

Al collegio docenti del Dottorato in Medicina Molecolare

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Ciclo: XXXVII

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Attività scientifica svolta nel 2° anno di Dottorato, Anno Accademico 2022/2023

The sperm cryopreservation is a common method for managing and preserving male fertility in humans and animals, however there is not yet a cryopreservation medium that completely prevents sperm damage. Indeed, freezing process causes reactive oxygen species formation and oxidative stress, which damages spermatozoa, inducing DNA fragmentation, apoptosis, and lipid peroxidation. To minimize spermatozoa cryoinjuries, different strategies have been proposed including the use of antioxidants as a supplement for freezing media.

In this year, I studied the use of chlorogenic acid (CGA) and zwitterionic liposomes as a supplement of cryopreservation media to investigate a possible increase in cryostability of human spermatozoa.

Semen samples from healthy donors (aged 23-38 years) were analysed following World Health Organization guidelines (2021). Raw semen was frozen under different conditions: 1) freezing medium alone (CTR); 2) freezing medium with zwitterionic empty liposomes (EL) diluted 1:10000; 3) freezing medium and CGA loaded liposomes (CGA) diluted 1:10000; 4) freezing medium with zwitterionic empty liposomes diluted 1:10000 and 100

μ M CGA (EL+CGA). After thawing, progressive motility percentage, mitochondrial membrane potential (MMP; JC-1 test), DNA status (acridine orange assay) and acrosome integrity (*Pisum sativum* agglutinin test) were assessed.

After thawing, all samples with zwitterionic liposomes (EL, CGA, EL+CGA) showed a significantly higher sperm progressive motility than the control ($p < 0.001$), although better results were observed in the CGA samples. The same trend was observed for DNA integrity parameter ($p < 0.001$). All samples treated with zwitterionic liposomes showed a significantly increase of sperm with high MMP than the control ($p < 0.001$), but, this phenomenon was particularly evident in spermatozoa from samples with CGA, both loaded in the liposomes and added in the medium. The same trend was observed also for sperm with intact acrosome ($p < 0.001$).

• **Publications:**

- Moretti E., Noto D., Corsaro R., Collodel G. Focus on centrin in normal and altered human spermatozoa. *Syst Biol Reprod Med.* 2023;9:1-13.
- Moretti E., Signorini C., Corsaro R., Giamalidi M., Collodel G. Human Sperm as an In Vitro Model to Assess the Efficacy of Antioxidant Supplements during Sperm Handling: A Narrative Review. *Antioxidants (Basel).* 2023;12(5):1098.
- Collodel G., Moretti E., Noto D., Corsaro R., Signorini C., Bonechi C., Cangeloni L., Luca G., Arato I., Mancuso F. Effects and Mechanisms Activated by Treatment with Cationic, Anionic and Zwitterionic Liposomes on an In Vitro Model of Porcine Pre-Pubertal Sertoli Cells. *Int J Mol Sci.* 2023;24(2):1201.
- Moretti E., Signorini C., Noto D., Corsaro R., Micheli L., Durand T., Oger C., Galano J. M., Collodel G. F4-Neuroprostane Effects on Human Sperm. *Int J Mol Sci.* 2023;24(2):935.
- Moretti E., Signorini C., Corsaro R., Noto D., Tripodi AS., Menchiari A., Micheli L., Ponchia R., Collodel G. Apelin is found in human sperm and testis and is raised in

inflammatory pathological conditions. *Cytokine*. 2023;169:156281.

- Mattioli S., Moretti E., Castellini C., Signorini C., Corsaro R., Angelucci E., Collodel G. Can Dietary n-3 Polyunsaturated Fatty Acids Affect Apelin and Resolvin in Testis and Sperm of Male Rabbits? *Molecules*. 2023;28(17):6188.
- Cheleschi S., Veronese N., Carta S., Collodel G., Bottaro M., Moretti E., Corsaro R., Barbarino M., Fioravanti A. MicroRNA as Possible Mediators of the Synergistic Effect of Celecoxib and Glucosamine Sulfate in Human Osteoarthritic Chondrocyte Exposed to IL-1 β . *Int. J. Mol. Sci.* 2023;24(19):14994.

• **Soft Skills/Courses:**

- Webinar “Lesson 8: I finanziamenti europei nel settore digitale: il programma “Europa Digitale””; May 11, 2023.
- Webinar: “Lesson 9: Europrogettazione: programmi, progetti e rendicontazione”; May 18, 2023.
- 1° session of the course THRUST - Tuscany Health Ecosystem Entrepreneurial Skills Training: “Progettare soluzioni nel settore salute”, Prof. Andrea Bonaccorsi, Università di Pisa; June 20, 2023.
- 2° session of the course THRUST - Tuscany Health Ecosystem Entrepreneurial Skills Training: “Cenni di proprietà intellettuale: tipologie, cenni normativi, valorizzazione, informazioni ottenibili”, Dr. Andrea Frosini, Fondazione Toscana Life Sciences; June 30, 2023.
- Webinar: “Last update in Sustainability reporting regulation”, Dr. Maria del Mar Miras; September 7, 2023.
- Course: “Ricerche bibliografiche, bibliometria e open access & science”, Drs. Fausta Cosci e Maria Cristina Costantini; September 14, 2023.
- Course: “Critical issues of patent law”, Prof. Alessandro Palmieri; September 19, 2023.
- Course: “How to exploit your research idea: a quick introduction to EU project design and management”, Dr. Donata Franzi; September 27, 2023.

- Course: “Crossing Boundaries: Harnessing the Power of Interdisciplinary Approaches in Complex Systems”, Prof. Alessandro Vespignani (Northeastern University); September 28, 2023.
- **Traineeship period to MVZ Next Fertility Ulm GmbH, Assisted Reproduction Center, Ulm, Germany; 15/04/2023- 31/07/2023.**

During this period, I tested chlorogenic acid (CGA), an antioxidant substance, directly on semen of ~70 patients affected by different pathologies (varicocele, genitourinary infections, leukocytospermia), where the OS is exacerbated. The effects of the antioxidant have been partly evaluated in Germany and will be partly evaluated in Italy.

In addition, I learned the techniques and the methods performed in an in vitro fertilization laboratory.