
The Choice and Management of Research [and Discussion]

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Phil. Trans. R. Soc. Lond. B 1979 **287**, 471-473

doi: 10.1098/rstb.1979.0079

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The choice and management of research

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Nowadays there is more research with an applied objective than there used to be. Values can be assigned to such objectives in non-technical terms; and research projects are like other human activities in that they can be assessed in terms of cost, risk and reward or loss.

I am no longer a working scientist, but rather a manager of scientists. Some speakers at this meeting would be unmanageable to me, because they tend to talk to themselves and not to expound their work in applied terms that I can understand and judge.

Insect migration was broadly understood many years ago, and I have heard little about it today that is new since I dropped out of locust work 15 years ago. If I were a control man now, and even more if I were a politician responsible for providing public money, I would not know what research programme to sponsor for the next 5, 10 or 20 years, since we have not been given the kind of information needed. For example, does Dr Launois think his work will be useful to a control director, and if he does, in how long a time?

It seems to me that more direct conversations are required between the men on the research jobs and the men who have to control pests and the men who have to provide money from taxes. What do the money-providers need from you? And what useful results might there be from what you propose to do with the money? How many years will such results take to be realized?

Scientists must always have their specialized ways of thinking and speaking, but to explain their projects in such terms is not enough. They must explain in terms not merely comprehensible but also assessable by non-scientists, so that their basic assumptions, choices of research paths, and alternative possibilities in results can be expressed in words that I can understand; my intention in sponsoring a research and development programme is to get some reward in either the short term or the long term.

Perhaps the fault is in me, and perhaps I don't understand what has happened in the 15 years since I was responsible for the control of *Locusta migratoria migratorioides*; in fact, today I feel I have learnt nothing from you. That worries me, for I would have expected that research since my time would have provided more help for the present Director.

So let us stop talking about migrant pests in general, and see if we can select research projects on locusts, stating how long we would want to produce useful results.

For example, Vernon Joyce has said that all he would need to prevent a big plague of the Desert Locust is a few aircraft, some crude predictive mechanisms, some reasonable methods of detection, and some bold methods of using dieldrin. That provides no basis for strategic research because the strategy is there and accepted. You can work out costs, and if people are willing to pay them, that settles the matter. Only someone who claims that he can greatly improve the cost-benefit relation can then be supported in strategic research.

For the Desert Locust, perhaps there are two kinds of population. In both kinds the locusts are widely dispersed when few and highly aggregated when in large numbers. At intermediate

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numbers, however, in the first kind they are mostly dispersed and in the second kind they are mostly aggregated. Different control systems are appropriate for the two kinds of population behaviour.

Dr Rainey considers the second kind to be characteristic, and that *Schistocerca* plague control would be possible and economic by paying attention to these aggregations of intermediate numbers. Mr Hemming, on the other hand, considers the first kind to be characteristic, mostly dispersed at intermediate numbers. Intermediate-level populations might get out of control on the Rainey strategy in places where people are not looking, ending up suddenly with a large densely aggregated population, i.e. a plague, before the situation is appreciated.

It seems to me that people who run control campaigns will not easily be convinced that either kind of population behaviour is the rule and will prefer to think that both are possible. If you rely on the Rainey supposition that intermediate numbers of the locusts are mostly aggregated and therefore discoverable aircraft targets, you might be surprised and defeated by a sudden large aggregation in the first kind of population; but the system would be cheap. Because of its cheapness, I would therefore follow the Rainey hypothesis of concentrations out of concentrations as a useful basis for surveillance and control of the Desert Locust and as the easiest method. I would, however, want to know how much it would cost to do other things on top of that, to reduce the risk of being taken by surprise or to pay for being caught in that way, before I would know how much public money I would risk on the research and control organization.

Discussion

R. J. V. JOYCE (*Cranfield Institute of Technology; formerly Director, DLCOEA*). I think that a cost-effective programme, of the kind for which Mr Yeo particularly asks, emerges directly from the papers of Dr Rose and Mr Odiyo. Their thesis, if I understand it correctly, is that the problem of armyworm outbreaks arises from the aerial concentration of adult moths; and here we have an opportunity. Aircraft exist, and instrumentation exists which would enable the aircraft to locate itself within zones of wind-convergence where these concentrations may occur: where the mechanism is available to produce them. We have heard this afternoon from Dr Schaefer how this has already been done on spruce budworm moth concentrations in Canada. Moreover, in East Africa they grow pyrethrum, which is probably a particularly suitable insecticide for killing the moths, and with Ato Adefris there is in DLCOEA an organization which is set up to do just this kind of job. Here to my mind is an immediate cost-effective programme offering a good chance of a solution to the armyworm problem, which I think is otherwise going to prove a particularly intractable one.

R. C. RAINEY, F.R.S. I would like to indicate my very strong support for Mr Yeo's plea for a much more critical consideration of research programmes, of the way in which we deploy the resources, both human and financial, which are available. In November 1976, in his Anniversary Address to the Royal Society,† Lord Todd expressed concern at the extent to which the image of science has become tarnished: the degree of disillusionment, disenchantment with scientific research which he detected over the decades since the heady days of the success of wartime operational research. I would suggest that maybe one of the troubles has been that as scientists we have collectively (if not individually) had things too easy for too long. It has

† Published in *Proc. R. Soc. Lond. B* **196**, 1–12 (1977).

perhaps been too easy to get support for research projects, sometimes not too clearly thought out, and accordingly without perceptible results. I therefore very much welcome these critical comments from Mr Yeo, and would emphatically disagree with those who might feel that his approach is perhaps more appropriate to the boardrooms of Shell than to the Royal Society. I would indeed like to see the Royal Society taking an increasingly critical view of research management, and looking seriously into the possibilities of how far this real disenchantment with science and scientific research may have been the result of things having been rather too easy for rather too long, in the way I have indicated.

J. W. S. PRINGLE, F.R.S. (Chairman). I am not disenchanted with science, and I don't know who else is!

R. S. SCORER (*Department of Mathematics, Imperial College, London*). I'm not and you're not, and I don't suppose many people in this room are, but a vast number of the intelligent population in this country and other countries are. Another reason is, I think, that as science and technology become more complex, we find a group of experts at the top, saying we will do this for you, and, when that does not work, they say we shall have to do this for you as well – and you will not have any choice any more.

D. YEO. To follow on from what I have already said: I think there should be a much greater encouragement of the conversations in and out of science than there has been in the past. And above all in this area of migrant pests I think that dialogue and that conversation need encouragement at this time.

J. W. S. PRINGLE, F.R.S. I think we could all accept that readily; I know I would.

R. C. RAINEY, F.R.S. Reverting specifically to the Desert Locust: in my presentation of my paper with Elizabeth Betts I had failed to emphasize our view that populations numerous enough, and at least intermittently dense enough to merit control, are indeed continuously present somewhere or other.