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A personal approach to embryological research in Soviet Russia

An Interview with Professor Tatiana A. Dettlaff

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Tatiana Dettlaff, now Professor Emeritus of the Kol'tsov Institute of Developmental Biology, Russian Academy of Sciences, Honorary Member of the Russian Academy of Natural Sciences, member of the International Society of Developmental Biologists, winner of the Kowalevsky Prize of the Russian Academy of Sciences (the most important scientific award in Russia in the field of developmental biology) held by her student Doctor Sergei Vassetzky, now head of the Filatov Laboratory of Experimental Embryology, which Prof. Dettlaff headed for more than 20 years, and Editor-in-Chief of "*ontogenez*" (Russian Journal of Developmental Biology).

What made you start in the field of experimental embryology? Who were your masters in science and what role did they play in your scientific career?

Dear Sergei, thank you so much for this interview. When one wants to do a lot at the end of his life and the possibilities for doing so are very limited, it is always advisable to share your thoughts with those who are still very energetic and vigorous. You ask me, how and why I became an experimental embryologist.

At Moscow University, I was a student at the Department of Developmental Dynamics, which at that time was headed by Prof. Mikhail M. Zavadovskii, an outstanding scientist and talented and brilliant lecturer. During my third year, at the Zvenigorod Biological Station, I had to attend a practical course in microsurgery in developmental mechanics conducted by the pioneer of this discipline in Russia, Prof. Dmitrii P. Filatov, an eminent scientist and a wonderful man. My interests were aimed at the field of developmental mechanics. But during the fourth year, when it was the time to prepare my diploma work, I did not follow Prof. Filatov, because I dreamed of working in phenogenetics. When Prof. Filatov learned about my dream, he asked me to come to the Institute of Experimental Biology and, quite unexpectedly, introduced me to Prof. Nikolai K. Kol'tsov, Director of the Institute. I was not prepared for such a conversation and felt very shy. I could not even remember my second name! The conversation was very short. Prof. Kol'tsov said: «Dmitrii Petrovich (Filatov) has told me that you want to study phenogenetics, but what object would you like to follow those studies on, animal or plant?» I answered in a trembling voice: «Certainly, on an animal». And Kol'tsov said to Filatov: «This means that now zoologists do not know botany.» And he proposed me a project to work on «Morphology of embryonic lethals in *Drosophila*». In addition, he took me to the Institute as a technician and I had to look after axolotls in the aquarial room. Axolots which, I soon discovered, were ill and regularly died. Nikolai Konstantinovich often came to the aquarial rooms and asked me how I treated them and whom did I consult.

My work on the project was no more successful. Within the next two months, I hardly learned how to obtain eggs, fix, embed, and

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cut them into sections. Dmitrii Petrovich, whose room I was sitting in with a microtome and quietly crying, once positively interrupted my activity. «You will have time to do that when you graduate at university, but now it is necessary to lead our efforts in the diploma work on frogs,» he told me. Seeing my tears, he told me quite seriously: «In order to decide whether the science you are working on is interesting or not, it is necessary to work a lot and it is necessary for your own thought to prepare yourself and only then, you can decide.» This piece of advice greatly impressed me and I somehow settled down. Indeed, it was necessary to present a diploma work and for this purpose I went to the biological station. I could not perform a good work but I became interested in specific structural features of the ectoderm in the Anura, which had been forgotten by embryologists, and later (as a postgraduate student), continued to study them with great interest.

I am not sure to this respect but I believe that Dimitrii Petrovich submitted the change of diploma project to Kol'tsov's approval. When I was proposed a position as a postgraduate student under the guidance of Prof. Filatov, I agreed. Nikolai Konstantinovich (Kol'tsov) was very offended and did not forgive this decision until the end of his life. Under these difficult circumstances, I became an experimental embryologist.

Thereafter I could not work seriously for a long time. For two years, I had to take care of my ill mother and then I could not find a place after graduating. Prof. A.A. Zavarzin, who had to move from Leningrad to Moscow with his department, wanted very much to count with an embryological laboratory with Prof. Filatov as its head and took me on. But, within a year, the laboratory was closed. Then Prof. Ivan I. Shmal'hausen took me on as a supernumerary research worker and paid me from the money that he received for his research work as a member of the USSR Academy of Sciences. Hereon, I continued my studies. My task was widened and deepened and I came closer to the comparative evolutionary interests of my teachers.

During these difficult years, I got to know and could communicate with Aleksei A. Zavarzin and Ivan I. Shmal'hausen and this was very important for me. Of course, M.M. Zavadovskii and D.P. Filatov were my main teachers but I learned and received much knowledge from communication with A.A. Zavarzin and I.I. Shmal'hausen and I am infinitely grateful to all of them. I always felt a certain guilt before N.K. Kol'tsov and, therefore, I wrote with a special feeling, a paper dedicated to the history of his famous Institute of Experimental Biology.

What do you consider as your highest achievement in science? Do you think that you have succeeded in developing your potencies in science and what helped or prevented their realization?

I consider the introduction of a relative criterion for biological time, comparable in different poikilothermic animals and at different optimal temperatures, in biological studies as my highest achievement. I believe that I have developed my potencies in research and scientific-organizational activity as far as the conditions in my country and at the Institute allowed me to do. My friends and colleagues helped me on my way, my long-time co-author Anna S. Ginsburg and qualified researchers and talented students. In many cases, I felt restrictions imposed on me as a research worker not affiliated to the communist party.

Did the political situation in the society (Stalin purges, Second World War, August 1948 session of the VASKHNIL) affect the development of science in the USSR and Russia and how did all this reflect on your fate as a scientist? How did your scientific career correlate with your personal life?

During the Second World War, I was evacuated with my baby to Chuvashia and then to Kazakhstan, where I worked at the Kazakh Division of the USSR Academy of Sciences in the Laboratory of M.M. Zavadovskii. There, I visited state and collective farms introducing the Zavadovskii's method of obtaining polycarpous farm animals in sheep husbandry and instructed shepherds and zootechnicians. I obtained great satisfaction from this work, since it was bringing real public benefits. I also had to take care of my seriously ill baby. Soon, I returned to Moscow with my father and son and was taken by I.I. Shmal'hausen for preparation of doctoral dissertation. My son died very soon after we returned to Moscow.

When I came to I.I. Shmal'hausen, he told me: «Now you have to work hard.» By the end of 1947, I wrote a doctoral dissertation: «Structure and Properties of Ectoderm, Chordamesoderm, and their Derivatives in Different Species of *Anamnia*» and defended it in the beginning of 1948, before the 1948 session of VASKHNIL (Agricultural Academy). The first volume of this dissertation was dedicated to the history of the theory of germ layers. After the VASKHNIL session, the confirmation of my degree was postponed and its publication was out of question. All studies in developmental mechanics were stopped. I.I. Shmal'hausen was removed from his position as Director of the institute. The laboratory of I.I. Schmalhausen and the laboratory of N.I. Dragomirov, where I worked, were closed.

There was a time when myself and A.S. Ginsburg, with whom I had a very close scientific contact, were said that we could not be taken on even as technicians in the Laboratory of Farm Animals because of our ideological mistakes. Our dismissal seemed imminent, but somehow, I cannot understand how, during merger of the remaining laboratories of the former Institutes of Experimental Biology and of Evolutionary Morphology, Prof. Vasilii V. Popov, who had become head of Filatov's laboratory after his death, took us to his laboratory. Under these conditions, we proposed a project of studies of development of the sturgeon fish with special reference to their artificial reproduction and breeding. Wide possibilities opened for this trend of research and it was actively pursued for many years.

How do you assess relations between Russian/Soviet scientists and the world scientific community, not only now, but also during your scientific career?

I consider international scientific contacts very important and, being the Chairman of the Embryology Section of the National Committee of Soviet Biologists, have tried to promote these contacts very hard. On the other hand, I believe that the present-day brain drain (mass exit of young researchers from the country), destruction of national scientific traditions and scientific schools, and interruption of the succession of ideas are very dangerous for our science.

You initiated, at least, three trends in developmental biology. How do you evaluate your role in their development and what is the fate for these lines of research?

Apparently, you have in mind studies of morphology and physiology of the sturgeon fish, studies of oocyte maturation, and introduction of relative criteria of biological time in developmental biology studies.

We, together with A.S. Ginsburg and A.I. Zotin, began our studies of development of the sturgeon fish at a very favorable moment («every cloud has a silver lining»). On the one hand, it was very important to develop artificial breeding of sturgeon fish with respect to construction of hydroelectric power stations on the basis of fundamental studies of their development and, on the other hand, many serious researchers had to change the topics of their studies. Hence, in addition, embryologists, cytologists, morphologists, ichthyologists, biochemists, and molecular biologists were involved in these studies.

The results of these studies allowed us to propose a number of recommendations and instructions and to write manuals and monographs [see Dettlaff, T.A. *et al.*, (1993). *Sturgeon Fishes: Developmental Biology and Aquaculture*, Springer, Berlin]. Development of sturgeon fish (oocyte maturation and embryonic and prelarval development) now compares, according to the degree of available knowledge, with the development of amphibians and even exceeds it in some aspects. Since the oocytes and eggs of sturgeon fish are a very convenient object of study, our knowledge will be expanded. At present the task of preservation and reproduction of sturgeon has become a current topic, even at international level.

As far as oocyte maturation is concerned, during my trip to China I learned about the experiments of Prof. Tchou-Su on maturation of toad oocytes in a saline with pituitary suspension and I had a happy brainwave to use experimental-embryological and molecular-biological methods in this system for identifying the mechanism and dynamics of oocyte maturation. After publication of the first results, this system was rapidly appraised and, within a few years, studies of oocyte maturation and meiosis control became a central problem of developmental biology. These studies are continued in our country [see Dettlaff, T.A. and Vassetzky, (1988). Oocyte Growth and Maturation, (Eds.S.G.), New York and London, Consultants Bureau), and abroad and will definitely be continued to deepen our knowledge about oocyte maturation and regulation of the cell cycle.

A different situation arises with the last large cycle of studies dealing with biological time. I consider development of relative criteria of biological time, comparable in different animals and at different optimal temperatures, as the main and most important result of my scientific work. A great contribution to this line of research was made by Galina M. Ignatieva (on teleostean fish) and a large group of authors of the book «*Experimental Species for Developmental Studies* [Dettlaff, T.A. and Vassetzky, (1990). Invertebrates, vol. 1.; (Eds. S.G.), New York and London, Consultants Bureau. and (1990) Vertebrates, vol. 2., New York and London: Consultants Bureau] . My brother Prof. Andrei A. Dettlaff, a physicist by education, greatly helped in this work. It was shown that the shortest cell cycle during synchronous divisions of the nucleus in early development (cleavage) can be used as a time unit comparable in most poikilothermic animals and that the duration of various developmental periods and processes changes proportionally with temperature. This allowed me to introduce the parameter of biological time in biological studies for prediction of timing of different processes at different temperatures and elucidation of temporal patterns of development, including the genetic program of developmental time.

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But these data have not yet been generalized and are not accessible to a wide community of biologists and, hence, did not become a practical tool. In literature, there are discrepancies regarding definition of these units and in methods regarding their determination. It is still necessary to maintain our recommendations of using this method. Therefore, I consider it my duty to generalize, as far as possible, the results of research along these lines and warn the researchers against possible errors in application of the method of relative criteria of developmental time. I am not sure, however, that I will succeed in completing this task. In addition, it is important to widely introduce the parameter of comparable time in fundamental and applied research. I hope that somebody among my colleague-associates will continue this line of research and make sure that the measurable and comparable biological time becomes an integral part of research tools.