

metric ($x^2 + y^2 + z^2 - (ct)^2$); and, second, how to avoid an unacceptable increase of reaction rates at high energy. Each was solved by a combination of two theoretical ideas. The first of these, generalizing the gauge-invariance of electromagnetism, had been invented in 1954 by Yang and Mills and by Shaw. The second idea was the realization that the states of minimum energy may not be unique, in which case the physical vacuum 'chooses' one of them, thus having less symmetry than the Hamiltonian.

The first triumph of these new ideas was the unification of the weak forces with electromagnetism, and the prediction of the heavy, spin-one particles, the charged W and the neutral Z . In this work, as in so much else in the period, Weinberg himself played a leading part. The second success was the construction of a theory of strong interactions, based on a substructure of quarks with forces between them due to spin-one gluons.

One more technical advance was necessary to complete this picture. That was the realization that the strength of forces mediated by particle exchange depends on the energy of the process considered, and may decrease at high energy. This fact led people to believe that quarks and gluons may, in Weinberg's term, be "trapped", that is to say exist only within hadrons and not as truly free particles, but at the same time appear as nearly free to high-energy probes. It is this work of the second half of this century that is the subject of volume 2. Weinberg calls it *Modern Applications*, but it seems to me that there are plenty of principles as well as applications.

It is a majestic exposition. The two volumes are structured in a logical way. Everything is explained with incisive clarity. Weinberg always goes to the heart of any argument, and includes many things that cannot be found elsewhere in the literature. Often I found myself thinking: "Ah! Now I understand that properly."

Will this be the last book on 'classical' quantum field theory? Is there any more to be said? Certainly there are topics that Weinberg does not include, such as quantum theory on a space-time lattice (as a limiting process to define field theory). But apart from technical things such as this, does the future lie beyond field theory with supersymmetry, supergravity and string theory? Weinberg says that the first two of these may form the subject of volume 3.

I find it hard to imagine a better treatment of quantum field theory than Weinberg's. All serious users of the subject will want to have these two volumes on their shelves. □

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In retrospect chosen by Steve Jones

The Government Inspector

by Nikolai Gogol
(1836)

In pre-Revolutionary Russia, 14 levels of excellence were needed to reflect the nation's diversity of worth: yes, from Governor General to State Counsellor Second Class, each was indispensable. To move up a grade was man's sole purpose. In that pursuit all else was allowed to languish.

The recent Research Assessment Exercise did the same for British science. Thousands of hours of effort by the finest judges, tens of thousands of scientific papers masterfully ranked, and no suggestion of anything but fairness, probity and honour. The exercise had to make do, though, with a mere seven degrees of merit (the highest decorated with a star of Tsarist brilliance). As only those in departments given government sanction are to be allowed to pursue a research career, to gain the right grade has become as important as it was in Russia.

Nikolai Gogol's play *The Government Inspector* has, for a work written in 1836, a curiously modern air. Its plot is simple. An impatient St Petersburg, concerned that outlying provinces are failing to obey orders, sends out officials to bring them into line. A distant town is thrown into panic. It tries to disguise its weaknesses: patients are discharged from the hospital to reduce overcrowding; teachers who question the official line are sacked; and everything not productive is hidden away. At first the strategy fails, but, fortunately, it seems that the inspector is open to persuasion. Offer him what he wants and all will be well.

Any academic recognizes the plot. What modern head of department can fail to see himself in the mercenary and egotistical mayor, Dhumanovsky? "He has grown old in the service, and in his own opinion is far from being a fool... He has become a tyrant, but this is not due to any innate malice or urge to tyranny. It is inspired only by the desire to grab whatever he sets eyes on. The thought of all the things he might acquire and the dread of missing anything have become with him habits too deeply rooted ever to be overcome."

As the mayor becomes persuaded that his town will earn a high grade — a five, perhaps even a five-star! — a fascinating prospect opens. He may be promoted and, at last, move to the centre of power: "It would be fine to be a general! And wear ribbons and a sash over the shoulder! Nobody else will get a look in; they will all have to wait. Some poor wretch of a mayor will stand when I sit in comfort!"

The story is familiar. As the winners in the Research Assessment Exercise, like Tsar

Nicholas' courtiers, pin that extra star onto each other's glittering chests do they, too, pause to think of the distant regions in which the serfs of science have learned that, by official whim, they are to starve? Probably not: after all, who cares about those stupid enough to make a career in the provinces when academia has an Imperial Household to support?

Gogol's plot, though, has a twist. The supposed inspector is in fact a buffoon whose

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only qualification is his own self-importance. The play ends in general dismay with the arrival of the real inquisitor and the sickening realization that all has collapsed and it is too late to do anything about it.

Russia's policy of central control with its matching corruption, intellectual and otherwise, lasted until long after the Revolution. So smoothly did it work that it persisted as the Soviet system itself fell into ruin. For those involved it made perfect sense. The logic, though, was completely internal. To any unbiased observer it was a dishonest shambles.

It would be quite wrong to use such terms to describe any British institution. Since the last Research Assessment Exercise the average score of those appraised has gone up by half a point. Perhaps the Dhumanovskys of the academic world are learning to manipulate the system as one five-year plan succeeds another. More likely, though, the exercise really does deserve the statement made by one of its officials, with the air of Stalin hailing yet another record year on the collective farms: "We congratulate universities and colleges on these results. The real winner is the United Kingdom."

Gogol's description of his play was: "In *The Government Inspector* I wished to turn all into ridicule. The real impression produced was that of fear. Through the laughter, the spectator feels only bitterness and sorrow."

What better description of a literary classic with significance for science today?

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