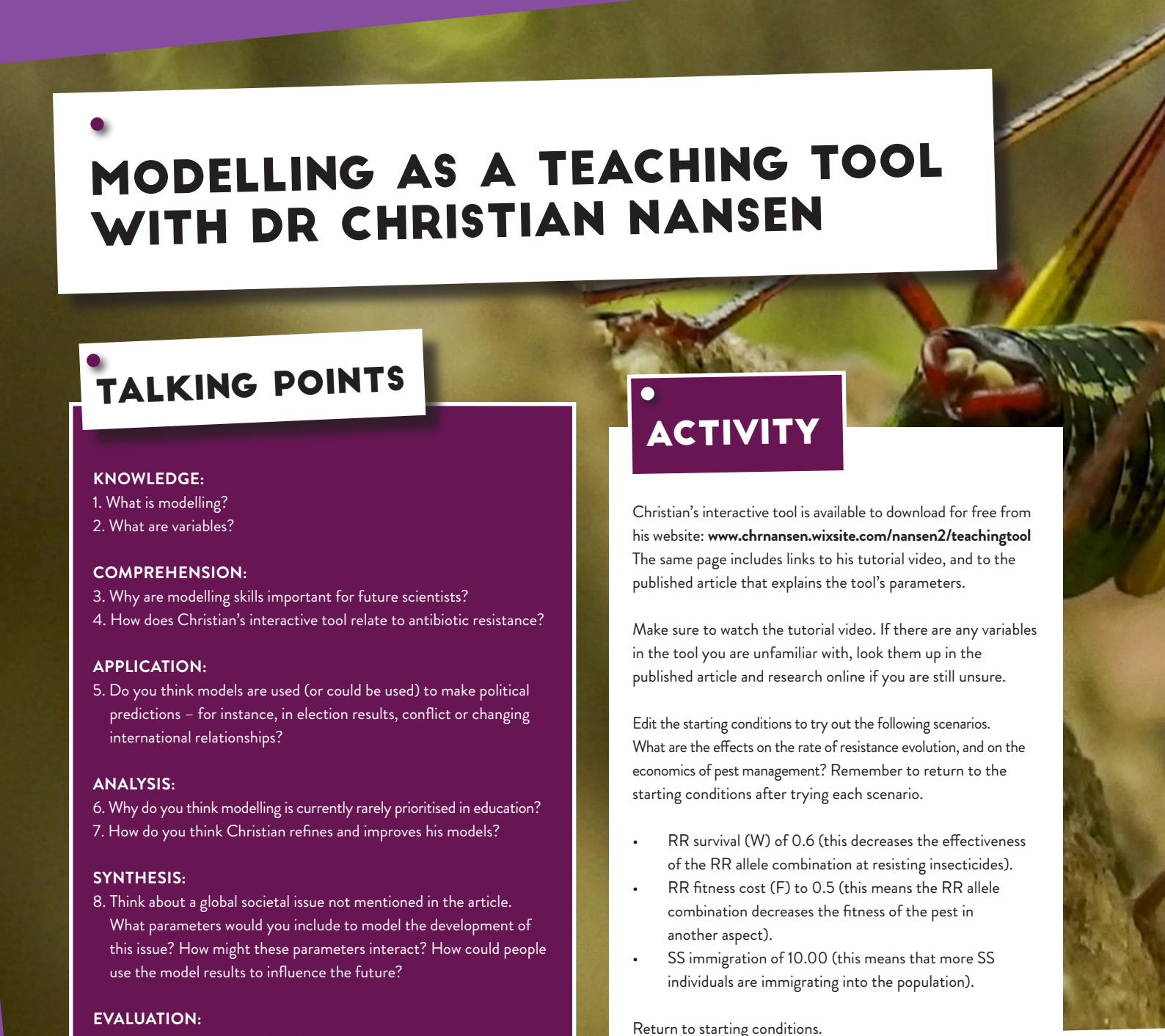
MODELLING AS A TEACHING TOOL WITH DR CHRISTIAN NANSEN



TALKING POINTS

KNOWLEDGE:

1. What is modelling?
2. What are variables?

COMPREHENSION:

3. Why are modelling skills important for future scientists?
4. How does Christian's interactive tool relate to antibiotic resistance?

APPLICATION:

5. Do you think models are used (or could be used) to make political predictions – for instance, in election results, conflict or changing international relationships?

ANALYSIS:

6. Why do you think modelling is currently rarely prioritised in education?
7. How do you think Christian refines and improves his models?

SYNTHESIS:

8. Think about a global societal issue not mentioned in the article. What parameters would you include to model the development of this issue? How might these parameters interact? How could people use the model results to influence the future?

EVALUATION:

9. If models can 'predict' the future, why do you think global developments (e.g., climate-induced wildfire prevalence) still come as a surprise, including for scientists?

MORE RESOURCES

- BBC Bitesize gives a basic introduction to how spreadsheets can be used for modelling and provides some tasks to try: www.bbc.co.uk/bitesize/guides/znjmn39/revision/1
- This video from TED-Ed explains the issue of antibiotic resistance and potential solutions. How might the variables it mentions be parameterised? **www.youtube.com/watch?v=ZvhFeGEDFC8**
- This article from New Zealand's Science Learning Hub explains more about modelling and why scientists, and society, use them: **www.sciencelearn.org.nz/resources/575-scientific-modelling**

ACTIVITY

Christian's interactive tool is available to download for free from his website: **www.chrnansen.wixsite.com/nansen2/teachingtool** The same page includes links to his tutorial video, and to the published article that explains the tool's parameters.

Make sure to watch the tutorial video. If there are any variables in the tool you are unfamiliar with, look them up in the published article and research online if you are still unsure.

Edit the starting conditions to try out the following scenarios. What are the effects on the rate of resistance evolution, and on the economics of pest management? Remember to return to the starting conditions after trying each scenario.

- RR survival (W) of 0.6 (this decreases the effectiveness of the RR allele combination at resisting insecticides).
- RR fitness cost (F) to 0.5 (this means the RR allele combination decreases the fitness of the pest in another aspect).
- SS immigration of 10.00 (this means that more SS individuals are immigrating into the population).

Return to starting conditions.

EIL stands for Economic Injury Level. It describes the minimum number of pests to which insecticides are applied. An EIL of 0 means that insecticides are applied regardless of how many pests are present.

- What happens to profitability over time if you adjust the EIL to, for example, 40 or 400?
- Under starting conditions, what appears to be the most efficient EIL for profitability?
- By modifying the population variables (in green), can you find any population traits where a higher EIL is more profitable?

Once you have completed these tasks, feel free to experiment more broadly to find out the effects of modifying variables or combinations of variables.

Christian encourages you to get in touch via his website to share your findings and ask any questions you might have. He may also be able to provide you with real-world values to input into the table.