***eLife’s* transparent reporting form**

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**Sample-size estimation**

* You should state whether an appropriate sample size was computed when the study was being designed
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* If no explicit power analysis was used, you should describe how you decided what sample (replicate) size (number) to use

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This information is reported in the main text methods section and in the appendix 3.

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* Statistical analysis methods should be described and justified
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Nonparametric statistical testing is used across the whole paper; please see main text methods and appendix 3 and 6. Comparisons against random null models are performed in the analysis, cf. Figures 3 and 4 and Section “Immunisation strategies” in the main text.

(For large datasets, or papers with a very large number of statistical tests, you may upload a single table file with tests, Ns, etc., with reference to sections in the manuscript.)

**Group allocation**

* Indicate how samples were allocated into experimental groups (in the case of clinical studies, please specify allocation to treatment method); if randomization was used, please also state if restricted randomization was applied
* Indicate if masking was used during group allocation, data collection and/or data analysis

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Allocation of animal species in different immunization strategies is described in Section “Immunisation strategies” in the main text and appendix 6.

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* We encourage you to upload relevant additional data files, such as numerical data that are represented as a graph in a figure, or as a summary table
* Where provided, these should be in the most useful format, and they can be uploaded as “Source data” files linked to a main figure or table
* Include model definition files including the full list of parameters used
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Model definition files are reported in the appendix 1, cf. Table 1-4. The definition of model parameters is reported in appendix 3.