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Nanoparticle-Infused-Biodegradable-Microneedle Technology for Skin Cancer Treatment

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Abstract: Melanoma affects over 200,000 people in the UK alone, with survival rates of around 86%. Over the last decade melanoma skin cancer incidence rates for males and females combined increased by 50%. The current main treatments of skin-cancer are surgery to remove the affected area, as well as chemotherapy/radiotherapy and immunotherapy to kill the tumour cells. However, around 33,000 people still die within the first five years after diagnosis and treatment. The purpose of this study is to explore the possible development of a new nanomedicine technology that uses anti-cancer drug doped-nanoparticles to kill tumour cells. Nanoparticles[1] are held in solution which can lead to aggregation, making them undesirable as drug delivery systems. The proposed solution to this is to formulate the nanoparticles into a microneedle array made from methylcellulose gels[2]. In solution, nanoparticles are subject to Brownian motion and tend to aggregate however when formulated into a gel-like microneedle patch, the aggregation is prevented. Methylcellulose is used specifically because it is biodegradable and will degrade by enzymatic reaction in the epidermis, thus releasing nanoparticles into the microenvironment. Microneedle patches have been used widely in cosmetics[3], as well as for insulin delivery[4]. To observe the disintegration of microneedles and the release of the drug-doped nanoparticles in the skin[5], optical coherence tomography (OCT) will be used[6].

Biography: Rachel E. Sully obtained her undergraduate diploma in Chemistry MChem from the School of Physical Sciences at the University of Kent in July 2018. Her masters project was on the synthesis of functionalised L-proline precursors which could be advantageous for the synthesis of functionalized N-Carboxy Anhydride (NCA) monomers with Dr Palma from the University of Kent.

Publications:

1. Poly-Carboxylated Dextran as a Multivalent Crosslinker: Synthesis and Target Recognition of the Antibody-Nanoparticle Bioconjugates in PBS and Serum
2. Syntheses, X-Ray Crystal Structures, Emission Properties and DFT Calculations of Monoprotonated Polypyridines
3. Study of the triplet excited states and DFT calculations of iridium(III) complexes with mixed ligands
4. Emission property and DFT calculation for the 3MLCT luminescence of Ru(bpy)2(L)2+ complex
5. Transition states of the 3MLCT to 3MC conversion in Ru(bpy)2(phen derivative)2+ complexes

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