

# Genome technologies, precision medicine and innovative therapies

We all share a common ancestry, and nowhere is this more apparent than in our genomes. Despite our differences, most of the information contained in our genomes is highly similar, if not identical. Yet it is the differences that make each of us unique. It is also these differences that have allowed for the delineation of a relatively new concept in modern medicine, namely that of 'precision medicine'. In contrast to 'personalised medicine', precision medicine aims to identify differences at a population level, thereby guiding the application of genome technologies to populations in a manner that results in improved outcomes. This is true in the three domains of prevention, diagnosis and treatment. The notion of personalised medicine on the other hand refers to the individualisation of care, which describes an ideal in which highly specific individual differences are taken into account. Given the cost, both monetary and in terms of skills required, this granularity is not technologically achievable at present across an entire population, but forms the basis for the manner in which medicine is, as far as is possible, currently practiced.

The notion that 'one-size-fits-all' in the management of human disease is not only incorrect but may in fact be dangerous. Therapies that work in one population at a given dose may not achieve the same result in another population in whom population dynamics may, over time, have resulted in the clustering of genotypic and ultimately phenotypic differences that render a given treatment either inefficacious or even frankly toxic. Likewise, diagnostic tools, configured for a given population, may not detect variants that are more prevalent in another population, thereby resulting in false negatives and therefore missed opportunities for appropriate therapies.

An exciting development in cancer immunotherapy relates to the use of



cells (lymphocytes) that have been genetically engineered *ex vivo* to target and destroy patient-specific tumor cells. Positive outcomes, never before seen with blood cancers such as leukaemia and lymphoma, are now being achieved using these new therapies which have recently been approved for use in the general population, i.e. are no longer part of clinical trials. The basis for these therapies relies on the identification of a unique 'address' for each tumour to which the engineered lymphocytes are directed. Cost and the labour-intensive nature of these procedures preclude them from being applied to the entire population at present, but this situation is likely to improve, particularly as economies of scale come to bear.

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