BIO-GENE TECHNOLOGY LTD

ASX: BGT

Public Health Mosquito Partnership

23 April 2020

Partnership Overview

Partnership with Clarke to develop Bio-Gene's novel insecticide technology Flavocide™ and Qcide™ for use in public health mosquito control

Recently announced partnership with Clarke represents major milestone in Public Health vertical

Partnership represents critical milestone in Public Health commercialisation strategy

Clarke is the worlds leading integrated mosquito control, research and solutions provider

MTA testing data supports existing mosquito control data

Focus on developing novel insecticide technology for use in North, South and Central America

Second partnership deal following stored grain pest control partnership with BASF / GRDC

Substantial commercial opportunity across >A$6.3bn public Health insecticide market

Partnership Overview

New agreement will focus on evolving formulations for both Flavocide™ and Qcide™ for use in mosquito control in North, South & Central America

Partnership Overview

A Material Transfer Agreement (**MTA**) was signed in Aug-19 with Clarke to allow initial testing of Flavocide and Qcide on three significant mosquito species:

1) Anopheles Gambiae
2) Aedes Aegypti
3) Culex

- Clarke's internal testing supports Purdue University data showing control of these mosquito species
- Partnership to focus on formulation development for Flavocide and Qcide, in combination with other active ingredients to determine best options for a commercial product
- Opportunity to expand into other markets with other stakeholders, including NGOs and philanthropists
- Second partnership for BGT following the stored grain pest control partnership with BASF / GRDC announced in Sep-19

Bio-Gene's technology addresses market needs

Our proprietary chemistry represents a step-change for resistant pest 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

About Clarke

The largest vertically integrated company serving the public health mosquito control market

Clarke Overview

- Expert in product development, registration, manufacturing, sales and service
- Played a front-line role in nearly every major US based mosquito-borne disease outbreak since West Nile Virus in 1999
- 2016: Lead response in US to Zika outbreak
- 2019: Aided multiple US regions to combat Eastern Equine Encephalitis

Founded	Offices	Headquarters
1946	21	Illinois, USA

Vertically Integrated Service Offering

Mosquito Control Products	• Adulticide and Larvicide active ingredients and formulations for public health mosquito control, with a strong focus on NextGen and low toxicity green chemistries
Mosquito Equipment	• Application equipment, field and surveillance tools and data management for recording, mapping, managing and reporting mosquito control data
Mosquito Control Services	• Public, commercial and residential mosquito control services, including emergency responses to disease outbreak

Bio-Gene Commercialisation pathway

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

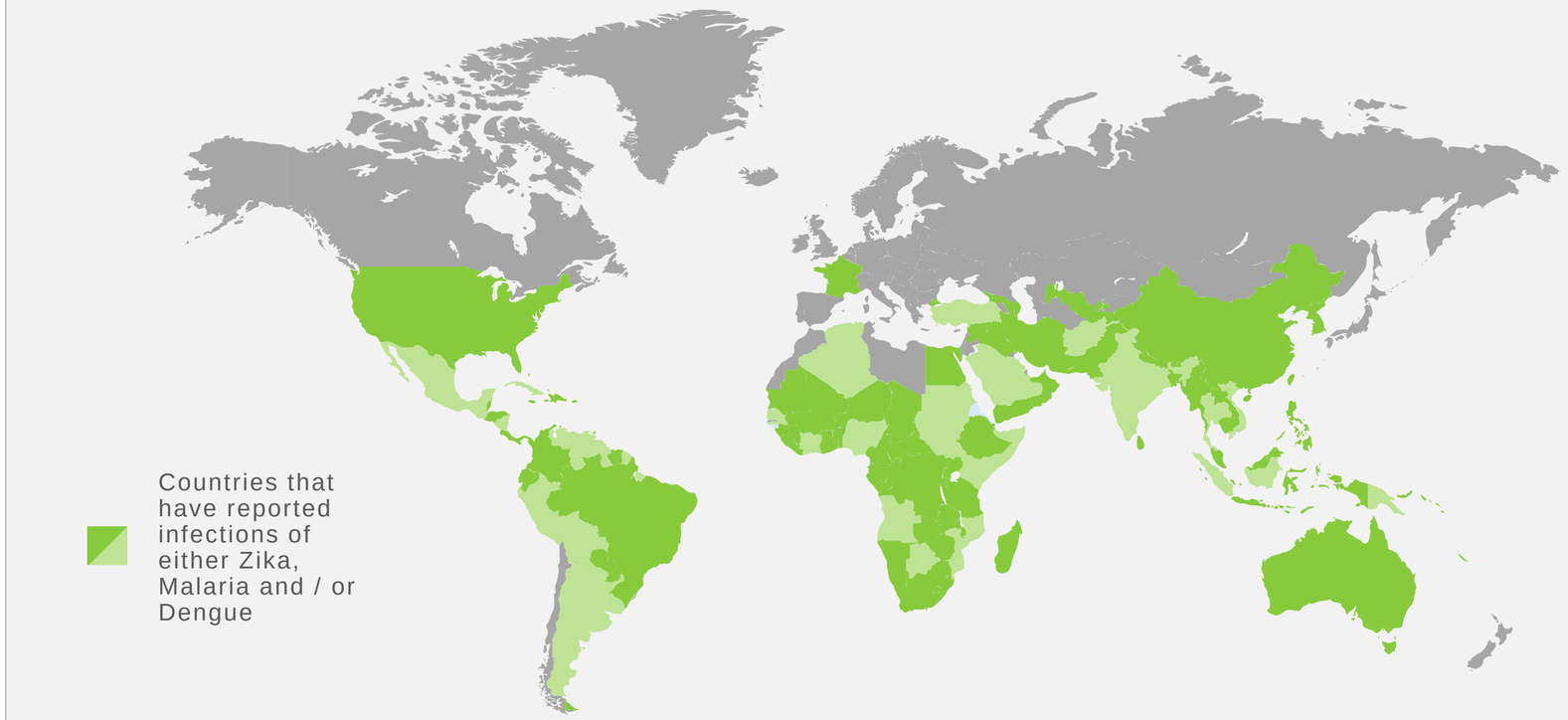
	Strategic approach	Progress
A	**In-house Testing & Data Generation** • Suite of data now well developed, with compelling evidence of efficacy of Flavocide against key pests	Well Progressed
B	**Progress Commercial Discussions Globally** • Progress several more Material Transfer Agreements (**MTA's**) • Now pursuing discussions with Corporates, NGO's, Philanthropic & Gov Agencies	7 MTA's in Place Across all Verticals
C	**Exclusive Partnership Arrangements – across multiple markets** • Public Health partnership for North, South and Central America signed • Stored Grain partnership for Australia signed	clarke BASF We create chemistry GRDC Grains Research & Development Corporation
D	**Commercial Deals** • Progress towards more formal agreements and development plans with key partners to enable commercialisation of our technology	Progressing

Public Health Market

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

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

“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.

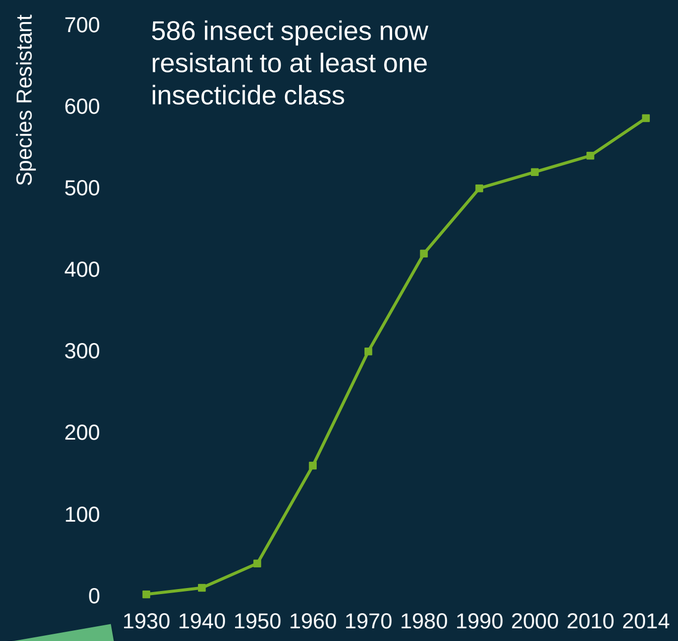
Zika virus has been declared a global health emergency, and death due to dengue fever has increased 30-fold in the last 50 years. Collectively, it is estimated that mosquito-borne diseases such as malaria, dengue, zika claim over 700,000 deaths every year. In addition, these diseases are known to exacerbate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

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

Insecticide resistance

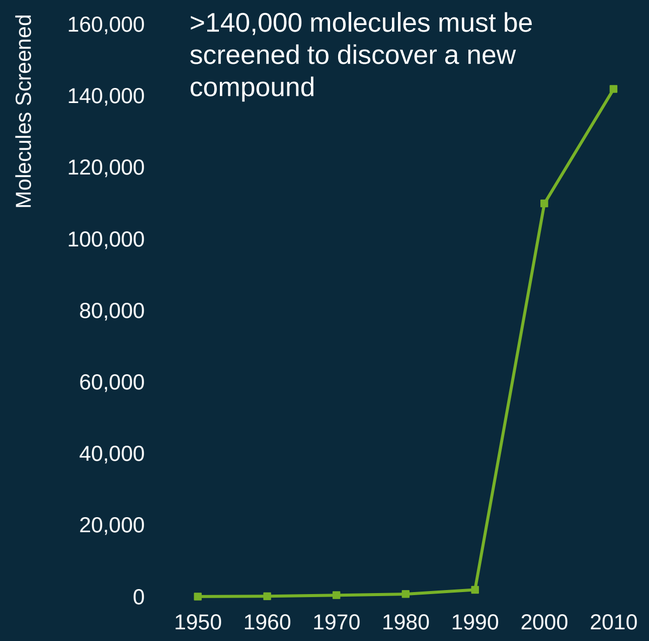
Resistance is rapidly increasing while our ability to find a solution diminishes

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

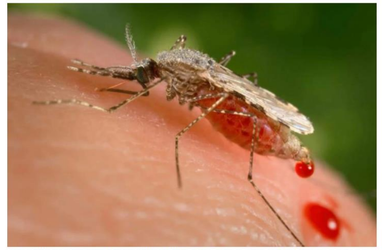
Insect 'apocalypse' in U.S. driven by 50x increase in toxic pesticides

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

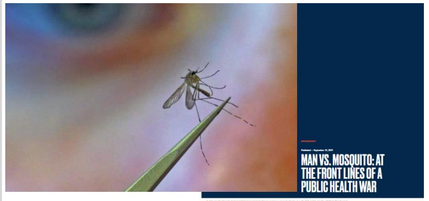
Climate change is altering the environment in ways that increase the potential for viruses like Zika.

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 2012, 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 2013, 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 2013, 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

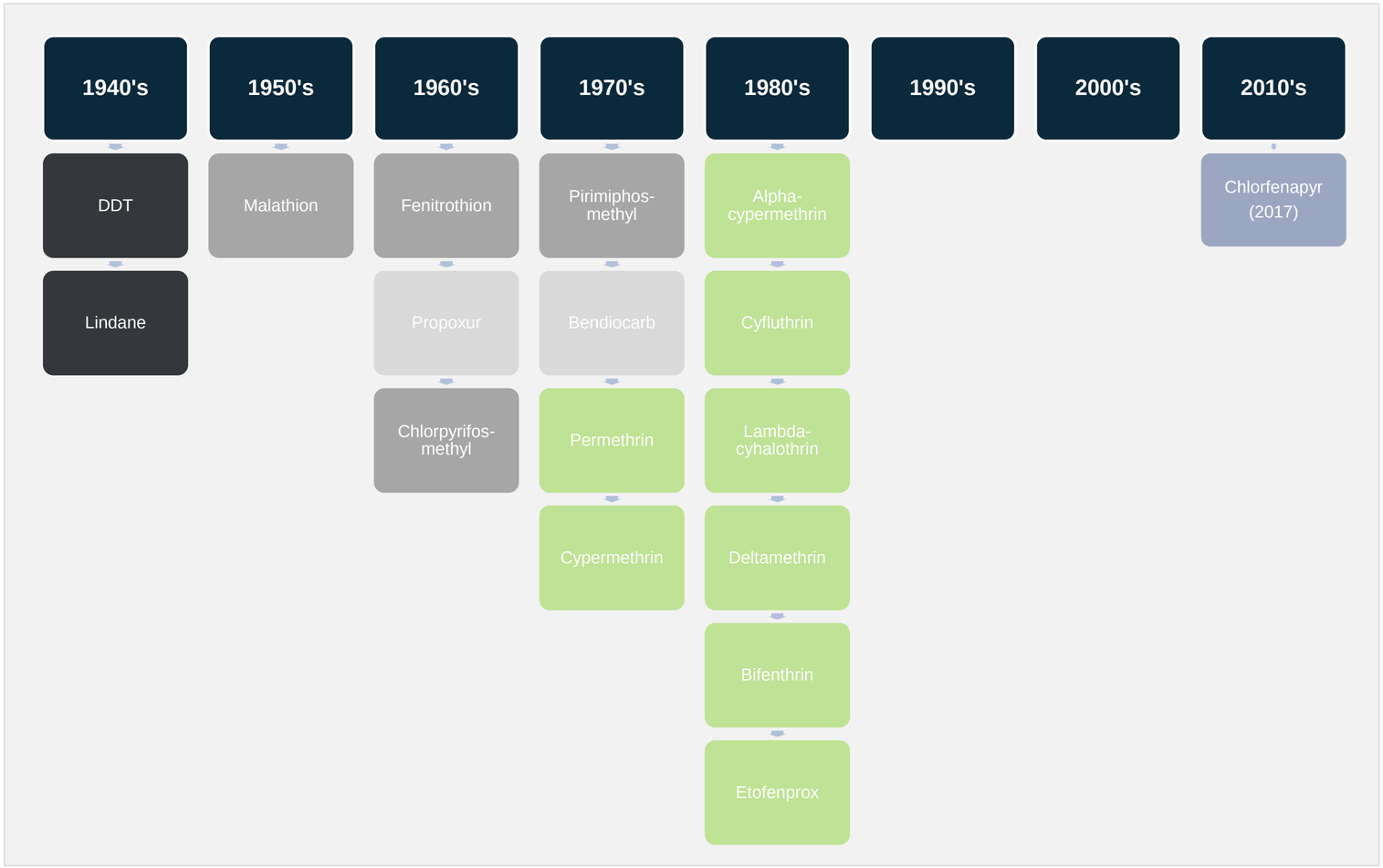
✗ Resistance recorded

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

Bio-Gene is well placed to deliver across multiple markets

Bio-Gene has two unique compounds

Novel platform technology based on a naturally occurring class of chemicals known as Beta-Triketones

Qcide™

Natural Compound

Extract of an Australian eucalypt

Applications in:

- Consumer Products
- Public Health
- Crop Protection

Flavocide™

Nature Identical Compound

‘Synthetic copy’ of a natural compound that can be mass produced for broad verticals:

- Crop Protection
- Public Health

Bio-Gene has four major target verticals

Two Partnership Agreements in Stored Grain and Public Health

Seven MTA’s in place across all four target verticals

Crop Protection

Stored Grain

Public Health

Consumer Products

Total addressable market of US$25.1bn

Australian stored grain pest control partnership trial

All key representatives aligned on stored grain partnership trial - commenced Jan 2020

Contribution	About
Funding, market access & regulatory expertise	**BASF** world's largest chemical company and leading developer of new chemistry to the agriculture sector
Research	Department of Agriculture & Fisheries, Queensland Government (**DAF**), recognised experts in field of resistant stored grain pests
Funding & industry validation	Grains Research & Development Corporation (**GRDC**) Australia's national grains RD&E body, committed to developing new technology
Technology, funding & expertise	**Bio-Gene** provides patented, nature identical molecule Flavocide™ to address the issue of resistant stored grain pests

Investment Highlights

Bio-Gene’s technology addresses the needs of a large and growing global problem of pest resistance

Bio-Gene has a compelling value proposition

Market Cap of $26.0m

Cash at Bank of $3.5m providing 18-month runway

Minimum impact on business from COVID-19 crisis

Third-party validation of technology by tier-1 partners

7 MTA’s in place across all verticals with several industry leaders

Natural chemistry is significantly growing in demand by consumers and suppliers

Strong IP Portfolio

$25.1bn global opportunity across four verticals

Appendix

Company Snapshot

Capital Structure	
Shares on Issue	132.9m
Share Price (22 Apr 2020)	$0.195
12-month Range	$0.08– $0.32
Market Cap	$26.0m
Cash Balance (19 Mar 2020)	$3.5m

Top 5 Shareholders[1]	Holding	(%)
Rumble Nominees Pty Ltd	6.7m	5.0%
Invia Custodian Pty Limited	3.1m	2.3%
Dead Knick Pty Ltd	3.0m	2.3%
Dr Russell Hancock	3.0m	2.3%
Magdajano Pty Ltd	2.9m	1.8%
Top 20 Shareholders	**42.9m**	**32.3%**
Top 30 Shareholders	**53.7m**	**40.4%**

Broker Options	
Options Issued	4,000,000
Exercise Price	20c
Expiry	24/11/2020

[1]Non-consolidated basis

Board & Management

DON BRUMLEY

Non-Executive Chairman

- 25+ years as a senior partner & leader of Ernst & Young – Oceania
- Significant experience across IPOs, transactions, audit & advising growing entrepreneurial companies

RICHARD JAGGER

CEO & Managing Director

- 20+ years working in agriculture globally
- Most recently employed as Managing Director of Sinochem Australia
- Previously spent 15+ years at Monsanto in various management roles

PETER MAY

Executive Director, R & D

- 20+ years experience in crop protection market with companies Orica & Crop Care Australasia (now Nufarm)
- Founded Xavca, consulted to companies such as Syngenta & Sorex (BASF)
- Former CEO & Chairman of BioProspect (now Medibio, ASX:MEB)

ROBERT KLUPACS

Non-Executive Director

- 30+ years corporate experience in international tech development
- CEO of the Bionics Institute
- Previously MD & CEO of ASX-listed Circadian Technologies Ltd and ES Cell International Pte Ltd
- Registered Australian patent attorney

KEVIN RUMBLE

Non-Executive Director

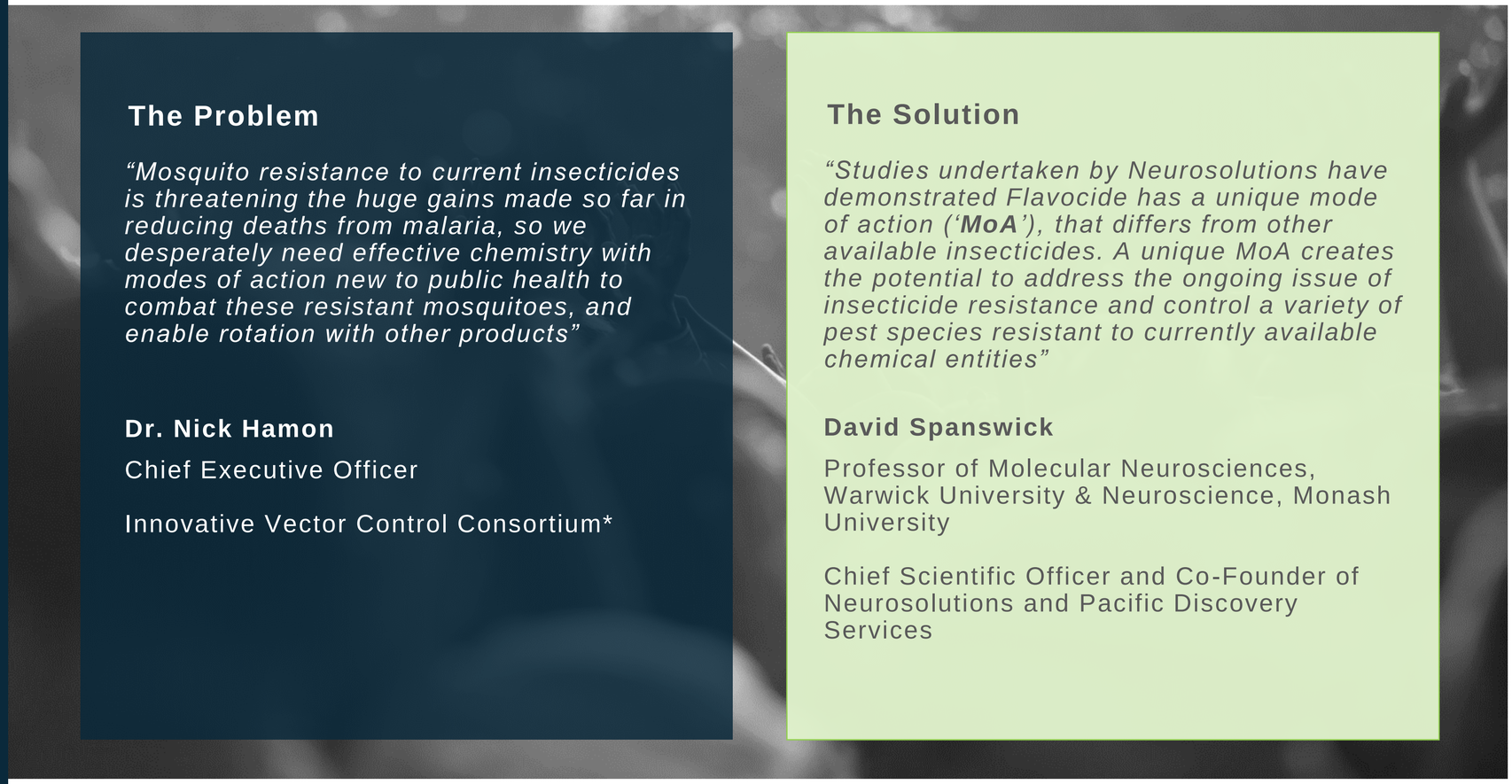
- Founding Director of Bio-Gene
- 20+ years experience in new plant propagation, farming & live plant transport techniques
- Involved in the development of Qcide™ & development of Flavesone as a first step in the commercialisation of Flavocide™

ROGER MCPHERSON

Chief Financial Officer & Company Secretary

- 15+ years experience as CFO & Company Secretary across both listed & unlisted companies
- Experience in the pharma manufacturing, biotech & biopharma industries
- Previously CFO & Co-Sec of TPI Enterprises (ASX:TPE)

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

Resistance Recorded	Mosquito Species			
	Aedes sp.	***Anopheles sp.***	***Culex sp.***	
Organochlorines	✗	✗	✗	Discovered 1930
Organophosphates	✗	✗	✗	Discovered 1944
Pyrethroids	✗	✗	✗	Discovered 1977
Carbamates	✗	✗	✗	Discovered 1950
Flavocide	✓	✓	✓	**New Chemistry**

Legend

✗ Resistance recorded ✓ Efficacy confirmed

Purdue collective trial results

This latest trial highlighted 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:** confirmed 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**: A substantially lower level of toxicity on bees and other beneficial insects

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

d) **Intervention Method:** Confirmed that Flavocide can be delivered via residual sprays as well as treated nets

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