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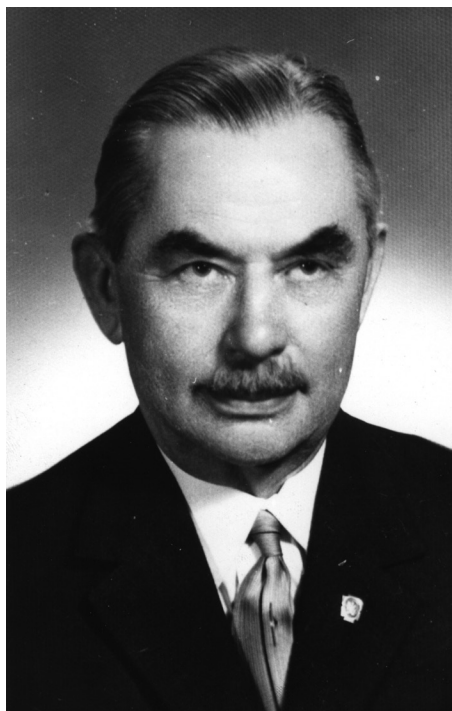
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REMEMBERING PROF. ZYGMUNT KRACZKIEWICZ (1900–1971) AND HIS PIONEERING RESEARCH



Zygmunt Kraczkiewicz (1900–1971)

On October 11, 2021, at the Holly Cross Church in Warsaw, there was a Holly Mass dedicated to the memory of Professor Zygmunt Kraczkiewicz who passed away 50 years ago, in 1971.

Zygmunt Kraczkiewicz was born July 20, 1900, in Biala in Ukraine. In 1928 he received his Ph.D. and in 1935 the doctor habilitatus (D.Sc.) degree at the Faculty of Philosophy of Warsaw University. From 1926

until 1939, he was an assistant professor in the Department of Cytology at Warsaw University. At the beginning of World War II, he was called to military duty. After the fall of Poland, he was interned in Romania until 1941, and from 1941 until 1945 he was held captive in Dorsten and Dossel German POW camps. In 1945, after the liberation by Americans and relocation to Belgium, he co-organized and lectured in the Polish Center of Academic Studies in Brussels. He returned to Poland in 1946.

Prof. Kraczkiewicz joined, in the rank of associate professor, the re-opened Department of Zoological Cytology at Warsaw University in 1946. From 1951 to 1956, he was the Dean of Faculty of Biology and Natural Sciences, and from 1956 to 1965, he held the position of the Pro-Rector of Warsaw University. From 1955 until retirement in 1970, Prof. Kraczkiewicz was the Chair of the Department of Cytology Faculty of Biology, University of Warsaw.

Zygmunt Kraczkiewicz (1900–1971)

W Kościele Św. Krzyża w Warszawie 11 października 2021 r. odbyła się msza święta upamiętniająca Profesora Zygmunta Kraczkiewicza, który zmarł 50 lat temu, w 1971 r.

Prof. Kraczkiewicz urodził się 20 lipca 1900 r. w Białej na Ukrainie. W 1928 r. został doktorem biologii, a w 1935 r. uzyskał habilitację na Wydziale Filozofii Uniwersytetu Warszawskiego. W latach 1926–1939 był adiunktem w Zakładzie Cytologii Uniwersytetu Warszawskiego. Po wybuchu II Wo-

jny Światowej ówczesny doktor habilitowany Zygmunt Kraczkiewicz został powołany do wojska, a po klęsce Polski był internowany w Rumunii do 1941 r. W latach 1941-1945 Zygmunt Kraczkiewicz był więziony w Niemieckich obozach Dorsten i Dossel. Po wyzwoleniu przez Amerykanów w 1945 r. prof. Kraczkiewicz wyjechał do Brukseli, gdzie założył Polskie Centrum Studiów Akademickich, w którym wykładał. Do Polski

wrócił w 1946 r. i od razu podjął pracę na Uniwersytecie Warszawskim. W tym samym roku został adiunktem w Zakładzie Cytologii UW. Od 1955 r., do emerytury w 1970 r., prof. Kraczkiewicz był kierownikiem Zakładu Cytologii. W latach 1951-1956 był Dziekanem Wydziału Biologii i Nauk o Ziemi, a w latach 1956-1965 był prorektorem Uniwersytetu Warszawskiego.

We live in the age of translational science. Under the seductive banner of curing diseases, translational science sidetracked the pure basic science and replaced it with clinically oriented research whose primary goal is to *Translate* the basic research into clinical/patent application. In this newly created scientific environment, clinically applicable research is prioritized by funding agencies and published in high-impact scientific journals. The *What, How, and Why* questions of the basic science derived from intellectual curiosity are often replaced by *What research subject to choose or how to adjust existing research* to be clinically relevant, get grants, and publish well. A sad consequence of this precedent is that the old scientific discoveries, which do not fit the *translational* mold, hadn't been read, and the new discoveries are published in low-impact journals. Ultimately, both vanish from scientific memory.

The perfect example of such basic science driven by pure intellectual curiosity is the research initiated by Professor Zygmunt Kraczkiewicz before World War II and continued by his team until early 1990 in the Department of Cytology at Warsaw University in Poland.

Prof. Kraczkiewicz was born July 20, 1900, in Biala in Ukraine. In 1928 he received his Ph.D. and in 1935 the doctor habilitatus (D.Sc.) degree at the Faculty of Philosophy of Warsaw University. From 1926 until 1939 he was an assistant professor in the Department of Cytology at Warsaw University. At the beginning of World War II, he was called to military duty. After the fall of Poland to the German and Russian invasion, his regiment was ordered to move to Romania, where he was interned until 1941. In February 1941, Kraczkiewicz was handed over to the Germans and held captive in Dorsten and Dossel German POW camps until the end of the war. All these heart wrenching experiences hadn't blunted his sharp intellect or diminished his scientific curiosity. In 1945, after the liberation by Americans and relocation to Belgium, he co-organized and lectured in the Polish

Center of Academic Studies in Brussels. After returning to Poland in 1946 he joined, in the rank of associate professor, the re-opened Department of Zoological Cytology at Warsaw University (Fig. 1). From 1955, until retirement in 1970 (he passed away in 1971) Prof. Kraczkiewicz was the Chair of

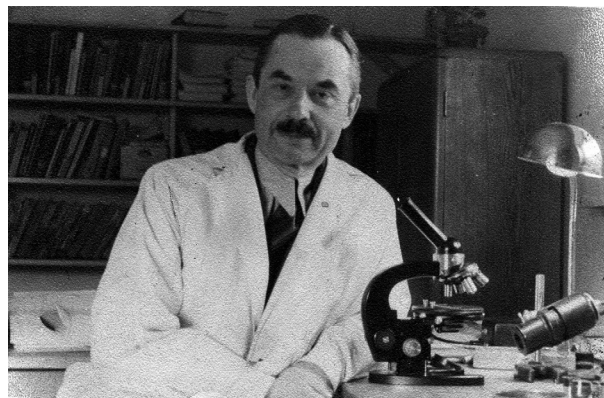


Fig. 1. Prof. Zygmunt Kraczkiewicz at the microscope



Fig. 2. Prof. Zygmunt Kraczkiewicz in his laboratory at the Department of Cytology with the staff and students in 1958. From the left: Ewa Perkowska (volunteer), Bohdan Matuszewski (later, professor and head of the Department), Professor Zygmunt Kraczkiewicz, and students: Teresa Pawelczyk, Grazyna Ejsmont, Janina Saska (from the Department of Physiology) and Irena Gey-Duszynska



Fig. 3. Doctoral graduation ceremony. From the left: Prof. Marian Rybicki, the Dean of The Faculty of Biology and Earth Sciences; Prof. Zygmunt Kraczkiewicz, the vice-rector of Warsaw University; Prof. Zdzisław Raabe, doctorate promoter.

the Department of Cytology (Fig. 2). From 1951 to 1956, he was the Dean of Faculty of Biology and Natural Sciences, and from 1956 to 1965, he held the position of the Pro-Rector of Warsaw University (Fig. 3, 4) (for details see KLOC, 2008).

Starting from 1935, the main subject of Prof. Kraczkiewicz and his team (Dr. Irena Geyer-Duszyńska, Dr. Bożenna Jazdowska-Zagrodzinska, and Dr. Bohdan Matuszewski) studies was the process of chromosome elimination (diminution) in the gall-midges that belong to lower Diptera group *Cecidomyiidae* (GEYER-DUSZYŃSKA 1959, 1961, 1966; JAZDOWSKA-ZAGRODZINSKA et al., 1992; KRACZKIEWICZ 1935, 1938; KRACZKIEWICZ and MATUSZEWSKI 1958; MATUSZEWSKI 1982). In



Fig. 4. 1958, the 140-year jubilee of Warsaw University. In the middle, wearing the ermine ceremonial robe Rector Magnificus Prof. Stanisław Turski. Second row, in the ceremonial robes with chains, from the right: the vice rectors Aleksander Gieysztor, Zygmunt Kraczkiewicz and Tadeusz Manteuffel.

these insects, the nuclei of germ cells contain two sets (S and E) of chromosomes. After fertilization, during early embryogenesis, the E chromosomes are eliminated from the presumptive somatic cells, while the presumptive germ cells retain both chromosome sets. Elimination of E chromosomes occurs through the inhibition of their movement in the anaphase of mitotic divisions of presumptive somatic nuclei. The nuclei of presumptive germ cells are in close contact with the polar plasm (oosome) that protects the chromosomes from being eliminated. Experimental removal of the oosome causes all cells to eliminate the E chromosomes, and the oosome misplaced by centrifugation protects all nuclei at its vicinity from the chromosome elimination. The oosome probably contains some, still undefined, diffusible factor that prevents chromosome elimination. Although these studies vanished from the scientific memory and are not even cited by newer review articles on the subject (GODAY and ESTEBAN 2001; WANG et al. 2017; 2020), this fascinating phenomenon of chromosome elimination, which is an example of developmentally programmed DNA engineering, is not unique for *Cecidomyiidae* but occurs in many species of ciliates, parasitic nematodes, crustaceans, insects, some vertebrates (Chondrichthyes, Cyclostomata, Marsupialia), and plants (for review see GODAY and ESTEBAN 2001, KLOC and ZAGRODZINSKA 2001, KLOC 2008, WANG et al 2020). In ciliates such as *Euplotes*, *Oxytricha*, and *Stylonychia*, only the germline nucleus (micronucleus) retains a full genome while 95–98% of the DNA sequences are eliminated from the somatic nucleus (macronucleus) (PRESCOTT 2000). In copepod *Cyclops* 94% of DNA is eliminated (eDNA) from presumptive somatic cells and only the germline cells retain a full genome. The eDNA has been shown to contain repetitive DNA with inverted repeats and a complex internal structure and spacer elements. Such intricate, and thus, nonrandom organization of eDNA, which is retained by the germ cells, suggests that its function is necessary for the germline specification/survival (DEGTJAREV et al. 2004). In the parasitic nematode *Ascaris* the germline chromosomes undergo chromosome end remodeling and loss of telomeres. The eliminated DNA is incorporated into the micronuclei, which form the cytoplasmic autophagosomes (WANG et al. 2020). Although common for many invertebrates and vertebrates, it remains unknown why such programmed DNA elimination occurs and why it occurs only in some species.

Prof. Kraczkiewicz was my first mentor of cell biology at the University of Warsaw.

The microscope images of spider and insect oocytes he showed during his presentations sparked my life-long fascination with oocytes and germ cell fate specification.

I will always remember Professor Kraczkiewicz with a great sentiment and gratitude for channeling my generic love of biology to this fascinating subject.

The pioneering research of Prof. Kraczkiewicz initiated before World War II (KRACZKIEWICZ 1935) exemplifies the amazing and still poorly understood biological phenomena that deserve to be studied by mainstream science.

ACKNOWLEDGMENTS

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REFERENCES

- DEGTAREV S., BOYKOVA T., GRISHANIN A., BELYAKIN S., RUBTSOV N., KARAMYSHEVA T. et al., 2004. *The molecular structure of the DNA fragments eliminated during chromatin diminution in *Cylops kolensis**. *Genome Res.* 14, 2287-2294.
- GEYER-DUSZYNSKA I., 1959. *Experimental research on chromosome elimination in Cecidomyiidae (Diptera)*. *J. Exp. Zool.* 141, 391-447.
- Geyer-Duszyńska I., 1961. *Spindle disappearance and chromosome behavior after partial embryo irradiation in Cecidomyiidae (Diptera)*. *Chromosoma* 12, 233-247.
- GEYER-DUSZYNSKA I., 1966. *Genetic factors in oogenesis and spermatogenesis in Cecidomyiidae*. *Chromosomes Today* 1, 147-178.
- GODAY C., ESTEBAN M. R., 2001. *Chromosome elimination in sciarid flies*. *Bioessays* 23, 242-250.
- JAZDOWSKA-ZAGRODZINSKA B., DALLAI R., REDI C. A., 1992. *Changes in DNA content and chromosome number during spermatogenesis in the gall midge *Monathropalpus buxi* (Cecidomyiidae, Diptera)*. *Genome* 35, 244-250.
- KLOC M., 2008. *Basic Science B.D. (before Drosophila): Cytology at Warsaw University (Poland)*. *Int. J. Dev. Biol.* 52, 115-119.
- KLOC M., ZAGRODZINSKA B., 2001. *Chromatin elimination - an oddity or a common mechanism in differentiation and development*. *Differentiation* 68, 84-91.
- KRACZKIEWICZ Z., 1935. *Nouvelle recherches sur l'oogenese et la diminution dans les larves paedogenetiques de Miastor metraloas (Diptera)*. *C. R. Soc. Biol.* 119, 1201-1205.
- KRACZKIEWICZ Z., 1938. *La spermatogenese chez Miastor metraloas (Diptera)*. *C. R. Soc. Biol.* 127, 1143-1145.
- KRACZKIEWICZ Z., MATUSZEWSKI B., 1958. *Observations sur une structure atypique des chromosomes salivaires de certains Cécidomyides*. *Chromosoma* 9, 484-492.
- MATUSZEWSKI B., 1982. *Diptera I: Cecidomyiidae*. [In:] *Animal Cytogenetics. Insecta 3*. JOHN B. CANBERRA (ed.). Australia. Gebruder Borntraeger, Berlin Stuttgart, 1-140.
- PRESCOTT, D. M. 2000. *Genome gymnastics: unique modes of DNA evolution and processing in ciliates*. *Nat Rev Genet.* 1, 191-198.
- WANG J., GAO S., MOSTOVOY Y., KANG Y., ZAGOSKIN M., SUN Y., ZHANG B. et al., 2017. *Comparative genome analysis of programmed DNA elimination in nematodes*. *Genome Res.* 27, 2001-2014.
- WANG J., VERONEZI G. M. B., KANG Y., ZAGOSKIN M., OTOOLE E. T., DAVIS R. E., 2020. *Comprehensive chromosome end remodeling during programmed DNA elimination*. *Curr Biol.* 30, 3397-3413.