Title of case study: G: Invention and development of the Livetec Nex® results in enhanced global poultry welfare

1. Summary of the impact

Underpinning Research: We compared welfare impacts of novel on-farm poultry killing tools with existing methods by behavioural, physiological and neurophysiological techniques. This led to the invention by Martin of the "Livetec Nex®", a novel design that improves efficiency and welfare outcomes compared with traditional manual cervical dislocation methods or mechanical cervical dislocation devices, such as captive bolts, for the killing of individual birds for stock management or to end suffering due to injury or illness.

Significance and Reach of Impact: In 2018, the UK Government's Department for Environment, Food and Rural Affairs (Defra) acknowledged that the Livetec Nex® is compliant under European Council Regulation 1099/2009 for mechanical cervical dislocation, providing an alternative to unreliable and low-welfare manual killing methods. Launched in July 2019, the Livetec Nex® was accepted as Red Tractor compliant in August 2019. In direct response, major UK-based poultry producers placed significant orders to equip their premises, including Moy Park (purchased [redacted] units; covers 800 farms and 312,000,000 birds per year), Avara ([redacted] units; 208,000,000 birds per year) and 2-Sisters Food Group ([redacted] units; 322,000,000 birds per year). Tesco is strongly encouraging its entire poultry supply chain (supplying 156,000,000 broilers per year equating to 53% of retail market share) to adopt the Livetec Nex®. Altogether, 3,476 units have sold. The Livetec Nex® was named "New Product of The Year" by Poultry Business Magazine in 2020.

2. Underpinning research

The Challenge: Sub-optimal application of cervical dislocation of poultry results in poor welfare

On-farm killing of poultry is required for stock management in intensive systems and to end suffering of injured or sick birds. The number of UK birds actively killed in this way is estimated at 1,350,000 chickens per year [3.1; 5.6b] with 96% of kills carried out using cervical dislocation methods [3.1]. The methods used in Europe and the UK adhere to European Council (EC) Regulation 1099/2009, which restricts methods by bird weight and numbers. Welfare concerns of cervical dislocation (both manual and mechanical) relate to the lack of reliability and operator skill, resulting in birds experiencing prolonged pain and distress. Consequently, manual cervical dislocation (MCD) has not been recommended for routine use in the European Union (EU) [5.11]. Our research showed that currently used approaches led to poor animal welfare [3.1; 3.2] and higher welfare methods, such as the captive bolt, had not been adopted by the industry owing to practical issues [3.2]. We addressed an unmet need for a reliable, practical and high-welfare killing tool to replace MCD by the design and validation of the Livetec Nex®.

Research established welfare advantages of the Livetec Nex®

Research funded by UK's Department for Environment, Food and Rural Affairs (Defra) and the Humane Slaughter Association [3.7; 3.8], jointly led by Martin and Sandilands, compared MCD with existing methods, and designed novel methods to establish their effectiveness at causing rapid loss of consciousness and death. Results showed that MCD and current mechanical methods, such as captive bolts, had less than 70% kill success, reliability issues

and maintenance concerns, resulting in poor welfare. The projects established and validated novel spectral thresholds for varying states of unconsciousness by measuring electrical brain activity via intracranial electroencephalography during anaesthesia [3.3] and killing [3.4] and cross-validated these with behavioural and reflex assessment. These thresholds were used to demonstrate advantages of the Livetec Nex® and reduced time to loss of consciousness.

Design of the Livetec Nex®

Through custom bioengineering undertaken by co-inventor Martin, the Livetec Nex® (**Figure 1**) was designed through multiple iterations to rest against the operator's fingers and focus the force required for cervical dislocation at the C0-C1 joint between the back of the skull and top of the spine (**Figure 2**), acting as a fulcrum, irrespective of bird species or operator skill. Compared with MCD, the Livetec Nex® is more likely to achieve a C0-C1 dislocation and severance of carotid arteries, resulting in ischemia to the brainstem and brain. This causes faster brain death and minimises time to unconsciousness [3.1; 3.3; 3.4]. The final design was validated in producing rapid, accurate and consistent cervical dislocation. This results in superior welfare outcomes compared with MCD [3.4; 3.5] and outcompetes other mechanical methods in practicality (e.g. maintenance and reliability on-farm) [3.1; 3.6].

Fig. 1 Livetec Nex®

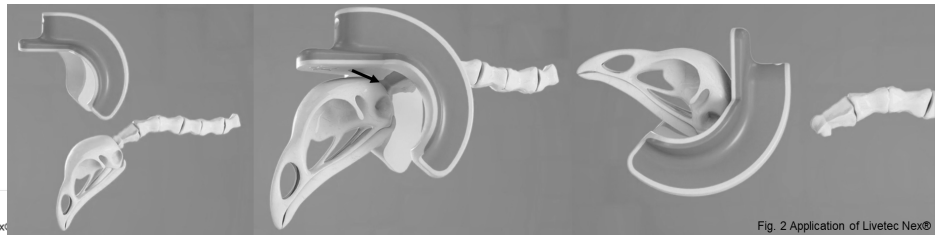
Fig. 2 Application of Livetec Nex®

Livetec Nex® welfare advantages validated in commercial use

Commercial trials led by Martin showed major advantages of the Livetec Nex® by standardising the technique irrespective of operator skill [3.1] and established that video demonstration provided the most effective training for operators in the use of both the Livetec Nex® and MCD, and prevented the use of incorrect techniques and the perpetuation of bad habits in MCD [3.1; 3.2].

Attribution: The underpinning research was co-led by Martin (named joint PhD candidate SRUC/University of Glasgow & later UoE), with Sandilands (SRUC) and McKeegan (University of Glasgow) acting as supervisors. The impact and commercial trials were, and continue to be, driven by Livetec Systems Ltd (J Sparrey) and Martin.

3. References to the research

[3.1] Martin JE, Sandilands V, Sparrey J, Baker L, McKeegan DEF. On farm evaluation of a novel mechanical cervical dislocation device for poultry. Animals 2018;8:10-25. doi: 10.3390/ani8010010

[3.2] Martin JE, McKeegan DEF, Sandercock DA, Sparrey J, Baker L, Brocklehurst S, Sparks NHC, Sandilands V. Welfare risks of repeated application of on-farm culling methods for poultry. Animals 2018;8:39-53. doi: 10.3390/ani8030039

[3.3] Sandercock DA, Auckburally A, Flaherty D, Sandilands V, McKeegan DEF. Avian reflex and electroencephalogram responses in different states of consciousness. Physiology & Behavior 2014;133:252-259 doi: 10.1016/j.physbeh.2014.05.030

[3.4] Martin JE, Sandilands V, Sparrey J, Baker L, Dixon LM, McKeegan DEF. Welfare assessment of novel on-farm killing methods for poultry. PLoS ONE 2019:14(2): e0212872. doi:10.1371/journal.pone.0212872

[3.5] Martin JE, McKeegan DEF, Sparrey J, Sandilands V. Comparison of novel mechanical cervical dislocation and a modified captive bolt for on-farm killing of poultry on behavioural reflex responses and anatomical pathology. Animal Welfare 2016;25:227-41. doi: 10.7120/09627286.25.2.227

[3.6] McKeegan DEF, Martin JE, Sparrey J, Sandilands V. Evaluation of potential culling performance of novel percussive and cervical dislocation tools in chicken cadavers. British Poultry Science 2017;58:216-23. doi: 10.1080/00071668.2017.1280724

Grants:
[3.7] 2010 – 2013 DEFRA "Welfare costs and benefits of existing and novel on-farm culling methods of poultry" GBP363,890 (DEFRA project code MH0145). Sandilands (PI) and Martin (Researcher).

[3.8] 2011 - 2014 Humane Slaughter Association PhD Centenary Scholarship "Humane mechanical methods for despatching poultry on-farm" GBP100,171. Sandilands (PI) and Martin (named PhD student).

4. Details of the impact

Pathway to Impact

In April 2018, the production concept and design for the commercial product was finalised and named "Livetec Nex®", co-developed by Martin (UoE) and Sparrey (Livetec Systems Ltd) [5.1a]. The webpage went live in July 2019 and has had [redacted] unique visits between its launch and November 2020 [5.1b]. The tool has a Registered Design Number in the UK and EU (6060691). A freely available training video for the Livetec Nex® and optimal MCD was developed with input from UK poultry producers and released online in February 2020. This provides the first UK standardised operating procedure for cervical dislocation in poultry [5.1c] and is adopted as part of all commercial sales.

Impact on policy and practice

In 2018, Defra acknowledged the Livetec Nex® as compliant under EC Regulation 1099/2009 as mechanical cervical dislocation, thus providing a legal and higher welfare alternative to manual cervical dislocation [5.2a,b] as well as a cheaper and more practical alternative to other mechanical methods; for example, the Livetec Nex® retails at GBP55/unit, compared with the captive bolt at more than GBP900/unit. Official Defra correspondence stated: *"After discussing with policy team and legal colleagues I can confirm that cervical dislocation using the tool glove you describe is interpreted by the policy team as mechanical cervical dislocation"* [5.2a]. This definition is key, as it allows the Livetec Nex® to provide a feasible alternative to manual cervical dislocation and therefore not be restricted by the current legal framework on manual cervical dislocation, which is limited to use in birds weighing less than 3kg and maximum application of 70 birds per person per day. Thus, the Livetec Nex® can now be considered for routine use in the majority of poultry species weighing up to 5kg with no maximum application limits [5.2b].

Red Tractor is the baseline assurance standard for all poultry production in the UK followed by all major food suppliers. In August 2019, Livetec Nex® was accepted as Red Tractor compliant, with the Technical Manager for Pig & Poultry at Red Tractor Assurance stating: *"Red Tractor considers the device, when used correctly, to be compliant with Red Tractor standards…This decision was made following consultation with the members of Red Tractor's duck, turkey and chicken Technical Advisory Committees"* [5.1d]. This means the use of the Livetec Nex® on-farm is considered higher welfare practice and aids in farms being included in the Red Tractor Assurance schemes; a major incentive to UK poultry producers to adopt the Livetec Nex® in routine practice [5.1b; 5.1d].

The Chief Executive for the British Poultry Council (BPC) stated *"The BPC has always contributed science and innovation in our sector, and we were very pleased to back the Livetec Nex project. We're delighted with both the outcome and that there is such strong support for the device through the industry"* [5.3]. In 2020, Poultec, the leading supplier of Apprenticeship Training and Poultry Industry Passport training in the UK, agreed to become 'Livetec Nex® Approved Trainers' [5.1b]; therefore, all novices entering the poultry sector from now on will adopt Livetec Nex®.

The Livetec Nex® was named as "New Product of the Year 2020" by the Poultry Business Magazine in May 2020. Judges recognised that the Nex® *"fulfilled a welfare need on farm and was the result of a collaboration between industry and academia. They also liked that it was a genuinely new product that hadn't been seen before, and that it was affordable for every business."* [5.4]. An EBVS European Specialist in Poultry Veterinary Science likewise confirmed the utility of the Nex® for industry: "*The researchers also understood the mindset of stockmen who may be resistant to change and have not just aimed to sell the industry a gimmick but to spend time understanding what would work, what would be acceptable and then put in place the appropriate explanations, training and support to enable the most effective outcome*" [5.5].

Impact on animal welfare

Globally, approximately 70,000,000,000 broilers and 6,400,000,000 laying hens are reared every year [5.6a]. Using the Livetec Nex® rather than MCD would reduce the suffering of approximately 2,000,000,000 chickens globally, including 1,350,000 chickens in the UK every year [5.6a, b; 3.6]. The Livetec Nex® reduces the time to loss of consciousness and reduces the risk of operators failing to euthanise birds due to restrictions on MCD or practical issues with alternative methods [3.1; 3.3; 5.4]. The Chief Executive Officer of the Humane Slaughter Association stated: *"The device represents a promising refinement with the potential to ensure that cervical dislocation of poultry species can be performed more reliably than current methods, reducing the possibility of serious suffering when manual cervical dislocation is performed incorrectly. The uptake of the device by commercial operators and its acceptance as compliant with Red Tractor standards demonstrates the impact the device is already having"* [5.7].

Impact on economy/commercial activity

(1) Livetec Nex® ordered by poultry companies

Following confirmation of compliance with Red Tractor standards, bulk orders have been placed by the major UK producers of broilers, breeders, ducks and turkeys. These include Moy Park (which purchased [redacted] units and has 800 farms, producing 312,000,000 birds per year [5.8a], Avara ([redacted] units; 208,000,000 birds per year [5.8b]), 2-Sisters Food Group ([redacted] units; 322,000,000 birds per year [5.8c]) and Green Label Poultry ([redacted] units; 8,000,000 ducks per year [5.8d]), together representing approximately 90% of the UK poultry industry [5.1b]. By November 2020, a total of 3,476 units had been sold across the UK, Canada, United States, New Zealand, Australia, Europe and South Africa [5.1b].

The Livetec Nex® is also being marketed to smallholder and backyard poultry keepers via a direct sales website and distribution agreements with farm supply companies [5.1a, b]. As of November 2020, 148 units have been sold online to smallholders [5.1b]. An additional 340 units have been sold to wholesale retailers [redacted] and Veterinary Service groups [redacted] [5.1b].

(2) The Livetec Nex® endorsed by Nationals Farmers Union (NFU)

Livetec Systems Ltd. became affinity partners of NFU in 2020, which means NFU poultry members receive discounts on products [5.1b; 5.9]. Affinity partnership status is highly valued and only granted when a "definite benefit" for NFU members is identified [5.9].

(3) The Livetec Nex® endorsed by Tesco

Tesco purchases approximately 156,000,000 chickens per year [5.8e], which must comply with Red Tractor standards. The Agricultural Manager of Poultry, Eggs & Feed at Tesco would therefore like to see the Livetec Nex® used throughout its supply base to prevent potential non-compliances [5.1b; 5.10]. Tesco can insist on 'best welfare standards' but cannot enforce the use of any particular product on independent farms; however, they have contacted all their UK supply farms to encourage them to adopt the Livetec Nex®. The Agricultural Manager said "*The Livetec Nex represents a useful, cost-effective addition to the portfolio of available methods for humane poultry culling. […] It has a place where immediacy of approach is key in potentially compromised birds or in disease situations where the 70 bird limit would pose a challenge in terms of welfare considerations verses legal compliance".* [5.10].

(4) The Livetec Nex® used for gamebirds

St David's Game Vets have conducted trials with pheasants and are actively promoting the Livetec Nex® to their clients through the Director of St David's, who sits on the British Game Alliance Board [5.1b]. St David's Game Vets supply vet services to more than 4,000 shoots. There are currently 9,000 shoots in the UK, at which 10-20 pickers per shoot collect and despatch birds that have been shot but not killed. The industry is under intense scrutiny for animal welfare and British Game Alliance is currently in conversation with Livetec to include the Livetec Nex® into their welfare codes as best practice [5.1b].

(5) Rest of the World

In total, 70 units have been sold internationally as part of product trialling to both poultry companies and welfare-related organisations.

- The National Council of Societies for the Prevention of Cruelty to Animals in South Africa placed an initial order for [redacted] units. The organisation is widely promoting the Nex® within the African poultry industry [5.1b].
- Egg Producers Federation Board for New Zealand is interested in using and distributing the Nex® and has purchased [redacted] trial units [5.1b].
- Chicken Farmers of Canada have purchased [redacted] trial units [5.1b].
- Happy Eggs and Tyson (both in the United States) are currently in discussions to run trials on breeder flocks. Some [redacted] trial units have been sold in the US [5.1b].

- **5. Sources to corroborate the impact**
- [5.1] a. Livetec Nex website b. Letter of support from Livetec Systems Ltd (Oct 2020). c. Livetec training video d. Livetec Systems Ltd. webpage – News updates announcing Red Tractor compliance.
- [5.2] a. Email from Defra official at Animal and Plant Health Agency (APHA) 15th Sept 2017 b. Council Regulation (EC) No 1099/2009 of 24 September 2009 on the protection of animals at the time of killing. Annex I.
- [5.3] Email Statement from Chief Executive, British Poultry Council 4th Nov 2020
- [5.4] Poultry Business May 2020, announcing the Livetec Nex® as the Product of the Year.
- [5.5] Email Statement from EBVS European Specialist in Poultry Veterinary Science.
- [5.6] a. Food and Agriculture Organization of the United Nations (FAO), 2020. Livestock Primary, Producing Animals/Slaughtered; figures from 2019 used as an example. b. Defra: United Kingdom Poultry and Poultry Meat Statistics – Aug 2019.
- [5.7] Email Statement from Chief Executive Officer of Humane Slaughter Association.
- [5.8] Annual bird production figures for Livetec Nex® customers and recommenders: a. Moy Park b. Avara c. 2Sisters Food Group d. Green Label Poultry e. Tesco
- [5.9] National Farmers Union webpage – offering a discount for Livetec Nex®
- [5.10] Email testimonial from Agricultural Manager of Poultry, Eggs & Feed at Tesco
- [5.11] EFSA Killing for purposes other than slaughter: poultry (2019).