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CRISPR in Parasitology

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EDITORIAL

Parasitic diseases including leishmaniasis, malaria, and trypanosomiasis continue to pose a significant threat to human health around the world. While the genomes of Leishmania, Plasmodium, Trypanosoma, and Anopheles were sequenced over a decade ago, genome-editing techniques have hindered the research of gene function. As a result, the initial research in eukaryotes employing CRISPR/Cas9 gene editing opened up fascinating new prospects in parasitology. The Cas9 endonuclease is used to produce a Double-Strand Break (DSB) at a site of interest in the genome in this basic but effective genome editing. Cas9 achieves specificity by attaching to a single guide RNA (sgRNA), which must contain 20 nucleotides complementary to a sequence surrounding a proto-spacer-adjacent motif in the genome (PAM). Depending on the organism, the DSB break is repaired utilising Homology-Directed Repair (HDR) with a repair template or the more error-prone Microhomology-Mediated End Joining (MMEJ) or Nonhomologous End Joining (NHEJ) pathways. CRISPR/Cas9 allows for DNA deletion, insertion, or mutation with minimal genetic scarring.

While this analysis concentrates on Plasmodium, Leishmania, Trypanosoma, and Anopheles, CRISPR/Cas9 technology has been successfully adapted to many additional parasite systems, including Toxoplasma, Cryptosporidium, Strongyloides, and Trichomonas vaginalis. The parasitology community is swiftly identifying ways that work well, tactics that may be improved, and ongoing issues that can only be overcome by sharing experiences and developing new approaches as CRISPR/Cas9-based technology advances. We present here a sample of material on the trial-and-error development of CRISPR/Cas9 in molecular parasitology, in the hopes that it may be useful to future users of this technology.

In the discipline of parasitology, CRISPR/Cas9 technology is quickly evolving, allowing for unparalleled efficiency in dissecting molecular processes. Communication and collaboration throughout the field are required for the optimization and deployment of a new technology like CRISPR, especially in non-model organisms. Scientists investigating Leishmania, Plasmodium, Trypanosoma, and Anopheles recently met at the Institute Pasteur Paris for a symposium on CRISPR in Parasitology. We will cover technological advancements and obstacles in employing CRISPR/Cas9 in parasite and vector systems. As CRISPR/Cas9 is applied to a wide range of parasitic systems, the community should now concentrate on improving and standardising the technology, as well as expanding the CRISPR toolkit to include Cas9 alternatives/derivatives for more sophisticated applications such as genome-wide functional screens.