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of the American Mathematical Society

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ABOUT THE COVER

Christopher M. Brislawn's article beginning on page 1278 discusses new image compression technology for the FBI's database of fingerprint records. Photograph by Laurence Dutton for Tony Stone Images.

Something There Is That Doesn't Love a Wall

Something there is that doesn't love a wall
And wants it down.
—Robert Frost, "Mending Wall"

In the fifty years of the postwar period, we have seen the growth of American research universities. Although professors at liberal arts colleges frequently boast of their ability (born of necessity) to transcend narrow fields, academicians at research universities esteem specialization. Their claim is that only in such an atmosphere can the research enterprise flourish.

Indeed, in this half-century we have gone at research with vim and vigor, and there have been spectacular successes. Within mathematics we have seen the classification of finite simple groups, the proof of (many cases of) the Shimura-Taniyama-Weil conjecture—and hence Fermat's Last Theorem—the solution of the Poincaré Conjecture for four dimensions, substantial progress in pseudo-differential operators, with applications to the theory of partial differential equations and to index theory.

But this specialization has costs. As we mathematicians concentrated on our own discipline, connections with other fields diminished. Statistics separated from mathematics; in many universities, the two fields are now distinct departments. Computer science was largely shunned by mathematicians in the 1970s; it too developed outside of mathematics departments.

Academic bean-counting often ensures that once disciplines are divided, walls go up. Why hire an applied mathematician if the physics or computer science departments can be convinced to do so instead? Once upon a time mathematics departments housed some mathematicians who applied their work to problems in other sciences. Nowadays the view of what constitutes a mathematician is significantly narrower. Most U.S. mathematics departments define a mathematician as someone who works in algebra, analysis, geometry, or topology (broad-minded departments sometimes add logic and combinatorics to this list).

In splitting, we have lost a real resource for mathematics. A friend in industrial research once remarked of an academic colleague that she viewed him as a mathematician although his career had been spent in computer science departments. The professor disagreed and explained that "What I do is computer science. Mathematicians aren't really interested in such problems."

"Bah and humbug," was the response of the industrial mathematician."Where I work there are physicists, engineers, chemists, mathematicians. The walls are mobile. We're interested in solving a problem. We don't classify it as a mathematics problem, only mathematicians need apply. A networks question might involve people in physics, in computer science, in math. We all work together and don't worry about what our titles are. Universities are so narrow in their definition of fields."

The history of mathematics is replete with examples of mathematicians whose pure research was fueled by applications, including Gauss, Euler, Laplace, Poincaré, Hilbert, Turing, Wiener, von Neumann. Funding pressures are pushing mathematicians in the direction of applied work, but the fact is that breaking down the walls may be good for our discipline. For example, in recent decades computer science has been a rich source of interesting mathematical problems, from cryptology and computational algebra and number theory to graph theory, computer visualization, and logic. In some cases, mathematicians in the associated fields became interested early on. What resulted was a beautiful development of new mathematics to solve questions posed by computer science—the Adleman-Huang hyperelleptic curve primality test method is one such.

The last two decades have seen a tremendous explosion of connections between various subfields of mathematics, including analysis and algebra in the Langlands program and topology and analysis in mathematical physics. A plethora of deep results have emerged. There is nothing inherently less beautiful about mathematics applied to other disciplines than mathematics applied to mathematics.

Without question, we cannot be good mathematicians without an appreciation and understanding of abstraction. But the inward focus that developed in university mathematics departments has not always served mathematics well, and a broadening of the definition of what constitutes mathematical research, and what a mathematician is, is in order.

—Susan Landau