers are still published in the *Bulletin of the Geological Society of America* is sufficient evidence that other reasons must be found.

Defined Disciplines

Although there was widespread interest in geology during the first half of the 19th century and many important contributions to this particular science were embodied in papers presented by professional geologists at meetings of the AAAS between 1848 and 1888, it was not until the last third of that century that the profession of geologist became clearly recognized and that professional standards for that vocation were developed. It is one thing to have sufficient interest in geology to become a member of section E or even to make a sufficiently "meritorious contribution" to geology to become a fellow of the AAAS; it is quite another thing to have adopted geology as a vocation and to have met the standards of preparation for its practice so as to be worthy of election as a fellow of the Geological Society of America. Professional status had at least a little influence upon the decision to set up the Geological Society of America as a professional society.

Then, too, there was in the 1880's a real problem with regard to publication. The *American Journal of Science* could not possibly meet the expanding needs of all the sciences. The *Proceedings of the AAAS* were drastically limited by meagre finances. Geologists wanted a journal of their own, in which they could communicate with each other, undistracted by reports directed to workers in other fields of science. The Geological Society of America was to have a *Bulletin* to meet this need.

Many important, highly technical, and narrowly specialized contributions to knowledge had been made by geologists at meetings of the AAAS. The annual meetings during the years 1848 to 1888

Fig. 2. William B. Rogers, association president in 1848 (acting) and in 1876. [Smithsonian Institution]

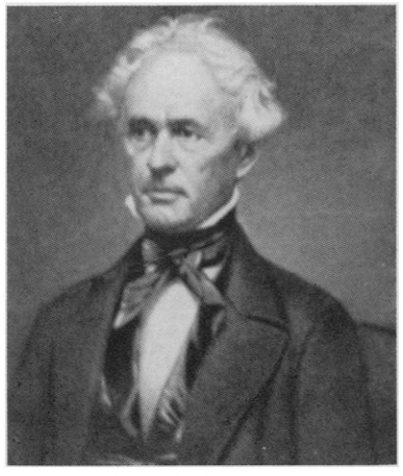

Fig. 3. William C. Redfield, association president in 1848. [Smithsonian Institution]

provided a platform from which eminent leaders in geological research could speak to their colleagues and a forum in which new ideas could be critically discussed. I have space for only a few of the many references that might be made. It was at the Montreal meeting in 1857 that Charles Whittlesey reported his initial studies of the former shore lines of the Great Lakes, one of the abandoned beaches of which was later named for him. The presidential address of James Hall at that same meeting was of such significance in the development of geology as a science that Mason and I included a portion of it in our *Source Book in Geology*. In 1859, T. Sterry Hunt contributed a paper at the Springfield, Massachusetts, meeting that, for the first time in North America, directed attention to the origin of evaporites among sedimentary rocks. Louis Agassiz announced in 1870, at the Troy, New York, meeting, his observations "On the former existence of local glaciers in the White Mountains." At the Hartford, Connecticut, meeting in 1874, G. K. Gilbert stressed the recency of volcanic activity in the western states, and John Muir reported his studies of the "Formation of mountains in the Sierra Nevada." J. W. Dawson's address as retiring president at the Minneapolis meeting in 1883 sketched the "Unsolved problems in geology" as he saw them at that time. At the Buffalo meeting in 1886, T. C. Chamberlin marshaled the evidence then known for multiple glaciation during the great ice age. In his address as retiring president at the Madison meeting in 1893, Joseph LeConte surveyed sagaciously the "Theories of the origin of mountain ranges."

On the other hand, the majority of the papers presented by geologists during those 40 years indicate that their authors were very conscious of the presence in their audiences of many persons not well trained in the science of geology and not competent to follow its increasingly specialized vocabulary. In the 1880's vocabulary barriers between the sciences were by no means as noticeable as they are today, but the trend toward their erection was beginning to manifest itself. Certainly, when, in 1888, the geologists in the AAAS organized their own separate society of specialists in a single, well-defined discipline, they were meeting what seemed to be a clear need and were blazing a trail that has been followed by many others since then.

The Botanical Society of America was organized in 1894, the American Society of Zoologists was formed in 1902 by the fusion of three older societies dating back to 1890, and the Association of American Geographers came into existence in 1904. The organization of these and many other professional and promotional societies posed many problems, both personal and institutional, relative to the relationship of the new societies with the AAAS. Most of the scientists involved soon found that, where loyalties were concerned, they were developing symptoms of schizophrenia. They recognized the different values, separate but possibly equal, of membership in the broadly inclusive Association for the Advancement of Science, on the one hand, and in the narrowly restricted, highly professional society, on the other. Conflicting schedules of meetings in widely separated localities were almost inevitable. Few individuals could afford the time for carrying out official organizational responsibilities in more than one society.

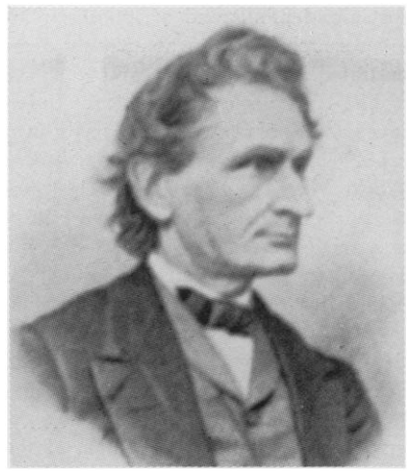

Fig. 4. James D. Dana, association president in 1854. [Smithsonian Institution]

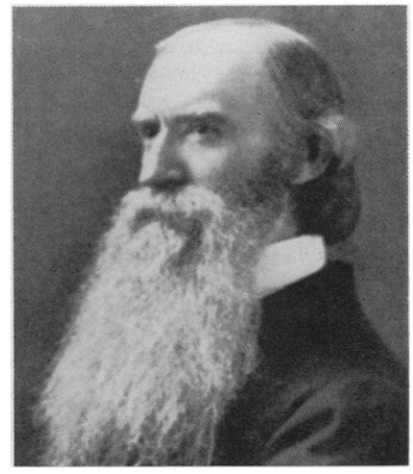

Fig. 5. J. S. Newberry, association president in 1867. [Smithsonian Institution]

Dual Membership

These problems have for the most part been solved, from the personal point of view, in the obvious way. Most scientists —geologists or others—have maintained their memberships in both the AAAS and the specialized society of their discipline. But they have limited their organizational activity to one or the other. As a rule (this is certainly true of geologists), the great majority have chosen the professional society rather than the association as the place in which they prefer to do their organizational chores. This seems to be the reason for the comparative dearth of geologists among the last 56 presidents of the AAAS. Election to that high post has been based, if I may say so, not so much on preeminence in one's field of scientific research as upon prior service to the association. Nearly every one of the last 15 or 20 presidents has climbed the ladder to that topmost rung from service on a sectional or other committee through at least one term on the executive committee or board of directors.

From the institutional angle, these problems of relationship have also been solved, equally well but in not nearly so inevitable a way. At the present time the administration of the AAAS, its fiscal affairs, and its strategy and tactics are actually in the hands of official representatives of the affiliated organizations, of which there are now 285, and of which most are the professional societies, each specializing in some one scientific discipline or segment thereof. These representatives constitute approximately three-fourths of the membership of the council of the association, the body responsible for policy making and for selecting officers and directors. Thus, from one very significant point of view the AAAS is the service organization for scientists otherwise banded together in disparate groups representing various segments of scientific disciplines according to their special interests and training.

But this is by no means all of the picture. The 18 sections of the AAAS continue to provide forums for the presentation and discussion of highly technical subjects far out on the periphery of the expanding frontier of research, where only specialists can fully comprehend their recondite significance. Witness the program for the joint session of

AAAS section E and the Geological Society of America, with its symposium on experimental geology. With the great increase in the number of geologists in recent years and the emphasis upon quantitative rather than merely qualitative observations in both field and laboratory, the pressure for time at the annual meetings of the Geological Society of America has become almost unbearable. Joint sessions with section E help notably to relieve that pressure, as do also the meetings of the state academies and the many local geological societies that have been formed in various parts of the country. There is plenty of room for all.

Specialization and Coordination

But the 20th century trend in science is not without its problems, too. The "settees" of "natural history" or "natural philosophy" in our institutions of higher learning were long ago broken down into "chairs" of geology or physics or chemistry or zoology, and so on. More recently those chairs have been splintered to provide "footstools," of (for example, in geology) petroleum geology, micropaleontology, geomorphology, sedimentology, petrology, seismology, and so on. There is much truth in the cliché that a scientist is "someone learning more and more about less and less." No longer does the label "geologist" tell the world what a man is doing to earn a living; a much more precise designation than that is now required.

Not many years elapsed after the birth of the Geological Society of America in 1888 before it too was holding concurrent sessions of subordinate, more narrowly specialized, groups at its annual meetings. In swift succession in subsequent years, such national organizations of specialists as the Paleontological Society, the American Association of Petroleum Geologists, the Mineralogical Society of America, the Seismological Society of America, the Society of Economic Geologists, the Meteoritical Society, the Society of Economic Paleontologists and Mineralogists, and the Association of Geology Teachers came into existence. Such specialization is, of course, a good thing; it is here to stay. It must, however, be balanced by a complementary development, else, pushed to the extreme, it may produce unfortunate results. Sooner or later, in science, analysis must be followed by synthesis. The value of cross-fertilization of highly specialized minds and of interdisciplinary research has been abundantly demonstrated in the last 30 years.

The American Geophysical Union was established in 1919 and has grown rapidly in membership since the end of World War II. The Geochemical Society is still an infant, but a very lusty one. In the activities of each, and in the research pursued by their members, the boundaries between geology, physics, and chemistry are being erased, even as those between geology and biology had long before been blurred by the paleontologists. Especially significant was the organization, a dozen years ago, of the American Geological Institute to coordinate certain phases of the activities of its sponsoring bodies, the ten major national societies of the devotees of earth science. Its primary functions are in the areas of public relations and communication, and thus only indirectly in that of promoting research. It therefore strives to do for geology in particular one of the things that the American Association for the Advancement of Science was originally designed to do for science in general.

Thus, we geologists find ourselves today in the midst of an extremely complicated network of interlocking, loosely coordinated, differentially specialized, and variously structured organizations. It is not easy to find one's way through the maze, or to decide—especially when the notices of annual dues arrive—where one's loyalties should be directed. Fortunately there are enough of us now to provide the necessary manpower to keep all essential organizations in a state of healthy vigor. Certainly, each of those I have named in this article has an important function to perform and is currently needed.

Not the least of these functions is involved in the relationship of geology and geologists to the AAAS. Here, of course, geologists should join with their fellow workers in all other scientific disciplines "to improve the effectiveness of science in the promotion of human welfare and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress." These are also important functions of the American Geological Institute insofar as geology is concerned. But geology cannot possibly enjoy a favorable climate of public opinion in splendid isolation from the other sciences. Here is just another instance of "united we stand, divided we fall." Through the AAAS we geologists must work together with other scientists to accomplish those aims of the all-inclusive association. This means that the channels of communication must be kept open, not only between geologists tempted to confine their activities within one or other of the increasingly specialized compartments into which our science is now being fragmented, but also across the more obdurate barriers that threaten to separate us from the similarly specialized workers in the subdivisions of other major scientific fields. Participation in the meetings of the AAAS and support of its other activities is an obvious, effective means to that end.

From Analysis to Synthesis

Finally, I want to make a distinction between the trend in modern science toward interdisciplinary research, to which I have already referred, and the need for multidisciplinary studies which accelerate the progress of science from analysis to synthesis. The former is exemplified by much of the current work in geophysics and geochemistry. The geologist acquires tools and techniques developed by physicists and applies them in his investigations of subsurface structures and materials. The results have practical value and sometimes far-reaching significance in our thinking about earth history and earth processes. Figuratively speaking, interdisciplinary research brings together a few of the tips of the branches of the tree of knowledge. Multidisciplinary studies, as I see them, involve the deeper quest for underlying verities, the broader view that considers the whole as something more than a mere aggregation of its parts, the endless search for meaning as well as understanding. This kind of research works from the tips of the branches of the tree of knowledge inward to the trunk and downward to its roots. It may indeed involve philosophy as well as science, or at least it is probably best prosecuted by scientists with a philosophical turn of mind. Certainly it is at the roots of the tree of scientific knowledge that the unity of science is most likely to be apparent.

The expansion of the Association of American Geologists to include all naturalists and the subsequent transformation of that organization into the American Association for the Advancement of Science was the work of geologists deeply concerned for multidisciplinary

research, although they probably never used those words. Not only is geology inherently multidisciplinary in its very nature, because of its dependence upon physics, chemistry, and biology and its relations with astronomy and meteorology, but those leaders in our science a century and more ago were men with a definitely philosophical bent. In a sense, the cycle of the history of science is even now coming full circle. Enlightened and inspired by such contacts with other scientists as those provided by the AAAS, geologists today and tomorrow may make contributions to human welfare far more valuable than even the discovery of new oil fields or additional bodies of uranium ore.

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Transliteration of Russian

Gregory Razran

On the last pages of the 1955, 1956, and 1957 index numbers of the *Mathematical Reviews* is given a table of seven different systems of transliteration of Russian, including the systems used by the U.S. Library of Congress, by *Science Abstracts,* by *American Slavic and East European Review,* and by *Mathematical Reviews* itself. No comment is offered and no question is asked about why there should be so many systems or why the *Mathematical Reviews* needed to set up one of its own. Moreover, the table is of course not—and admittedly not intended to be—complete. The British Museum, the Slavonic Division of the New York Public Library, the Library of the New York Academy of Medicine, the Institute for the Study of the U.S.S.R., *Biological Abstracts, Chemical Abstracts,* and, above all, the *U.S. Government Printing Office Style Manual* all use systems that are in some respects different from each other and different from each of the systems in the table of the *Mathematical Reviews.* Indeed, essentially the widest difference in transliteration is that between (i) the system used by the Library of Congress and (ii) the one recommended by the Government Printing Office *Style Manual.* The former, for instance, resorts to no less than 11 diacritically marked letters while the latter is content with only one such marking—the dieresis over *e,* which, too, the Government Printing Office manual suggests, may be omitted whenever it is omitted in Russian (as it often is).

Clearly, use of this multiplicity of systems and the resulting waste and confusion need not continue. The multiplicity persists indeed only in scientific periodicals and in library catalogs and publications. The daily press, popular magazines, and by far most current translations of books seem to evolve gradually a more or less uniform system. One does not find, for instance, in these latter media the *Mathematical Reviews' Hruščev* and *Čerenkov* or the Library of Congress' *KHrushchev* and *CHerenkov* (with ligatures over *KH, CH,* and *shch*) for familiar *Khrushchev* and *Cherenkov,* to name only two common examples and two science-and-library systems of transliteration. Moreover, it should in general be noted that transliteration divergences exist only with respect to 13 of the 33 letters in the modern Russian alphabet: six consonants, six vowels, and a semivowel. *Bulganin, Pasternak,* and even *Pavlov* present no problem (Pawlow and Pavloff are quite obsolescent by now). But let me detail briefly the argument and the suggestion for uniformity.

Consonants

Use of ligatures, multiple capitals, inverted circumflexes, and the letters H, J, *and* TZ. The Library of Congress system uses ligatures over *zh, kh, ts, ch, sh,* and *shch* in transliterating Russian **ж, х, ц, ч, ш,** and **щ** (it also uses ligatures for some vowels, but this will be taken up later) and in addition capitalizes the two—in one case, four—letters when they occur initially. The rationale of the practice is presumably that of facilitating library cataloging and filing by indicating that the English combinations of letters correspond to single Russian letters. But, plainly, this limited and doubtful advantage must be pitted against the fact that ligatures and extra capitals are both expensive and unesthetic, add nothing from the standpoint of approximate pronunciation, and, indeed, have hardly ever been maintained consistently. The Library of Congress itself does not use ligatures in its *Monthly List of Russian Accessions,* nor does the *Current List of Medical Literature* published by the National Library of Medicine. Why, then, not give up the cumbersome practice altogether and avoid confusion and expense?

Several systems, notably the *American Slavic and East European Review* and the *Mathematical Reviews,* use *ž, č, š,* and *šč,* instead of *zh, ch, sh,* and *shch,* in transliterating the corresponding Russian letters. But, again, there is the problem of expense and esthetic appearance, to which should be added the even more important consideration of the average reader's unfamiliarity with the meaning of these marks and consequent gross mispronunciation. A good number of my colleagues—even the literary ones—pronounce the name of the famous Czech dramatist Čapek as "Kapek" and not, as they should, "Chapek." Besides, in general, diacritical marks are alien to both Russian and English, the former utilizing them only in **й** and occasionally in **ё,** and the latter resorting to them even more rarely.

Finally, there is the use of *h* instead of *kh* for Russian **х** by the *Mathematical Reviews,* of *j* instead of *zh* for Russian **ж** by the Library of the New York Academy of Medicine, and of *tz* instead of *ts* for Russian **ц** by the Slavonic Division of the New York Public Library. And here the inadequacies are even more evident. English *h* does not have the sound of Russian **х**; the French, and not the English, *j* is equivalent to Russian **ж**

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