

Impact case study (REF3)

Institution: University of Southampton		
Unit of Assessment: 05 Biological Sciences		
Title of case study: 05-09 A systems approach to strengthening food security policy and protecting public health through the role of Chief Scientific Adviser		
Period when the underpinning research was undertaken: 2002 – 2019		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Guy Poppy	Professor of Ecology	February 2001 – present
Period when the claimed impact occurred: August 2014 – July 2020		
Is this case study continued from a case study submitted in 2014? N		

1. Summary of the impact

Research by Professor Guy Poppy into risk analysis and communication, coupled with a systems approach to food security, prioritising human and environmental health, led to his appointment as Chief Scientific Adviser (CSA) for the Food Standards Agency (FSA). Applying his research expertise to this role, Poppy has strengthened the UK Government's evidence-based policymaking around food safety by enhancing the FSA's scientific advisory functions and horizon-scanning capabilities, with impact overseas. His research has: shaped the UK's EU exit food policy response; addressed the challenge of antimicrobial resistance by playing a key role in reducing the food industry's use of antibiotics by more than half and contributing to a review commissioned by the Prime Minister; influenced policy debate on food hygiene legislation; and guided recommendations by the FSA to toughen allergen labelling laws, later implemented by the UK Government. Poppy has also led the communication of risks associated with various food safety concerns to the UK population including the insecticide fipronil and COVID-19.

2. Underpinning research

Poppy was an early advocate of a systems approach to food security; his research has explored ways to increase food security in a climate-resilient way, while protecting human health and conserving biodiversity.

Poppy's early 2000s research focused on the analysis of the environmental and health risks of GM crops, and how these risks are communicated. Applying a whole system approach, Poppy argued that researchers had focused too narrowly on assessing the *frequency* of gene flow from GM crops to wild species at a *localised* level. He called on multi-disciplinary research teams to unite and scale up their studies in order to quantify risk more accurately [3.1]. A further paper identified two central misunderstandings around the role of scientists and that of society in regulatory decision making, which were inhibiting effective regulation of GM crops. First, scientific risk assessment needed to test well-defined hypotheses, not simply collect data. Second, risk assessments should be placed in the broader context of risk analysis to enable the consideration of wider 'non-scientific' questions in regulatory decision making [3.2]. Consistent with the emerging 'One Health' approach, Poppy showed trade-offs between crop protection and AMR with an important role for insecticide as a driver, rather than antibiotic. Framing AMR as an evolutionary biology problem, Poppy illustrated how resistance can be rapidly selected but take much longer for the genes to disappear when selection pressure is removed [3.3].

This interrelated body of research was key to Poppy's 2014 appointment as the Government's first CSA for the FSA, a role created to ensure the FSA understood how policy changes might impact on elements of the wider food system. Poppy's research continued alongside this role and aligned with the challenges that the FSA was seeking to address. Collaborating with academic and government researchers, including those from the European Food Safety Authority (EFSA) and the UN's Food and Agriculture Organisation (FAO), Poppy underlined the need to overcome both cultural and methodological challenges in order to incorporate an understanding of human behaviour to managing emerging food security risks. This required a shift away from a narrow view of specific hazards to the adoption of a wider systems approach that considers a broad spectrum of potential risk outcomes, and a greater focus on new methodologies to exploit growing amounts of data [3.4]. This directly informed the FSA's approach to horizon scanning in predicting pathogen emergence in animals or plants that may constitute a public health threat. Poppy called for human health to be placed at the centre of a redesigned food system, which in turn would safeguard the health of the planet [3.5]. Poppy also analysed the meat trade flows to and from the

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UK and found that the US, New Zealand, Canada and Australia had the capacity to meet the UK's demand for meat in the event that imports from the EU were disrupted as a result of Brexit [3.6]. Poppy's method of analysing datasets offers excellent evaluation of emergent patterns in global food trade, shaping appropriate regulatory and policy responses.

To devise and enforce effective food safety policies, Poppy worked with colleagues at the FSA to explore the relationship between: compliance with food hygiene law as reflected in FSA's Food Hygiene Rating Scheme (FHRS) scores; microbiological contamination in food samples taken from food businesses in England, NI and Wales; and outbreaks of foodborne illness [3.7]. This study confirmed that low hygiene ratings were associated with higher microbiological contamination and high hygiene ratings were associated with lower contamination.

3. References to the research

3.1 Geneflow from GM plants—towards a more quantitative risk assessment (2004) GM

Poppy. Trends in biotechnology 22 (9), 436-438 <https://doi.org/10.1016/j.tibtech.2004.07.005>

3.2 How does scientific risk assessment of GM crops fit within the wider risk analysis? (2007) KL

Johnson, AF Raybould, MD Hudson, GM Poppy. Trends in plant science 12 (1), 1-5

<https://doi.org/10.1016/j.tplants.2006.11.004>

3.3 Fitness trade-off in peach-potato aphids (*Myzus persicae*) between insecticide resistance and vulnerability to parasitoid attack at several spatial scales (2011) SP Foster, I Denholm, GM Poppy, R Thompson, W Powell Bulletin of entomological research 101 (6), 659-666

<https://doi.org/10.1017/S0007485310000623>

3.4 Drivers for emerging issues in animal and plant health (2016) J Richardson, C Lockhart, S Pongolini, WB Karesh, M Baylis, T Goldberg, ... GM Poppy. EFSA Journal 14, e00512

<https://doi.org/10.2903/j.efsa.2016.s0512>

3.5 Rethinking the food system for human health in the Anthropocene (2019). Poppy, G.M. and Baverstock, J. Current Biology, 29(19), R972-R977. <https://doi.org/10.1016/j.cub.2019.07.050>

3.6 Meeting the demand for meat – Analysing meat flows to and from the UK pre and post Brexit.

GM Poppy, J Baverstock, and J Baverstock-Poppy (2019). Trends in Food Science and

Technology 86, 569-578. <https://doi.org/10.1016/j.tifs.2019.01.010>

3.7 As clean as they look? Food hygiene inspection scores, microbiological contamination, and foodborne illness (2019) J Fleetwood, S Rahman, D Holland, D Millson, L Thomson, G Poppy

Food Control 96, 76-86 <https://doi.org/10.1016/j.foodcont.2018.08.034>

4. Details of the impact

Appointment as Chief Scientific Advisor to the Food Standards Agency

Poppy's research into the assessment and communication of risk, and a systems approach to food security, was fundamental to the FSA's decision to appoint him as the first CSA in August 2014. Catherine Brown [5.1], FSA Chief Executive (2012 to 2017), cited the importance of Guy's risk assessment and food security research [3.2]. She was "*particularly attracted by the international focus of his research, evidenced through many international collaborations and publications, because we were moving the FSA to recognise the global nature of the food system and away from a more parochial UK/European focus historically... His focus and body of work on food systems wider than the traditional microbiological focus of the FSA's science leadership was very important in enabling us to embrace new aspects of science – particularly data science and social science.*"

Poppy has contributed to the work of other CSAs across government with "*his research-led expertise taken from a published body of work on risks in challenging areas such as GM crops and food safety,*" confirms the CSA for the UK Government as a whole, Sir Patrick Vallance [5.2]. He said: "*These have been exemplars for environmental and public health risks which many of the CSAs need to oversee in their departments.*" Throughout six years in post, Poppy played a significant role in reshaping the process of science-based policymaking across government, achieved substantial progress in addressing specific public health challenges, influenced high-level policy and legislative debates, and increased public understanding of food-related health risks.

Embedding a systems approach to food security within UK Government policymaking

Poppy's systems approach made significant contributions to restructuring the scientific advisory functions of the FSA. According to FSA Director of Science Steve Wearne [5.3], a "*key influence of Guy's research-led expertise was in the focus and methodology for the triennial review of FSA's scientific advisory committees in 2016.*" Poppy's recommendations led to the creation of

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the FSA Science Council (SC), an independent expert committee designed by Poppy to provide strategic insight and advice on the FSA's use of science. The SC has since provided guidance on key principles of risk analysis, which were agreed by the FSA Board following input from Poppy, based on his risk research. The new SC has *"fundamentally changed the FSA's capabilities"*, says Wearne, giving the FSA access to a broader range of interests and expertise. Chair of the FSA board Heather Hancock [5.4] said: *"I have seen a much more targeted and focussed approach of the SC, which has made a real difference to the FSA."*

Poppy reshaped the FSA's scientific advisory committees' objectives, resulting in some being disbanded and new committees being formed. Hancock said: *"Guy influenced the outcome by repositioning the committees to be more appropriately designated forums, which provide agility by allowing flex in the membership for new food risks that arise."* [5.4] The impact goes beyond the FSA: Chief Medical Officer Prof Dame Sally Davies [5.5] describes the new advisory structure led by Poppy as *"much more structured and effective"* which *"has made a big impact (on) our evidence-based work and is absolutely essential in ensuring high-quality evidence flows"*. She said: *"Guy has ... broadened the field of the committee, which has made a vast difference. Specifically, FSA submissions are more science and evidence based than they were before e.g. the written submissions to me and ministers."* The committee restructure allowed Poppy to recruit more multidisciplinary academics, reflecting the ethos of the whole system approach. Poppy had a central role in the FSA's recruitment campaign. Videos featuring Poppy received 14,120 views via platforms like LinkedIn, leading to 86 high-quality applications for 40 roles. This resulted in the recruitment of 40 new experts covering risk, AMR and regulatory approaches to emerging new food security challenges post EU exit. Wearne said: *"Through this refocussing ... the FSA is now as prepared as it can be – whatever the nature and timing of the UK's exit from the EU. Guy's research on GM helped to get a handle on the future capacity and capability within the FSA both internally with staff and also in terms of the external advisory support."* This fed into the FSA's successful bid to the Treasury for additional funding of £30m over three years, he added. [5.3]

Poppy's research around GM crops, risk analysis and dynamic systems approach to food security has shaped the FSA's new horizon-scanning capabilities. Hancock and Wearne confirm that Poppy's research [3.4, 3.5] has helped steer an 18-month SC programme, culminating in the 2019 RAND Europe report of a new strategic surveillance system. Its conclusions, including the more effective use of data and novel risk assessment methodologies, *"will determine the future approach to horizon scanning and the methodologies used"*, according to Wearne [5.3]. FSA Chief Executive Jason Feeney [5.6] said: *"Guy's work on horizon scanning has contributed to a process of prioritisation of research whether it be through commissioning in house or through data mining."* This has reduced the FSA's science spend by GBP3,000,000 to GBP4,000,000 per year, he said.

Poppy's *"work on food systems [3.5] and horizon scanning [3.4] was pivotal for the FSA in designing and delivering the work on 'Our Food Future'"*, Wearne said. This report (February 2016), explored public concerns on an increasingly complex global food system. Wearne states that Poppy's research provided *"a sense that it was reasonable for FSA to connect personal health with food security... his accomplishment in interdisciplinary research was influential in stitching together a coherence in what was, until then, a disparate evidence-base"* and *"led to range of publications and materials that are widely regarded and quoted in the field and which, even three years on, will provide foundational material for Henry Dimbleby's major review of the food system for Defra."* [5.3] Vallance confirms that Poppy's horizon-scanning work *"contributed to the cultivation and creation of policy for UK science, ...helping shape and drive a new £50 million strategic priorities programme on UK food systems informed by his research"* [5.2]. This programme, launched in October 2019, appointed Poppy as Programme Director. Poppy is a member of the cross-government group of CSAs, chaired by Vallance. According to Prof Sir Ian Boyd [5.7], CSA for Defra, Poppy has increased the government's capabilities in behavioural sciences research, which has helped develop cross-department linkages. This, says Wearne, has given the FSA *"disproportionate influence"* relative to its size by improving communication of FSA science to select committees [5.3].

Shaping the UK food policy response to exiting the European Union

The FSA will ensure that EU-level activities are repatriated to the UK. Vallance said: *"Guy has influenced the development of resilience planning informed by his research on the global food system"*, noting his analysis of post-Brexit meat supplies in [3.6], *"with the US offering the potential to become a main exporter to the UK, which brings issues relating to UK food standards and safety*

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such as chlorine-washed chicken and hormone-treated beef. This expertise has been particularly impactful in Operation Yellowhammer planning and in emergency planning exercises.” [5.2] According to Hancock, *“the FSA has needed to completely redesign a risk analysis system that the UK can rely on outside of the EU”* and Poppy’s contribution *“has enabled the FSA to build a system that will be resilient and robust”*. She said: *“Guy’s ability to anticipate where and when the challenges will arise, and then utilise his work in this area to assess the science and evidence, and therefore build a regime which accepts challenge (but does not bow under the weight of it), is critical.” [5.4]*

According to Boyd, Poppy has played an active role in developing the UK’s new Advisory Forum on Food and Feed to replace risk assessment by the EFSA [5.7]. As Feeney puts it, *“end-to-end risk analysis within the FSA had to almost be designed from scratch”*. He said [5.6]: *“This work has placed the FSA, in terms of international best practice for risk management, in the top 2 or 3 countries in the world with all Guy’s work around risk analysis absolutely at the centre of this process [3.2].”* Poppy’s research on data standards on meat flows [3.6] informed wider considerations around imports and exports, says Wearne, and has *“aroused significant interest from other national food regulatory bodies, notably in the US (FDA), Canada (CFIA) and provides the basis for significant future international collaborations, leveraging interest and investment on a global scale.” [5.3]* Feeney confirms that these novel approaches to risk were presented to the Codex (WHO and FAO) international food standards committee and that feedback from Codex said the FSA *“is setting new benchmarks in terms of transparency and openness.” [5.6]*

Reducing food industry use of antibiotics in order to address AMR

Poppy’s research on AMR has made a significant contribution to reducing the food industry’s use of antibiotics in animals. His CSA Science Report on AMR in 2016 [5.8] provided the first evidence of AMR levels in campylobacter in broiler chickens. Poppy then played an instrumental role in bridging disagreements between the medical and agri/vet sectors. As Davies, UK Special Envoy on AMR, explains: *“Guy has worked and published on evolutionary selection and trade-offs in resistance and has used his research expertise to nudge industry to accept the need to act. I have seen that Guy has persuaded the FSA to undertake more surveillance of AMR. He has driven the FSA to have fruitful discussions with industry on a different level to what had been achieved prior to his appointment.”* She said that Poppy’s framing of AMR as an evolutionary biology problem *“was important in convincing the FSA and industry to undertake long-term surveillance.”* She used Poppy’s CSA Science report in her presentation to the UN Global Summit on AMR in 2016 at which global leaders, for the first time, committed to taking a *“broad coordinated approach to address the root causes of AMR across multiple sectors”*. [5.5]

Poppy was acknowledged as a key contributor to Prof Lord Jim O’Neill’s Review on AMR, commissioned by the Prime Minister in 2014 and published in 2016. Hancock said: *“Without Guy’s intervention and the meetings that he had with Professor Lord Jim O’Neill, the role of food in either transmission or building resistance would have almost completely been overlooked. The use of a ‘one health’ approach, driven by Guy, has made a material difference. Without this work being included in the O’Neill report, the FSA would not have achieved the significant impact it has had on antibiotic use in the primary production sector.” [5.4]* This impact was demonstrated in the 2019 Veterinary Antibiotic Resistance Sales and Surveillance report [5.9], which showed that sales of antibiotics for use in food-producing animals fell by 53 per cent from 2014 to 2018. Sales of ‘Highest Priority Critically Important Antimicrobials’ were down 68 per cent. Fresh meat product sales also increased with sale values of GBP2.7bn for fresh poultry and GBP1.7bn for fresh beef. This increase in trade reflects the use reduced antibiotics.

Influencing government policy debate around legal requirement for food hygiene ratings

Campylobacter, the leading cause of food poisoning in the UK, costs the economy GBP1bn a year. The need to reduce foodborne illness led to the introduction of the FHS in 2012, designed to help consumers choose where to eat out, or shop for food, by providing clear information about business hygiene standards. In Wales and NI FHS sticker display is mandatory by law but voluntary in England. Poppy’s CSA Science Report, December 2017, explored the scheme’s impact and resulted in a 2019 paper [3.7] that demonstrated its efficacy. Hancock said the research provided the FSA *“with the evidence-base for pushing forward with the final hurdle for persuading the Government to legislate FHS mandatory display in England.” [5.4]* Feeney added: *“This will shift the balance from protecting 4-5 million people (in the devolved nations) to protecting 65 million nationally and will create practical ways of making a difference. The model developed in the paper*

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offers estimates of savings to the Health Economy, which will be used in the case for mandation.” [5.6]

Improving public understanding of food safety and risk through communication of science

Poppy has participated in Scientific Advisory Group for Emergencies (SAGE) exercises, assessing food safety risks and communicating those risks to the UK public including the 2020 COVID-19 SAGE (food and packaging). Vallance said: *“His leadership and expertise in this difficult area is enhanced by his published work on risk assessment and how to manage and communicate complex risk decisions.”* [5.2] In August 2017 millions of eggs were pulled from supermarkets across Europe after the discovery that some had been contaminated with fipronil. Feeney notes for the FSA, this was a *“major incident”*... *“Guy’s expertise on risk assessment contributed significantly to enabling the FSA to produce evidence quickly with appropriate messages for the public ... Using his risk research, Guy set the interventions appropriately to reassure the UK population”* [5.6]. As a result millions of food products were kept in UK food businesses, ensuring a major public health incident was avoided without significant economic impact.

Poppy has engaged with the media to communicate food safety risks to the public, appearing on the likes of BBC Radio 4’s Today Programme and BBC 2’s Victoria Derbyshire programme to discuss the issues including fipronil in eggs, cancer risks from acrylamide in burnt food and the safety of rare beef burgers. The thematic CSA Science Reports [5.10], which explain key issues in accessible language, were Poppy’s initiative and, combined, have had 219 unique downloads over the impact period [5.11]. Poppy also contributed to two ‘FSA Explain’ videos on Arsenic in Rice and AMR [5.12]. The latter was the FSA’s best performing video on Twitter with engagement of 2.1%, and the agency’s second best performing video on Facebook with an engagement rate of 4.6% (industry average is 1-2%).

Ensuring FSA prioritises policies that protect people with food allergies and intolerances

In September 2018 a teenager died as a result of an allergic reaction to food consumed which did not display allergen information on the packaging. A UK-wide consultation followed and, in May 2019, the FSA Board agreed on advice for Ministers that full ingredient labelling should be mandatory for all pre-packed foods for direct sale. In June, the Environment Secretary proposed new legislation to this effect, to come into effect by summer 2021. Hancock, Chair of the FSA Board, said at the time: *“This is an important step forward in our ambition for the UK to become the best place in the world for people living with food hypersensitivities.”* [5.13] The recommendations adopted by the FSA Board were based on evidence that Poppy had presented, which showed the health outcomes that the FSA could achieve by prioritising food hypersensitivity. Hancock said: *“From my perspective as Chair, the FSA could have been in a risky position if it had not used this evidence to increase the focus on food hypersensitivity. I would have found it much more difficult to deliver this important outcome from the Board without Guy’s input.”* [5.4]

5. Sources to corroborate the impact

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- 5.1 Supporting statement from Catherine Brown, Chief Executive (2012-2017), FSA.
 - 5.2 Supporting statements from Sir Patrick Vallance, Government Chief Scientific Adviser
 - 5.3 Supporting statement from Steve Wearne, Director of Science, FSA.
 - 5.4 Supporting statements from Heather Hancock, Chair of the FSA Board.
 - 5.5 Supporting statement from Professor Dame Sally Davies, Chief Medical Officer.
 - 5.6 Supporting statement from Jason Feeney, Chief Executive (2017-date), FSA.
 - 5.7 Supporting statement from Professor Sir Ian Boyd, Chief Scientific Adviser, Defra.
 - 5.8 https://www.food.gov.uk/sites/default/files/media/document/csa-amr-report_0%20%281%29.pdf
 - 5.9 <https://www.gov.uk/government/news/sales-of-veterinary-antibiotics-halved-over-the-past-four-years>
 - 5.10 <https://www.food.gov.uk/sites/default/files/media/document/fsa-digital-csa-report-final.pdf>
 - 5.11 Supporting statement from Senior Communications Manager, FSA.
 - 5.12 FSA Explains: Arsenic in Rice https://www.youtube.com/watch?v=Pbu6kz_ZBJY and AMR <https://www.youtube.com/watch?v=TsjwDluoX64>
 - 5.13 <https://www.food.gov.uk/news-alerts/news/fsa-welcomes-new-allergen-labelling-law>