Wastage of resources and scientific manpower in India

India is a poor country by all standards and can ill afford the wastage of scarce resources. The state universities have meagre resources to pay salaries of their staff and there is absolutely no money for funding research activity. Hence, research activity in the country is mostly supported by funding agencies like DST, CSIR, DAE, ICMR, DRDO and various ministries having science and technology cells to develop and promote relevant R&D in the project mode. Unfortunately, the gestation period for sanction of projects is too long in India, varying from two to five years. This is based on my personal knowledge and experience of dealing with funding agencies during the last three decades. The projects may be sanctioned for three years at the first instance and if the progress is satisfactory then extension for a year or two is possible in some special cases.

The project staff is employed on a purely temporary basis and the tenure is coterminous with the project. Most of the JRFs/SRFs/RAs working in the research projects are a frustrated lot during and after the tenure of the project is over. There is no guarantee clause provided in the projects by the funding agencies to secure a job for the project staff. Rather, there is a clause to discourage the research staff to register for their Ph D degrees, if it hampers the progress of research, because most of the agencies are interested to use the research data relevant to their own thrust area programme and not for a Ph D thesis. They consider it a waste of time and resources if the candidate wants to register for a Ph D degree during the tenure of the project. So there is an inbuilt contradiction in most of the agency-funded research projects. This leads to strained relations and some tension between the project investigators (PI) and the research staff who want to submit their findings for some degree to secure a job when the project is over.

After the introduction of NET as an obligatory condition for securing lectureship in a college or a university, the research scholars are a frustrated lot and have lost all hopes of placement after the project is over. They try to look for alternative jobs even during their tenure in the project and sometimes leave without producing any results. If they stay till the end of the project, they either work for the Ph D degree or look for greener pastures in Europe and America. So our trained manpower is available to foreign-based laboratories as a cheap labour force. Every year, Italian laboratories recruit about two dozen young Indian scientists under ICTP-sponsored programmes to help Italian scientists to carry out research projects. I wonder why Indian laboratories under CSIR, DAE, DRDO and other agencies have failed to evolve such programmes where our trained scientific and technical manpower can be employed after the completion of the research projects. The Department of Atomic Energy (DAE) which employed Ph D graduates in its research programmes initially, discontinued the direct recruitment policy at some later stage in favour of BARC Training School graduates. I feel direct recruitment of university Ph D graduates will be a welcome step to promote research programmes of DAE and other agencies in India.

Another flaw in agency-funded projects is the clause pertaining to costly equipment purchased out of project grant. It becomes the property of the institution where the PI is employed during the tenure of the project. In case the PI moves to some other institution or retires from the service of the project-sponsoring university, the equipment is retained by the parent institution. Equipment worth several crores of rupees purchased out of research project grants is lying idle in most of our institutions because there are no end-users after the retirement/transfer of the PI. In my view, PIs should be given priority over the institution to transfer the equipment to their new place of posting with the concurrence of the funding agency. In case of retirement of a PI, the agency should advertise in scientific journals the availability of such equipment to any other PI or scientist who is engaged in active research in the relevant area.

Despite the best efforts, the culture of collaborative research has not taken roots in the Indian soil. There is much duplicity in scientific research in India. In our own university, there are four units of X-ray equipment and a similar number of UV/IR spectrophotometers. Despite UGC instructions for a central instrument laboratory on the university campus, PIs are not prepared to pool the costly equipment. The University Science and Instrumentation Centre (USIC) has failed miserably to provide any useful service either for repair or maintenance of costly equipment. There are many examples where equipment worth crores of rupees is lying idle or dismantled after the failure of the funding agency or the parent institution to make use of it on a permanent basis.

Let us ponder for a while: can we afford this type of wastage of resources and scientific manpower in India at the cost of state exchequer?

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Chick embryo 'twins'

A report on two embryos developing from a single blastodisc appeared in *Current Science* some time ago[1]. We have been using the early, gastrulating chick embryo as a model system to address diverse questions in developmental biology[2–4] and continue to use them in our studies. The blastoderm is explanted, usually at the full primitive streak stage and cultured *in vitro* for about 24 h. Over the past 5 years we have used about 4000 embryos, out of which 10 were 'twins' or 'double embryos' (frequency: 0.25%). Interesting representative cases are presented here (Figure 1).

The twins usually exhibit either fused heads (Figure 1 *a* and *b*) or tails (Figure 1 *c*). Although the frequency of such

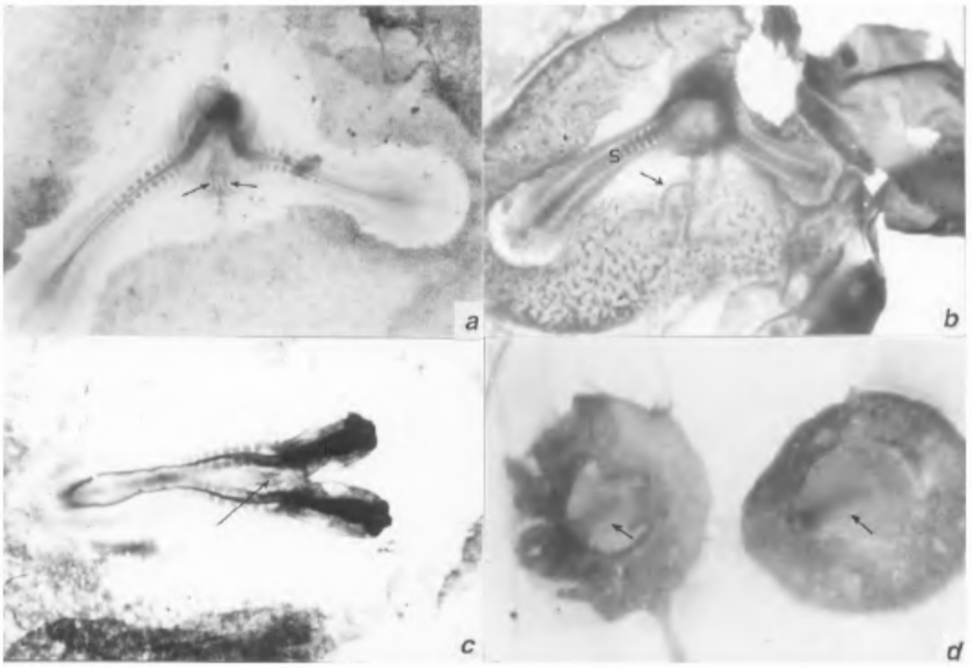

Figure 1. Chick embryo 'twins'. White Leghorn chicken embryos were explanted at the full primitive streak stage and cultured *in vitro* at 37°C. ***a***, An explant cultured for 18 h. Note fused heads. The arrows indicate two heart primordia about to fuse; ***b***, Same embryo after a total of 36 h in culture. Note increase in the number of somites (s) and common heart looped to the left (arrow), indicating progression of development in culture; ***c***, An explant cultured for 20 h. The arrow indicates common median heart. The early embryonic development seems to have progressed normally except for the fused tissues; ***d***, Two blastoderms found on a single yolk. The apparently normal primitive streaks are indicated (arrows). These blastoderms, however, did not develop further when cultured (not shown). ***a, b*** and ***d*** photographed live; ***c***, stained with hematoxylin and eosin.

twins is very low, it would be interesting to know the cause of such aberrations, especially in view of the recent interest in the molecular regulation of axis formation in vertebrates. A point worth noting is that irrespective of whether the heads or tails are fused in such embryos, they usually share a single heart (Figure 1 *a–c*), which is a median structure, at least in the early development.

An extremely intriguing case of two blastoderms developing on a single yolk ball was also encountered (Figure 1 *d*). Reasons for such occurrences are rather difficult to imagine, especially in birds, where the first few cleavages are discoidal[5]. Since the cleavage furrows do not extend up to the base of the daughter cells, the latter are continuous at the base. Under such conditions, it is difficult to speculate how the daughter cells can form two independent, identical twins after initial division. Since the entire yolk ball is part of the single egg, it is not possible for the twins to be fraternal.

Note added in proof: In the reprints collection of Leela Mulherkar, we recently came across two old but relevant papers, one on natural[6] and the other on experimentally induced[7] twinning in chick embryo.

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