Synthesis, characterization, and applicability of aptamer-linked metalic nanoparticles against prostate cancer

André P. Sousa [1,2,3], Ana Cláudia Pereira [2,4], Rúben Fernandes [2,4], Lucía G. Allonso [3], Margaritta V. Gonzalez [3], Miguel Correa-Duarte [3]

1 Faculty of Medicine of the University of Porto, Portugal

2 Hospital-School of the University Fernando Pessoa, Gondomar, Portugal

3 CINBIO – Center of Investigation in Nanomaterials and Biomedicine, Vigo, Spain

4 RISE – Network of Investigation in Health, Portugal

andre.mp.sousa2otmail.com

The anatomical location of the prostate poten-tiates several internal and external injuries, such as infectious agents, carcinogens, urinary reflux, hormonal changes, and physical trauma [1]. These factors can lead to chronic inflam-mation, resulting in the initiation and progres-sion of benign prostatic hyperplasia and pros-tate cancer [1–3]. This indolent carcinoma, with a non-invasive nature, presents one of the highest rates of neoplastic transformation in the human body, leading to death not only due to anatomical susceptibility to damage but also due to failures in controlling the metastatic process [1]. Prostate cancer affects more than 90% of men over 80 years old and is considered a serious threat to patients' lives [4]. It is among the five most prevalent cancers, repre-senting a significant global issue in terms of frequency and cancer-related mortality [5,6]. With the aging and rapid growth of the global population, it is expected that by 2030 more than 1.7 million men will be diagnosed with prostate cancer, with around half a million new deaths [1]. Currently, various treatments are available, including surgery, androgen depriva-tion therapy, chemotherapy, radiotherapy, and active surveillance by prostate-specific antigen. However, the choice of the most suitable treatment combination is still unclear, and the most common solution is total prostatectomy [7]. Given the limited potential of current ther-apies to prevent progression and treat prostate cancer, developing targeted, less toxic, and more efficient therapeutic strategies is crucial, especially for managing metastatic potential. Nanoparticles offer great potential for drug delivery and therapeutic applications due to their unique properties compared to macroscop-ic materials [8]. Various materials, such as iron, copper, cobalt, and some inorganic complexes, can be used to synthesize nanoparticles [9]. Thus, this work aimed to explore the synthesis of nanoparticles, functionalize them with fluorophores for tracking and aptamers for tar-geted therapy and test their effect on the pros-tate in vitro models.

References

[1] 1. Rawla P Epidemiology of prostate cancer. World J Oncol Elmer Press 2016, 10, 107–125

[2] Sharp, V.J.; Takacs, E.B.; Powell, C.R. Prostatitis: Diagnosis and Treatment. Am. Acad. Fam. Physicians 2010, 82, 397–406.

[3] Bachmann, C. Serenoa repens for benign prostatic hyper-plasia. Schweizerische Zeitschrift fur GanzheitsMedizin 2015, 27, 202–206.

[4] Bott, S.R.; Ng, K.L. Prostate Cancer; Exon Publications: Australia, 2015; Vol. 8; ISBN 9783030326555.

[5] Hulvat, M.C. Cancer Incidence and Trends. Surg. Clin. North Am. 2020, 100, 469–481.

[6] Bray, F.; Ferlay, J.; Soerjomataram, I.; Siegel, R.L.; Torre, L.A.; Jemal, A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA. Cancer J. Clin. 2018, 68, 394–424.

[7] Litwin, M.S.; Tan, H.J. The diagnosis and treatment of prostate cancer: A review. JAMA - J. Am. Med. Assoc. 2017, 317, 2532–2542.

[8] Ezhilarasu, H., Vishalli, D., Dheen, S. T., Bay, B. H., & Srinivasan, D. K. Nanoparticle-Based Therapeutic Approach for Diabetic Wound Healing. Nanomaterials (Basel, Switzerland). 2020, 10(6), 1234.

[9] Hasan, S. A Review on Nanoparticles: Their Synthesis and Types. Res. J. Recent Sci. 2015, 4, ISC-2014, 9-11.

Figures

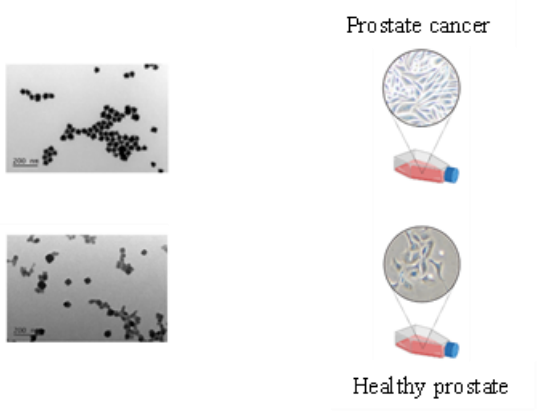

Figure 1. Figure ilustrating the fundamental question of this work: what is the impact of metallic nanoparticles against prostate cancer in in vitro models?