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Progress in aligning nanomedicine with precision therapeutic approaches for the treatment of chronic diseases

Precision Medicine is considered by many to be a necessary future for the treatment for all diseases. Fundamentally, this can be divided into two subsections, namely personalized medicine and precision therapeutics. With personalized medicine, the aim is to understand the genetic, immunological and/or metabolic individuality of patients in order to match individual patients with the most appropriate active pharmaceutical ingredients (APIs) for treatment of their particular disease(s). With precision therapeutics, the aim is to take control of the delivery of APIs to disease target tissue, by means of nanomedicine, and/or make use of select APIs that have extreme target specificity. The focus of this lecture is in precision therapeutics, as demonstrated by four worked examples of precision therapeutic approaches (PTAs) that are currently being taken forward in my laboratories and the laboratories of key collaborators for the treatment of chronic diseases. The chronic diseases of interest are chronic pain, epilepsy, cancer, non-alcoholic fatty liver disease (NAFLD) /diabetes type II, and infectious diseases such as influenza, Zika virus and HIV. By way of example, the right-hand side panel outlines a PTA for the treatment of cancer. In effect, a combination of bio-imaging and the application of image-guided targeting enable anti-cancer drug delivery nanoparticles to accumulate in a tumour lesion of choice and no obvious place elsewhere in the body. Accumulated nanoparticles may then release these anti-cancer drugs for local activity against tumour tissue saving other body tissues from unwanted exposure to these otherwise cytotoxic drugs. Implementation of such a PTA in the clinic could radically improve patient chemotherapy outcomes whilst reducing both required drug doses and side effects to an unprecedented degree. Such potential step changes in disease treatment explain why precision therapeutics should be an indispensable part of future medicine.

Recent Publications

1. Miller A D (2016) Nanomedicine therapeutics and diagnostics are the goal. *Ther. Del.* 7(7):431-456.
2. Miller A D (2016) Precision active pharmaceutical ingredients are the goal. *Future Med. Chem.* 8(11):1209-1238.
3. Miller A D (2016) Evolving from academic to academic entrepreneur: overcoming barriers to scientific progress and finance. *Future Med. Chem.* 8(11):1157-1162.
4. Mašek J et al. (2017) Multi-layered nanofibrous mucoadhesive films for buccal and sublingual administration of drug-delivery and vaccination nanoparticles: important step towards effective mucosal vaccines. *J. Control. Rel.* 249:183-195.
5. Brody L P et al. (2017) Cationic lipid-based nanoparticles mediate functional delivery of acetate to tumour cells *in vivo* leading to significant anticancer effects. *Int. J. Nanomedicine.* 12:6677-6685.

Biography

Andrew David Miller is well known as a leading Chemist Expert in the understanding and exploitation of molecular mechanisms in biology. The overall goal of his academic research has been and continues to be the design and creation of advanced therapeutics and diagnostics that address unmet medical need in the treatment of chronic diseases (such as cancer, diabetes, pain and some infectious diseases). From 1990-2010, he was a Member of academic staff in the Chemistry Department of Imperial College London (UK) where he founded the Imperial College Genetic Therapies Centre (GTC) in 1998, and became Full Professor of Organic Chemistry and Chemical Biology in 2002. Since 2010, he has been affiliated with King's College London (UK) and more recently with the Veterinary Research Institute (VRI) in Brno, Czech Republic, where he is the Director of OPVVV Project FIT and its Key Foreign Scientist (KFS). He Co-Founded KP Therapeutics Ltd in 2016 with a pipeline of Precision Therapeutic Approaches (PTAs) in discovery & development for the diagnosis and treatment of chronic diseases. He has currently published nearly 250 papers, book chapters and alike, including at least 26 patents and patent applications. He is also Principal Writer of the first textbook of chemical biology "Essentials of Chemical Biology", John Wiley & Sons.

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