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Geochemical variables as plausible aetiological cofactors in the incidence of some common environmental diseases in Africa

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Over the last two decades, there has been a rapid growth in research in the field of medical geology around the world, and we continue to encounter "new" and important correlations between certain environmental health conditions and factors related to our interactions with geological materials and processes. A review of the possible role of geochemical factors such as the circulation of Mg, Se and F and the physico-chemical composition of volcanic soil particles, on the aetiology of some common diseases in Africa, is presented. Such studies till now, have tended to emphasise only the deleterious health impacts due to geoenvironmental factors. This is justifiable, since a proper understanding of the negative health impacts has contributed significantly towards improvement in diagnosis and therapy. But there are also beneficial effects accrued from judiciously exploiting geological materials and processes, exemplified in this paper, by the several important medical applications of African clays, the therapeutic gains associated with hot springs, and balneology of peat deposits. The criticality of the "optimal range" of intake for the nutrient elements Mg, Se and F in metabolic processes is also emphasised, and illustrations given of illnesses such as cardiovascular disorders and various cancers (all major causes of mortality in Africa) that can possibly occur on either side of this range. It is hoped that this review would help generate ideas for the formulation of experimental studies that take into account the role of the geochemical environment, in an attempt to establish precisely the obscure aetiology of some of the diseases treated, and uncover new pathways in their pathogenesis.

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Mutant tRNA – A novel alternative approach for enhanced inhibition of HIV-1 replication

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Host derived cellular $tRNA^{Lys3}$ plays an essential role in the HIV-1 replication as a primer to initiate the synthesis of viral cDNA during reverse transcription. As a consequence, this tRNA primer has constituted as an attractive potential target for anti-HIV-1 *int*ervention. Previous *in vitro* experiments demonstrated that the 1st generation of mutant $tRNA^{Lys3}$ with limited substitution of nucleotides in the 3' terminus led to aberrant reverse transcription from designed TAR site and detectable inhibition of HIV-1 replication. However, the mutant $tRNA^{Lys3}$ could also direct the reverse transcription at the normal primer-binding site (PBS) with potentially weakened inhibition of HIV-1 infection. To achieve more patent inhibition of HIV-1 replication, a series of 2nd generation of mutant $tRNA^{Lys3}$ were constructed with extended lengths of nucleotide substitutions or by targeting different viral genome sites. Following stable transduction and expression of newly constructed mutant $tRNA^{Lys3}$ in human T-cells, a positive correlation was determined between the length of mutation in the 3' PBS-binding region of $tRNA^{Lys3}$ and the specificity of HIV-1 reverse transcription initiation from the target site and associated inhibitory effect on HIV-1 replication. Moreover, *in vitro* expression of two mutant $tRNA^{Lys3}$ targeting the *Int*-encoding region and Env gene, respectively, both showed a high anti-HIV-1 activity, suggesting that not only the TAR, but other distant sites downstream of the PBS could be effectively targeted by mutant $tRNA^{Lys3}$. In addition, this *in vitro* test demonstrated that increased production of mutant $tRNA^{Lys3}$ through transducing the T-cells with multiple-copy of mutant $tRNA^{Lys3}$ expression cassettes further enhanced the potency of mutant tRNA-mediated anti-HIV-1 activity. These new findings lay ground for more in-depth studies at both *in vitro* and *in vivo* settings in future and support the *int*ervention of the HIV-1 genome conversion through mutant $tRNA^{Lys3}$ as an effective alternative approach to the current anti-HIV-1 regimens.

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