Lipman Bers was born in Riga, Latvia. He received his doctorate in 1938 from the University of Prague, where he was a student of Karl Löwner (Charles Loewner). In 1940 he joined the wave of mathematical immigrants to the U.S. Having held positions at Brown, Syracuse, IAS, NYU, and Columbia, he is now at the Graduate Center of CUNY. His research has ranged through gas dynamics, partial differential equations, and complex analysis. He is a member of the National Academy of Sciences.

The Migration of European Mathematicians to America

LIPMAN BERS

Dedicated to Mary

The migration of European mathematicians to the United States in the late thirties and early forties was an unqualified success. It was good for the Europeans; that is quite an understatement: for most it was a question of life or death, and for all it was a question of professional survival. It was good for American mathematicians, though at the time it was not at all clear that it would turn out to be so. And it was good for mathematics. The story is worth telling, and part of it has been told by a professional historian (Nathan Reingold) who had access to relevant material, in particular, to letters by G. D. Birkhoff, R. G. D. Richardson and O. Veblen, see [**NR**]. This report is highly recommended.

I am not a historian and what I will tell will be based on what I experienced myself, or what colleagues told me and on what was common knowledge among mathematicians.

I read somewhere that "common knowledge" is a euphemism for village gossip, and I accept this definition. In some sense mathematicians do form a village, and 50 years ago this village was considerably smaller than it is now.

Johns Hopkins and the University of Chicago

It may be worthwhile to say something about European mathematicians who came to the United States before the "big migration." Two important events in the history of American mathematics involved Europeans, the

founding of the Johns Hopkins University (1875), and that of the University of Chicago (1892).

Johns Hopkins, which was conceived from the very beginning as a research university, offered a chair to the British algebraist J. J. Sylvester who was then sixty-two years old. Sylvester stayed in Baltimore for six years, during which time he founded the *American Journal of Mathematics.* In 1883 he left to become, at 70, the Savilian Professor of Geometry at Oxford. It would be wrong to call Sylvester a refugee comparable to those who came here in the thirties or forties. Yet it is a fact that being a Jew he could not obtain a degree, let alone a chair, at Oxford or Cambridge, before the abolition of the so-called test laws.

(Incidentally, this was Sylvester's second visit to the U.S. In 1841 he accepted a position at the University of Virginia, quit after 3 months because the administration did not discipline a student who insulted him, and then spent a year in America looking for another position. Among the places he applied to was Columbia; add this to the list of missed opportunities.)

The first mathematics professors at the University of Chicago were the Germans Oskar Bolza and Heinrich Maschke and the American E. H. Moore, who studied at Yale and in Germany. It was E. H. Moore who became the leader of American mathematics, through his original research and even more so through his inspired teaching.

Many distinguished American mathematicians were students of, or students of students of, E. H. Moore. Most of them worked in the then relatively new fields of abstract algebra and topology, and few had many intellectual links with classical analysis or mathematical physics. Notable exceptions were, however, G. D. Birkhoff, the undisputed leader of American mathematics, and Norbert Wiener.

The Migration From Russia

There were two significant migrations of intellectuals in the 20th century. The first, which occurred after the Russian revolution, involved very few mathematicians. The civil wars, the white and red terrors, the famine, and the totalitarianization of the Soviet Union did not affect mathematicians *qua* mathematicians. In fact, mathematicians were in some sense privileged. They were respected, supported and, which was quite important, left alone and rarely forced to pretend to do Marxist mathematics, whatever this may be. Discrimination against Jews and women which existed under the Czars was swept away by the revolution. All this, coupled with a strong mathematical tradition and a seemingly inexhaustible supply of mathematical talent made the Soviet Union into one of the mathematical superpowers. The unpleasant changes in the situation of mathematicians occurred much later and need not concern us at this point.

Still several Russian mathematicians came to America as refugees, among them the applied mathematician S. P. Timoshenko, the probabilist J. V. Uspensky, and the analysts J. A. Shohat and J. D. Tamarkin.

Tamarkin's influence on American mathematics was pervasive and beneficial, not because of his own research, but because of his wide mathematical culture, his catholic interests, his excellent taste and his enthusiasm for talent. An editor (A. Weil called him "inspired editor") of the *Transactions*, Tamarkin was a critic and sponsor of several promising and later well-known mathematicians.

True scholars and inspired critics are rare among mathematicians; one cannot be one without being capable of creative work, and creative work is usually irresistibly attractive. We could well use a few Tamarkins today.

We can also thank the Russian revolution for the presence in America of two giants of our science, Solomon Lefschetz and Oscar Zariski. Both were born in Russia but left at a young age. Lefschetz was educated in France as an engineer and worked as an engineer after coming to the States. He lost both hands in an industrial accident and only then became a mathematician. Zariski studied in Italy and came to America in response to an invitation from Johns Hopkins, as Sylvester did 40 years earlier.

The Big Migration

The "big migration" (of European scholars and scientists escaping the Nazis) involved relatively many mathematicians, ranging from truly great ones, to some just beginning their careers. Precise numbers are hard to get, and it is not clear where to draw the line. For instance, should one count people who came as students and got their degrees here? (This group includes P. R. Halmos, G. P. Hochschild and P. D. Lax.) There are some estimates (one is 150), but I believe one gets a better feel for the magnitude of the migration and for the standing of the people involved by looking at a representative though incomplete sample.

From Germany: Emil Artin, Alfred Brauer, Richard Brauer, Herbert Busemann, Richard Courant, Max Dehn, K. O. Friedrichs, Hilde Geiringer-Pollaczek, Fritz John, Rudolf Karnap, Hans Lewy, Otto Neugebauer, Emmy Noether, William Prager, Hans Rademacher, C. L. Siegel, Richard von Mises, Aurel Wintner, Hermann Weyl.

From Hungary (mostly via other countries): Paul Erdös, George Pólya, Tibor Radó, Otto Szász, Gabor Szegö, Theodor von Karman, John von Neumann.

From Austria: Kurt Gödel, Karl Menger, Abraham Wald.

From Czechoslovakia: Charles Loewner (= Karl Löwner).

From Yugoslavia: William Feller.

From Poland (mostly via other countries): Nachman Aronszajn, Stefan Bergman, Salomon Bochner, Samuel Eilenberg, Witold Hurewicz, Mark Kac, Jerzy Neyman, Alfred Tarski, Stanislaw Ulam, Antoni Zygmund.

From Russia: Stefan Warschawski (via Germany) and Alexander Weinstein (via France).

From France: Léon Brillouin, Claude Chevalley, Jacques Hadamard, Raphael Salem, André Weil.

For most Hungarian and Polish mathematicians who came to America this was their second emigration; for most the first was to Germany. (Between the two world wars, anti-Semitism was rampant in Polish and Hungarian universities, while the hiring practices of German universities were relatively free from anti-Semitism and xenophobia.)

Why did the European mathematicians come? Mostly because they had to. The majority of the newcomers were Jews, sometimes baptized, or of partly Jewish descent, or had Jewish wives. Some, very few, were politically active and therefore endangered. A few could have stayed in Germany but could not bear to live under the Nazis.

This small group included three great mathematicians: Siegel, Gödel, and Artin. Siegel and Gödel could pass the Nazi racial examinations with flying colors and had no political record. Indeed, Siegel originally stayed in Germany in the hope of preserving something of German mathematics. When he finally left, his departure, through Norway, coincided with the start of the German invasion of that country, and Siegel lived through some dangerous moments.

Artin did have a flaw; his father-in-law was Jewish, which made his three children "quarter Jews." Such were considered salvageable, but only under special circumstances. The Artins were made an offer: Artin remains a German professor and his children will be "aryanized." (The man who carried the offer was the famous mathematician Helmuth Hasse.)

Quotas and Jobs

Of course, there were many people, mostly neither intellectuals nor politically active, who endangered their lives and the lives of their children by staying in Europe. But for them getting out and coming to America was very hard if not impossible. One obstacle was the harsh immigration laws which imposed rigid quotas on the annual number of immigration visas issued to people born in a given country.

Fortunately, for academics, a special amendment exempted professors appointed to American universities, and their dependents, from the quotas. (Warren Weaver is considered to have been instrumental in passing this amendment.)

Still, getting a job as a mathematician during that time was not at all a simple matter, even for Americans. While the scientific level of American mathematics was very high (more about this later), the economic status of the profession was not at all favorable. The depression was not really over, and jobs were rare. There were only two post-doctoral positions in the whole country. Teaching loads were heavy and most teaching assignments involved very elementary subjects. Except in a few favored institutions, research was neither expected nor rewarded. Promotions were slow, the usual pace being three years as an instructor, five as an assistant professor, and another five as an associate.

For a foreigner, getting a university position involved additional problems. Some of the Europeans had difficulties with English (and some, including myself, still do). Many lacked relevant teaching experience — teaching American freshmen trigonometry, college algebra and even analytic geometry was quite different from teaching in a European university or even a European Gymnasium.

(The Russian analyst Shohat was assigned to teach trigonometry to a freshman class at the University of Pennsylvania. He asked the chairman, J. R. Kline, a great friend of European mathematicians, what to do. Kline handed him a textbook and said "cover as much of it as you can." Shohat returned after two class periods and announced that he covered the whole book. "Fine, Professor Shohat," said Kline, "why don't you try to do it again?")

ANTI-SEMITISM

For some young American mathematicians, and for some foreign mathematicians, finding a job was made harder by a pervasive though quietly expressed and unostentatious academic anti-Semitism.

How pervasive it was can be seen from letters published by Reingold in **[NR]**. These show that even the great mathematician G. D. Birkhoff was not free from anti-Jewish prejudices. Of course, such things must be taken in historical perspective. Before the German mass murders anti-Semitism was ugly and small-minded, but it was not a mortal sin.

Besides, people are complicated. The same Birkhoff who could toss off an anti-Semitic remark in a private letter, did not let his racial prejudices interfere with his evaluations of other peoples' scientific work. The late complex analyst Wladimir Seidel, who graduated from Harvard and later taught there as a Benjamin Peirce Instructor, told me about a phone call made by Birkhoff to a departmental chairman. "I know you hesitate to appoint the man I recommended because he is a Jew. Who do you think you are, Harvard? Appoint Seidel, or you will never get a Harvard Ph.D. on your faculty."

Seidel was duly appointed. (Of course, I cannot vouch for the verbatim accuracy of the quotation; I am sure that neither Seidel nor I forgot the gist, or the question "Who do you think you are?")

In many places there was no absolute ban on Jewish professors, but if there was one, the chairman of the department was supposed to worry that there shouldn't be too many, "too many" being usually defined as one more.

Peter Lax [**PL**] already published the story of Norman Levinson's appointment to an assistant professorship at MIT. Levinson, Wiener's favorite student, was a natural for the job, but the "not too many" principle prevented it. The famous British mathematician G. H. Hardy, who was visiting MIT at that time, threatened to disclose on the pages of *Nature* that the initials MIT stand for Massachusetts Institute of *Theology*. Levinson was appointed.

I myself was advised by a well-meaning dean to change my first name. "The second is all right, but the first ... " and he suggested the name Lesley. He also advised me to join the Unitarians.

The Emergency Committee and the Institute

All difficulties notwithstanding, most newcomers got positions, usually temporary ones. The credit for this belongs primarily to the Emergency Committee to Place Foreign Scholars and to the Rockefeller Foundation and other charitable foundations which supported the work of the Emergency Committee. Very often the salary of a newly appointed foreign professor was paid by a foundation for the first or more years.

The mathematics expert of the Emergency Committee was Oswald Veblen who was advised by Hermann Weyl.

Some refugee mathematicians, the luckiest ones, were appointed to temporary positions at the Institute for Advanced Study which was founded just as the refugee wave hit America. The original mathematics faculty of the Institute consisted of three Europeans (Einstein, von Neumann, and Weyl) and three Americans (Marston Morse, J. W. Alexander, and Veblen); the temporary memberships were also divided among Europeans and Americans. The Institute provided a first haven for many European mathematicians and the first meeting ground for many European and American mathematicians. In assessing the impact of the big migration on American mathematics it is hard to disentangle it from the effect of the founding of the IAS.

Adjusting to America

The post-placement experiences of different refugee mathematicians were, of course, different. My teacher Loewner's story was especially unpleasant. He came to America relatively late; his friend von Neumann obtained for

him a position at the University of Louisville; the initial salary was paid by a foundation.

Loewner, already a world famous mathematician, taught 18 or more hours a week, only elementary courses. He had to grade staggering amounts of homework, and had to show the corrected homework to the chairman of the department.

When some students found out who Loewner was and asked him to teach an advanced course (without pay, of course), the university authorities tried to prevent him from doing it by first claiming that he needed all his energy for his elementary teaching, and then that there was no free classroom. Finally Loewner taught his advanced course in the local brewery, before the first shift arrived.

I hasten to add that this example was not at all typical. Most newcomers were treated with kindness and understanding.

But everybody had to learn a different life style, and this was not easy for many people, especially the older ones. Some refugees were snobbish and convinced that "bei uns" everything is better (if one disregards the present deviations).

Sometimes the simplest things were a problem, for instance to learn not to shake hands twice a day with a colleague one sees daily (as I had to).

The first-name habit was confusing; I cannot resist retelling a story, told by Peter Lax [**PL**] about Stefan Bergman explaining to the newly arrived Hilde Geiringer-Pollaczek: "In company I must call you Hilde and you must call me Stefan. Of course, when we are alone I will call you Frau Professor and you will call me Herr Doktor."

Birkhoff's Semicentennial Paper

In 1938 the AMS celebrated its 50th anniversary. The main address, on 50 years of American mathematics, was given by G. D. Birkhoff [**GB**], and I would like to quote a few paragraphs from this paper.

Birkhoff estimated that 40 to 50 American mathematicians are "highly creative, with established international reputations," and made the proud, and correct, claim that

> In all previous mathematical history perhaps no mathematical development in any country has been so extensive and rapid as that which ensued here upon the founding of the Society.

A little later Birkhoff lists American mathematicians

> ... who have shown the rare quality of leadership, of which E. H. Moore was an outstanding instance. Among the earlier of these I

> would mention the late eccentric geometer, George Bruce Halsted, who attracted to mathematics two notable figures, L. E. Dickson and R. L. Moore, both of whom in their turn have been able to exert a large personal influence. I would also mention with high esteem James Pierpont, who for many years was a source of inspiration at Yale. Among the other and younger men, besides Dickson, R. L. Moore, and Veblen, the names of G. A. Bliss, G. C. Evans, Solomon Lefschetz, Marston Morse, J. F. Ritt, M. H. Stone, and Norbert Wiener come to mind as having shown the same quality to an exceptional degree.

With the benefit of hindsight the list could be considerably extended, by adding, say, the names of A. A. Albert, J. W. Alexander, Garrett Birkhoff, Alonzo Church, Joseph Doob, Jesse Douglas, Nathan Jacobson, S. C. Kleene, Saunders Mac Lane, Deane Montgomery, Emil Post, Paul Smith, Norman Steenrod, J. H. M. Wedderburn, Hassler Whitney, R. L. Wilder, Leo Zippin, and others.

Birkhoff proceeds to discuss the group

> ... made up of mathematicians who have come here from Europe in the last twenty years, largely on account of various adverse conditions. This influx has recently been large and we have gained very much by it. Nearly all of the newcomers have been men of high ability, and some of them would have been justly reckoned as among the greatest mathematicians of Europe. A partial list of such men is indeed impressive: Emil Artin, Salomon Bochner, Richard Courant, T. H. Gronwall, Einar Hille, E. R. van Kampen, Hans Lewy, Karl Menger, John von Neumann, Øystein Ore, H. A. Rademacher, Tibor Radó, J. A. Shohat, D. J. Struik, Otto Szász, Gabor Szegö, J. D. Tamarkin, J. V. Uspensky, Hermann Weyl, A. N. Whitehead, Aurel Wintner, Oscar Zariski.

The lists on pp. 233, 234, 238, 241 disclose an important fact about the "big migration." The level of mathematical activity in America was comparable to that brought to America by the newcomers. American mathematics was about to enter a phase of explosive development which would have happened independently of the massive infusion of mathematical knowledge and talent which accompanied the big migration. But the infusion did take place, and the results were truly spectacular.

Let us, however, continue to quote Birkhoff:

> With this eminent group among us, there inevitably arises a sense of increased duty toward our own promising younger American mathematicians. In fact most of the newcomers hold research positions, sometimes with modest stipend, but nevertheless with

> ample opportunity for their own investigations, and not burdened with the usual heavy round of teaching duties. In this way the number of similar positions available for young American mathematicians is certain to be lessened, with the attendant probability that some of them will be forced to become "hewers of wood and drawers of water." I believe we have reached a point of saturation where we must definitely avoid this danger.

If one remembers what was going on in Europe, and what was about to happen there, as these words were pronounced and published, one understands why their effect was somewhat chilling. The apprehension expressed was by no means only Birkhoff's opinion; it was shared by other leading American mathematicians, for instance (according to Reingold, loc. cit.) by Norbert Wiener.

In the very next paragraph Birkhoff strikes a more optimistic note:

> It should be added, however, that the very situation just alluded to has accentuated a factor which has been working to the advantage of our general mathematical situation. Far-seeing university and college presidents, desirous of improving the intellectual status of the institutions which they serve, conclude that a highly practical thing to do is to strengthen their mathematical staffs. For, in doing so, no extraordinary laboratory or library expenses are incurred; furthermore the subject of mathematics is in a state of continual creative growth, ever more important to engineer, scientist, and philosopher alike; and excellent mathematicians from here and abroad are within financial reach.

It was this optimistic paragraph which turned out to be prophetic — as a result of World War II and America's entry into the war.

War Work

Even before, and especially after, Pearl Harbor the situation of mathematicians, including refugee mathematicians, underwent a dramatic change. The country needed applied mathematicians and discovered it did not have enough of them. Among American-educated mathematicians there were very few, which surprised Europeans who expected Americans to be practical down-to-earth fellows. Among the refugees there also were few applied mathematicians, of the type of von Karman or von Mises; yet European mathematicians often knew more physics than their American counterparts, and were cognizant of, or experts in, classical analysis. Thus, almost overnight, refugee mathematicians became a boon rather than a burden.

The participation of mathematicians (American-born and foreign-born) in the war effort is rather known and well-documented, see the report by Mina Rees [**MR**] and the remarks by Lax [**PL**]. Nothing as spectacular as the atom bomb is to their credit, but mathematicians played their part in the development of the proximity fuse and of radar, in the application of mathematical statistics to quality control (Wald, a refugee from Austria and a former topologist was a leading participator in this work), in the new science (or art) called operations research, and in the development of automatic electronic computers.

John von Neumann's contribution was decisive in this. He was also active in Los Alamos and in every other significant part of the scientific war effort. Another refugee mathematician very active in Los Alamos, during World War II and also later, was S. M. Ulam.

Centers of war-related mathematical activities were the Aberdeen Proving Ground, the Radiation Laboratory in Cambridge, the New York groups working under the Applied Mathematics Panel of the OSRD, the Advanced Research and Instruction program at Brown, and others. I spent the war years at Brown and know more about this place than the others.

It was organized and run by Dean R. G. D. Richardson, the scientific direction was first in the hands of Tamarkin and then of Prager. The aim was to train pure mathematicians — both holders of Ph.D.s and advanced graduate students — to do applied work, and the program centered around fluid dynamics, elasticity and partial differential equations. The faculty consisted mostly of refugee mathematicians; it included Feller, Prager, and Tamarkin, who had Brown appointments, and, at one time or another, Stefan Bergman, K. O. Friedrichs, Witold Hurewicz, Charles Loewner, F. D. Murnaghan, I. S. Sokolinkoff, Richard von Mises, Stefan E. Warschawski, Antoni Zygmund and myself.

The excellent student body, many interesting visitors, and the proximity of Cambridge made wartime Brown an exciting place. There were, of course, several war-related research programs; for instance, a project on gas dynamics for NACA and a highly classified project, nicknamed the Suicide Club, which dealt with defense against kamikaze attacks. Loewner, rescued from Louisville, participated in this work and it led him to write one of his most original papers entitled "On a topological characterization of a class of integral operators" (in *Ann. of Math.*, 1948).

The Post-War Period

Harvey Brooks was right in describing the World War II atmosphere in this country as a love affair between the government and the scientists. This was truly a just war, if there ever was one, the enemy truly represented absolute evil, and the scientists were able to make a contribution to victory. The love

affair continued after the war ended; even the tragic farce of McCarthyism did not put insufferable strains on this relationship. After Sputnik, it matured into a marriage. Only the real tragedy of Vietnam put it in jeopardy. (It is too early to assess the effect of the bizarre Star Wars episode. History, whether done by professionals or by dilettantes, always looks backward.)

After the war, government support of mathematics continued, primarily through the Mathematics Branch of the Office of Naval Research. (The part played by Mina Rees cannot be overestimated.) In effect, for five years the ONR acted as the National Science Foundation which was founded in 1950. It established the system of summer grants, of support of graduate students, of support of conferences, and it developed the system of peer reviews. The effects, on mathematics, as well as on other sciences was dramatic and beneficial. Research was not anymore, as it used to be in all but a few elite institutions, the private pastime of professors paid for teaching elementary courses. Many universities were eager to hire mathematicians capable of doing research (and of obtaining a government grant). This changed the power structure in many universities giving the most qualified investigators the most influence on policy decisions. I am convinced that this by itself raised the intellectual level of many American universities.

We heard and we read much criticism of the grant system. We were told that professors' loyalties shifted from their institutions to their disciplines. In practice this meant, I believe, that good scientists became less dependent upon university administrators. We heard a lot about the evils of the "publish or perish," maxim, and much of what we heard is true. Yet this maxim sometimes replaced "serve on many committees or perish," "don't fail football players or perish" and even "go to the right church or perish."

At any rate, the grant system worked. Post-World War II America became the center of world mathematics.

The stream of immigrant mathematicians continued, and this time the immigrants came not only from Europe. I list only a few names: Lars Ahlfors, Aldo Andreotti, Arne Beurling, Armand Borel, S. S. Chern, Harish-Chandra, Heisuke Hironaka, Shizuo Kakutani (for whom it was a return), Kunihiko Kodaira, Masatake Kuranishi, Wilhelm Magnus, Jürgen K. Moser, Ichiro Satake, M. M. Schiffer, Atle Selberg, Goro Shimura, Michio Suzuki, Hans Zassenhaus. One could draw an equally impressive list of long-term visitors which would include M. F. Atiyah, Alexander Grothendieck, Hans Grauert, Fritz Hirzebruch, J. P. Serre, René Thom, and others.

Conclusion

Now what part did the immigration of 1932–1942 play in transforming the United States from a sound provincial city in the kingdom of mathematics into its proud capital? How can we measure this part against the impact

of the war or against the potential for growth which was present in American mathematics before the big migration started, or against the government policies caused by the Sputnik shock? I believe we cannot. But I also think that nobody would doubt that this part was considerable.

Let us now return to the 1932–1942 period, to Birkhoff's semicentennial address and to the young American mathematicians about whose future Birkhoff and others fretted. It would be very understandable if these young mathematicians, who had good reasons to worry not just about becoming "hewers of wood and drawers of water," meaning, I assume, teachers of analytic geometry and elementary calculus, but about remaining unemployed, should then, and again at the close of World War II, consider the refugee mathematicians as competitors, and look at them with suspicion and even hostility. None of this happened, at least to my knowledge.

On the contrary, it was primarily the young, unsettled American mathematicians, graduate students, instructors, beginning assistant professors, who made the refugees feel welcome. They did not seem to think what the presence of the refugees would do to their job opportunities, but only about what mathematics they could discuss with them. They did not seem to resent the advantage many Europeans had being older, more experienced and better known; often they would help the Europeans to overcome their handicaps, to improve their English, to learn to drive, to adjust to the strange mores of an American campus, etc. If our story has a hero it was certainly Veblen. But there was also a collective hero: this generation of American mathematicians who, at the very beginning of their careers, experienced the influx of Europeans and who reacted to this influx with so much grace and so much cordiality.

It is pleasant to recall that in this case virtue was rewarded. The young men (they were almost all men), about whose future Birkhoff worried, did not become "hewers of wood and drawers of water." On the contrary, they became the leaders of American mathematics and under their leadership America became the strongest mathematical country in the world. Also, under their leadership all traces of xenophobia and anti-Semitism disappeared from mathematical life.

A word of thanks should be said about the patience of the undergraduates whom we, the refugees, taught. Not all of us did or could do a good job. But the students, for the most part took it in stride. I am convinced that in no European country would students tolerate teachers whose language they could hardly understand.

Those who experienced, as I did, the generosity and comradeship of young American mathematicians, and the tolerance and sense of humor of American students, will never forget it. In the name of my fellow refugees, most of whom are no longer with us, I would like to say, "Thank you."

References

[**GB**] George D. Birkhoff, Fifty Years of American Mathematics, *Semicentennial Addresses of the American Mathematical Society*, New York, AMS (1938) v. **2**, pp. 270–315.

[**PL**] Peter D. Lax, The Bomb, Sputnik, Computers, and European Mathematicians, *The Bicentennial Tribute to American Mathematics*, MAA (1977), pp. 129–135.

[**MR**] Mina Rees, The Mathematical Sciences and World War II, *Amer. Math. Monthly* **87** (1980), pp. 607–621. Reprinted in this volume pp. 275–289.

[**NR**] Nathan Reingold, Refugee Mathematicians in the United States of America, 1933–1941: Reception and Reaction, *Annals of Science* **38** (1981), pp. 313–338. Reprinted in this volume, pp. 175–200.