

On the present situation of Developmental Biology in Italy

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A changing situation

Much as all Biomedical Research in Italy, Developmental Biology is enjoying the end of a long period of difficulty, whose causes are multiple and complex and cannot be discussed in detail in this chapter. Suffice it to mention the unfair distribution of the few available funds and the lack of career perspectives for young scientists.

The recent good news, that is already significantly changing this situation can be ascribed to the appearance of significant and rationally distributed funding from the Charities and, to a different extent, from the European Community and the Ministry of Research itself. Furthermore, these new funds make it now possible to start different, though non-permanent career positions (i.e. the Telethon careers) that encourage young scientists to continue their work in Italy.

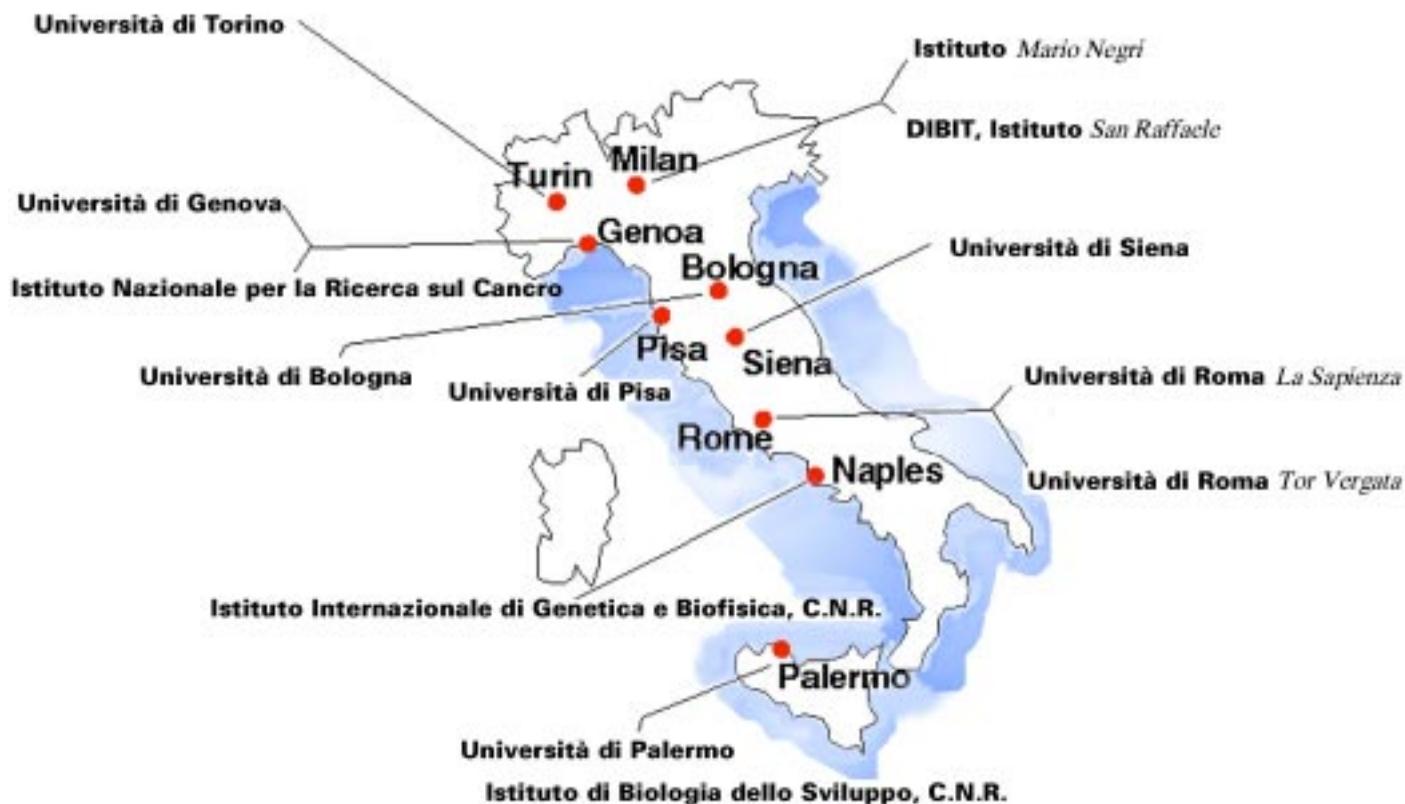
Within this scenario, Developmental Biology runs slightly behind other Biological disciplines, for the reason that it is less likely to generate patents or therapies, even though it is clear that alterations of many developmentally regulated genes are responsible for many human diseases. For example no National Research Council (CNR) project was ever focused on Developmental Biology. The European Community follows a similar strategy, and there is no room for projects in Development in any of Key Actions of the 5^o Programme, unless integrated in more general projects.

However, the establishment of European networks in a number of fields certainly had beneficial effects on many Italian laboratories, including those involved in Development Biology. On the other hand, much as in countries like France, UK or US, the Charities, namely Telethon and AIRC as well as smaller ones, have shown enough wisdom to support basic research in Cell, Molecular and Developmental Biology, with the assumption, proven correct by experience, that generation of quality results in basic research, will later benefit applied research as well.

In the tradition

The peculiarity of Science policy in Italy is certainly a factor, but not the only one in determining the current situation of Italian Developmental Biology. As detailed in other chapters of this issue, the general history of research in this field has contributed significantly to the current picture. Briefly, experimental embryology reached a plateau in Europe and in the US during the fifties and the early sixties. Lack of molecular and immunological tools at that time hampered further developments and most researchers in the field turned to newly developed cell culture systems that would allow more precise biochemical studies. The development of immortal cell lines was instrumental to successive development of mammalian molecular biology, but put classic embryology in the museum. Needless to say, most crucial developmental

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processes could not be studied in cell lines, and the teratocarcinoma cells were for many years the only resource on the market that at least would allow the studying of several genes involved in development. It was only when molecular biologists began to look back into the embryo that molecular embryology was born and gave rise to the revolution celebrated in recent articles and books. On a different route, *Drosophila* geneticists began to look for genes responsible for developmental mutations, and, again with the help of molecular biology, isolated a large and still rapidly growing number of genes that control different phases of development. Searching for the mammalian homologues turned out to be a gold mine and contributed primarily to the recently celebrated "triumph of the embryo".

While this is a general scenario, let's briefly review what has been happening in Italy at the same time, since this will be a key of lecture for the rapid overview that we will do on the current situation. There is unfortunately no real continuing tradition within Italian experimental embryology, with few exceptions in Palermo and Naples, thanks to the leading work of Giovanni Giudice and Alberto Monroy. The *Drosophila* group, active in Naples and led by Ferruccio Ritossa in the late sixties and early seventies, has been the roots of current groups working on early regulatory genes in this species as well as on genes related to pattern formation in other species. Experimental embryology of other organisms has left a legacy of very few groups still active in the area. On the other hand, many cell and molecular biology groups became interested in genes important for development. They subsequently turned into developmental biologists and presently represent the majority of active groups working in Italy.

The current situation

There are currently several groups working on spermatogenesis, oogenesis, fertilization and early development, many of which have a report in this issue. They are mostly students of Valerio Monesi, work mainly in Rome and focus their research on mammalian embryology. Few other groups, working on fertilization in invertebrates are still active, following the work of Giuseppe Reverberi and Alberto Monroy. Lastly, for the early embryology, there are groups working on *Drosophila* oogenesis in Naples and Bologna.

Pattern formation and regionalization, mainly of the nervous system, is the topic of research of two groups actually working in Naples and Milan. In this case the origin of this research came from the cloning of the mammalian homologues of *Drosophila* homeogenes and concentrated on patterning of the spinal cord first and of the brain later. In addition, few other groups in Palermo and Naples are studying homeogenes in sea urchin and ascidia. Finally, and marginally related to pattern formation, there is a group working on *Dictyostelium* in Turin.

The majority of groups working on Development in Italy have a different origin and came to investigate developmental processes by following the genes or cells they were interested in. Many of these groups have a contribution in this issue (see map above) and we do not need to mention them here, other than to give a few examples of the general scenario described above. Several researchers were trained as muscle biologists, on the tracks a tradition on muscle physiology and pathology that was initiated in Padova by Massimo Aloisi. Interest in different aspects of

myogenesis then led research into somitogenesis and early signaling in amniotes. Other researchers working on genes specific of tissues such as thyroid, cartilage or CNS begun to investigate the transcriptional regulation of these genes and identified upstream transcription factors that turned out to have key regulatory functions in histogenesis. Furthermore, research on genes initially studied for their role in processes such as oncogenesis, apoptosis or angiogenesis found in embryonic development a different and important side to look at the same processes in a developmental rather than pathological context.

The future

The explosive development of new high power technologies will soon produce immense information on virtually any aspect of biomedical research, including developmental biology. Hundreds of new genes differentially expressed in different phases or

tissues of a developing embryo will be identified and their role investigated mainly by gene ablation. As usual, Italy will be on a side of these highly competitive and expensive research avenues. However, accumulation of information will not automatically solve all the problems that still face researchers in Developmental Biology, but rather will provide new tools to address these problems. This will be especially true when we will be able to study in detail gene expression in a single cell isolated from a given embryonic structure under a particular experimental situation. The complexity of embryonic development will still offer many new areas where the existing expertise and enthusiasm of Italian researchers may result in new achievements both in basic development and in applied related fields such as stem cell biology, cell therapy and tissue engineering. The better environmental context that appears to be created now, will hopefully result in what we wish will be a continuing Renaissance of Italian Developmental Biology.