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EDITORIAL

Research and the Human Element

The communication revolution has dramatically increased the generation gap. The Internet has spawned an ever expanding universe of blogs; a public medium for self-expression, that appears irresistibly attractive to a new generation of communicators. There are wonderful sites where thoughtful bloggers draw attention to articles that may pass unnoticed by many, quickly providing an entry to an unseen and diverse discussion group spread across the world. There are others which appear to be a public forum to vent frustration; often accumulating comments which are harsh and poorly worded. Some sites are exceptionally useful providing a quality of practical technical discussion, which can enrich both the practising researcher and the beginning student, tentatively taking the initial steps in research. Sharing information, experience, knowledge and occasionally, wisdom with an unseen audience seems to have become routine in the bloggers' universe. Having grown up with the traditional printed word, I have been slow to shed my prejudices and inhibitions and learn to browse electronically. 'Surfing' was always a word that I found hard to associate with the world wide web. It was thus almost completely by accident that I stumbled upon a blog site devoted to chemistry, where a discussion seemed to be raging on the travails of graduate students and post-doctoral fellows, who appeared to be toiling, at times with limited success, in the laboratories of ambitious, aggressive and successful professors. Their condition was likened by some imaginative correspondents to that of slaves, unable to break free from the shackles imposed by cruel and unforgiving supervisors. The immediate provocation for this collective outburst by graduate students working in chemistry laboratories, primarily those involved in 'total synthesis' of complex organic molecules, was the posting on a blog site of a letter written in 1996 by a Caltech professor to an apparently errant, young coworker, whose absences from the laboratory must have jarred the sensibilities of a workaholic professor. Having spent sometime in my youth in surroundings that seemed to resemble the environments described by the correspondents on the blog site, I was irresistibly drawn to read the discussion; at times with the guilty feeling of eavesdropping on a conversation between students, enjoying the time honoured practice of mercilessly deconstructing professorial reputations.

The offending letter, curiously enough dug out of oblivion, appears to state the expectations of some of the most competitive and productive laboratories, where long hours and seven day work weeks are the norm. This was and probably continues to be the expected work ethic in some of the high profile experimental groups, especially in the United States. The ability of US laboratories to accommodate large numbers of overseas graduate students, especially from Asia, ensures that the famed American 'weekend' is not necessarily a part of the culture of many laboratories. The work ethic varies widely across the world and many European laboratories probably provide a more relaxed ambience. The primacy, over the last half a century, of American science is in large measure due to a culture of work in a highly competitive environment. The tenure system for young faculty together with the tremendous pressure to raise research grants to support laboratories, postdoctoral fellows and graduate students ensures that only the 'fittest' survive to build long careers at the best institutions. The competitive pressures of research have dramatically increased over the years as the academic research world has expanded. Publishing results in the most prestigious journals is becoming increasingly difficult as the number of manuscripts jostling for limited journal space increases. To reach and maintain a high level of performance is not easy; requiring total committment and an obsessive focus on success. Unsurprisingly, the pressure is felt, sometimes suffocatingly, at the lowest rung of the academic ladder – the graduate student. Some fields are worse than others; synthetic organic chemistry, according to the blog site, and, I suspect, some areas of molecular biology and biomedical science. Traditionally, synthetic chemistry always involved long hours, a great deal of physical labour and continuous spells of work that cannot be easily interrupted. Curiously, unlike many other areas of experimental science, the march of technology has not really reduced the physical burdens of synthetic chemistry. While professors may enjoy the intellectual challenge of designing synthetic routes, plotting strategies to conquer complex molecular structures, the students and postdocs must toil in the laboratory, to achieve experimental realization of the goal. Success demands perseverance and hard work. As in many other areas of research, the

ability to fail repeatedly without getting disheartened is the key to success in difficult problems. Unlike some areas of theoretical science, these fields require teams of workers, with the professor doubling as coach and manager. The sobriquet of 'slave driver' is almost inevitable as the competitive stakes begin to rise. The professors, of course, have won their spurs after passing through the rigours of apprenticeship in laboratories where the 'work ethic' was clearly defined by tradition. Their expectations of those who work under them are undoubtedly a result of their own training, tempered at times by their own personalities. The correspondence on the blog site reminded me of a familiar complaint – the enormous power that professors seem to wield over the academic futures of their coworkers. The power of recommendation letters, especially those written by powerful professors, can make or break academic careers of students and postdocs. The sword of Damocles thus hangs over the heads of the non-conformist and rebellious student. As the academic job market shrinks, these pressures are bound to rise.

The research ambience in institutions and individual laboratories can vary widely. In India Ph D students in the best of our institutions may feel some of the competitive pressures that are more common in US laboratories. However, in most institutions research students may be left to their own devices, often working on problems that lie on the fringes of a field. In the most visible institutions the pressures of competitive research are evident. In some fields, notably chemistry and biology, the pressures to publish in 'high impact' journals constantly increase. Peer review committees which evaluate grant proposals and assess faculty for career advancement are undoubtedly influenced by publication lists. Inevitably, the pressure is transmitted to students and coworkers in the more ambitious laboratories. While in Indian academic laboratories large research groups rarely work coherently towards a single goal, the demands of many contemporary fields require a strongly multidisciplinary approach for success. Thus collaboration between research groups and cooperation within a group become essential ingredients for high productivity. Cooperation within a research group is not always easy to achieve; friendly and fruitful collaboration between groups is relatively rare. Issues of credit sharing – some real, others imaginary – dominate the discourse in research laboratories. How often have we heard the question while evaluating the credentials of a potential candidate for an academic position in a national institution: 'How many "first author" papers does the individual have?' The popularity of this question, admittedly in some fields, ensures that there is a scramble for 'first authorship', a syndrome that afflicted Western laboratories a long time ago. The footnote that appears in many papers stating 'these authors contributed equally' is a sad commentary on the widely held perceptions on credit sharing for a research outcome. In collaborations between researchers who bring complementary skills to bear on addressing a scientific problem, assessment committees often have the distressing habit of apportioning a disproportionate share of the credit to the individual who is not being assessed. There is also another unusual statistic that is often sought: 'How many "single author" papers do you have?' This question appears to signify a degree of disapproval of collaborative work, even when it may involve students working closely with research supervisors. In some fields, mathematics and some areas of theoretical physics are examples, groups and collaborations are less frequent. In many areas of experimental science the lone scientist is a species nearing extinction. Running large experimental laboratories requires professors with management skills, patience and the temperament to handle difficult coworkers; a combination of qualities that are rarely present in ambitious and aggressive scientists. The problems of maintaining common equipment and sharing common resources can be formidable, leading to discord and unhappiness within groups. Often the most hard working members of a group bear the greatest burden for keeping a laboratory functional. Artful dodgers who shirk any common activity are unlikely to be looked upon kindly either by their supervisors or their more industrious colleagues. In many of our institutions the work ethic of large sections of faculty is also a matter of concern. However, this issue is rarely raised or even acknowledged.

Research is performed best in an ambience that encourages the practitioners to enjoy their work. This is possible only in institutions where the collective morale is high and a significant proportion of its members are high performers. There must also be a high degree of respect for those who are scholarly, even when their productivity, as measured by the mundane parameters of scientometrics, is less than stellar. The diversity of temperaments and work habits amongst students and faculty members ensures that there can be no simple formula that promotes a harmonious relationship. Recognition of this fact may sometimes help in minimizing discord and unpleasantness. Modern science is an intensely competitive activity. The long time spans over which Ph D research is completed adds to the pressures and tension felt by young scientists as they begin to search for academic positions to launch their independent careers. Since the work of Ph D students also advances the careers of their supervisors, a failure to obtain results, in difficult and important projects, can result in unpleasant consequences. When I read the blog on synthetic chemistry and the shared experiences of graduate students, I was reminded of generals who sometimes control the troops at the frontlines, from the safety of fortified headquarters. The battle is lost when the generals lose contact with their men.

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