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Implementation of optical biosensors based on silver nanoparticles for the diagnostics of misfolding protein deposit diseases

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In several different forms of malignant monoclonal gammapathy immunoglobulins free light chains may be produced in high rate of several grams/24 h. This overproduction in some patients is asymptomatic while in others leads to wide spectrum of protein deposition diseases. In AL amyloidosis light chain form organized extracellular fibrils. In other pathologies deposits are amorphous or crystalline. In Fanconi syndrome intracellular crystalline structures impair kidney tubular structures. Until now there is no laboratory test estimating susceptibility of LC for aggregation. Aim of this research is to elaborate optical biosensor based on silver nanoparticles (SNPs) and afterwards obtain its functionality for clinical applications in order to improve the diagnostics of deposit diseases. In view of the alarming increase in frequency of those potentially lethal ailments among older generation, our project responds to global necessity of effective techniques allowing for unequivocal diagnosis. SNPs were synthesized by reduction of silver ions with sodium borohydride. Free light chains have single cysteine group which theoretically should facilitate simple covalent attachment on the surface of silver. In practice this sulfhydryl requires activation with reducing agent. Aggregation of SNPs induced by polyclonal antibodies was demonstrated by change in color of solution from yellow to orange. Furthermore, a characteristic red-shift was detected during the analysis of absorption spectra. Direct optical measurements by means of dark field microscope allowed visualizing dynamics of the aggregation process. By confirming simplicity of SNPs' synthesis and satisfying availability of detection methods we proved previously assumed usefulness of SNPs for creating a reliable nanobiosensor.

Biography

Agata Dziwinska is in the final year Majoring in Laboratory Medicine at Jagiellonian University. As an active member of the Laboratory Diagnosticians Scientific Society within the Department of Medical Diagnostics, he is currently conducting a research on silver nanoparticles. He has already participated in several international students' conferences such as: International Students' Medical Congress Kosice and Medical Students' Conference in Cracow.

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Electrospun nanofibrous mats for post-menopausal wound dressing

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In women the transition to delayed healing coincides with menopause, where hormone levels, particularly estrogen, rapidly fall. Post-menopausal women have an increased risk of developing a number of degenerative pathological conditions, linked by the common theme of excessive inflammation. Systemic estrogen replacement is able to accelerate healing of acute cutaneous wounds in elderly females, linked to its potent anti-inflammatory activity. Normal female skin undergoes profound changes postmenopausally, including a decrease in dermal collagen and reduced skin thickness, both of which can be reversed by topical estrogen application. Furthermore, systemic hormone levels profoundly influence wound healing: Post-menopausal females taking systemic hormone replacement therapy heal standardized acute wounds more rapidly. Wound dressing from electrospun nanofibers potentially offers many advantages over conventional processes. Generally, the ultimate goal of the nanofiber design is to provide an ideal structure that can replace the natural extra cellular matrix until the host cells can grow and synthesize a new natural cellular matrix. In addition, the unique electrospinning process can be invoked to impregnate the nanofiber membranes with antibacterial and therapeutic agents. So here we introduce a new material for post-menopausal wound dressing. In this work, a composite nanofibrous wound dressing material loaded with estrogen will be obtained through electrospinning. This study involves the characterization of these nanofibers and analysis of cell growth and proliferation to determine the efficiency of tissue regeneration on these biocomposite polymer nanofibrous scaffolds and to study the possibility of using it as a post-menopausal wound dressing material in the *in vivo* models such as ovariectomised mice.

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