Reading and Writing Genomes.

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Nucleic acid synthesis and sequencing technologies are intimately connected. In the past 4-5 years our team has helped develop 'second-generation' sequencing by a radical shift from electrophoresis to a system of multiplex fluidic cycles and imaging [1] bringing costs down by 10,000 fold to 25 Mbp/$. We have also developed an analogous second generation approach to synthesis of genes from oligonucleotides on chips [2] such that DNA can be made for 30 Kbp/$ (and much less if one counts combinatorial strategies). Finally we have integrated these with a third class of technology to program cells and viruses and greatly accelerate and monitor their lab evolution [3] -- Multiplexed Automated Genome Engineering (MAGE). We are constructing a (4.7 Mbp) bacterial genome with a new translational code that should result in resistance to multiple viruses (or all viruses). We have a related project to construct a mirror-image cell based on *E.coli* in vitro protein synthesis (a replicating 110 kbp genome [4]) resistant to most existing enzymes, drugs, predators. We have championed methods for safety and surveillance in synthetic biology.

References (see also http://arep.med.harvard.edu/

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