

What is Responsible Research and Innovation?

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Highly efficient Cas9-mediated gene drive for population modification of the malaria vector mosquito *Anopheles stephensi*

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Significance

Malaria continues to impose enormous health and economic burdens on the developing world. Novel technologies proposed to reduce the impact of the disease include the introgression of parasite-resistance genes into mosquito populations, thereby modifying the ability of the vector to transmit the pathogens. Such genes have been developed for the human malaria parasite *Plasmodium falciparum*. Here we provide evidence for a highly efficient gene-drive system that can spread these anti-malarial genes into a target vector population. This system exploits the nuclease activity and target-site specificity of the Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) system, which, when restricted to the germ line, copies a genetic element from one chromosome to its homolog with $\geq 98\%$ efficiency while maintaining the transcriptional activity of the genes being introgressed.

BBC Radio 4 “Today” programme – November 24, 2015



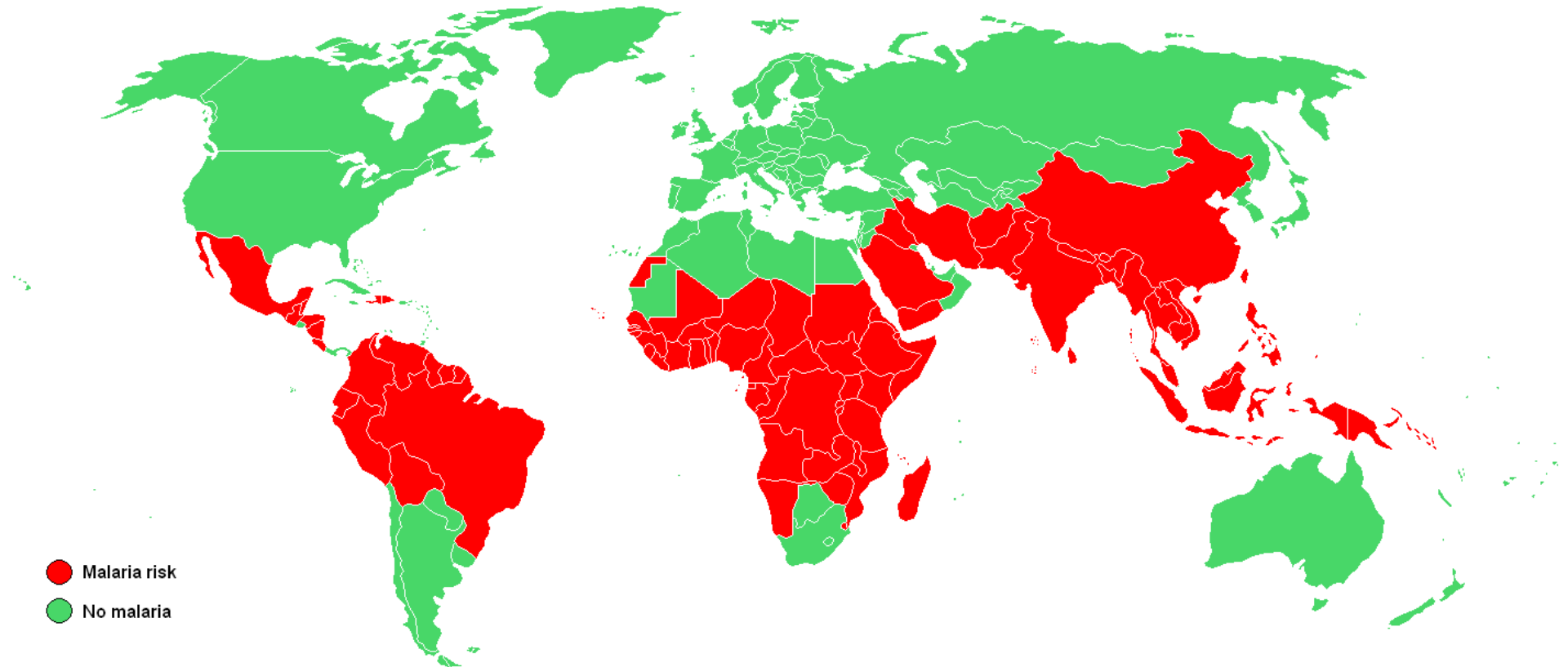
Look at the issues raised here

European Union Grand Challenges



Health, demographic change and wellbeing
Climate action, environment, resource efficiency and raw materials

European Union Agenda “keys”



“Mosquitoes no respecters of borders”

Governance

Law of unintended consequences



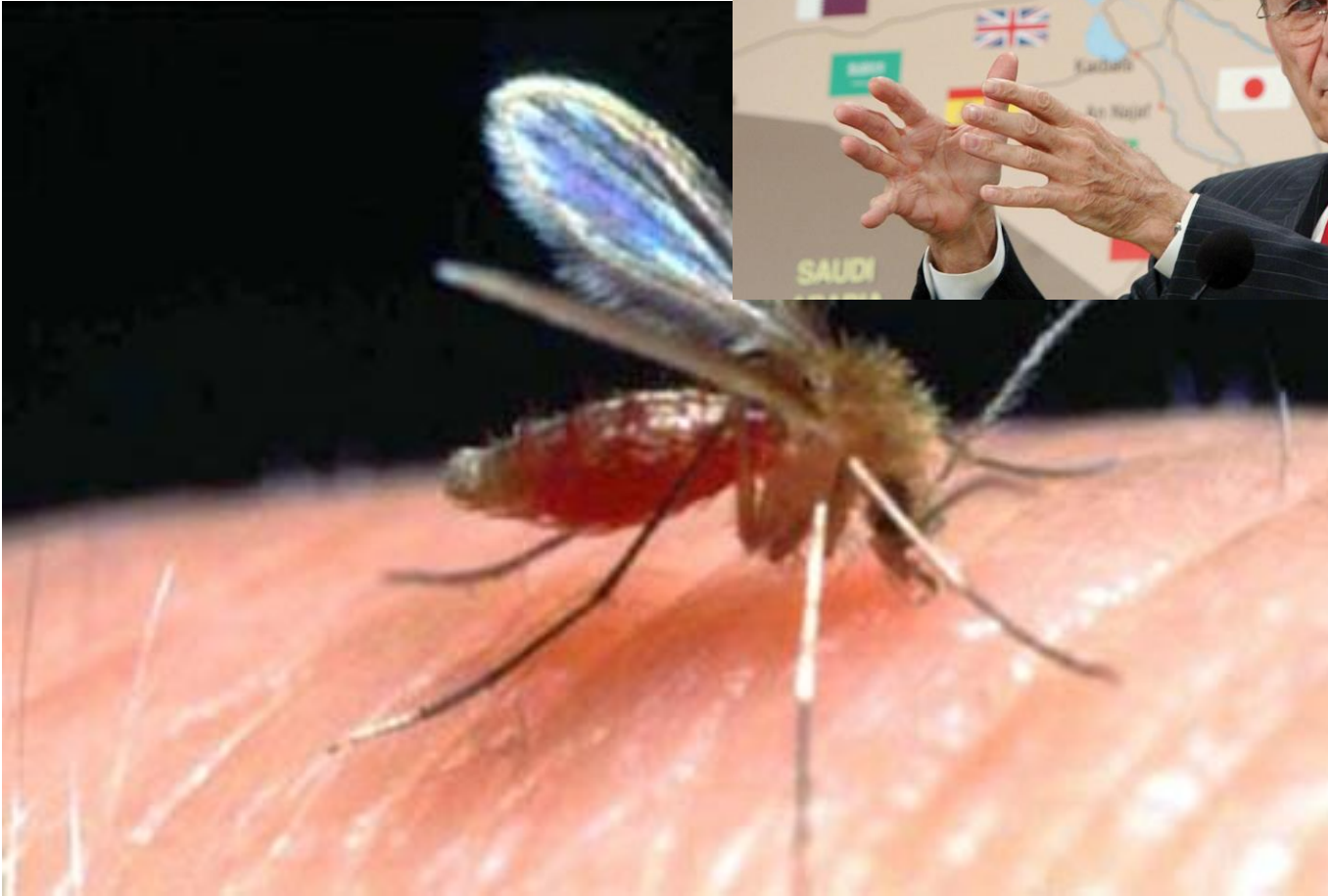
Mosquito - malaria

Law of unintended consequences



Sand fly - leishmaniasis

RRI Process Requirements



Anticipation and Reflection

Looks like “textbook” how to communicate science in a straightforward and factual way but it raises:

EU Grand Challenges as Outcomes

EU Agenda “keys”

EU “process requirements”



Public engagement →



What is it that RRI is hoping to achieve?

<i>Learning outcomes</i>	<i>R&I outcomes</i>	<i>Societal impacts</i>
<ul style="list-style-type: none">• Engaged Publics• Responsible actors• Responsible institutions	<ul style="list-style-type: none">• Ethically acceptable• Environmentally sustainable• Socially desirable innovations	<p>Contribute to solving societal challenges</p> <p>e.g. 7 Grand Challenges (EU)</p>

How is RRI hoping to achieve this?

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**DIVERSITY &
INCLUSION**

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**ANTICIPATION
& REFLECTION**

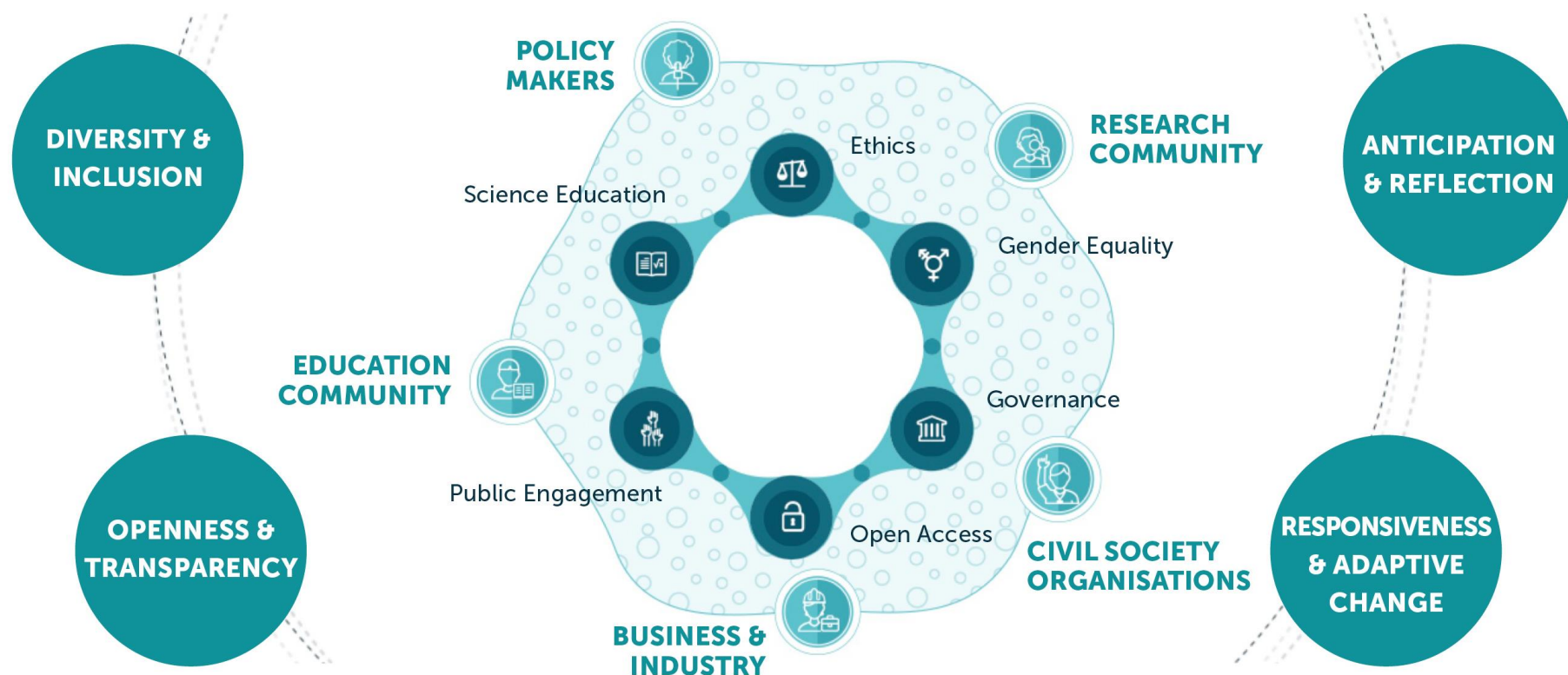
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**OPENNESS &
TRANSPARENCY**

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**RESPONSIVENESS
& ADAPTIVE
CHANGE**

With whom and why?



The RRI Tools logo is on the left side of the header. It consists of a dark blue circle with a light blue ring around its top-left portion. Inside the dark blue circle, the letters 'RRI' are written in a bold, white, sans-serif font.

RRI Tools has assembled:

- **Definition of RRI, Project Brief, Catalogue of Promising Practices**
- **Explanations of the opportunities flowing from RRI, and what's needed to overcome obstacles**
- **A toolkit of existing “RRI Tools” and our own “showcases”**
- **An RRI training programme for all and individual stakeholders**
- **An advocacy and dissemination programme**
- **A one-stop website – www.rri-tools.eu**