

The Foster Method: Rapid And Non-Invasive Detection of American Foulbrood Disease Levels In Honeybee Colonies



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¹dnature diagnostics & research Ltd, Gisborne

²Scandrett Rural Ltd, Invercargill



**2nd Australian & New Zealand
eDNA conference, Feb 2025**

Swabbing, Infectious Disease & qPCR . . .for bees . . in 2018



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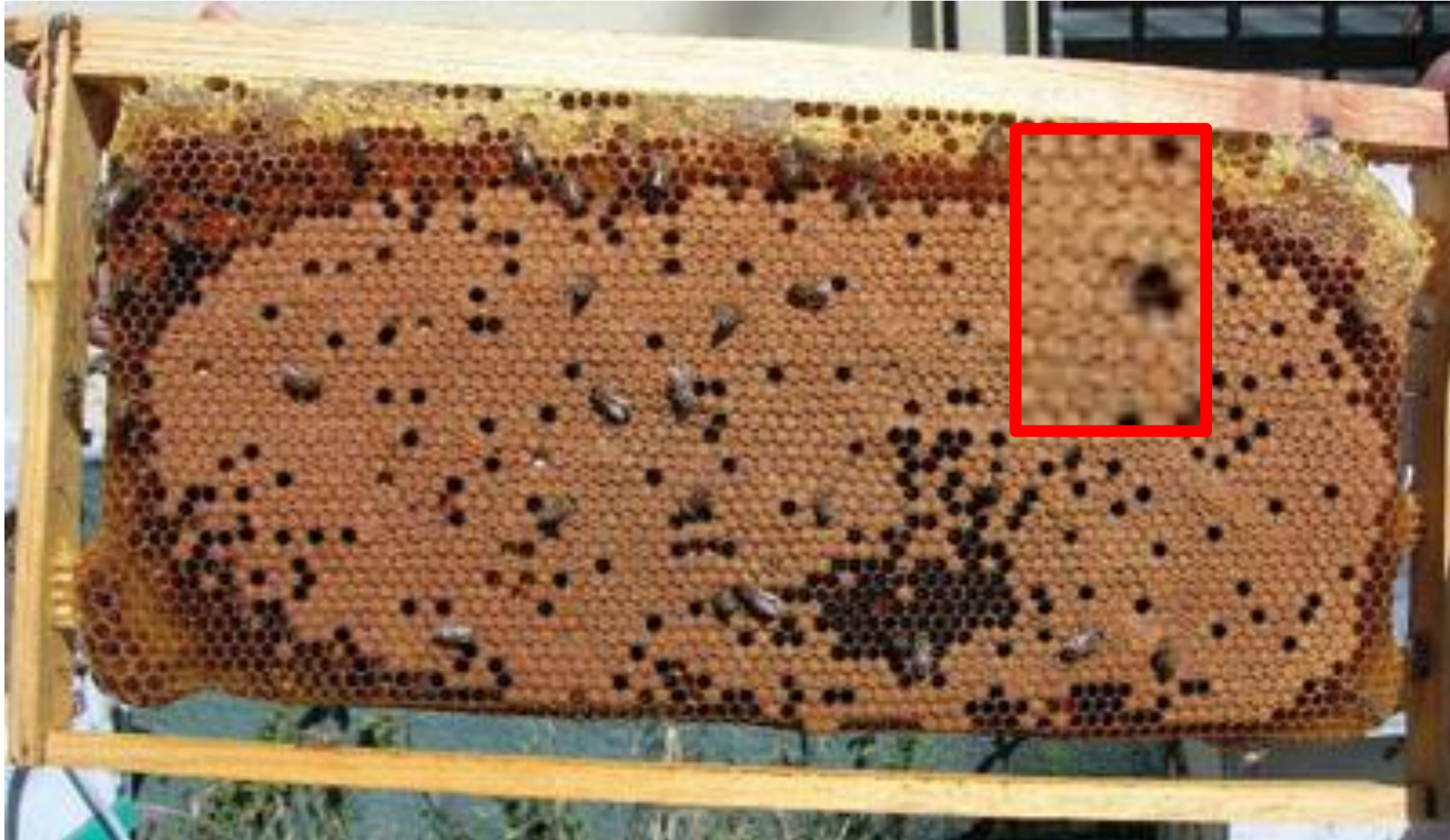
²Scandrett Rural Ltd, Invercargill



American Foulbrood

- Gram-positive spore forming bacteria
 - *Paenibacillus larvae*
- Extremely hardy (>70 years)
 - Withstand boiling water
 - Dry environment
- Found in all countries with bees
- **Most dangerous disease of bees**
- **Kills larvae and whole hive**

American Foulbrood

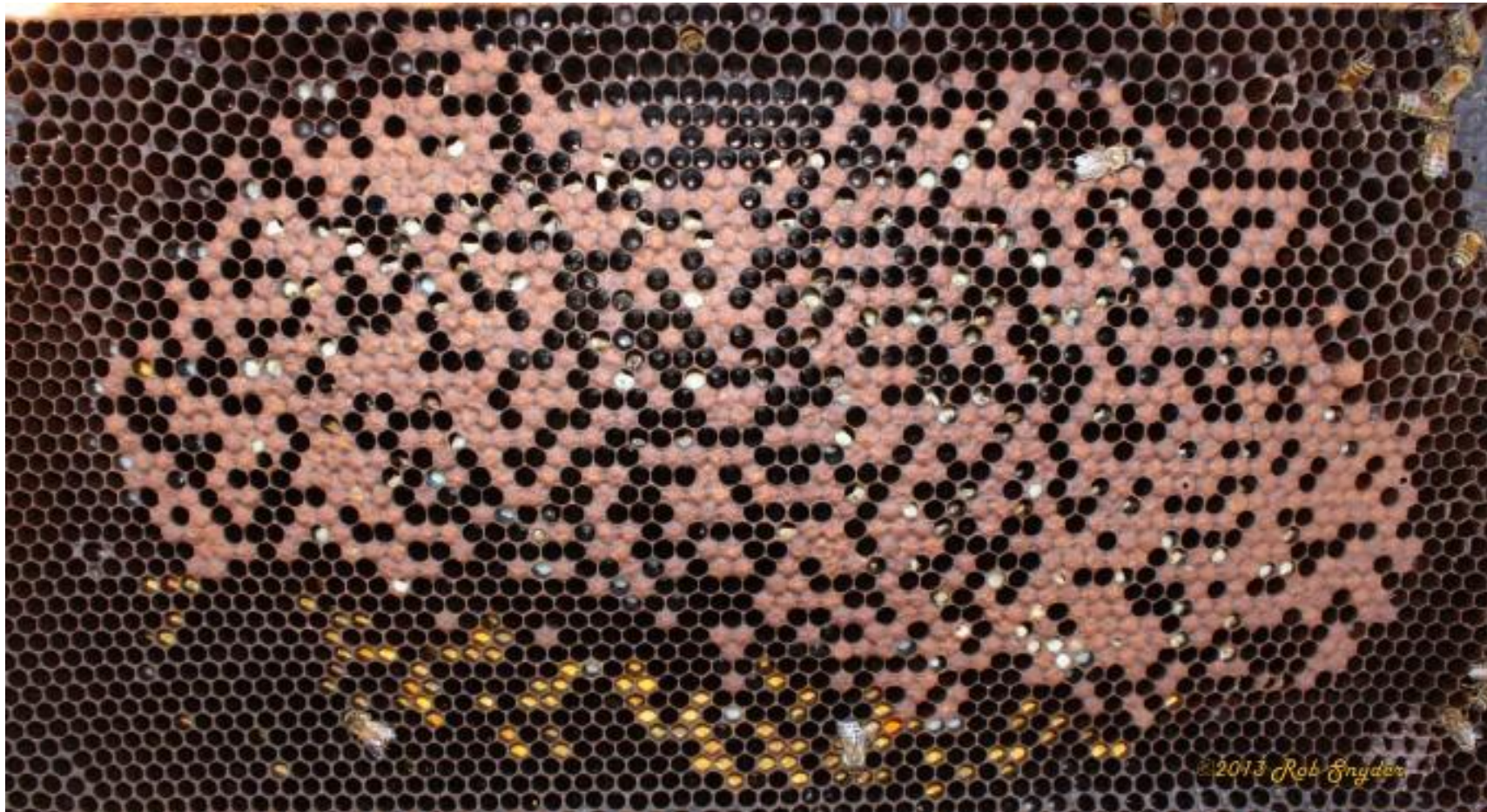


Try and hide now you little shit



American Foulbrood

- Disease being missed by beekeepers
- Other diseases can mimic symptoms



**caused by
varroa**

American Foulbrood



American Foulbrood



The cure. . . . ?

AFFB

The image features the letters 'AFFB' in a bold, sans-serif font. Each letter is filled with a vibrant, dynamic texture of fire and flames, transitioning from deep reds and oranges to bright yellows and whites. The letters are outlined with a thick, clean white border, which makes them stand out sharply against the solid black background. The overall effect is one of intense heat and energy.







**Honey company
forced to burn beehive boxes**

American Foulbrood

Laborious to
get samples

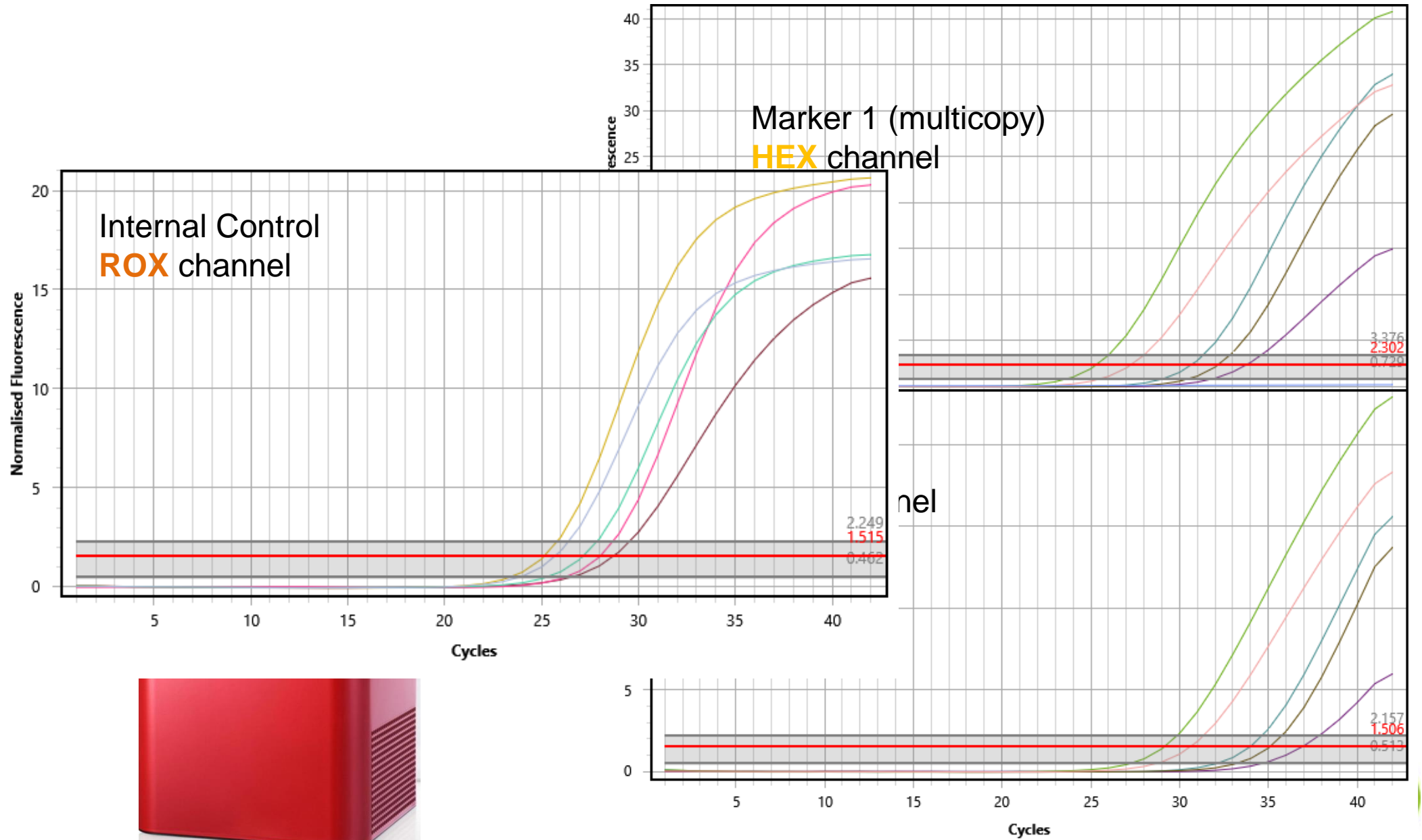


American Foulbrood

2017 thought:

is there an easier way to detect this disease?

American Foulbrood



- Why dual target ?

Chlamydia

American Foulbrood

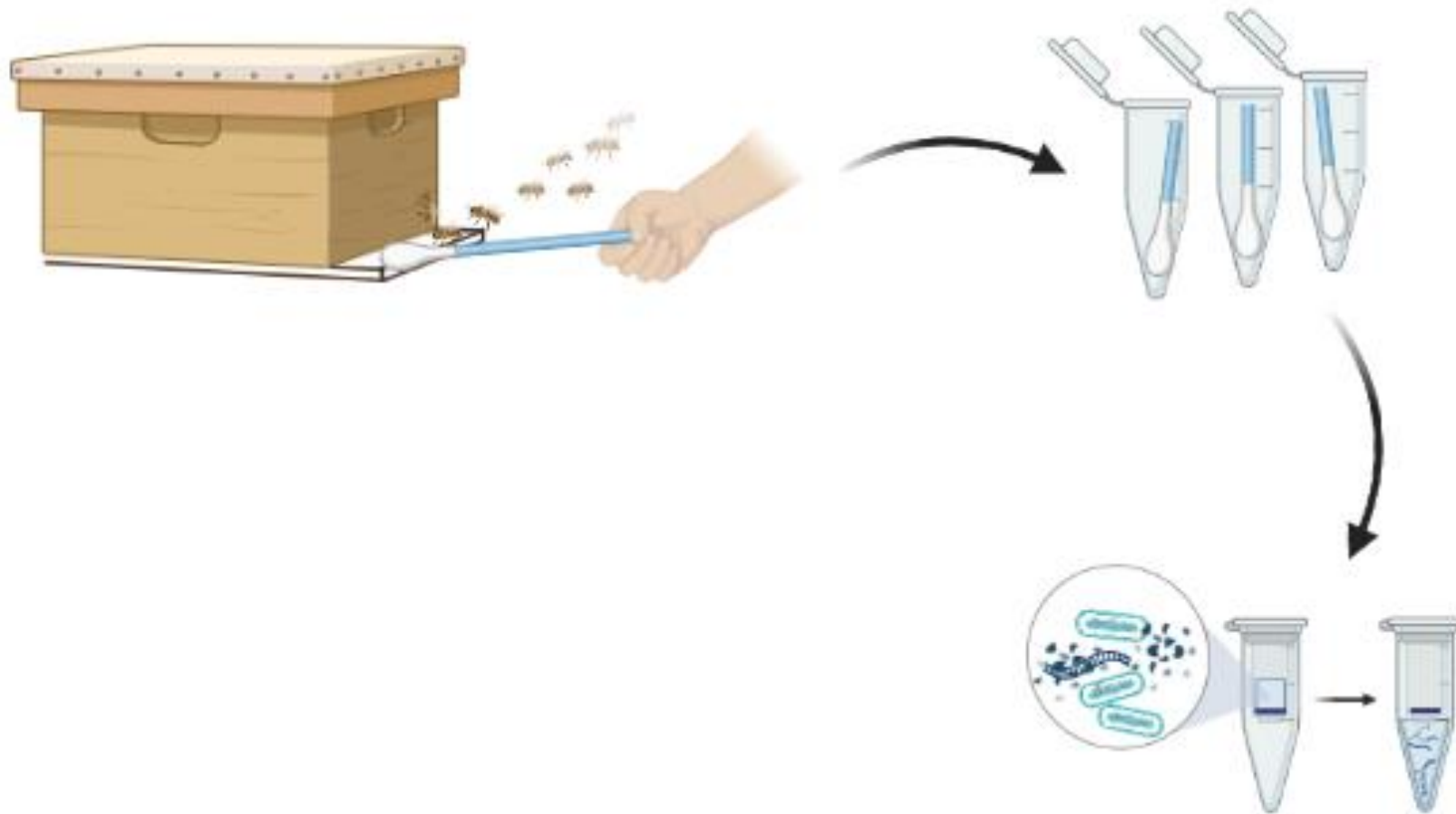
- Swabs
 - Infectious disease
 - 2018 !
 - Could we sample hives through the entrance ?
-
- Project began in 2018
 - Compared bees vs entire baseboard vs entrance
 - Followed quarantine apiaries from 6 beekeepers
 - Gisborne, Wairarapa, Wellington, Ashburton



Swab entrance



Snapped into tubes



Lab: Extract DNA

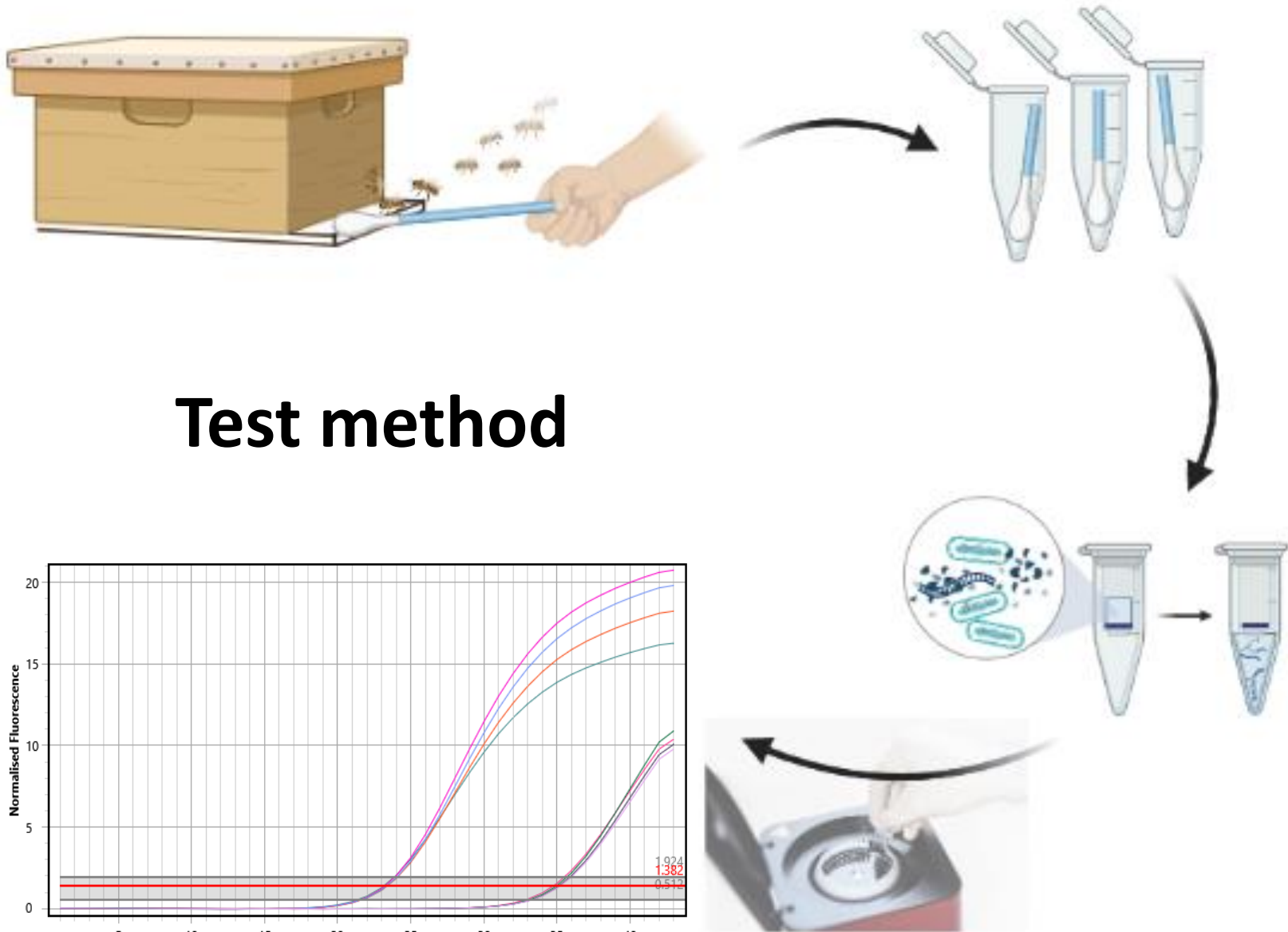
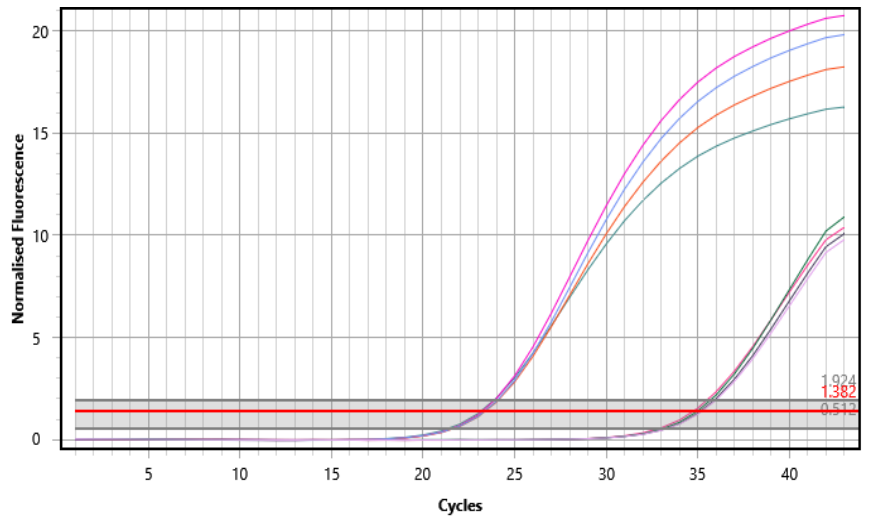


Figure: biorender.com

Test method



Run qPCR and estimate spores (based on Cq)

Do we need the whole baseboard ?

Do we need the whole baseboard ?

Hive	Location	Estimated Spore level (ftsZ target)	Hive status
ML Shearer	Baseboard	52 million	Clinical signs of AFB
	Entrance	25 million	
ML Ellis	Baseboard	3.6 million	Clinical signs of AFB
	Entrance	3.4 million	
FL 10	Baseboard	61	No AFB seen
	Entrance	335	

Apiary screening

Project Clean Hive

	Clinical signs of AFB?	Bees	Entrance Swab
		Spores/10 bees	Spores/swab
<u>MLHive 1</u>	Yes	37,097,589	3,138,994
<u>MLHive 2</u>	Yes	514,061	24,008
<u>MLHive 3</u>	No	ND	ND
<u>MLHive 4</u>	No	387	1,107
<u>MLHive 5</u>	No	539	377
<u>MLHive 6</u>	No	ND	ND
<u>MLHive 7</u>	No	80	ND
<u>MLHive 8</u>	No	210	ND
<u>MLHive 9</u>	No	205	ND
<u>MLHive 10</u>	Yes	55,866,177	962,621

Major benefit of swabs ?

**Ability to composite samples
(pooling)**

	Pooled result (12) ftsZ spore levels	Individual Swab Result ftsZ spore levels (per swab)	Clinical Signs of AFB (following testing)	
Hive SB216	15,630	Not detected	No	
Hive SB217		Not detected	No	
Hive SB218		Not detected	No	
Hive SB219		165,103	Yes	
Hive SB220		Not detected	No	
Hive SB221		Not detected	No	
Hive SB222		Not detected	No	
Hive SB250		Not detected	No	
Hive SB251		Not detected	No	
Hive SB252		Not detected	No	
Hive SB253		Not detected	No	
Hive SB254		Not detected	No	
Hive SB255		Not Detected	-	No
Hive SB256			-	No
Hive SB257	-		No	
Hive SB258	-		No	
Hive SB259	-		No	
Hive SB260	-		No	
Hive SB261	-		No	
Hive SB262	-		No	
Hive SB263	-		No	
Hive SB264	-		No	
Hive SB265	-		No	

Swabbing hive ware (supers)

Same swab can be used for multiple boxes

Swabbing in 'W' pattern across middle of frames (top or bottom)



Lab testing

Old hives suspected of being contaminated by AFB

Swab #	284		290		291		293		294	
dnature #	19676		19677		19678		19679		19680	
AFB	Result	Cq	Result	Cq	Result	Cq	Result	Cq	Result	Cq
Marker 1	Pos	20.56	Pos	27.92	Pos	9.68	Pos	19.49	Pos	8.19
Marker 2	Pos	25.43	Pos	31.62	Pos	13.51	Pos	23.51	Pos	11.84
Spore est.	389,554		6,537		1,020,889,196		1,384,153		3,075,390,843	



> 3 billion spores

Swab #	295		296		297		298		300	
dnature #	19681		19682		19683		19684		19685	
AFB	Result	Cq	Result	Cq	Result	Cq	Result	Cq	Result	Cq
Marker 1	Pos	26.38	Pos	17.68	Pos	21.42	Pos	27.42	Pos	22.73
Marker 2	Pos	30.41	Pos	21.32	Pos	25.44	Pos	31.27	Pos	26.64
Spore est.	14,535		5,878,019		386,990		8,237		175,212	

Case example

Large manuka honey company

From 1 to 3 to 7 to 11 to

23 tonnes manuka honey contaminated with AFB spores

Checking live and 'deadout' beehives with the Foster method

From 23 tonnes to < 1 tonne

At ~\$50 per kg wholesale

\$1.1 million

Swabbing 'game-changer'

By **Shawn McAvinue**



Rural life > Other News

A new technology helping fight against a bee-killing disease is a “massive breakthrough”, an Otago apiarist says.

New Zealand Alpine Honey owner and Project CleanHive chairman Peter Ward, of Hawea, said he ran about 5000 hives across Otago, Southland and the West Coast.



Bee smart: Covid detection method inspires apiarists

Publication

JOURNAL OF APICULTURAL RESEARCH

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ORIGINAL RESEARCH ARTICLE



The Foster method: rapid and non-invasive detection of clinically significant American Foulbrood disease levels using eDNA sampling and a dual-target qPCR assay, with its potential for other hive pathogens

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Foster Method

Board member AFBPMP 9 years

AFB recognition course trainer

AP2

11 years on NBA board

ApiNZ Life Member

Early adopter (with John Maynard)

Barry Foster



Assoc Prof Russell Poulter



John Maynard, AP2

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