Email Submission: Timothy Paul Ross Croxson BMedSci (Pharm)

To The Office of the Gene Technology Regulator,

I work with Gene Technology and I consider myself a stakeholder in the GT Regulations update as I work with Site Directed Nuclease (SDN) technology and oligo-directed mutagenesis, the targets of this review. I would like to support option one, to not amend the GT regulation.

The benefit of option one is that it avoids further complicating Sections 1 and 1 A) of the Gene Technology Act 2001, which I believe are sufficient definitions of Genetically Modified Organisms. This, in addition to the Prohibition of Human Cloning Act 2002, which also prohibits the introduction of heritable genes to humans, form firm boundaries between which responsible science takes place.

I believe that SDN technology is sufficiently similar to the already exempt process of Transposon Mutagenesis that it would be difficult to distinguish final organisms produced by either process, this makes regulation impossible. A report to the Journal of Science and Engineering Ethics comments "While a precautionary principle should be applied at all stages of genome engineering research, the stigma of germline editing, synthesis of new life forms and unrealistic presentation of current technologies should not arrest the transition of new therapeutic, diagnostic or preventive tools.[As such a] right to try new technology is assured" (R. Heidari, 2016)

The majority use of Crispr/Cas9 and Crispr/Cfp1 is to reliably insert Selectable markers in a highly specific manner (Warmflash, 2016). This is currently allowable under Section 1 A) as selectable markers generated by transposon mutagenesis are allowed. The potential for oligo-directed mutagenesis to be performed using the same tools is currently regulated as the resultant organism contains genetically modified material, which is prohibited under section 1 A).

Options 2-4 would increase the regulatory burden on my work. Option 2 would mean that the application of Restriction Enzymes to cell culture would require regulatory approval for every instance. Currently the use of Restriction Enzymes is only reportable as a method to create GMO's The use of Restriction enzymes is a very safe practice and produces most significantly by introducing a grey area between SDN-2 and SDN-3.

In my work I currently utilise item 1 of Schedule 1 to allow the knockout of genes or the removal of small parts of genetic code using Restriction Enzymes and Cell Ligase. This can be indistinguishable from Electromagnetic Mutagenesis (Warmflash, CRISPR-Cas9 is hot but it's not the only way to edit a genome, 2016) in final product but is a targeted, precise method. This means the process is more efficient requiring less time, money and luck to generate a desired deletion mutation. In addition, evolving SDN technologies offer even more specificity. The specificity of these technologies in their use to delete sections of DNA also means they are less likely to produce unintended mutations by their action. If this item were removed it would lead to confusion over whether organisms with removed genetic code are GMO's. In my

opinion item 1 should be expanded to specifically allow Selectable markers. This keeps the focus on the created product rather than banning techniques.

Contained laboratory research on GM drive organisms does not pose and different risks from other contained research with GMO's .

My proposal for any amendments to GT regulations is that is continues the OGTR's focus on product organism and heritable properties rather than the technologies or methods used to generate them.

Yours Sincerely,

Timothy Paul Ross Croxson BMedSci (Pharm)

Works Cited

R. Heidari, D. S. (2016). CRISPR and the Rebirth of Synthetic Biology. Journal of Science and Engineering Ethics, 1-13.

Warmflash, D. (2016). CRISPR-Cas9 is hot but it's not the only way to edit a genome. Genetic Literacy Project, 20-23.

Warmflash, D. (2016). DIY CRISPR-Cas9: Should we fear or embrace programmable gene editing kits for the home? Genetic Literacy Project, 50-62.