

# REFLECTIONS ON LEADERSHIP, TEAMWORK AND MENTORING

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## **Introduction**

I think that most people will agree that a skilled and dedicated workforce is one of the most important assets, perhaps *the* single most important asset, which any organization, including a research team, can possess. I had considerable experience in recruiting, training and working with individuals of the highest intellectual calibre. I would like to share these, my experiences, with others.

For the sake of stylistic simplicity, I shall adopt the male gender (To which I happen to belong myself) throughout most of this discussion. This does not, nor should it not, imply that there are not many very able female scientists (my wife is one!). Fortunately, we are recruiting now many more able young women into the professions in general, and into science in particular. A little aside for politically ambitious young women – two of the most prominent recent female Heads of Governments were both trained as scientists: Margaret Thatcher, Prime Minister of the United Kingdom 1979-1990 took a degree in Chemistry; Angela Merkel, Chancellor of Germany since 2005, took her first degree in Physics and then earned a doctorate in Physical Chemistry.

## **The Team**

The bulk of my adult working life has been spent as a university teacher and researcher. I am a scientist, a chemist, by profession. Popular folklore often projects the image of the dedicated, perhaps slightly mad, scientist working away all alone late at nights in his garret. The reality in my branch of science is very different from this very erroneous view. Admittedly there is the occasional researcher, who produces excellent work entirely on his own. However, the vast majority of chemical research, both academic and industrial, is based on teamwork. This applies worldwide, regardless of the political persuasions of the team, and has been so for at least the past hundred years. This is documented by the number of authors listed on chemistry research publications; a number which appears to have been rising over the years. In addition to the increase in the number of authors, there has been a trend for joint work by two or more laboratories, often based in different countries. I shall return to this elsewhere.

Chemical research is an intellectual and experimental endeavour based on the interactions of a number of different individuals, in other words teamwork. How are such teams organized? In universities, and similar institutions, the team leader is usually a member of the academic staff, perhaps a lecturer or a professor, who is usually called the research supervisor, research director or director of studies. To my mind, the Germans have a most appropriate nickname; they call him “*Doktorvater*” (the father to the aspiring doctor candidate). Some may object to this as sexist. However, the background to the term is easy enough to understand. Regrettably, chemistry has been until recently, at least in the U.K., the U.S.A. and Germany a rather male dominated subject. It is to be hoped that we shall soon begin to see “*Doktormutter*” putting in an appearance. The indication of a parental relationship is apt and I shall return to it later on. The other members of the team are typically in their early to mid-twenties. They are usually graduate students working for a higher degree such as the PhD (Doctor of Philosophy) or postdoctoral research fellows (“post-docs” for short), who desire more advanced research training.

In industrial chemical research, often staffed by PhD's or postdocs, more layers in the hierarchy will be observed from team leaders, group and divisional heads up to director of research. Let me return to the university team. What need is there for a research supervisor - why can't the graduate chemist work on his own? The reason for this relationship is that the aspiring researcher will generally lack certain vital pieces of information, which he needs to make an informed choice. Concerns could include whether the length of the project is too great for the time span of a thesis (generally 3-4 years) or conversely is it too trivial for this degree? Has this idea been carried to a successful conclusion elsewhere? No medals or degrees are awarded for re-inventing the wheel! Are there the necessary resources available to carry out this type of research? Additionally, the supervisor will be able to guide the tyro researcher on where to access prior knowledge. Without this guidance, enormous amounts of time can be wasted and demoralization might set in at this very early and tender stage of the new researcher's initiation into the field. This should not, however, degenerate into spoon-feeding. It is also helpful, if the supervisor can arrange a period of familiarisation with the experimental techniques required for the project.

Let me intercalate here an email (related to experimental techniques) sent to me three years ago in 2013 from my very first PhD student, Cedric Stratton, now a highly respected, and still very active, Emeritus Professor in the USA.

*Hallo again,*

*I have written a time or two previously about what you gave me over the years – the go-for-broke enthusiasm; the no-stone-untuned detailed thinking, and so on.*

*I am not just saying this, I really do think of you every single day, and here is why – the reason may amuse you.*

*I have an old-fashioned coffee percolator. I distrust those all-in-one coffee machines, because you cannot see inside their polished monolithically moulded plastic. I like mine better because you can separate it into its four parts to clean it, and you can inspect every surface. The filtration chamber is exactly the same shape as a 10 cm. Buchner funnel, without the stem – the part holding the ground coffee fits directly into the top of the coffee pot.*

*Well, do you remember showing me how you prepared the little circles of filter paper for the Buchner funnel? You ensured against mistaking snippets of paper fiber for long monoclinic crystals of a new product. You held the circle of Whatman's filter paper in your left hand and gave it a couple of flicks with the right thumb and middle finger to dislodge loose bits of paper fiber picked up in the cutting and packing process, then set it in the funnel and wetted it to make a proper seal. That's how you told me to do it, and I always did so, after that.*

*My coffee routine does not use Whatman's, of course, just plain white precut and packed coffee filter circles. When I make my morning coffee, I flick the paper just as you did, and smile to myself in recollection, and mentally thank you for turning the thinker my school mathematics teacher made me, into the doer that you made me.*

The analogies to the induction and training of new staff, regardless of whether the environment is commercial, industrial or academic, will be apparent. In an ideal situation the research supervisor is a highly knowledgeable, charismatic figure, who also takes a deep pastoral interest in his charges. Similarly, the ideal novice researcher is highly intelligent, experimentally skilled, with a very strong motivation to succeed and has, into the bargain, a pleasant personality and fits well into his working environment. I am speaking of an ideal situation and in real life there are frequent, and often considerable, deviations from this model of perfection. The supervisor may not be as knowledgeable as the student had hoped. He may be personally unpleasant and treat his younger colleagues as cheap labour. He may be unconcerned with their pastoral needs or their future careers. I will show that these counterproductive in not being in the true interest of either the student or his mentor.

### **Induction of New Team Members**

When a new researcher joined my team, we jointly explored our interests against the background of our strengths and weaknesses. It is pointless to let somebody loose on a project, where their abilities do not match the requirements of the task to be tackled. Let us imagine a theoretical project with much intellectual appeal, but which also requires considerable mathematical skills. If these are absent, and the prospects of acquiring them to an adequate level in a reasonable time are poor, then realism must prevail. However much the tyro researcher or I may wish that project to be investigated, it is a futile task with the human resources available. Our attention must focus elsewhere. Perhaps the new candidate has green fingers in the laboratory. This is an ability highly valued and very much in demand in laboratory sciences. He may be capable of carrying out experiments, perhaps achieving separations, which others cannot. The researcher with a great mathematical mind might, in contrast, be all fingers and thumbs in the laboratory and could never aspire to such experimental success.

Hence, our first task must be to explore what people are good at and also, equally importantly, what fires their enthusiasm. We must do some matching. If they are “turned on”, they will obviously perform better than somebody, who feels that he is working with his nose at a grindstone. It may not always be immediately obvious, as to where the newcomer’s strengths and weaknesses lie; they may not even be obvious to the person himself. The matching process may require some time.

I recall a young man who, quite a number of years ago, joined my research team. He had no particularly strong paper qualifications, but he impressed me with the sense of keenness that emanated from him. I gave him a task studying some chemical reactions, which at that time were a “very hot” topic in my group and I was most anxious to make further progress in this field. He performed adequately enough. I noticed, however, that whilst carrying out this work, he designed and constructed a range of new instrumental devices. It became obvious to both of us, that this was his “forte” and I promptly switched him with (I stress) his enthusiastic agreement to another research project; one which had been lying fallow for some time, for lack of candidates with the required skills for instrumentation. He carried out outstanding work in this field, which he continued to pursue after he had obtained his PhD and left me. Fortunately for the earlier referred to “hot” topic, I soon found a replacement researcher, who was exceptionally suited for this task. Hence both of my projects progressed better than I had hoped for.

## **Flexibility in Attitude**

I learned two lessons from this experience with this young man. The first one is that by keeping a watching brief on your team you can discover, from the way they tackle their tasks, that they may have hidden talents; talents of which they themselves were not initially aware of, but which can be put to good use for the benefit of the individual, the team and the organization. Thus by switching my existing manpower around, I obtained results far beyond my initial expectations. Hence one should be flexible in the deployment team members. The second lesson took longer to sink in for me than the first. Research teams are, or at least used to be, informal groupings. Working hours were usually left to each member's own discretion, provided an adequate effort was being put in. Some were early risers, others were late night birds. I never attempted to lay down rigid rules on working hours. More recently, because of stringent Health and Safety Regulations, this flexibility has been reduced. Before these regulations held sway, rules about starting and finishing times were so relaxed as to be virtually non-existent. Nevertheless, the ethos and the camaraderie of the team produced an atmosphere in which long working hours were accepted, and a long working week was the norm. It almost goes without saying that, regardless of the regulatory background, the example of the team leader is of paramount importance. Don't ask your team for commitment if you don't demonstrate it amply yourself. In other words, lead by example; lead from the front. Do not rely on verbal or written exhortations, if you cannot or will not set an example in practice. It was quite usual, in pre-Health and Safety Regulations days, to work long into the night and to work weekends and public holidays. Some types of work required continuous observations and measurements around the clock. Indeed, working weekends and public holidays were often very popular because of the greater availability of equipment and other facilities. I recall my astonishment when first observing such activity over Christmas. Similarly, I was amazed to see some Israeli postdocs, in one of my colleagues' teams, working on the Day of Atonement!

Hence the young man in question stood out a great deal from the others by keeping more or less fairly fixed working hours; you might say almost regular office hours. Whilst at work, however, he did not waste time on social chit-chat, lengthy tea breaks, etc. He concentrated intensely on his work. He produced a great amount of high-class work using his own working times and methods. He was a most methodical worker. If a new instrument arrived he did not, like most others, rush in and use it. Instead he studied the accompanying handbook in the greatest of detail, fine-tuned the instrument and then... got the instrument to perform better than the manufacturer's own specifications! The moral is "don't try and put a straightjacket of conformism" on your team members. Be flexible and let them find their own niche, in what manner they perform best. It pays in the long run!

## **Selection of Team Members**

This brings me to another very important point, one pertaining to the selection of new team members. As they are members of a team and will interact to a larger or smaller degree with the others, some inter-personal skills are required. One should try and avoid introducing a "cuckoo into the nest"; a new member, who by his personality may cause such disruption in the working of the rest of the team, that his presence has a negative effect. Of course, there may be circumstances, when the contributions a particular individual can bring, are so great that some personal shortcomings can be tolerated. In such cases they might gently be manoeuvred into an "isolation zone".

I will highlight the above point with a true story. Some years ago I attended an International Symposium in Paris. Apart from the formal lectures and discussions, one also participates in quite informal gatherings, where one might talk shop, exchange gossip, do some lobbying, or simply socialize with colleagues. One particular conclave of fairly senior professors was discussing vacant posts and likely candidates to fill them. One German professor, whom I knew well, sounded out opinions for a second Professorship in his institution. Various names were mentioned. Some he turned down as not innovative enough; others he dismissed as “crazy”, meaning the person was difficult to get on with. Then somebody chipped in by saying, “If you don’t like crazy people, you wouldn’t want...”. (He named an outstanding scientist, who had, however, a rather difficult personality.) The answer came back at once and with great conviction “If he is that good, he *can* be crazy”!

The lesson one can learn from this is that one must balance the contributions and drawbacks an individual can bring to a team and then weigh these up carefully. An outstanding individual can merit extra care in placing him into a working environment, where he can be creative, but not disrupt others. He can be a semi-detached team member so to speak. He need not have a great deal of personal contact with the rest of the team, but his output can be utilized by the others; perhaps with the team leader as the intermediary. The effective team leader needs to hone his skills in diplomacy, if he is to utilize his human resources to the greatest advantage.

### **Individuals**

In any discussion of teamwork it is easy to forget that teams are built from individuals. This is a mistake, which one cannot afford to make. Individuals have their own personalities, working methods and habits (see the example I gave above); in short their own strengths and weaknesses. The team leader must take account of these, if he wishes to maximise the team’s effort and output. Equally important, in the long run, is the need to create a pleasant working atmosphere and an *esprit de corps*. By playing to the strengths of individual team members, the quality and quantity of the team’s output can be increased, often considerably so. We all know the common adage of the square peg in the round hole. To avoid this, is one of the many tasks the team leader has to perform. He must discover the, sometimes latent, talents of his team and harness them to good use. I have given several examples of this already.

### **Co-operation**

The fact that people are individuals must not, however, obscure the fact that they are members of a team. They must work together; to co-operate for the benefit of the team, as well as also from enlightened self-interest. If you help others, when they are having difficulties, they are more likely to do the same for you, when you are under pressure. There will also be the need, when some people are unavailable, for one reason or another that somebody else will stand in - perhaps at short notice. If this is done willingly, rather than under pressure, the work will be performed much more smoothly.

It will be obvious that some team members will have a greater aptitude for certain tasks than others. An example, from my own PhD student days, illustrates this nicely. In those days the skill of glass blowing was a very valuable asset. When one sees such a craft in action on television or when visiting a glass blowing workshop, it all looks delightfully easy. But when you try it for yourself the glass will frequently either be too hot or too cold. In the former case the structure will collapse; in the latter it will probably break, when one attempts to bend it. Alas, I never achieved great skills in that beautiful craft.

Some of my fellow students were real artists and produced, in addition to their scientific apparatus, beautiful looking trinkets. I, however, had my own skills to trade, which luckily for me, were in even greater demand than glassblowing. I had language skills! I could translate scientific articles from French and, in even more demand, from German. There was a healthy trade in glass blowing and translation. Here were tangible results of co-operation.

At the same time, a spirit of co-operation need not, and should not, prevent a healthy degree of competition within a team. Competition to excel can, if it is kept within bounds, produce a considerable increase in the team's output. It is the team leader's task, once again, to ensure that competitive pressures do not damage the atmosphere in which the team is working. But competition and peer pressure can produce results.

### **Peer Pressure**

I have examples of this, both as a student and as a teacher. When I was demobilized from the Army and went to University, I found that there were two cohorts of students in my intake, and they displayed different attitudes to study. The ex-servicemen and the female students had much in common. The other group comprised the male school-leavers. The school-leavers were exhausted around 5 pm and stopped studying. My group had to be thrown out of the library when it closed around 9 or 10 pm and studying commonly continued in our digs after this. One could not claim greater intellectual ability for the ex-service types. Indeed they would have been more rusty than the school-leavers. What they did have, was a vastly greater commitment and a determination to work. The ex-service personnel felt that there was no more time to be wasted and wanted to get on with the job in hand - their studies. The youngsters did not feel that pressure and took life rather more easily. When the first year exam results were published these differences showed. Marks for the ex-service people ranged from 50% upwards, for the school-leavers from 40% downwards. Peer pressure together with camaraderie had, however, produced an *esprit de corps*. Over time, while the school-leavers never quite caught up with the ex-service personnel the margin of difference began to diminish.

The other example stems from my experience as a university teacher. Everybody involved in teaching groups or classes over a period of time will have noticed that in some years the standards were much lower than the norm, in others much higher. I look back with great pleasure and satisfaction to one class, which stands out very clearly, even today, in my mind. There were three outstanding students in that class: two were young women (Ann Fitzsimmons and Joyce Hurley), the third was a Jesuit priest (Bernard Conroy). They were sparkling, bright, enthusiastic and very, very hard-working. They continuously asked searching questions, which kept all the lecturers, including myself, on their toes. Over the 4-year course they caught the rest of their class in their slipstream and overall the class exam results were the best we ever recorded. Not surprisingly, the three in question did outstandingly well!

I rest my case regarding the benefits of peer pressure.

Whilst this article is mainly concerned with the training of graduate researchers, I cannot resist telling you of another outstanding undergraduate achievement at my institution, Birkbeck College, University of London. One, very bright and hard-working woman student received the Neil Arnott Prize for the best chemistry degree (internal or external) of that year for the whole of the University of London! Quite an achievement and she went on studying with us for a PhD!

I want to add a postscript to this story. You will recall that league tables of the academic successes of schools made their appearance a few years ago. I remember looking at them and noticed at the head or very near of the head of the table pertaining to state schools: Colchester High School for Girls. I glanced down to the name of the head-teacher. It was Dr Mary Aline Black, our Neil Arnott Prize winner!

I had known about the Neil Arnott Prize since my student days. Only very recently did I look up its origins. Neil Arnott (1788-1874) was a distinguished Scottish physician, who was also very interested in education, especially relating to the sciences. He was one of the founders of the University of London in 1836, and in 1838 he was elected a Fellow of the Royal Society. He also donated the money for the Neil Arnott Prize in Chemistry. Thus I greatly appreciated the efforts of two Scottish Physicians. Although George Birkbeck (1776-1841) was born in Yorkshire, he trained as a Doctor at Edinburgh University. He founded the London Mechanics Institute in 1823, which metamorphosed into Birkbeck College (University of London), where I spent my academic career.

Here are some of my own golden rules on how to treat students and junior colleagues. Stretch them as far as they will go, but take care not to break them. One will be surprised how much stretch there is in some of them; much more than they themselves had ever suspected. (Alas, the opposite also holds true and the elastic limit of some is reached after only a very small extension). Praise in public, but criticize in private. There is a great deal to be gained from giving public recognition. It is good for the recipient. It raises their spirits and, provided it is not overdone, will encourage them to even greater effort. It will also spur on others in your team to achieve a similar accolade. I believe that competitive peer pressure can have a very salutary effect.

### **Pastoral Care**

I have had plenty of experience of that. Over the years I found that I had to devote a greater proportion of my time to pastoral care, leaving a smaller percentage for purely technical/scientific guidance. This role had increased in importance as I became more experienced in dealing with members of my team and perhaps also because working conditions in particular, and life in general, became more stressful. People with great intellectual abilities suffer the same stresses and strains as anyone else. In fact, as they are often less street-wise, they can be less well-equipped to deal with the ups and downs of life. If a member of my team had worries, his performance would inevitably suffer. The difficulties might have been financial, health related, emotional or any one of a whole host of concerns. If the stresses were to become too great, my team member might even decide to leave.

I would like to demonstrate that by an imaginative use of human resources, by being observant and flexible, by giving the appropriate training, by providing leadership, whilst not forgetting to give them pastoral care (extending well beyond the requirements of training and supervision at the workplace), and above all, by giving credit where credit is due, one can obtain results beyond one's wildest expectations. If one can create a great "*esprit de corps*", one's team can, and often will, perform superbly. These views of mine are not starry-eyed; they do not exclude the removal of clearly unsuitable or unpleasant recruits. Nor do they imply that one is obliged to hold the hands *ad infinitum* of those, who do not possess the required sense of initiative. If necessary, steps must be taken to remove the inadequate performer. When I have had to take this course of action, I have always tried to do it, as far as possible with kindness and compassion. You are doing a recruit no favours by keeping him in a position, for which he has neither the aptitude nor the inclination. The sooner the nettle is grasped the better.

Like other team leaders, I invested a great deal of time and effort in supporting and developing my staff. This investment consisted to varying amounts of: grant finance, use of scarce equipment and laboratory facilities, often also of difficult or impossible, to replace scientific samples. There was also, my personal time and that of other experienced team members, who devoted a lot of effort to the training of the novice researcher involved. There is also the loss of face with the providers of finance and other facilities, when a tyro researcher fails. Additionally, one must also consider the effect on one's reputation amongst one's peers and on the recruitment of future members to one's team.

I strongly believe that the personality and reputation of the team leader can be an asset or a liability, when it comes to recruiting high level candidates. In addition, there is the loss of time, when one has to start a project, yet again, from the same starting line. I am sure many others will recognize all these deleterious effects in their work environment.

What was my response to stress-related problems amongst members of my team? It was pastoral care in the widest sense. Anybody plagued by worries cannot give of their best. If they lack the experience to cope with them, the problems are exacerbated. One hopes that the team leader is more worldly-wise and can give help and advice in such situations. For this to become feasible a bond of trust must already exist. Trust in, and respect for, a team leader must be earned. That will have to come from the impressions the person in trouble will have formed himself; it may also come from the collective view of the other members of the group. It might well have become part of the folklore of this particular group of people. The team leader must be crucially aware that trust is hard to earn and easy to lose. I consider that, for pastoral care, being an older team leader is an advantage. You have certainly seen more water run under the bridge. But you are also able to project a paternal (or maternal) image to the person with worries. Hence they may turn to you with greater ease and confidence. (In spite of the "*Zeitgeist*" about the advantages of youth, yes there are also some compensations coming with greater age!)

One would be surprised by the number and variety of problems, I was presented with over the years. One of my team had a child with a hole in the heart problem, and they required a good deal of support in that difficult time. I've had spouses wishing to terminate a co-workers participation in a project for short-term advantage at the expense of a longer term gain. I've dealt with marital problems, lovers' tiffs, loneliness and depression caused by homesickness, as well as more straight forward financial problems.

I had the privilege of supervising some part-timers amongst my post-graduate students. These were students, who frequently carried out demanding full-time jobs. Typically, they were people with considerable responsibilities and could only study in their very limited spare time. They were often mature people with spouses and children. Apart from the logistical and time-management challenges, inevitably, some personal problems also arose. The spouse might have felt aggrieved about the frequent absences of their other half, and their apparent inability or unwillingness to share the burden of the household and children. They were often also unaware of the benefits, which awaited the family unit, when the extra qualification was secured; they had no appreciation of the edge which would be gained in the employment market. My wife and I had numerous discussions with the disgruntled spouses of part-timers. We talked through their, often quite legitimate, grievances, but explained the advantages of putting up with a difficult situation just a bit longer in order to reap the benefits of their partner's efforts. Quite a number of these, gained very well earned PhDs, which were followed by lucrative promotions. The whole family reaped these well-deserved rewards.

Having said all of the above about pastoral care, it is nevertheless crucial not to become too starry eyed. The team leader is neither a psychiatrist nor a social worker. At the end of the day a cost-benefit analysis must be done. Is the effort devoted to extending pastoral care to a particular team member yielding an adequate return? Frequently, though not invariably, those requiring an excessive amount of propping up are those who, for a variety of reasons, are not up to the job. This type of person tends to look for extraneous causes for their lack of success and not to their own shortcomings. Such team members must be excised as soon as possible. Carrying passengers is bad for the morale of the team and an excessive burden on the team leader.

### **The International Mix**

With the globalization of many enterprises the employment of expatriates is becoming increasingly more common. We have a long track record of dealing with expatriates in Academia. Expatriates, or even team members from another part of the same country, can add an extra dimension to the work of a team leader. Challenges can arise, if the newcomer, who may be superbly technically suited to the work, has problems adjusting to cultural or social conditions, which they find alien or threatening. I would like to give an example of this. For many years I have had strong scientific links with colleagues, students and former students, as well institutions on the Indian sub-continent. I co-directed a joint project with the Indian Institute of Science in Bangalore, which enjoyed British and Indian Government support and encouragement for more than 10 years<sup>1,2</sup>. Through this I became involved with the “Younger Scientists’ Exchange Scheme” and helped to recommend British candidates for such exchanges, which lasted usually for 4-6 months. We became painfully aware that quite a number of excellent young candidates, who were of the highest calibre scientifically, were not emotionally prepared for the shock of the poverty, which they then encountered in India. Some had to be repatriated after a very short time. These exchanges took place quite a number of years ago and I am sure that conditions in India will have considerably improved. Nevertheless, it highlights the potential dangers of cultural shock and disorientation. Extra vigilance and care is required on the part of the team leader, when members of their team find themselves in an environment, which may initially be very strange to them.

When the team leader carries out this pastoral role effectively, it generally generates a feeling of loyalty to him. This increases the “*esprit de corps*” of the team, and this in turn affects not only the quality and the quantity of the output, but also contributes to a much happier working environment. Both my wife and I have practiced this approach to our respective teams with very considerable success. One can’t deny that occasionally one will encounter the proverbial “snake in the grass”, who will respond with ingratitude to the care extended to him. I fear, however, that occasional ingratitude is part of the human condition and does not alter the conclusions, which I have reached. After all, in any investment, financial or human, one can’t always be making the right choices.

I have stressed elsewhere the mutual loyalty, which should exist, between research director and research worker in training. Let me give you an example. Neville Bean carried out some research under my supervision in the late 1950s. He made a promising start and we published a short communication together. His industrial job was very demanding; he moved away from the London area and thus was unable to finish a higher research degree. He later rose very high in the chemical industry and became the Managing Director of his company. Some 20-30 years after Neville had left me, I received a letter from him – his company had been dissolved and he had been made redundant. He was going to an industrial tribunal and could I, please, provide a letter, that I considered him to be a competent chemist. Not only did I produce this letter, but I also offered to appear in person on his behalf before the tribunal. I did so and he won his case!<sup>3</sup>

I hope that I have said enough about my thesis for the need of pastoral care. Now I would like to address, what I consider to be another most important factor in the leadership of a team. This is the need for the team leader to give credit for the work done by his or her team members and not to try and hog the limelight all, or even most of, the time.

### **Give Credit where Credit is due.**

I have stated earlier that ideally the team leader by his personality, intellect and track record of achievement should have earned the respect and loyalty of his team. The same qualities should have impressed his peers and superiors. Hence there should be no need to claim credit for the work of others at their expense. I stress *at their expense*. Obviously the team leader is entitled to take the credit for recruiting and training his staff. He may have initiated or supervised their work.

However, he will probably not have done all the spadework for the particular piece of work. This should be publicly acknowledged so that the appropriate member of the team receives the credit for their work and achievement. This is all the more important, when it is a very junior member of the team starting out on their academic career. Giving public credit to one's team is a sign of the self-assurance and professional status of the team leader. It is not a sign of weakness. Such an attitude by the team leader fosters a strong "*esprit de corps*". A "boss" (I would not demean the title team leader for such a person, who goes into a meeting and gives the impression that what he presents to his peers and superiors is all his own work, is in my view morally despicable. That individual is also doomed to fail in the long term, as sooner or later the false clothes he is sporting will be discovered for what they are. Within their team his own authority will be undermined and instead of loyalty, he will engender contempt and rebellion.

I will give some examples from my own experience. When I joined Academia a type of bonded labour was widely practiced. Thank goodness this has now largely, at least in this country (the United Kingdom), disappeared. In those days a new member of the teaching staff was not a fully independent researcher. They were frequently obliged to serve a sort of journeyman apprenticeship under a professor or other senior member of the academic staff. If this time was always spent working under a great mind, that would have been a valid and valuable period. The tyro researcher could learn a greater depth of his subject, before he became scientifically fully emancipated. Alas, more frequently than not, this was not the case. Their subservience was due to rank and power, not to intellectual superiority, greater experience and wisdom. I did resist this pressure, but as a result had a very thin time for my first few years. An exceptionally heavy workload was placed upon me, with virtually no facilities extended to prove myself. Eventually my perseverance, hard work and ability won the day. My oppressor became a laughing stock amongst those who knew him and is now forgotten. I, however, enjoy an international reputation and respect. I promised myself, that I would never inflict such a scandalous abuse of power on my own staff and have endeavoured to live up to this vow.

I recall an example of how trying to hog the limelight can be very counterproductive. It was at a meeting in Sweden and the language of the forum was English. I still remember the name of the organiser - Professor Lars Gunnar Sillén, a distinguished Swedish chemist. He had a very dry sense of humour. He introduced one lecture by saying "...as Professor X's English is not up to giving this lecture in this language, his most senior collaborator, Dr Y will deliver the talk." (Dr Y had probably done most of the work in any case). I remember Sillén added dryly "...after the lecture, Professor X will step forward to take the applause." And this was indeed what happened. The younger man was brusquely pushed aside and Professor X bowed, but to unexpected effect - he was greeted by titters of mirth and richly deserved it.

Unlike some other team leaders, who always insisted in presenting their team's work themselves, I believed that members of my team should be allowed to show their own paces. Hence I coaxed, bullied and persuaded them to give talks at public meetings on the work they had done with me. I always made sure that they had adequately prepared and practiced for this, initially, rather daunting experience. They, and I, usually had reason to be proud of their performance.

Another aspect of working with a team is the publication of the results. Many countries have quaint customs about the hierarchical pecking order of the authors' names on a paper. In some the most senior is named first, in others they come last. The rest follow in strict hierarchy and/or presumed value of their contribution. I value the British custom in my field of science, chemistry, where this does not become an issue. We generally publish in strict alphabetical order. You cannot alter this by pulling rank. Your only recourse would be to change your name!

### ***Esprit de Corps***

I believe that in a successful team competitive attitudes can be combined with co-operation and teamwork. This is a challenging task for the team leader. He should create the right atmosphere and he needs to balance competitive pressures with a spirit of co-operation.

Let me give you an example of "*esprit de corps*". Some years ago, along with a large group of my co-workers (students and postdocs), I attended an international meeting in Paris. All the members of my team presented papers about their work. Contributions by our group far outnumbered those by any other. Frankly we dominated the meeting. I recall some of my team sitting a row or two behind me and overheard their conversation with a quite senior, and clearly jealous, scientist. At one point he berated them, saying "You are a funny lot, presenting so many papers at one meeting." To which my PhD student from Qatar replied, with a great deal of pride in his voice, "We are not a funny lot - we are a very productive and hard-working team, with much *esprit de corps*!" That remark made my day.

### **Training**

Let me return to another important function of the team leader. This is to look after the professional training and development of his team members. We hear a great deal about the need for Literacy. In many aspects of one's working life, Numeracy is equally essential. Lord Dainton, a very distinguished Professor of Chemistry, when he was Chairman of the University Grants Committee, coined a name for a third essential skill - "Oracy". He defined this as, the ability to present clearly and concisely one's results or ideas to others by means of the spoken word.

### **Literacy**

Let me deal first with literacy. It is an unfortunate fact that far too many people are unable to express themselves clearly and concisely in writing, even in their own mother tongue. How much more difficult is it for others, who have first to acquire a command of the language. Whilst one hears frequent complaints that scientists, engineers and other technical people are particularly bad at this, arts graduates are not immune to this charge. I have even heard it said by colleagues in English departments of Universities, that even their students couldn't write decent English! I recall that some years ago I had a batch of six postgraduates producing their PhD theses all at the same time. Three were English, three were foreign. Believe it or not, out of those six, only one could write acceptable English! Each thesis ran to about 300-400 A4 pages of double-spaced text. I had to help to rewrite five of these tomes.

For several months, I was at my desk every day until midnight and back again at 4 o'clock in the morning. Don't believe the tales you might hear about ivory tower existences. I know what deadlines and pressure of work mean and so do many of my colleagues! To add insult to injury, I discovered, too late to relieve the strain on me, that one of my charges had a wife with, believe it or not, a degree in English! She could and should have taken some of this strain. I had an inkling, however, that the student in question was more reluctant to face his wife than to face me!

The right people can be trained, however. I recall another young co-worker of mine. He was outstandingly good in the laboratory. I suspected, however, that he had other qualities in him. I suggested that he should attempt the task of producing a draft of a paper on work he had done under my direction. This was a task that, for others, I usually had to do myself. His first draft was rather a mess, one has to admit. I returned it to him, having had a very lengthy discussion on how I thought that it could be improved. The second draft was an improvement, but still far from the desired end product. To cut a long story short, after the seventh draft, I put in the finishing touches, which only I could do, and sent it off for publication. The second time I asked him to prepare a piece of work for publication it took only five drafts. We wrote and published together seven scientific papers based on his work and his drafts continued to improve all the time. When he left me to go into industry, his rise up the managerial ladder was rapid. I flatter myself that the discipline of the training I had imparted to him (for which he might have cursed me at the time), might not have been unconnected with this.

David Lean, the famous film director of such classics as "Lawrence of Arabia" and "A Passage to India", usually wrote his own film scripts. He is on record as stating that he never knew the exact nature of his films until he had finished writing the scripts. I share his attitude. I have now written more than 360 papers, most of them scientific, and yet, whenever I put pen to paper, I have a moment of truth. At this stage, I find that, although I will have mulled over the ideas innumerable times in my own mind, discussed them *ad nauseam* with my students and colleagues, there are still surprises in store for me. On writing, I may find gaps in the work and inconsistencies. I may also find correlations, which had not previously struck me. Putting one's thoughts on paper can clear a lot of mental fog. That is one of the reasons, why my wife and I are great believers in the merits of having to write a thesis. It forces one to assemble, order and interpret a considerable amount of data. It must also be written using clear language, as examiners can demand a rewriting of the thesis, should the literary standard be inadequate. One also has to write clearly in non-examination situations to get one's ideas across to others. In a way, one is in the business of marketing ideas. Hence the great need for literacy.

### **Numeracy**

Numeracy is usually not a problem with people working in my field though, God help us, it is in many others. I am appalled by the number of people, who are incapable of doing the simplest mathematical manipulations, who have no inkling of what different magnitudes mean. My daughter in her primary school days could perform better at mathematics than many adults can!

When we compare the standards of mathematical skills in many of our schools to those achieved by our continental neighbours, say in France or Germany, we have a lot of hard thinking to do. I doubt though whether even they have room for complacency. Even when we confine our comparisons to this country, and look back to the standards current in Victorian times, we must ask ourselves some difficult questions about what has gone wrong. Alas, we are not alone in this. I have read of serious worries in the United States of America about the effectiveness of the teaching of mathematics and science in their schools.

Clearly this is not a problem just affecting one country. In an age where numeracy is becoming more and more important for many jobs, there is an urgent necessity to address this question.

### **Oracy**

I now come to “Oracy”, the most neglected skill of these three. I am worried and amazed, how many people, often very senior in their organizations, balk at the idea of a public presentation to their staff or to their clients. Perhaps I am biased; after all university teachers, by the very nature of their profession, are professional speakers. Let me also be frank; not all university teachers are equally successful in carrying out this task. Many of us will have experienced the tedium of sitting through a lecture or other public presentation, where the speaker drones on and on in a dull and uninspired manner. Whilst some of us may be natural performers, others can be helped by training, advice and practice. I recall myself as a student, wishing to make a very short observation in a students’ union meeting and getting terribly nervous and tongue-tied at the thought of saying a few words. Later on in my career, I was able to address hundreds of my peers without any difficulty. Inhibition turned to pleasure; a rush of adrenaline was experienced. Regardless of one’s innate or acquired speaking ability, one can always learn to have timed the length of the presentation, to have one’s slides or other projected material in the right order and the right way up, to address the audience and not the blackboard or the screen, and there are many other tools and tricks of the trade, which can and should be acquired. All this is not only courtesy to one’s audience; it is also a vitally important ingredient, if we are to convince them, in other words to sell them our ideas.

### **Public Speaking**

I have always made it a point that all members of my team had adequate training and some experience in these aspects of communication before leaving my care. Numeracy is *de rigueur* for a scientist. From many years of experience, I fear that I have to say that literacy cannot be assumed. Oracy is even rarer. Hence I endeavoured to ensure that all my co-workers were given the tools of this trade. You will be surprised how badly one can misjudge one’s presentation time. I recall one of my very best research students giving his first “30 minutes” talk, which eventually stretched to over two hours!

It does not take a great deal of mathematical skill to discover that there are eight ways of inserting a slide into a projector, only one of which is correct one. It does rather distract from the impact of one’s presentation, if the members of the audience have to contort themselves to see the slides. It is all too easy to panic under pressure. I have vivid memories of a lecture at University College, London, by a distinguished German professor, who was very much of the old authoritarian school. He brought his own projectionist with him. This unfortunate young man managed to get some slides the wrong way up. The formidable *Herr Professor* was enraged. The stream of abuse in German, which followed, caused such an attack of panic in the projectionist that some of the other slides were inserted into the projector the wrong way round *more* than eight times.

The need for good lecture preparation must be hammered into the tyro speaker. He must not only check his own preparations but, sadly, also those of the hosts, who have organized the talk. From my own personal experiences over many years and in many locations, this problem is particularly acute, you may find it difficult to believe, in the United States of America. Technical staff are scarce there and the task of the projectionist may well be handed to a graduate student looking to earn a few bucks.

Two experiences stick particularly strongly in my mind. One was in the Mid-West, where I was due to give a rather prestigious lecture, the other was at a New England University. At the former, in spite of great pleadings by myself to be allowed to check the projection facilities, I was told that everything was under control and need not be inspected. Alas, when I came to give the presentation, I found that the young student, who had used one of these circular carousels to house my slides, had failed to remove somebody's holiday slides from it. He had simply inserted my scientific slides into the remaining gaps. You can imagine the chaos; I had to apologize to my audience, re-sort my slides and start from the beginning again. The incident in New England was due a technical fault in the projector; it did a type of hysteresis curve with my slides continually coming in and out of focus.

Thus good timing and lecture preparation are drilled into all my flock. After internal trial runs, they are then let loose on a public audience. All this is part of my training and development programme for them. I have stressed oracy, because it is the most neglected skill of the three.

### **Communications**

I think that most of us will agree that good quality staff is probably the most valuable resource of an organization. It is, however, often forgotten that the skills, knowledge and know-how that these people possess is not always widely shared. Either accidentally, because a lack of thought, or deliberately, because of a sense of insecurity, valuable knowledge is not always widely disseminated. This is detrimental to the team effort and it is the task of the team leader to ensure that the channels, through which information flow, are kept open. He must encourage informal exchanges or formal presentations within the team. If need be, he should shoulder the task of spreading the knowledge around. On far too many occasions I have seen people struggling with techniques or concepts, wasting time and effort, when the requisite know-how was available on the next computer terminal or the next laboratory bench. Not only does a free flow of information speed up and enhance the work of the team; it is also a lifesaver, when unavoidable absences require that urgent tasks are covered by other team members. There may also be crisis situations, when everybody needs to drop their own tasks to concentrate on one issue of overriding urgency. All of the above should demonstrate the need for good communications within a team and, for that matter, between co-operating teams.

### **Analysis of Staff Abilities**

What does all this training and development effort add up to at the end of the day? For convenience sake, I will divide the hypothetical members of one's team into three groups: the very able, the adequate, and the misfits. It is a well-known adage that the best members of your team, who are able and ambitious, will move on one day. This is a fact of life; one has to learn to live with. They may, however, stay within your organization, if the opportunities are available and if they have been treated well and fairly. Even when they leave, it is in the team leader's and the organization's interest, that they leave with pleasant memories. After all they may become your customers. They might even return one day as your bosses!

Then there are the obvious failures and misfits. Sometimes a move to another task may be the answer. At other times a clean break with the organization is the only solution. Either through misjudgement or sheer bad luck, they find themselves out of their depth. Kind, but firm, guidance is then required to help them to make the break. Alas, the inability to come to terms with your own strengths and weaknesses is not uncommon. It is tempting for the individual, who lacks insight to blame outside forces and even in extreme cases to develop a persecution complex of "The world is against me" type.

An example from my own experience will illustrate this. Quite a few years ago I was approached by an international agency to accept a visit by a professor from overseas. He wished to receive some training in the research techniques practiced in my group. After reviewing his background and experience, I had severe misgivings. However, against my better judgment, I allowed myself to be persuaded to accept him. As a person he was a very pleasant and courteous man. At his request I gave him a task in the laboratory; he was to repeat a novel chemical reaction, which we had recently discovered. He failed repeatedly and claimed that the procedure was not working. I then pointed out that several people in my group had successfully carried out this task. He then came up with a novel excuse - he was being sabotaged! I had no alternative, but to suggest to him that he dropped experimental work. He mistook this for an invitation to come and have frequent social, and rather meaningless, chats with me. I was in full cry directing a large, dynamic and successful research team and could not afford the time to look after someone who had, frankly, turned out to be a drone. I managed to persuade him, firmly but politely, that our library had many books, which he might be interested in consulting, and that London had many cultural attractions. I needed to get him out of my team, as he wasted my time and that of my co-workers'. He utilised space and resources, which were needed for productive members of my team. Eventually I was able to get rid of him, without causing a diplomatic incident, and was able to get on with my work again.

Now I come to the “adequate” members of one’s team. Every team, indeed every organization, will have a share of these. They may fulfil useful functions. We can’t all be Chiefs (or would-be-Chiefs) and have no Indians. These people will not set the world on fire, but they can be relied on to conscientiously carry out routine tasks. Such roles still exist, but this may not be the case in the future, as automation takes over. It is an old adage that your best people will leave you sooner or later, but the mediocre ones will stay with you forever. Careful planning and a good deal of foresight are required to get the balance right so that the team and the organization are not overburdened with mediocre performers.

### **The Team Leader**

I think that it is appropriate to say a few more words about the personality and qualifications of the team leader. I would distinguish between two types of individuals who manage teams. The first type I would describe as “the Administrator”. This sort of manager recruits and organizes, but leaves most of the truly creative work to the members of his team. He is basically a facilitator. He has the gift of recognizing talent in others, of persuading them to work for him and smoothing their paths. He also has the priceless gift of knowing his own limitations. He knows when to step back and let others, more gifted in this sphere, to do the creative work. Do not underrate such a person. He can be very valuable to an organization. Quite a number of years ago I met an older American colleague, who had done rather minor work in my field. He was, in football terminology, a second division player. He was aware of this and was happy to play an administrative role; a role which he carried out with considerable distinction. When given a chance and the means to create a superb team or department, he grabbed the opportunity with both hands. He would set out to recruit first division players. He would then endeavour to create a working environment as suitable as possible for creative effort. In this role he was often successful. As a scientist, he was outshone considerably by virtually all the members of his team. But the team itself, with all its sparkle and distinction, was *his* creation and *his* legacy.

The other type of individual in charge of a team is “the Team Leader.” He may not be the world’s greatest organizer or the greatest diplomat. However, he has an enthusiasm and professional grasp of his subject, which gains him the respect of his team. This is combined with a personality, which inspires their loyalty. He should have “fire in his belly”, but also able to create *esprit de corps*. Ideally such a person should excel in a particular field. It is of course preferable, if he excels in the field in which his team is engaged. Excellence in any field can, however, act as an acceptable substitute. The key point is that an aura of success surrounds him. On the debit side, such a person may not always be the best administrator or the most suitable person to represent the interests of the team on committees. Ideally a blend of both skills would be best, but life is never perfect. We can, however, always strive for perfection. With hard work, and perhaps an occasional bit of luck thrown in as well, we can get nearer and nearer to the ideal, a sort of asymptotic approach.

### **Delegation**

Delegation of work and authority can always be somewhat of a problem. It is easier for the Administrator as he is less likely to have the superior expertise at his fingertips and therefore less likely to be tempted into doing the work himself. By contrast, this temptation is greater for the Team Leader as he will frequently have the greatest expertise and experience in the field in which his team is engaged. He may frequently feel that he can carry out the task faster and better than his less experienced staff. This temptation should, unless exceptional circumstances prevail, be resisted. The team leader owes a duty to his team to train them; he also owes it to his organization to provide a trained succession. He also must consider situations where he may be unavoidably absent. He must further consider that the workload, if his team is successful, may increase to such an extent that, even when he is working at full stretch, he can no longer cope with the volume. Even if we assume that he can do the job in half the time of one of his team members, then six well-trained members of his team could do a lot more work than he himself working all alone could achieve. It is of course true that the training of a new team member, their supervision and the checking of their work is much more time consuming than doing the job yourself. Everybody who has found himself in such a situation knows that. Like almost any other investment, one has to put up with the initial expenditure, be it in time or money, before one sees the eventual return one is hoping for. However, the right person given the correct induction will repay this investment manifold. The choice of a suitable team member and his training remains the responsibility of the team leader. There can be crisis situations when all hands need to be on deck; when the team leader himself needs to knuckle down and help, wherever he can; when he must be prepared to do the work himself. But this type of scenario should be the exception not the rule.

Delegation of work may be difficult, but the delegation of authority is a great deal more so. Some people find this so difficult that they never come satisfactorily to terms with it. Nevertheless, this too is essential if the team and its leader are successful and growing in stature and the, with it coming, increased responsibility. It is the team leader’s task to find and train suitable members of his team to whom he can delegate responsibility. This is usually a gradual task. As one’s trust is rewarded, greater trust can be extended. The end result can be a larger and larger team with more layers of responsibility within its structure.

## **Finding Time**

One obvious objection to what I have said about pastoral care, training and development is “But where shall I find the time for this?” In my experience for much of the time most people work well below their ability and capacity. If suitably motivated, however, they can achieve their full potential. If they don’t, their team leaders have failed to involve them. Involvement is a two-way activity. It requires input by the team leader as well as by the team members. This is much more likely to happen (and students will tend to flourish), if there is good pastoral care and as a result, a strong *esprit de corps* has been created.

Because this lack of involvement is so common, it is far too widely accepted. Far too many managers are unaware of the true potential of their staff. My motto has always been “stretch people as far they can, but be beware not to break them!” You will be surprised how much stretch there is in some people, much more than they were aware of themselves. This resultant awareness is of benefit to them, their team and its leader, as well as to the organization as a whole. As a team leader, you are responsible for the output of your team. If it falls short, you will be blamed; if it exceeds expectations, you will receive the praise. If by giving pastoral care to your staff you can meet or even exceed your targets, it is in your interests, as well as theirs, to provide it. The team works better as a result. You must find time by rearranging your priorities to give this support. Your team’s interests and your own enlightened self-interest demand it!

Finally, I would like to add a few words about pressure of work and having to meet deadlines. It is often assumed that people in academia do not have to worry about meeting these. I have already mentioned some of the pressures my colleagues and I have had to face. There are deadlines for setting and marking exams, for getting research grant applications submitted, for getting conference papers in for typesetting and many, many others. Perhaps there are some disciplines in which pressures are less. Science, like financial services, is a very competitive, fast moving field, in which those, who do not act quickly or thoroughly enough, get left behind. Hence do not think that in what I have been saying that I have been unaware of deadline pressures.

Having stated my case, you might well ask “What evidence have I got to prove whether any of these ideas work or not?” A University Teacher has two ways to demonstrate his competence – as a Researcher and as a Mentor. For the former I can cite as evidence more than 360 publications in prestigious, refereed journals with high Impact factors.

However, of even greater importance, for the themes developed in this article, is the latter function – that of the Mentor! Many of my former students have kept in touch with me. I have heard from them not only about their professional progress, but they have also shared news about their families. I treasure these links and take great delight in their achievements. I can tell you that, so far, at least 25 have become full Professors in different parts of the world. At least one became the Vice-Chancellor (Head) of his University and, on his retirement, an Ambassador for his country.

Another one recently retired from the Directorship of a Higher Education Technical College. Quite a number headed Governmental and Industrial Science-oriented Organisations. Several made outstanding contributions to the Chemical and Pharmaceutical industry and were recognised by having Laboratories named in their honour.

Finally, let me give you, what is to me the most convincing argument. Several of my former co-workers returned on one or more occasion to my laboratory and sent their own students to me for PhD and post-doc training. I found myself mentoring the students of former students of former students of mine – three academic generations!

As Mathematicians might say: QED (*Quod erat demonstrandum*).

### **Acknowledgements**

I am greatly indebted to my Scottish friend, Donald Mackintosh, an avid and most helpful reader of the drafts of my very long Memoirs. This article had been originally written as a Lecture and when, at very short notice, I had decided to send this to my old friend Roberto Acevedo for the forthcoming issue of his Online journal, *Inglomayor*, Donald came speedily to my help, when I was under considerable time pressure, to make the ideas expressed in this essay more reader-friendly.

Writing this brought back many pleasurable memories of my life. I am still in touch with many of my former students and sympathised greatly, on hearing from my very first research student, Cedric Stratton (now an Emeritus Professor in Savannah, Georgia), who had joined me in 1957, about his trials and tribulations with Hurricane Matthew in October 2016!

Finally, I would not be writing this, in the 10<sup>th</sup> decade of my life, were it not for my soulmate, my beloved Turkish wife, Leyla. I did not know what happiness was, until I met her and this happiness has given me the strength and enthusiasm to carry on working, researching, writing and occasional lecturing! With her help and encouragement I hope to continue doing so.

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