Letters to the Editor

Averting Tenure Pogrom

Steven Krantz's editorial (*Notices*, January 1997, p. 4) is an eloquent summary of a pro-tenure position. While the essence of his argument is impressive, we believe that the community of university scholars can and should be much more pro-active in identifying and implementing practical measures to strengthen its support base. All good reasons for it notwithstanding, tenure as a social institution is almost certainly bound to yield to the powerful anti-tenure forces unless the university community is ready to make the necessary adjustments to avert the impending pogrom in academia. The problem transcends national boundaries. The recent anti-tenure rhetoric coming from different sources (e.g., some articles in the American, Canadian, and British press) have much in common.

Talking on social roles of tenured academia, Krantz says, "If we leave it to General Motors and Microsoft to carry out these functions, then civilization as we know it is in jeopardy." So far, so good, but the reality is that such a pronouncement requires a serious backup in real actions in order to be truly convincing. We have to face the unpleasant fact that the way the present trend is developing, too many people "out there" are tending to think that, yes, General Motors and Microsoft will do it better.

Not pretending to offer all the answers and strategies, we would like to mention two aspects where we believe academia has some serious homework to do. The first is the unjustifiably high level of inter- and intradisciplinary competition within the science community. The competition for research grants long ago passed all reasonable limits needed for healthy stimulation and turned into a ferocious rat race and Darwinian fight for survival. Publicly acclaimed cases of research misconduct, misuse of anonymous peer review, and patent court battles between rivalling groups also do not seem to show signs of receding. Is this the best way to impress the outside public with the impeccable quality of our value system? How likely is it to invoke a broad social sympathy to our cause?

The second aspect where urgent correction is long overdue is a highly regretful, if not shameful, split between the "tenure elite" and our nontenured science brethren (we assume a gender inclusivity, of course). While it is natural for any meritorious system (including tenure) to keep some junior members in a candidate status for some period, the present realm is such that much of this populous (part-timers, postdocs, "soft-money" research assistants, etc.) are getting progressively more and more marginalized. Often they face exploitively high job stress, low security, meager pay, and poor benefits. This group is largely (but not exclusively) fed by the Ph.D. overproduction which was recently well documented in many areas of science, including some letters in *Notices*. The most recent mass emergence is the category of "eternal postdocs", and soon the first wave of them will approach retirement age (often without pension). The problem is unlikely to be solved in a single stroke, but at least on the side of Ph.D. (over)production, much of the responsibility is ours.

About the Cover

Dewdrops on a Spider Web. We weave these fine webs to arrest the flight of things passing through, but it does become weighty, particularly during inclement times. Photograph by Darrell Gulin for Tony Stone Images.

Correcting the above flaws is neither easy nor entertaining. But without this hard and long-term job of reevaluation and adjustment, the emergence of McTenure (perhaps in several breeds) seems just the next natural evolutionary step.

Alexander Berezin
Irene Berezin
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Request for Information

The family of Dr. Okee Jekeri has lost contact with him and would like to reestablish it. Okee Jekeri was born in Uganda in 1934, earned degrees in mathematics in England and Germany, was a lecturer at Makerere University in Uganda, left Uganda fearing political persecution, and, when last heard from, was at a university somewhere in the United States. It would be greatly appreciated if anyone with information about Okee Jekeri would contact his nephew, Kilama George, through me.

James E. Ward
Makerere University

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On Mathematics and Social Responsibility

I was quite glad to see Susan Landau's editorial on "Mathematicians and Social Responsibility"; these issues deserve all the discussion that they can get, and I agree with her examples of areas in which mathematicians have a particular social responsibility. However, the article seemed to sidestep many of the issues raised in its opening paragraphs and was disingenuous with its claims that, unlike other scientists, it's not clear how questions of social responsibility apply to us. On the contrary, these questions apply to mathematicians in exactly the same ways that they apply to other scientists.

While many mathematicians do work in abstract areas with no direct application to the real world, this hardly sets us apart from physicists, who frequently investigate aspects of the physical world far removed from everyday experience, such as what the universe looked like in the first fractions of a second after the big bang. And, just as many scientists work in areas that clearly raise questions of social responsibility, so do many mathematicians. Many of us, myself included, accept funding or have in the past accepted funding from military sources. Many of us work for government agencies such as the NSA. Our government's military agencies and other agencies dealing with foreign affairs and operations have had a huge effect on the lives of Americans and an even huger effect on the lives of people living in other countries, whether we are invading those countries or protecting them from invasion, working to overthrow their governments (possibly democratic, possibly not) or working to prevent their governments from being overthrown (ditto), giving economic support to help other countries or forcing them to adopt economic measures that hurt their own citizens. Wherever you fall on these issues, they all raise questions of social responsibility, and by associating ourselves with the agencies involved, we are implicated in their actions.

Furthermore, newspapers constantly run articles about moral issues involving mathematicians. For example, over the last few years there have been many articles about encryption, debating whether it is a good thing (because it protects our privacy) or a bad thing (because it prevents the government from catching crooks). This is a moral issue; it would not have arisen without mathematicians. Or to come up with an example more directly relevant to Pugwash, the U.S. Government is the only government in the world right now that wants to continue to be able to test nuclear weapons, mainly by simulating them on computers, and our insistence on being able to maintain a nuclear arsenal this way is the main stumbling block to disarming nuclear weapons and preventing further proliferation. Not only are there mathematicians working directly on simulating nuclear weapons in this way, but doing so would be impossible without the centuries of mathematical tradition that lie behind us, even though such applications would have been inconceivable to many of the mathematicians making up that tradition.

We cannot simply absolve ourselves of responsibility because our current research doesn't seem to have anything to do with the real world: we are all part of a tradition that will lead to further opportunities to do good or bad in ways that are unimaginable to us currently, and as such we all have a responsibility as mathematicians to work for the good and work against the bad.

David Carlton
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On the Work of E. Cartan on Real Simple Lie Algebras

In [2], A. J. Coleman asserts that E. Cartan had obtained in [1] (which, by the way, is [38] in his *Collected Papers*, not [39]), not only a classification of real forms of complex simple Lie algebras, but also of their Cartan subalgebras, a fact he had never seen referred to in the literature. I was asked to comment on this assertion, and it was later suggested that I write to the *Notices* about it, whence this letter.

First, let me dispose of a very minor point. By classification of Cartan subalgebras, we mean nowadays up to inner automorphisms. The distinction between inner and outer automorphisms does not seem to me to occur in E. Cartan's work before 1927, so that it would have been a classification up to automorphisms. However, had he obtained one, this would be minor quibbling, but I do not believe he had, even implicitly. Let me explain why.

By index of a nondegenerate quadratic form on $\mathbb{R}^n$, Cartan means the number of positive squares minus the number of negative squares, once the form is diagonalized. Let $\mathfrak{g}_c$ be a complex simple Lie algebra, $\mathfrak{h}_c$ a Cartan subalgebra of $\mathfrak{g}_c$, and r its rank. The character δ of a real form $\mathfrak{g}$ of $\mathfrak{g}_c$ is the index of its Killing form. Given a Cartan subalgebra $\mathfrak{h}$ of $\mathfrak{g}$, Cartan denotes by δ_0 the index of the restriction of the Killing form of $\mathfrak{g}$ to $\mathfrak{h}$. It may depend on $\mathfrak{h}$, of course. The integers δ and δ_0 play a fundamental role in [1]. It turns out that "in general" (see below) the index characterizes the real form, up to isomorphisms, and this dictates Cartan's strategy. He starts from a real form $\mathfrak{h}$ of $\mathfrak{h}_c$ and tries to construct, by analyzing the constants of structure and the restrictions of roots to $\mathfrak{h}$, a real form $\mathfrak{g}$ having $\mathfrak{h}$ as a Cartan subalgebra. This gives him a certain number of possibilities for δ and δ_0. Furthermore, early in his discussion, he divides the possibilities into two categories for some types of $\mathfrak{g}_c$'s. Then, within one category, he proves that two real forms $\mathfrak{g}, \mathfrak{g}'$ with the same δ are isomorphic. To this end he first shows that $\mathfrak{g}$ and $\mathfrak{g}'$ contain Cartan subalgebras $\mathfrak{h}, \mathfrak{h}'$ with the same δ_0. [If $\delta = r$ (split form; he says normal form), he may try $\delta_0 = r$ (split Cartan subalgebra). If he finds $\mathfrak{h}, \mathfrak{h}'$ with $\delta_0 = -r$ (compact Cartan subalgebras), he often uses those; this would of course be the only possibility if $\delta = -\dim \mathfrak{g}$ (compact form).] Then the argument consists in establishing an isomorphism of $\mathfrak{g}$ onto $\mathfrak{g}'$ bringing $\mathfrak{h}$ onto $\mathfrak{h}'$. This is indeed a conjugacy assertion in a given $\mathfrak{g}$ for Cartan subalgebras with the chosen δ_0, but it is only a first step towards a classification. As a second one along those lines it would be necessary, given $\mathfrak{g}$, to find all possible values of δ_0. As far as I can see, Cartan does not do it, nor does he seem interested. There would then be the problem of the conjugacy of Cartan subalgebras with a given δ_0. If they were conjugate, one might hope that some generalization of Cartan's procedure might prove it, but this is not always true. Since δ_0 is the only invariant of $\mathfrak{h}$ considered in the paper, this rules out a priori the possibility for this paper to contain such a classification. There is indeed only one conjugacy class if $\delta_0 = r, -r$, as Cartan shows in many cases, but even for those he does not make a general statement.

To conclude, I note that Cartan's tables give a quantitative meaning to the above "in general": $\mathfrak{g}_c$ may have two nonisomorphic real forms with the same character only if it is of type $A_r, r = m^2 - 3 \quad (r > 1,\ \text{odd})$, or D_r, $r = m^2$, where m is a positive integer.

In order not to lengthen this letter, I shall not discuss the other assertions of [2] about Killing and Cartan, though they seem to me somewhat misleading and inaccurate.

References

[1] E. Cartan, *Les groupes réels, simples, finis et continus,* Ann. Sci. École Norm. Sup. **31**, (1914), 263–365.

[2] A. J. Coleman, *Groups and physics, dogmatic opinions of a senior citizen*, Notices Amer. Math. Soc. **44**, number 1 (1997), 8–17.

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Editor's Note: The classification in question was first accomplished by Bertram Kostant in two papers submitted (by Saunders Mac Lane) to the *Proceedings of the National Academy of Science.* The first was published [*On the conjugacy of real Cartan subalgebras I*, Proc. Nat. Acad. Sci. U.S.A. **41** (1955), 967–970], but the editors objected to the elaborate tables in the second, which nevertheless was widely circulated among those with an interest in the area. About four years later a list was published by M. Sugiura [*Conjugacy classes of Cartan subalgebras in real semi-simple Lie algebras*, J. Math. Soc. Japan **19** (1959), 374–434), who, upon subsequently seeing Kostant's second paper confirmed to him that the lists were identical.

Cartan Knew Almost Everything!

Armand Borel is perfectly correct. I used the word "classification" in a loose way. I am glad that my error has elicited from him a careful exegesis of Elie Cartan's 1914 paper. Hopefully this will encourage others to study one of the crucial documents in the history of Lie Algebras. Never before have I seen it discussed in any detail.

As far as I am aware, Bertram Kostant was the first person to classify the conjugacy classes of Cartan subalgebras of the real semisimple Lie algebras.

Cartan's paper is long and tedious. When I struggled with it I was already acquainted with the papers of Kostant and Sugiura. I was amazed by how many "Cartan subalgebras" were listed. During many years, Cartan referred to these as "the group γ". For example, in the case of the Exceptional simple LA of rank 4, Kostant and Sugiura found that among its three real forms there are 11 conjugate classes of γ. All of these appear in Cartan's lists. Similarly, for the normal form of the Exceptional algebra of rank 7, all 10 types of γ appear.

Borel is correct in stating that at no point does Cartan say that he is trying to find possible classes of γ. His single-minded purpose was to classify the "continuous real simple groups". He does this and, for instance, notes—a result often ascribed to Weyl—that for each complex simple LA there is a unique compact real form. In so doing, in order to be on firm ground, he found it necessary to distinguish various γ. Like Monsieur Jourdain who was amazed to discover that he had been speaking "prose" all his life without realizing it, so Cartan found many inequivalent classes of Cartan subalgebras without noticing he had done so. Of course, he was too modest to ever attach his name to an object which had been defined and deployed effectively by Killing some years before he began the study of Lie algebras!

Ten years later when classifying homogeneous spaces he manifests much detailed knowledge of the various classes of γ in the real Lie algebras making many references to his 1914 paper. The more I read him the more amazed I became of his detailed intuitive grasp of everything about Lie groups.

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