

*The Opinion column offers mathematicians the opportunity to write about any issue of interest to the international mathematical community. Disagreements and controversy are welcome. An Opinion should be submitted to the editor-in-chief, Chandler Davis.*

## There Are Too Many B.A.D. Mathematicians

Melvin Henriksen

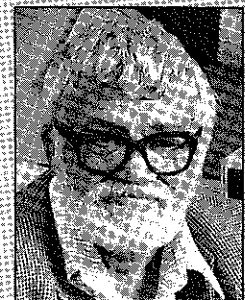
I have always been slow to learn the ways of mathematicians and, for most of my life, reluctant to be critical of those with substantial reputations for doing research. In the mid-60's, my former colleague Holbrook MacNeille, who worked for the Atomic Energy Commission before becoming the first Executive Director of the American Mathematical Society, remarked often that whereas laboratory scientists were mutually supportive in evaluating research proposals, mathematicians were seldom loath to dump on each other. I attached little significance to what he said because at that time most worthwhile research in the United States was funded and there seemed to be enough money for all but the most greedy. Perhaps some nastiness existed, but not on a scale that was doing much harm.

Federal support of research in mathematics done in universities is a post-Second-World-War phenomenon that was a spin-off of the contribution made by mathematicians and scientists to the allied victory. Research grants were made to individuals rather than institutions, to reduce fear of federal control of education. For, unlike today, in the immediate postwar years there was great concern about the unprecedented growth of the federal government. Americans' fear of big government was overcome by the cold war and the national mania to beat the Russians to the moon.

The number of research grants to individuals grew rapidly. University administrations complained that the need to supply more laboratory and office space to visitors and/or replacements for regular faculty whose time was being released for research had indirect costs. Soon "overhead" charges were added to these grants. Initially small like the nose of a camel, with time they occupied more and more of the tent. Overhead charges from these grants became a significant part of university budgets, and staff were hired to help faculty hustle them up, and research that attracted support money was considered more worthwhile. Love of Mammon

overcame, with little or no debate, any residual fear of control of research or education by the federal government or other granting agencies. Money flowed freely, and nobody seemed to notice that converting research scientists into fund-raisers amounted to creating a Frankenstein monster.

The mathematical community greeted the new prosperity with enthusiasm. Page charges were introduced for publication in many journals to transfer some of the cost of publication to federal agencies. Those without grants had to beg their institutions to pay page charges or accept the status of mathematical welfare recipients. Existing graduate programs expanded and new ones were created with the help of federally financed fel-



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lowships. The number of doctorates awarded in the mathematical sciences in the United States and Canada increased from 300 in 1959–60 to over 1200 in 1967–68 and was expected to double by 1975. (It actually peaked at a little over 1500.) So the effects of any backbiting were made invisible by a federally financed *pax mathematica*. After a little over a decade of prosperity, the public's love affair with science and technology ended, perhaps because we had gotten to the moon first and, more likely, because the bill for the war in Vietnam came due.

### **A Lost Generation of Mathematicians**

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By 1970, the illusory bottomless pit of need for mathematicians had been filled as far as the taxpayer was concerned, and graduate schools were full of able students about to earn a Ph.D. and compete for the few existing jobs with those being laid off by academic institutions and industry because of budget cuts. Funding could not keep up with the increase in the supply of eager and able mathematicians trained to do research. Universities rued the days when they expanded in anticipation of continued federal funding, and dependence on "soft" money joined the list of sins not to be committed again by academic administrations. Tenure, once automatically granted to the capable and hard-working at all but the most elite institutions, became precious. Faced with a faculty more than half of which had tenure, often while in their thirties, with little hope of turnover, deans and presidents began to insist that only beginning Ph.D.s be hired, and reduced the number of positions that could lead to tenure. In the first half of the 1970s, a goodly number of capable mathematicians left the profession for different if not greener pastures. When the dust had settled by the middle of the decade, most of the new Ph.D.s had gotten jobs at undergraduate colleges they had never heard of before.

Most of these young mathematicians, imbued with the ideals of their major professors and full of enthusiasm about the research area of their dissertation, wanted to continue to be active. Faced with heavy teaching loads, committee responsibilities, and little or no encouragement from their new senior colleagues (whose attitudes toward research had often been shaped by being denied tenure at a research-oriented department), most gave up in a year or two. The abrupt downturn in support kept their former major professors busy licking their wounds and wondering what to do about their own junior colleagues. As far as research opportunities were concerned, most of the Ph.D.s trained in the 1960s were cut adrift. According to E. T. Bell, projective geometry was developed by Poncelet while in prison, and Ramanujan did great work in isolation, so it might have been possible for

these young orphans to remain active in research. In fact, few of them did, and in spite of substantial expenditures on their training, most of them became a lost generation as far as research was concerned.

Research grants in the United States were used to increase the salaries of individual faculty members by 2/9 (as if all research activity occurred only in the summer months) and to bring in substantial overhead to the coffers of the university, rather than as a means of nurturing the mathematically young or encouraging research outside of a small number of centers. Competition for support intensified, and losing it amounted to a pay cut and a reduction in the budget of one's academic employer. At many "publish-or-perish" institutions, getting grants became a necessary condition for tenure or promotion. This raised the stakes in the game of competing for them, and those with funding were reluctant to share it with their brethren in the boondocks, where most of their recent Ph.D.s had taken jobs. A certain amount of money was put aside to support young mathematicians with major research accomplishments, but little was done to help the bulk of the new Ph.D.s to stay active in the face of poor working conditions and little stimulation. In sharp contrast, Canada developed a system whereby established senior mathematicians controlled the bulk of the research funds, but could not use them to supplement their own salaries. As a result, beginning Ph.D.s with research ambitions could count on two to three years of support, and the most able could get it for five years in the face of a job market even tighter than in the United States.

**In the United States, instead of trying to nurture and sustain our mathematical community, we seem to turn our backs as a small but influential group wreaks havoc. I call them B.A.D.: Bigoted And Destructive.** They have always been with us; what has increased in recent years is their ability to be destructive. They are often very able at research and it is easy to believe that their proven expertise in one area qualifies them to pass judgment on every part of mathematics; just as we might expect someone who goes over Niagara Falls in a barrel and lives, to be able to bring peace to the Middle East. As members of the elite, they have no doubt that they know what is important, and all else is inconsequential or trivial. They usually write only for fellow experts and regard writing for a general mathematical audience as a waste of time. They often write referee's reports or reviews of research proposals that are nasty or condescending. Clear exposition, if it adds a few pages to a research paper, elicits often the contemptuous suggestion that the paper be sent to the *American Mathematical Monthly*. They often say that too many papers are published, and would not be caught dead giving a 10-minute paper at a meeting of the A.M.S. While proclaiming their devotion to high standards, they feather their own nests by reducing the

number of serious competitors for grants or space for publication in high-prestige journals. For in quite a few mathematics departments, tenure and promotion depend on publishing in the "right" journals.

Certainly, there are large differences in quality of mathematical research, and all of us agree that some problems are substantially more important and/or difficult than others. This does not justify condemning whole fields of mathematics out of ignorance. Defending a negative view on a subject about which one knows hardly anything is not easily done in public. Like their racial or religious counterparts, mathematical bigots deny that the workers in the fields they regard as inferior are worthy of any kind of recognition or of having their work read. Like Galileo's inquisitor, they see no need to look in the telescope.

At the beginning of my career, when you submitted a paper to a journal, it was read carefully by a referee and you got a set of critical and detailed comments about it as well as a decision on whether it would be published. I did not always agree with referees or editors, but my colleagues and I almost always got the impression that our papers had been read with care, if not sympathy. For the last decade or more, papers seem to be read at best in a cursory way, especially when the report is negative. The author's results are said to be "well-known" without even a hint of a reference, or the paper is called padded or poorly organized without any constructive criticism. Writing to the editor to ask for more detail or correct erroneous comments is usually an exercise in futility. The attitude that part of the job of an editor and referee is to help authors to turn their papers into something worthy of publication while maintaining high standards seemed fairly common in my youth; it has gone the way of the dodo bird.

I was shielded from mathematical bigotry until I got to Princeton as a temporary member of the Institute for Advanced Study in 1956. My office-mate and collaborator was a Princeton Ph.D. One of his former professors asked out of curiosity who I was. When he learned that my major professor at Wisconsin was R. H. Bruck (an outstanding expert in the theory of loops and nonassociative algebras, as well as the projective geometries that motivated them), he asked contemptuously, "What does he work on—moops?" Soon I learned that it was common practice at many institutions for the faculty to put down individuals and whole fields of mathematics in front of graduate students. Actually, my thesis had been written on the ring of entire functions and rings of continuous real-valued functions, which led me to work in general topology. I soon discovered that the latter is so low on the prestige totem pole that it seems unworthy of a name in elite circles; no modifying adjective to the word "topology" is used by algebraic topologists in describing their work.

At first, these attitudes hurt, and like a victim of racial discrimination, I began to feel inferior; indeed, nobody at the elite institutions worked in my areas of interest. After a while, I learned to live with my original sin, and, in addition to doing research in algebra and general topology, I have published papers in number theory and numerical analysis, and directed projects in applied mathematics. Rationalizing ignorance of some kinds of mathematics on the grounds that they are "inferior" seems ludicrous. In my old age, I have come to wonder if perhaps some of the clothing I fail to see may exist only in the minds of those who are so free to condemn others. Mathematicians intolerant of areas remote from their own work can be very destructive. When mathematics began to be applied extensively in industry and industrial mathematicians tried to publish articles on new applications of mathematics, they often found their work judged only on the quality of the new mathematics they had produced; neither clever mathematical modeling nor the applications themselves weighed in for much. Surely, this kind of mathematical bigotry contributed to the founding of S.I.A.M. and the paucity of papers on applied research presented at meetings of the A.M.S. or published in its journals.

### Pariah Fields of Mathematics

The *bêtes noires* of the B.A.D. mathematicians vary with time. For many years, the parts of linear algebra having to do with extensive computations with matrices were reviled, whereas those that avoided computation brought forth kudos. The elegance of the latter makes functional analysis and the structure of finite-dimensional algebras easier to understand, but hard computations are needed for numerical analysis as well for parts of the theory of differential equations. As electronic computers became increasingly accessible, the importance of numerical analysis could no longer be denied, and the mathematical bigots had to find other fields to pillory. They have little difficulty concluding that if they see no application of an area to what interests them, it should be pushed out of the "important" general journals. This is not as easily done with journals published by the A.M.S., but when it is, the mechanism used is to take control of the editorial board and/or the position of managing editor while making sure that no member is a specialist in an "inferior" field. Whereas the journal is still advertised as one that publishes articles in all areas of mathematics, anyone who submits a paper in certain areas is told that no member of the editorial board has the expertise to evaluate it, or that the paper is "unduly technical" and should be submitted to a specialized journal. Since these boards are almost always self-perpetuating, once a field is deemed unfit for the journal, it stays that way.

I have heard many stories about this method for

(allegedly) increasing the prestige of a general journal by stopping the publication of papers in "inferior" fields, and witnessed it at first hand twice. In the early 1970s, the new managing editor of the *Duke Journal*, unaware that I published papers in anything but algebra, bragged to me that he was quietly ceasing to publish papers in general topology. When I asked him if he sent such papers to a referee, he replied that if he did, the referee would be a general topologist and might recommend publication. Also, when James Dugundji died, so did general topology as far as the editors of the *Pacific Journal* are concerned. Two of my co-authors and I got a "your paper is unduly technical" letter in 1984, and after realizing the futility of asking that it be sent to a referee, sent it instead to the *Transactions of the A.M.S.*, where it met the standards for publication. Many others had similar experiences. Attempts to get these editors to admit openly that the journal would not publish papers in general topology evoked evasive replies delivered with a technique that officials in Texas before the Voting Rights Act would have envied when they were asked why only blacks failed literacy tests used as a qualification for voting. Academics usually have great difficulty admitting, even to themselves, that they act in their own self-interest, so the mathematical bigots have little trouble in rationalizing their selfish or dishonest acts as the maintenance of high standards.

(In the late 1960s, Robert Solovay pioneered the use of the techniques developed by Paul Cohen to establish the independence of the continuum hypothesis to show that many of the unsolved problems in general topology were undecidable. General topology has never been the same since, and strong connections with model theory and set theory have been firmly established. The undecidability of the existence of an incomplete norm on the ring of continuous functions on an infinite compact space established by Dales, Esterle, and Woodin served to cement more firmly the connections between general topology and functional analysis as well as ordered algebraic systems. So, seemingly, the efforts to push general topology out of journals occurs just when this field has increased vitality and connections with other parts of mathematics.)

I have no objection to editors instructing referees of papers to apply high standards; as an associate editor of the *American Mathematical Monthly*, I did so often, as well as acting as a referee myself. I contend that rejecting papers unread by experts while giving reasons that are evasive euphemisms is bigotry pure and simple. It is clear also that the members of the editorial boards of journals that engage in such practices are in a position of conflict of interest as long as research grants, promotions, and salary increases in so many academic institutions depend on being able to publish in "high-prestige" journals.

One of the destructive effects of excluding whole

fields from journals has been a large growth in the number of specialized journals. Authors who publish in such journals tend to write only for specialists in their area, and, as a result, mathematics tends to become a Tower of Babel. As we become more specialized, we tend to be reluctant to teach even advanced undergraduate courses outside of our specialty, and the intellectual incest passes to the next generation. Worse yet, publication of mathematical articles becomes difficult for all but a small elite. The prestige of a field changes with time, sometimes for good reason, but often as a result of power struggles which have an impact on granting agencies and the composition of editorial boards. This puts those not on the faculty of elite institutions in the position of playing against loaded dice. A small number of nasty referee's reports or evasive letters from editors are often enough to push "outsiders" out of research. Faculty who do no research tend not to keep up with change, and in the steady state, we can expect that most undergraduate institutions will be unable to send students to the better graduate schools. Students rarely choose a college with a view to preparing to do graduate work in mathematics, so this reduces our ability to attract talented young people into our profession. The impact of this waste is being delayed by the large influx of talented foreigners into the U.S. job market, but in the not-too-distant future, the faculty that entered the profession in the Sputnik era will retire in large numbers.

At this point, my crystal ball gets very cloudy. Even if my fears are exaggerated, the problems we face as mathematicians are formidable, and giving free reign to the B.A.D. mathematicians among us can only make things worse. It amounts to letting our young be eaten at a time when the birth rate is dropping. While the size of this destructive group is small and they do not gather together to conspire, we all bear a share of the guilt when we avert our eyes and let them operate with impunity out of fear that we may be regarded as defenders of mediocrity.

Freeing ourselves of this kind of self-destructiveness will not be easy or pleasant. We must begin by demanding accountability from those editors and reviewers of proposals who condemn whole areas of mathematics while presenting no evidence in support of their actions. We can no longer close our eyes to the blatant conflict of interest that this presents and permit mathematicians who freeze out their competition to control key journals. We should no longer accept the self-serving claims that only the journals in which this self-appointed group of censors publish have really high standards. These problems will not go away unless we speak out and condemn the hypocrisy of B.A.D. mathematicians.

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