ASX ANNOUNCEMENT
13 DECEMBER 2019

PRESENTATION ON BREAKTHROUGH IN CONTROL OF RESISTANT MOSQUITOES

Bio-Gene Technology Limited (ASX: BGT, '**Bio-Gene**' or the '**Company'**) is pleased to release this slide presentation relating to the recent Bio-Gene announcement "Significant Breakthrough in Control of Resistant Malaria Mosquitoes" and providing further information on insecticide resistant mosquitoes and public health.

Approved for release by the Chairman of the Bio-Gene Board of Directors.

- ENDS -

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About Bio-Gene Technology Limited

Bio-Gene is an Australian ag-tech development company enabling the next generation of novel insecticides to address the global problems of insecticide resistance and toxicity. Its novel platform technology is based on a naturally occurring class of chemicals known as beta-triketones. Beta-triketone compounds have demonstrated insecticidal activity (e.g. kill or knock down insects) via a novel mode of action in testing performed to date. This platform may provide multiple potential new solutions for insecticide manufacturers in applications across crop protection and food storage, public health, consumer applications and animal health. The Company's aim is to develop and commercialise a broad portfolio of targeted insect control and management solutions.

BIO-GENE TECHNOLOGY LTD

ASX: BGT

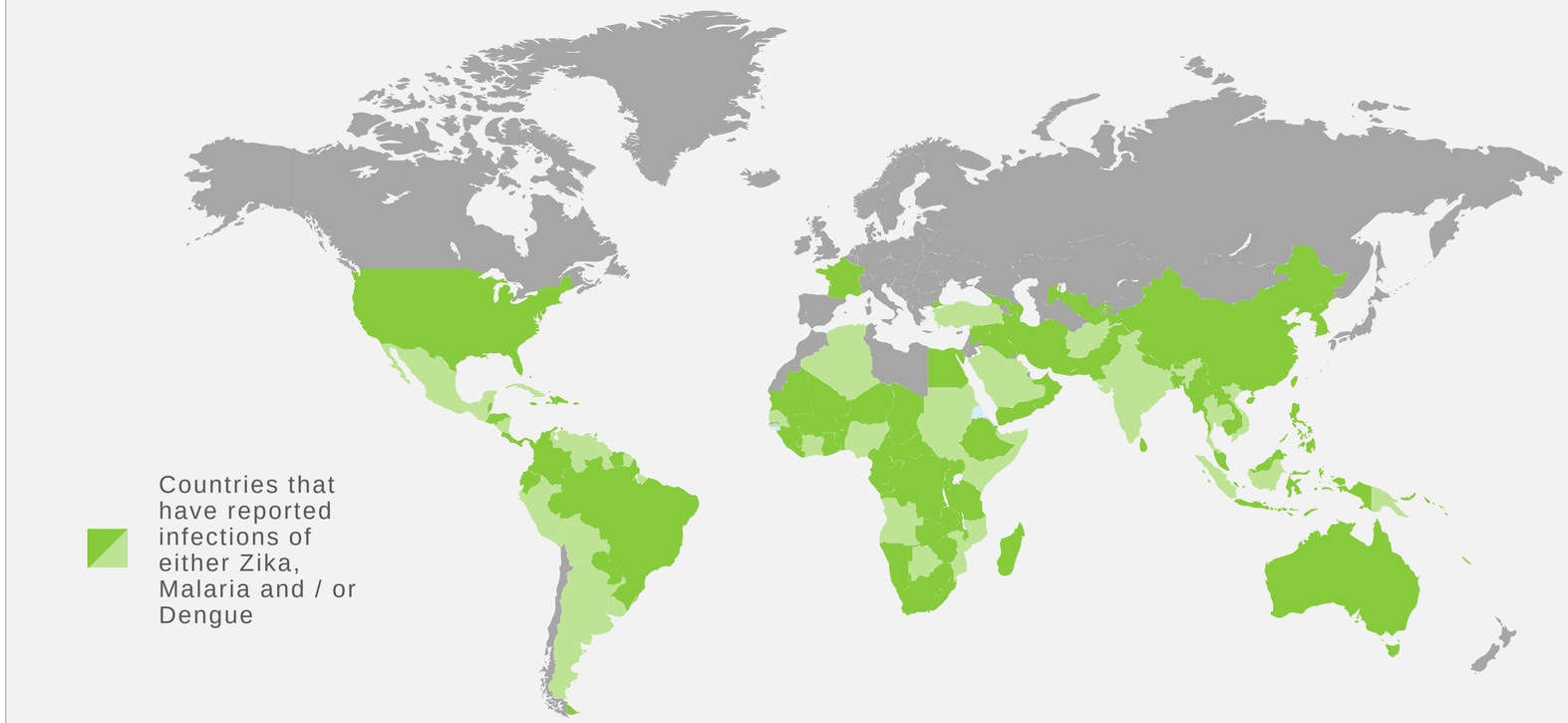
Breakthrough in control of resistant mosquitos

13 December 2019

The increasing problem of global vector-borne diseases

Major vector-borne diseases account for 17% of the estimated global burden of communicable diseases & claim >700,000 lives every year

Incidence of Three Major Vector-borne Diseases



Malaria	**50%** Of global population are at risk of exposure to Malaria	**>219m** Currently have Malaria	**>400,000** Die every year from malaria	**$12bn** Annual economic impact of Malaria in Africa
Dengue	**>40%** Live in an area at risk of Dengue Fever	**390m** Dengue infections annually	**>25,000** Deaths from Dengue each year	**30x** Increase in dengue in past 50-years
Zika	**$10m** Lifetime healthcare cost for child infected in utero	**86** Countries reported mosquito-borne Zika virus at Feb 2018	**76** Reported detections in Australia	**$1.1bn** Provided by US Congress in 2016 to combat zika

Vector-borne diseases are a growing problem

“The issue of vector-borne disease is a rapidly growing global problem due to increasing insecticide resistance, population growth, urbanisation, travel, and climate change.

Currently more than half of the world’s population is at risk of vector-borne diseases. Globally there are more than 200 million cases of malaria and over 400,000 people die from the disease every year, most of them children under the age of five.

Zika virus has been declared a global health emergency, and death due to dengue fever has increased 30 fold in the last 50 years. Collectively, it is estimated that mosquito-borne diseases such as malaria, dengue, zika claim over 700,000 deaths every year. In addition, these diseases are known to exacerbate poverty and prevent economic development.

Unfortunately, the effectiveness of currently used insecticides is diminishing due to resistance.”

Prof. Catherine Hill

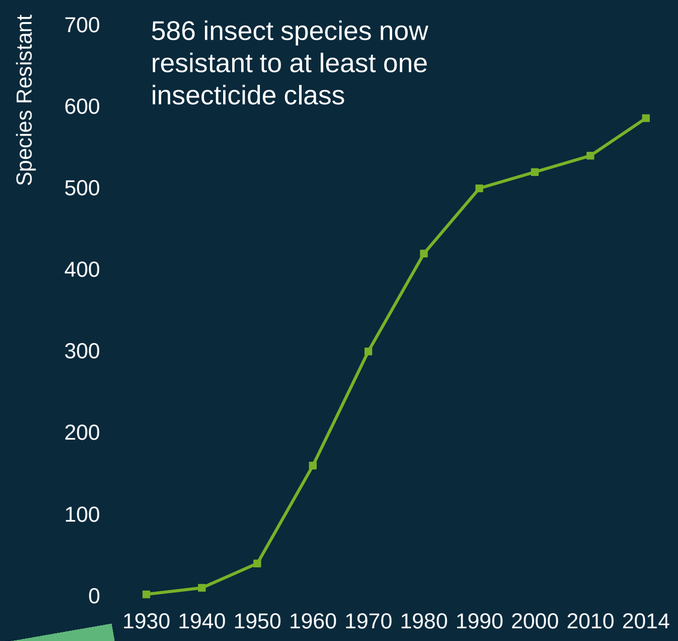
BGT Scientific Advisor

PURDUE UNIVERSITY

Insecticide resistance

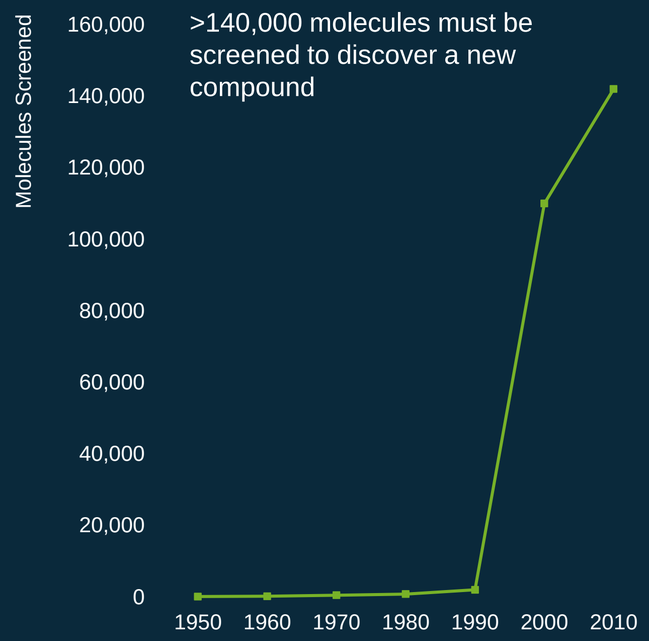
Resistance is rapidly increasing while our ability to find a solution diminishes

Increasing number of resistant species



586 insect species now resistant to at least one insecticide class

New insecticides are increasingly elusive



>140,000 molecules must be screened to discover a new compound

World Health Organization

Widespread resistance has been recorded in **all major malaria vectors** across the four most commonly used insecticide classes:

- Pyrethroids
- Organochlorine
- Carbamates
- Organophosphates

New solutions are needed to address resistance & toxicity

Increasing incidence of resistance threatens effectiveness of existing controls

Significant concern over the toxicity of existing and new insecticides to the environment

EU bans a number of Neonicotinoids, (the most widely used insecticide class) for outdoor use due to bee safety concerns

*CLICK LINKS TO LAUNCH ARTICLES

The Guardian

EU agrees total ban on bee-harming pesticides

The world's most widely used insecticides will be banned from all fields within six months, to protect both wild and honeybees that are vital to crop pollination

▲ People protest ahead of the historic EU vote on a full neonicotinoids ban at Place Schuman in Brussels, Belgium. Photograph: Olivier Matthys/AP

The European Union will ban the world's most widely used insecticides from all fields due to the serious danger they pose to bees.

The ban on neonicotinoids, approved by member nations on Friday, is expected to come into force by the end of 2018 and will mean they can only be used in closed greenhouses.

Bees and other insects are vital for global food production as they pollinate three-quarters of all crops. The plummeting numbers of pollinators in recent years has been blamed, in part, on the widespread use of pesticides. The EU banned the use of neonicotinoids on flowering crops that attract bees, such as oil seed rape, in 2013.

NATIONAL GEOGRAPHIC

ENVIRONMENT

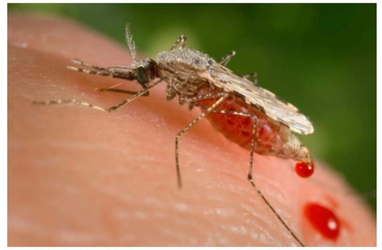
Insect 'apocalypse' in U.S. driven by 50x increase in toxic pesticides

Bees, butterflies, and other insects are under attack by the very plants they feed on as U.S. agriculture continues to use chemicals known to kill.

The Washington Post

Malaria is getting bigger and badder — and we're not ready for it

By Robert Gebelhoff February 5, 2018 Email the author



A female Anopheles stephensi mosquito feeds on human skin. (James Gathany/Centers for Disease Control and Prevention via Associated Press)

theguardian

Malaria menace: when insecticide-resistant mosquitoes bite back

▲ A pregnant woman holds a mosquito net in Cali, Colombia. Insecticide-treated bednets and other measures have averted millions of deaths, says the World Health Organisation. Photograph: Luis Robayo/AFP/Getty Images

Malaria death rates have fallen 60% since 2000, but with some mosquitoes developing resistance to treated bednets, is it time to change strategy?

Advertisement

The underlying fact seems incontrovertible: mosquito resistance to the insecticides used to treat bednets is growing. The question is what can be done to combat this resistance and ringfence the dramatic drop in global malaria deaths over the past 15 years?

Since 2000, the numbers of people dying of malaria have dropped by 60% and

THE WALL STREET JOURNAL.

In the Fight Against Zika, Insecticides Hit a 'Dead End'

Because of high costs and low rewards of Zika-elimination business, the world is running out of insecticides that work

The effort to eliminate the mosquitoes that carry Zika and other diseases is facing new challenges as the pests become more resistant to a thinning arsenal of insecticides. Photo: Gaston De Cardenas/Zuma Press

By Jacob Bunge and Betsy McKay
Jan. 5, 2017 8:00 a.m. ET

Health workers have a thinning arsenal of insecticides capable of killing mosquitoes that carry Zika and similar viruses as the Southern Hemisphere's summer begins and as outbreaks persist in other areas.

The New York Times

Why the Menace of Mosquitoes Will Only Get Worse

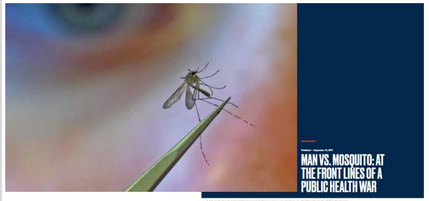
Climate change is altering the environment in ways that increase the potential for viruses like Zika.

BY MARTIN MCCANNA APRIL 20, 2017

The outbreak began so slowly that no one in Dallas perceived it at first. In June 2014, a trickle of people began showing up in emergency rooms broiling with fever, complaining that their necks were stiff and that bright lights hurt their eyes. The numbers were initially small, but by the middle of July, there were more than 50 victims each week, slumping in doctors' offices or carried into hospitals comatose or paralyzed from inflammation in their brains. In early August, after nine people died, Dallas County declared a state of emergency: It was caught in an epidemic of what turned out to be West Nile virus, the worst ever experienced by a city in the United States. By the end of the year, 1,062 people had tested positive for the mosquito-borne virus; 226 had become sick enough to be hospitalized; and 19 were dead.

West Nile was not new to the United States. It had been a minor summer threat since August 1999, when it made 17 people sick in New York City. That was the virus's first entry into the country, and it expanded through it thereafter. It landed in Dallas in 2002, sickening 202 people and killing 15. When it moved on toward the West Coast, epidemiologists in the city thought West Nile would no longer be a threat. And events seemed to prove them right: Each year, there were just a handful of cases. In 2011, the year before the epidemic, there was only one.

"We all thought these things come as a flash in the pan: one big outbreak and then you don't see them again," Dr. Robert Haley says. Haley is the director of epidemiology at the University of Texas Southwestern Medical Center in Dallas and a former disease detective at the C.D.C. After the last cases were recorded in the final days of 2012, he and a team of researchers studied the episode. Right away, they could see the geography of the illness: Victims were clustered in affluent ZIP codes where many owners had



This story was published in partnership with The Weather Channel.

The New York Times

Philippines Declares a National Dengue Epidemic

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The long read

People v mosquitos: what to do about our biggest killer

These tiny pests adapt so successfully to changing conditions that they have become humankind's deadliest predator. We might soon be able to eradicate them – but should

Infectious diseases spread via mosquitoes

Resistance to commonly used insecticides is evident in all key mosquito species; hampering efforts to control disease worldwide

		Mosquito Species			
		Aedes sp.	*Anopheles sp.*	*Culex sp.*	
Disease Carried	Zika Virus	✓	-	-	42 countries
	Dengue Fever	✓	-	-	390m infections
	Yellow Fever	✓	-	-	30,000 deaths
	Malaria	-	✓	-	219m infections
	West Nile Virus	-	-	✓	47 states in the US with infections
	Chikungunya	✓	-	-	2019 cases in Ethiopia, Thailand & Brazil
	Ross River	-	-	✓	5,000 infections annually in Australia
Resistance Recorded	Organochlorines	✗	✗	✗	Discovered 1930
	Organophosphates	✗	✗	✗	Discovered 1944
	Pyrethroids	✗	✗	✗	Discovered 1977
	Carbamates	✗	✗	✗	Discovered 1950

Legend

✓ Infectious disease carried

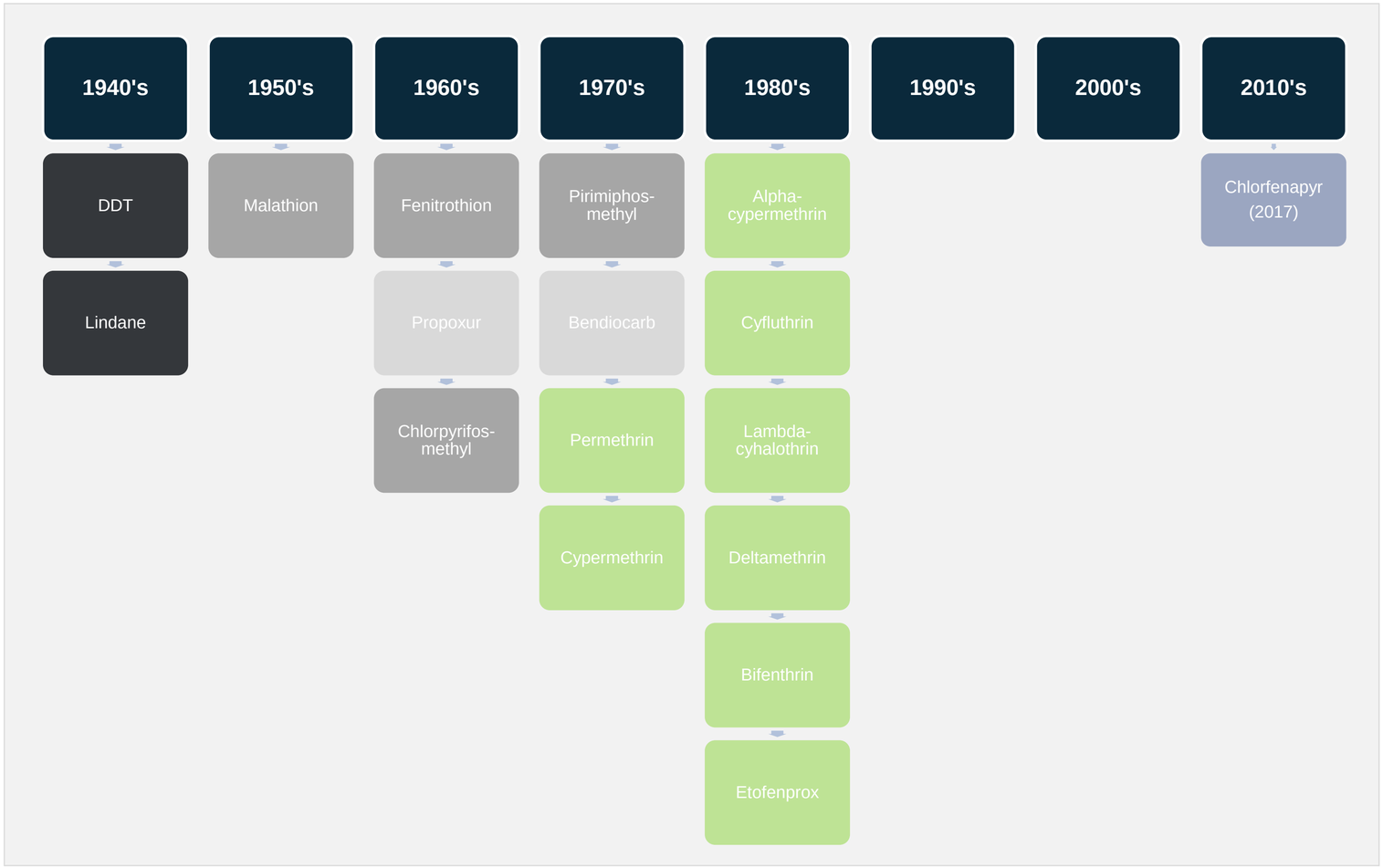
✗ Resistance recorded

Malaria mosquito resistance

Widespread resistance is leading to multiple incidences of failure to prevent Malaria outbreaks

Nearly all insecticide classes used for malaria mosquito control are over 40-years old, with the vast majority now experiencing resistance and toxicity issues

History of WHO-approved insecticides for adult Malaria Mosquito control

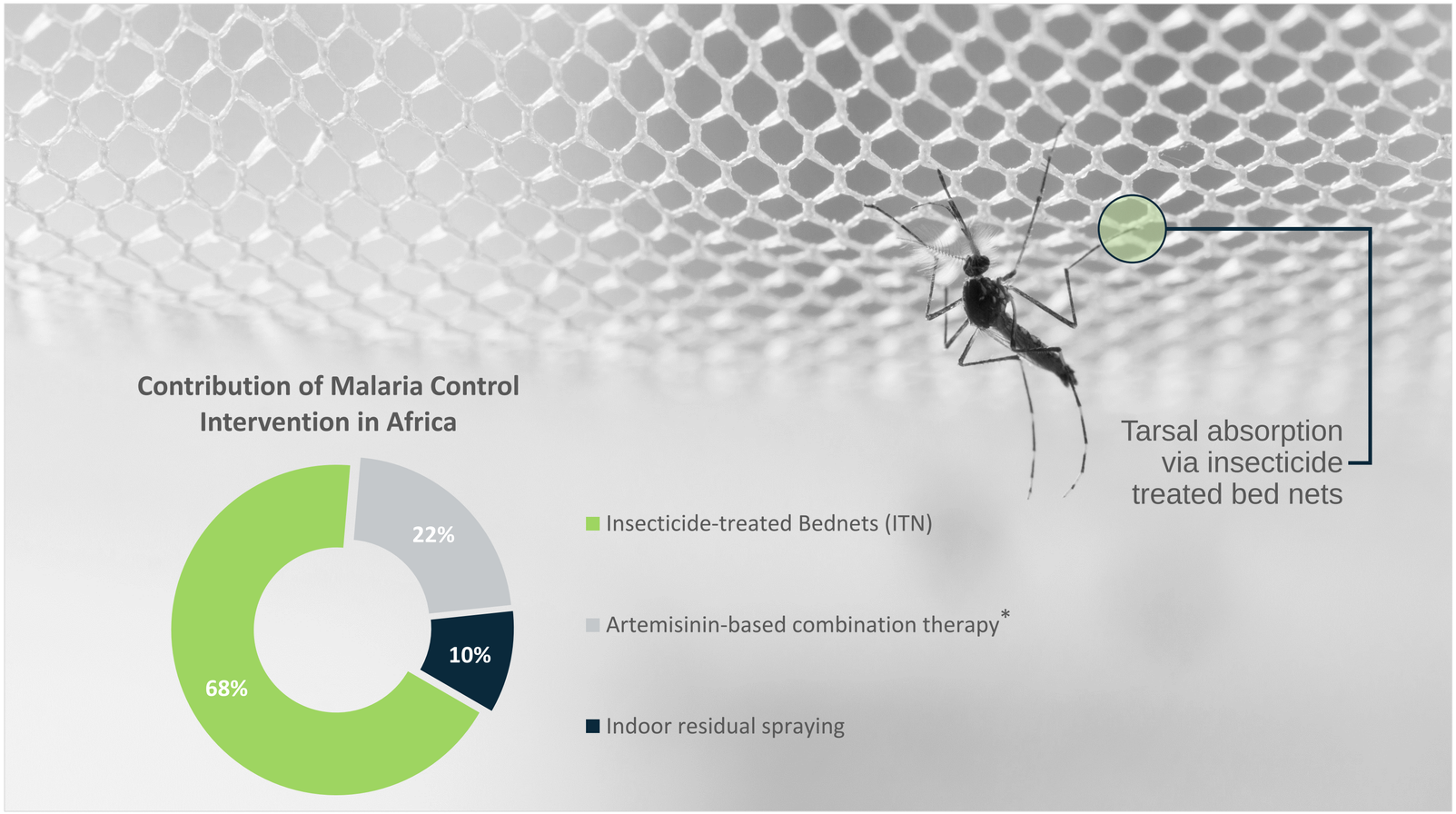


	Organochlorines	Organophosphates	Carbamates	Pyrethroids	Pyrroles
Toxicity	Banned in agriculture	Yes. Monitoring recommended	Yes	Low	Low
Resistance	Yes, and cross resistance with pyrethroids	Yes, and cross resistance with carbamates	Yes, and cross resistance with organophosphates	Widespread Global Resistance	Limited Use

Critical intervention methods

Insecticide-treated bed nets (‘**ITN**’) are the most common method to control Malaria mosquitoes

At least 700 million ITNs have been distributed in Africa since 2000



Most Common Intervention Methods:

1) Insecticide-treated bed nets are infused with insecticides providing:
   - A physical barrier protection; and
   - Control of mosquitoes via contact with the net & absorption of the insecticide through the tarsi (feet)
2) Indoor residual spraying with contact insecticides is also an important component of Malaria control strategies

**WHO recommended drug therapy for malarial cases*

Bio-Gene is well placed to deliver a solution

Bio-Gene's technology addresses market needs

Our proprietary chemistry represents a step-change for resistant mosquito control

Safe Chemistry

- **Flavocide™** is a '*nature identical mimic*' of a natural compound that can be mass produced for vector control
- Low toxicity to bees & beneficial insects, favourable safety profile for use

Efficacy

- Testing to date confirms potential for controlling resistant pests across multiple markets

Novel Mode of Action

- Operates via a novel Mode of Action, potentially addressing resistance to other classes of chemistry

Scalability

- Production processes are refined, scale-up in progress

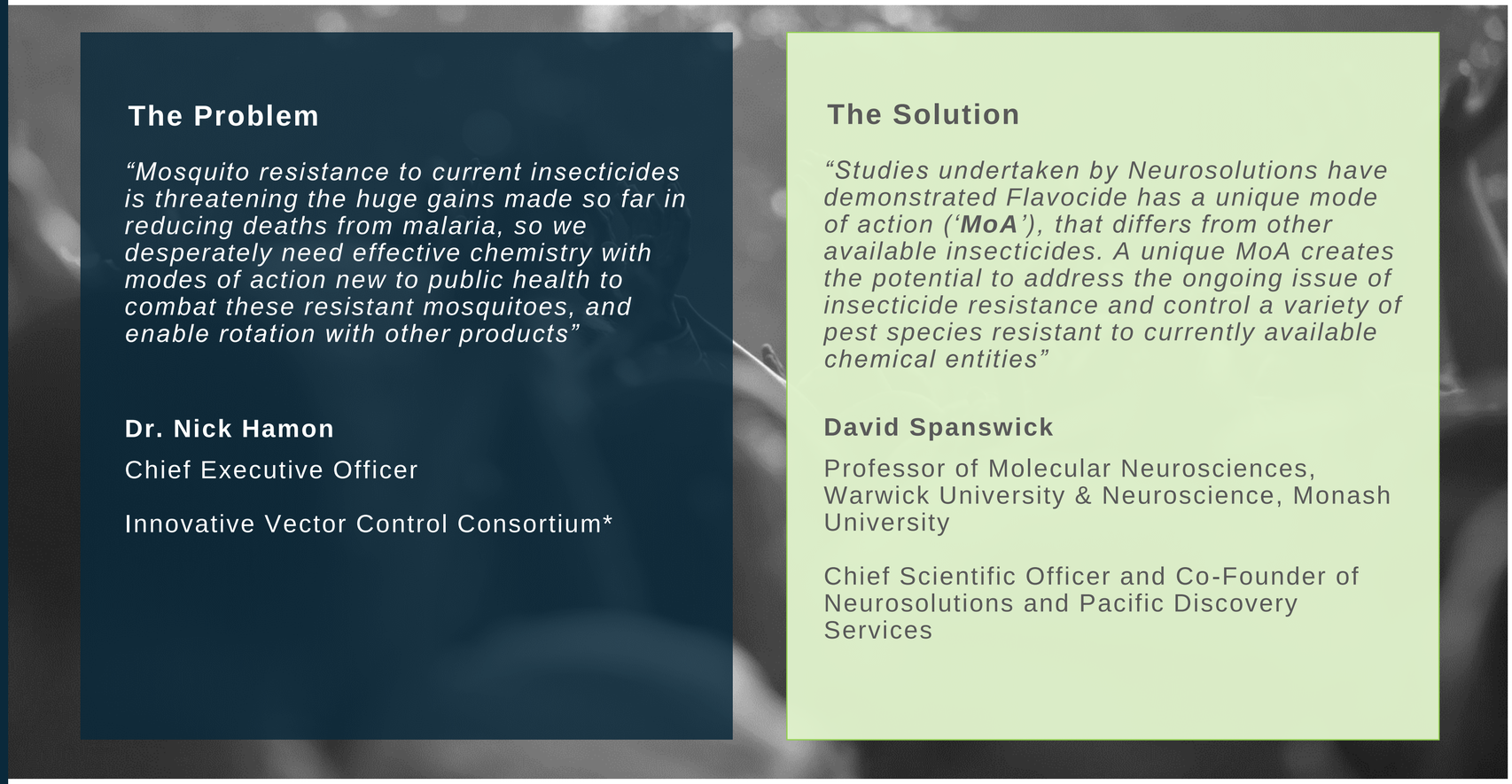
Synergies & Combinations

- Proven synergy in combinations with synthetic pyrethroids – the most commonly used mosquito insecticides

Control of Multiple Generations

- Potential to impact pest populations by controlling adults and offspring

A novel Mode of Action is key to addressing resistance



The Problem

“Mosquito resistance to current insecticides is threatening the huge gains made so far in reducing deaths from malaria, so we desperately need effective chemistry with modes of action new to public health to combat these resistant mosquitoes, and enable rotation with other products”

Dr. Nick Hamon

Chief Executive Officer

Innovative Vector Control Consortium*

The Solution

*“Studies undertaken by Neurosolutions have demonstrated Flavocide has a unique mode of action (‘**MoA**’), that differs from other available insecticides. A unique MoA creates the potential to address the ongoing issue of insecticide resistance and control a variety of pest species resistant to currently available chemical entities”*

David Spanswick

Professor of Molecular Neurosciences, Warwick University & Neuroscience, Monash University

Chief Scientific Officer and Co-Founder of Neurosolutions and Pacific Discovery Services

Flavocide operates via a novel Mode of Action, addressing resistance to other classes of chemistry

- Insecticides are classified by the Insecticide Resistance Action Committee (‘**IRAC**’) under their Mode of Action which is the way the insecticide works to control the pest
- Development of insecticides with new MoA’s curtail the issue of resistance; but the last significant MoA class introduced was in 2008, Diamides, not currently used to control mosquitos
- Our extensive testing clearly demonstrates that Flavocide has a significantly different MoA from any other class of chemistry used or classified by IRAC

**IVCC works globally to facilitate innovative approaches to preventing vector-borne diseases and tackle the growing threat of insecticide resistance.*

Flavocide mosquito results

Prof. Catherine Hill
BGT Scientific Advisor
PURDUE UNIVERSITY

- Purdue University, Department of Entomology
- Showalter Faculty Scholar
- President's Fellow for the Life Sciences
- Authority in new insecticide development & novel chemistry

Testing Overview

- Bio-Gene has engaged Purdue University, world leaders in vector control, to evaluate Flavocide for control of mosquitoes carrying diseases such as Malaria, Dengue, Zika and West Nile Virus
- Recent studies have involved tarsal assays that demonstrated Flavocide's activity against the malaria vector *Anopheles gambiae* including resistant strains
- Tarsal assay studies confirmed the potential application for Flavocide in the two key insecticide control methods used:
    1) Insecticide treated bed nets
    2) Indoor residual sprays

		Mosquito Species			
		Aedes sp.	***Anopheles sp.***	***Culex sp.***	
Resistance Recorded	Organochlorines	✗	✗	✗	Discovered 1930
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	Carbamates	✗	✗	✗	Discovered 1950
	Flavocide	✓	✓	✓	**New Chemistry**

Legend

✗ Resistance recorded ✓ Efficacy confirmed

Flavocide results

Overview of Flavocide tarsal assay studies completed at Purdue University

Studies funded by Bio-Gene Technology Ltd. Statements are those of the principle investigator and do not represent the position of Purdue University

Purdue Tarsal Assay Summary

Demonstrates Flavocide's potential as an insecticidal treatment for control of resistant adult *Anopheles gambiae* mosquitoes

Studies demonstrate the potential for Flavocide to be used as an insecticide for control of SP-resistant mosquitoes

Test Overview:

- Tarsal assay used to assess the response of adult mosquitos (*Anopheles gambiae*) to a surface treated with Flavocide
- Assesses the potential of a compound for use as an Indoor Residual Spray or Insecticide Treated Nets

Findings:

- Tarsal assay revealed toxicity of Flavocide formulation to Synthetic Pyrethroids ('**SP**') resistant strain of adult mosquitos (*Anopheles gambiae*) at 1, 24, and 48 hours
- Data revealed that Flavocide-treated surface was toxic to SP resistant *Anopheles gambiae* and suggest that mosquitoes acquire the Active Ingredient via the tarsi
- High doses of Flavocide caused rapid paralysis/incapacitation of mosquitoes within 30 minutes

Conclusion:

- Study suggests Flavocide delivered via treated surfaces such as Indoor Residual Sprays and Insecticide Treated Nets has potential as insecticidal treatment for control of adult mosquitoes resistant to SPs
- The differences observed between resistant mosquitoes exposed to permethrin and Flavocide suggest that the Mode of Action is different for Flavocide versus SPs

Purdue collective trial results

This latest trial highlights a major discovery in the control of resistant Malaria-carrying mosquitoes.

This adds to previous work on other species that are vectors of other global vector-borne diseases.

Bio-Gene now holds a completed suite of mosquito data

Flavocide data set relating to mosquito vector control is compelling:

a) Efficacy: Collective data from all laboratory studies now confirms Flavocide activity against resistant strains of *Anopheles gambiae (malaria), Aedes aegypti (Dengue and Zika)* and *Culex pipiens (West Nile, Ross River)*

b) Toxicity to Non-targets: Data showing a substantially lower level of toxicity on bees and other beneficial insects in comparison to incumbent insecticides

c) Mode of Action: Confirmed an activity profile unique & different from that of other known insecticides

Commercialisation pathway

Capitalise on the results achieved to date to create opportunities for commercial development

Strategic approach

A

In-house Testing & Data Generation

- Suite of data now well developed, with compelling evidence of efficacy of Flavocide against key vector mosquito species

B

Progress Commercial Discussions Globally

- Now pursuing discussions with Corporates, NGO's, Philanthropic & Gov Agencies
- Progress Material Transfer Agreements (**MTA's**) relevant to this Vector Control

C

Exclusive Partnership Arrangements

- Work to structure exclusive partnerships (similar to recent Grain Storage program with BASF)

D

Commercial Deals

- Progress towards more formal agreements and development plans with key partners to enable commercialisation of our technology

Executive summary

Our proprietary chemistry represents a step-change for resistant pest control

Bio-Gene has a compelling value proposition in vector control

Proven efficacy in key mosquito vector control methods

Low toxicity to beneficial insects

>5,000x less toxic to bees

Novel Mode of Action

Strong IP portfolio

Scalable technology

Proven synergies with key existing insecticides

Trial results validate technology

References

Page – 2	https://www.who.int/neglected_diseases/news/comprehensive_global_approach_against_vector-borne_diseases/en/ https://mosquitoreviews.com/learn/disease-death-statistics https://wwwnc.cdc.gov/travel/page/zika-information https://www.who.int/gho/malaria/malaria_003.png?ua=1 https://www.cdc.gov/dengue/areaswithrisk/around-the-world.html https://www.who.int/news-room/fact-sheets/detail/malaria https://www.unicef.org/media/media_20475.html https://www.worldmosquitoprogram.org/en/learn/mosquito-borne-diseases/dengue https://www.who.int/news-room/fact-sheets/detail/zika-virus https://www.abc.net.au/news/2016-10-24/queensland-preparing-for-mosquito-season-as-zika-cases-rise/7960948 https://www.npr.org/sections/health-shots/2016/09/28/495806979/congress-ends-spat-over-zika-funding-approves-1-1-billion
Page – 4	Sparks & Nauen, 2015: IRAC: Mode of action classification and insecticide resistance management
Page – 6	https://www.who.int/news-room/fact-sheets/detail/malaria https://www.who.int/news-room/fact-sheets/detail/zika-virus Sparks & Nauen, 2015: IRAC: Mode of action classification and insecticide resistance management https://www.who.int/news-room/fact-sheets/detail/dengue-and-severe-dengue https://www.who.int/news-room/fact-sheets/detail/yellow-fever https://www.who.int/news-room/fact-sheets/detail/west-nile-virus https://www.cdc.gov/westnile/statsmaps/preliminarymapsdata2019/index.html https://www.cdc.gov/chikungunya/transmission/index.html https://www.ecdc.europa.eu/en/chikungunya-monthly http://conditions.health.qld.gov.au/HealthCondition/condition/14/217/120/ross-river-virus http://www.abc.net.au/health/library/stories/2006/01/19/1831791.htm https://parasitesandvectors.biomedcentral.com/articles/10.1186/s13071-019-3556-y https://idpjournal.biomedcentral.com/articles/10.1186/s40249-019-0572-2 https://www.researchgate.net/publication/312689482_evolution_of_resistance_to_insecticide_in_disease_vectors https://apps.who.int/iris/bitstream/handle/10665/170964/db2009v33p194.pdf?sequence=1&isallowed=y https://journals.plos.org/plosntds/article?id=10.1371/journal.pntd.0005625 https://www.ncbi.nlm.nih.gov/pmc/articles/pmc4119017/ https://www.cambridge.org/core/journals/bulletin-of-entomological-research/article/mechanisms-of-organophosphate-and-carbamate-resistance-in-culex-quinquefasciatus-diptera-culicidae-from-cuba/82bd4b58fca72debe1dd1b5a670f6bea https://www.sciencedirect.com/topics/earth-and-planetary-sciences/organochlorine
Page – 7	Himeidan, Temu & Kweka, 2012: Insecticides for vector-borne diseases: current use, benefits, hazard and resistance
Page – 8	Insecticide-treated nets (ITNs) in Africa 2000-2016: coverage, system efficiency and future needs for achieving international targets. Malaria Journal, 2014, 13 Bhatt et al, 2015: The effect of malaria control on Plasmodium falciparum in Africa between 2000 and 2015
Page – 12	Himeidan, Temu & Kweka, 2012: Insecticides for vector-borne diseases: current use, benefits, hazard and resistance

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