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Exploring Novel Biochemical pathways for the Management of Arthropod Vectors to Reduce Incidence of Zoonotic Disease Transmission

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Emerging zoonotic disease is a significant threat to human and animal health today, as per the American Relief Action Plan, 2021. Arthropod vectors transmit a wide range of zoonotic diseases of significance to human health and food, animal welfare and productivity globally. In situations where people and food animals are in proximity, food animals can sustain high populations of vector species that increase zoonotic disease incidence in people and animals. Reliance on a few conventional insecticides for vector management can lead to human exposure, and negative impact on environmental health. The novel mode of action of nitisinone, (2-(2-nitro-4-trifluoromethylbenzoyl)-1,3-cyclohexanedione, (Cycle Ltd., Cambs. UK) in blood feeding arthropods has been demonstrated by Serkel et al. 2016 as a (FDA-approved) tyrosine catabolism inhibitor. Interruption of the enzymes responsible for the phenylalanine-tyrosine degradation pathway has been demonstrated with the use of a human drug, Nitisinone. Application by feeding with blood from Nitisinone-treated cattle was used to treat feeding arthropods. This study aims to demonstrate that Nitisinone, or structurally similar compounds, could provide alternative antiparasitic that disrupt a critical metabolic pathway for hematophagous insects to digest bloodmeals. The study includes the use of stable fly survival when fed with blood dosed with the drug and rumen fluid degradation to observe drug digestion in cattle. Further, calves administered intravenously or intramuscularly with Nitisinone at scaled doses and blood collection provided drug levels in the blood of a ruminant species for the first time. With current tools available being limited, this research demonstrates that this could be an alternative method to combat the threat of known and emerging pests of importance to Public Health and Agriculture, and in this novel application route, for livestock producers battling with the economic and welfare issues caused by pests such as ticks, stable flies (*Stomoxys calcitrans*), horn flies (*Haematobia irritans irritans*).

Recent Publications:

1. Bismark, Opoku, Enoch Adjei Osekre, George Opit, Augustine Bosomtwe, and Georgina V. Bingham. 2023. "Evaluation of Hermetic Storage Bags for the Preservation of Yellow Maize in Poultry Farms in Dormaa Ahenkro, Ghana" Insects 14, no. 2: 141. https://doi.org/10.3390/insects14020141

2. Joseph Mathu Ndung'u, Georgina V. Bingham, et al.; (2020). Trypa-NO! contributes to elimination of gambiense human African trypanosomiasis by combining tsetse control with "screen, diagnose and treat" using innovative tools and strategies. PloS NTDs : November 12, 2020 https://doi.org/10.1371/journal.pntd.0008738

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Biography

Georgina V Bingham has more than 20 years' experience working in developing regions including sub-Saharan Africa and Southeast Asia and holds qualifications for project management and good clinical practice. Her research focuses on entomological impacts on food security and nutrition, and insects of medical and veterinary importance. She had 12 years within private industry at Vestergaard (a global company dedicated to improving the health of vulnerable people, especially in developing countries) directing research and development of textile-based products, specially modified for controlled release of active ingredients/ or molecules that provide protection for humans and animals from disease vectors and pathogens. Bingham leads, and acted as industry liaison, for research in designing appropriate and affordable tools and techniques to prevent the spread of zoonotic disease, provide safe drinking water and store food safely within community-based international research programs.

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