



# Brood diseases of honey bees

Mairi Carnegie

SASA

# SASA *(A Division of the Agriculture and Rural Economy*

*Directorate of the Scottish Government)*

SASA  
Helping Scotland Grow



- ❖ Community of inspectors, policy professionals and scientists
- ❖ Provides scientific advice and services
- ❖ Arable agriculture, plant health, food safety, wildlife crime
- ❖ Horticulture and marketing inspectorate
- ❖ Policy responsibility for pesticides and fertilisers, plant health and plant varieties and seeds





# The SASA Bee Team

Elizabeth Sharp – Senior Analyst



Fiona Hight MBE – Senior Entomologist



Zoology Team



Molecular Team



Chemistry Team





# About me

- ❖ Manager in the Zoology Branch
- ❖ Entomology testing services, including bee diseases
- ❖ Worked at SASA since 2004
- ❖ Involved in bee work since 2007, including Scottish foulbrood discovery in 2009



# Bees at SASA

image © Crown copyright



Varroa screening  
service



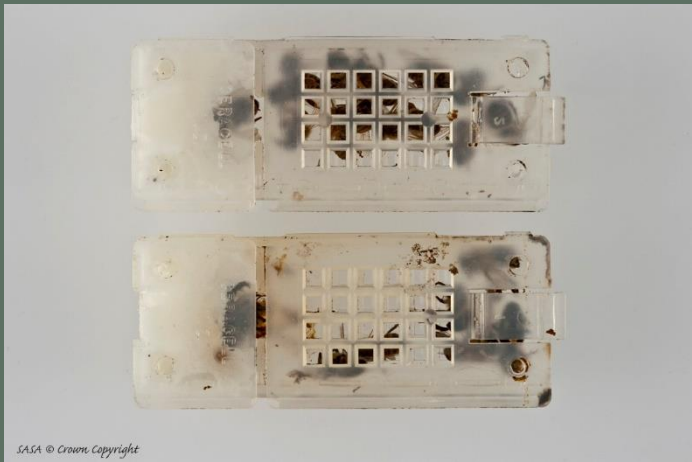
Dead adult bees  
disease screening



Foulbrood testing



# Bees at SASA



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Import testing/  
notifiable pests

## Wildlife Incident Investigation Scheme (WIIS)

Incidents of suspected poisoning of animals by pesticides in Scotland are investigated. The scheme is to identify any adverse effects on non-target animals that might arise from pesticides. If the data gathered by the scheme, and sister schemes throughout the UK, identify a particular problem, then the registration status of the pesticide concerned is subject to review by the regulatory body. The data are also used in the validation and improvement of risk assessments for existing and new compounds.

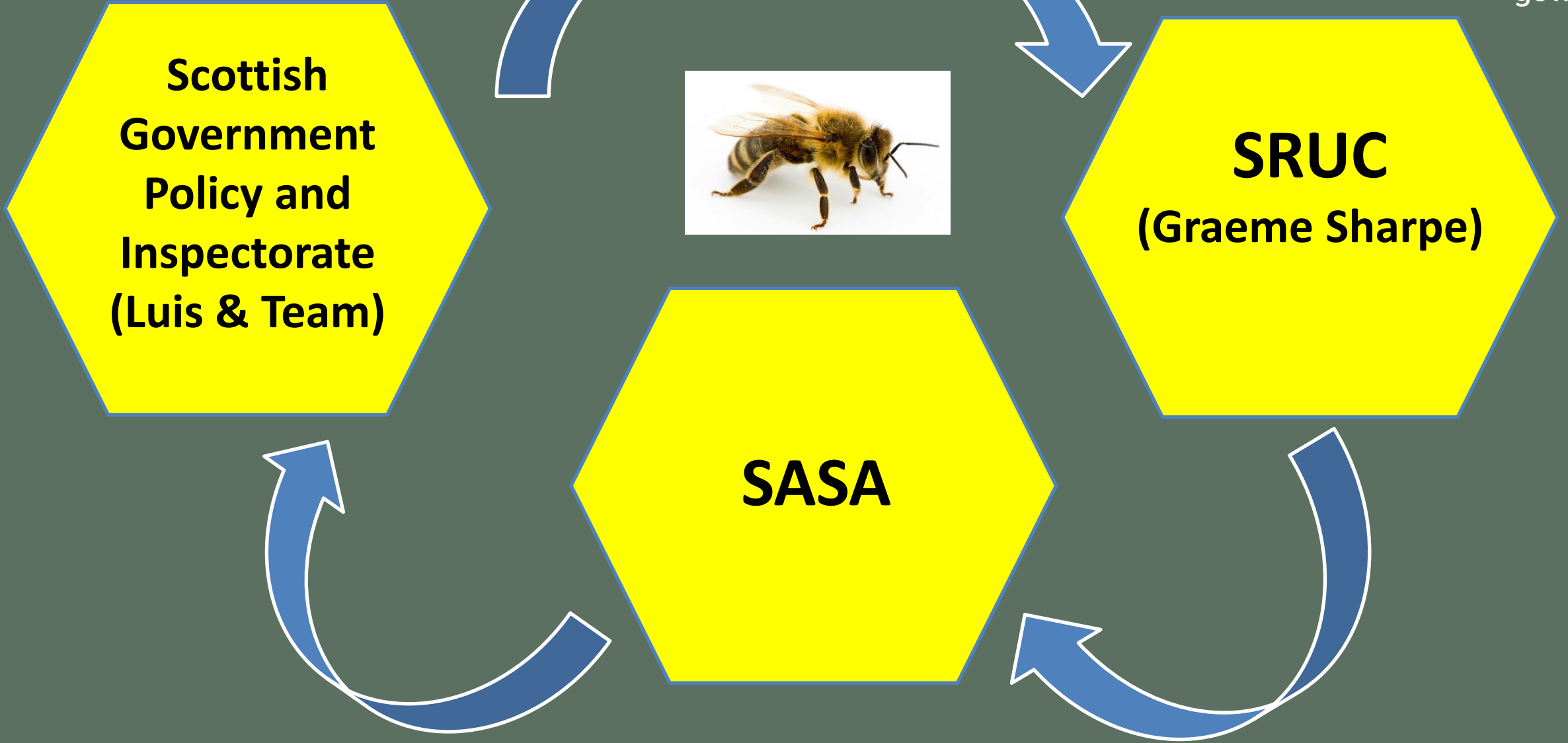


WIIS – monitoring  
accidental or deliberate  
misuse of pesticides



Asian Hornet  
contingency plans

# Working Together



# Brood Diseases and Disorders

## Minor brood diseases and disorders

- Chalkbrood
- Sacbrood
- Parasitic mite syndrome (Varoosis)
- Neglected brood (chilling)
- Drone layer

## Notifiable brood diseases

- European Foulbrood (EFB)
- American Foulbrood (AFB)



# First things first – recognise healthy brood!

## Overall Brood Pattern:

- Even, and with similar aged larvae close together (concentric circles)
- Few spaces
- Quantity as expected for time of year

## Cappings:

- Biscuit coloured
- Domed (recognise worker and drone)
- Dry

## Larvae:

- Pearly white
- C-shape in base of cell
- Clearly segmented



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# Chalkbrood (*Ascosphaera apis*)

- ❖ Fungal disease
- ❖ Likes damp, humid conditions (apiary location/ waterproof hives)
- ❖ White/ grey 'chalky mummies' with hard creamy head capsule
- ❖ Also seen under cappings with perforations
- ❖ Removed by house bees
- ❖ Can be sign of other problems/ food stress (e.g Damp, Varroa, EFB)





# Sacbrood Virus

- ❖ Virus particles fed by infected nurse bees
- ❖ Larvae die after capping (upright position)
- ❖ Cuticle thickens, darkens and insides liquify
- ❖ Dries out to a 'slipper shaped' removable scale (similar to AFB)
- ❖ Perforated, darker cappings
- ❖ No treatment – not a cause of colony loss in A.m.m





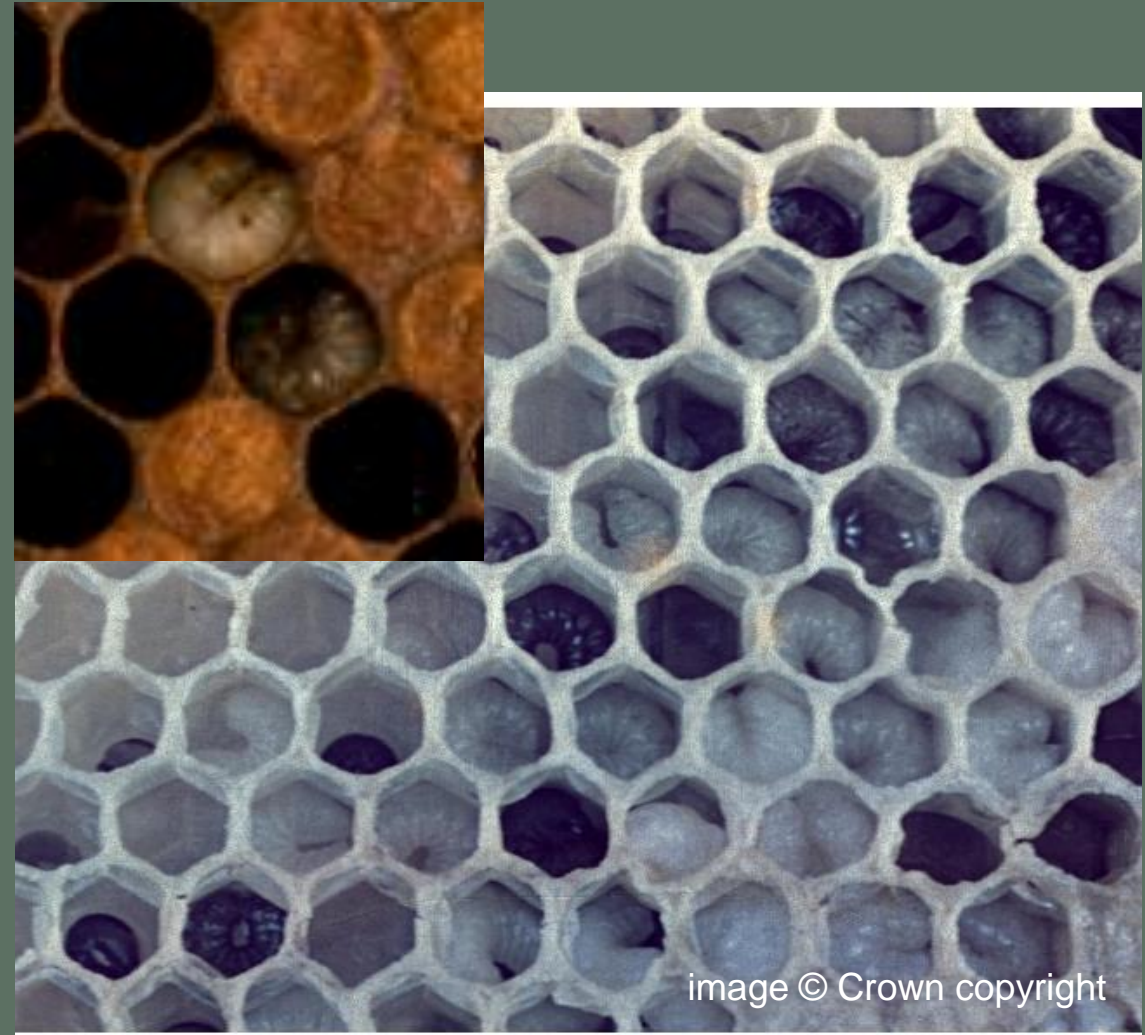
# Parasitic Mite Syndrome (PMS)

- ❖ Caused by Varroa infestation
- ❖ Perforated cappings (1)
- ❖ Pupated bees dead in cells- heads can be chewed off (2)
- ❖ Secondary problems, e.g chalkbrood/ starvation
- ❖ Causes colony loss
- ❖ Good varroa monitoring and control essential!



# Neglected brood (chilling)

- ❖ More a symptom than a disease, hence disorder
- ❖ Larvae turn grey, then black
- ❖ Watery larvae
- ❖ Causes can vary
  - Cold snap during brood expansion – especially in spring
  - Varroa infestation
  - Beekeeper management, e.g. splitting a small colony





# Drone layer

- ❖ Caused by queen laying drone eggs laid in worker cells or laying workers
- ❖ Surface of comb uneven
- ❖ Patchy brood pattern
- ❖ Little or no worker brood
- ❖ If queen issue – kill and replace or unite
- ❖ If laying workers – shake out



# Foulbrood Disease

209



## Bees Act 1980

CHAPTER 12

### ARRANGEMENT OF SECTIONS

Section

1. Control of pests and diseases affecting bees.
2. Power of entry.
3. Interpretation.
4. Enactment of same provisions for Northern Ireland.
5. Short title, commencement, repeals, transitional provision and extent.

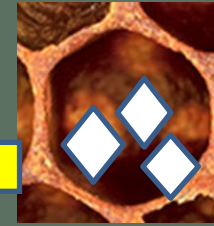
SCHEDULE—Specific Matters with respect to which Provision may be made by Orders under section 1.

- ❖ Two types of foulbrood
  - American Foul Brood (AFB)
  - European Foul Brood (EFB)
- ❖ **Statutory notifiable diseases**
- ❖ Bacterial diseases affecting honey bee brood
- ❖ **Spread within colony** - Larvae fed brood food containing bacteria by nurse bees
- ❖ **Spread between colonies** - Most commonly spread by beekeeper

# EFB Biology



Nurse bee picks up bacteria while cleaning dirty cell



This one survives to pupate



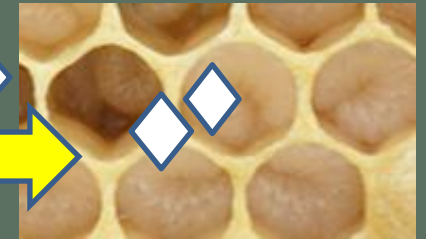
This one dies before capping and is removed by house bees



Bacteria lives in gut and competes with the larva for food



Nurse bee feeds contaminated food to larvae





## EUROPEAN FOULBROOD (*Melissococcus plutonius*)

Primarily a disease of the unsealed brood

- erratic or uneven brood pattern



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- **discoloured larvae**



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- discoloured larvae
- **larvae which has a melted appearance (no segmentation)**

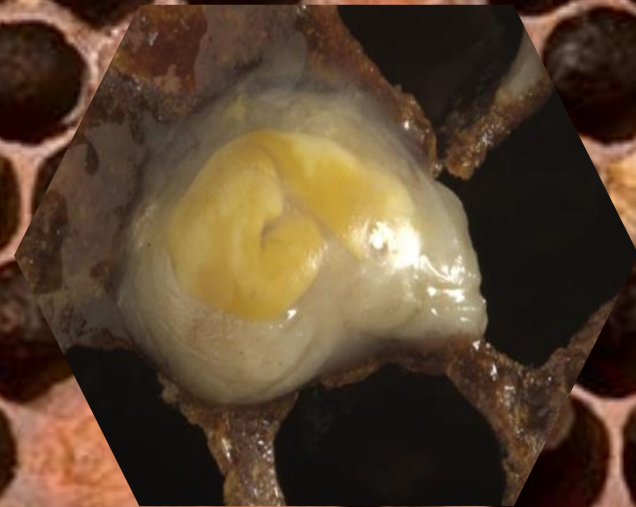


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- larvae which has a melted appearance (no segmentation)
- **an unpleasant sour smell**

Can be 'treated' by shook swarm



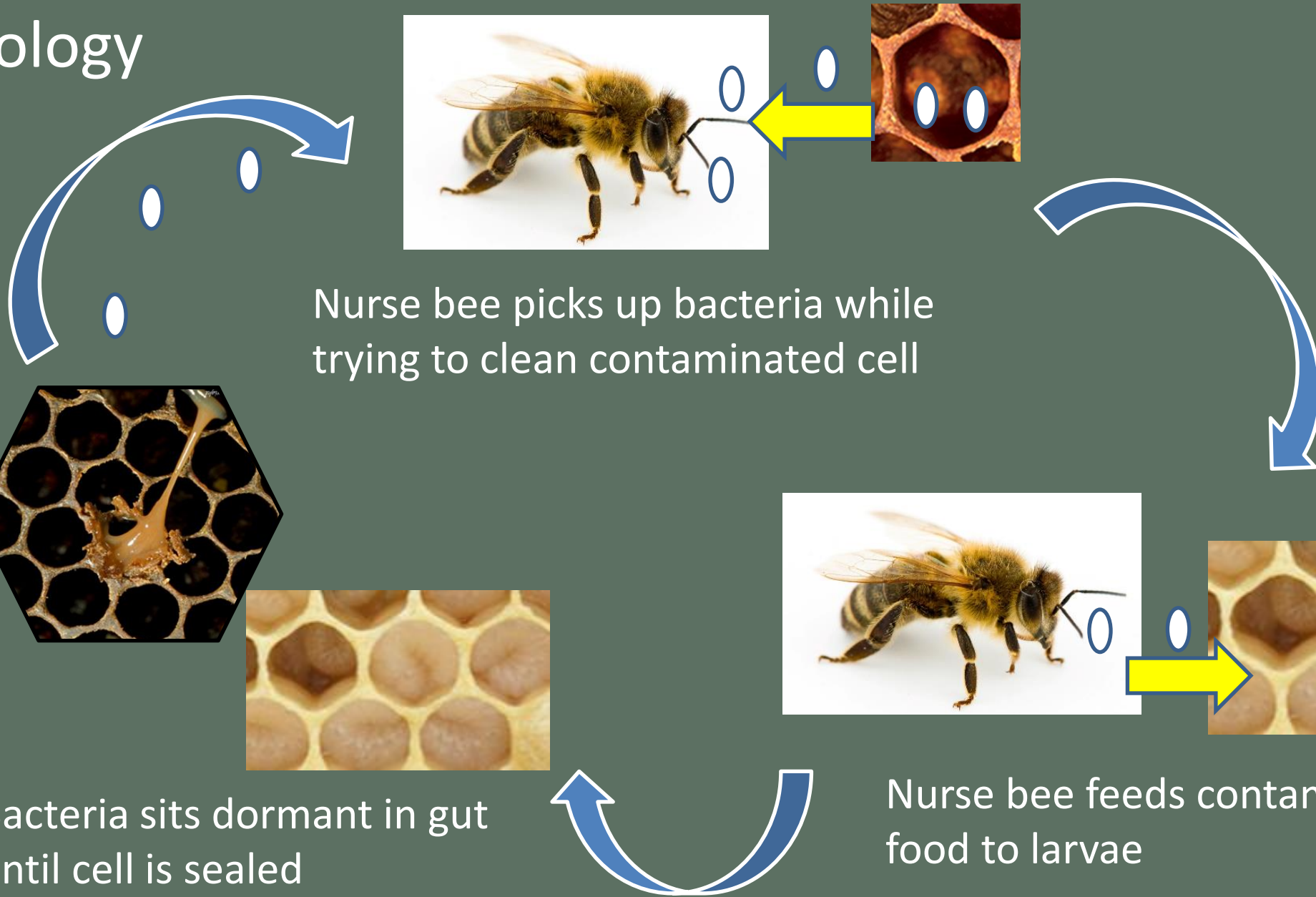


**One thousandth of a millimetre!!**



10  $\mu$ m

# AFB Biology



After cell is sealed  
bacteria  
consumes  
whole larva

Bacteria sits dormant in gut  
until cell is sealed

Nurse bee feeds contaminated  
food to larvae





## AMERICAN FOULBROOD (*Paenibacillus larvae*)

This disease affects sealed brood

- uneven 'pepper-pot' brood pattern



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- **darkened, sunken, greasy cell cappings**
- **perforated cell cappings**





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- **sticky larval remains which can be drawn out with a matchstick ('ropiness test')**



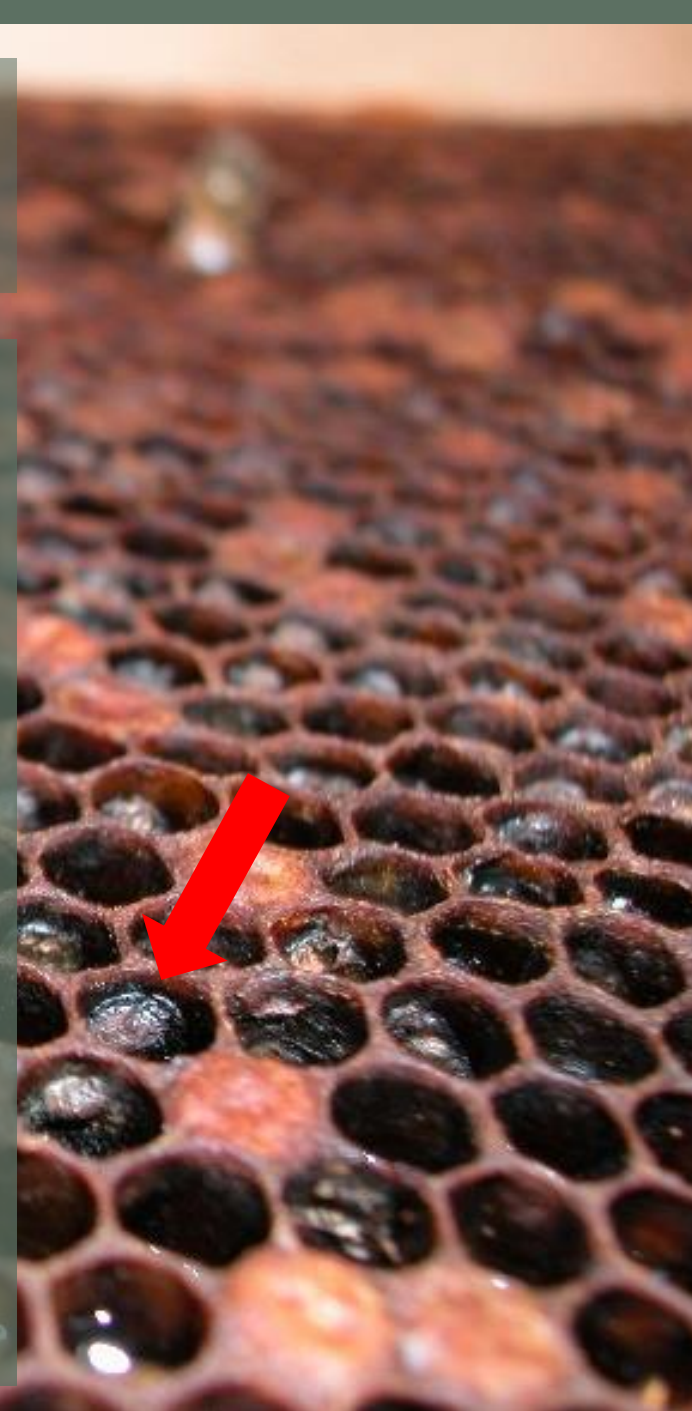


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- darkened, sunken, greasy cell cappings
- perforated cell cappings
- sticky larval remains which can be drawn out with a matchstick ('ropiness test')
- **hard, dark scales which are difficult to remove from cells**

**Infected colonies must be destroyed**





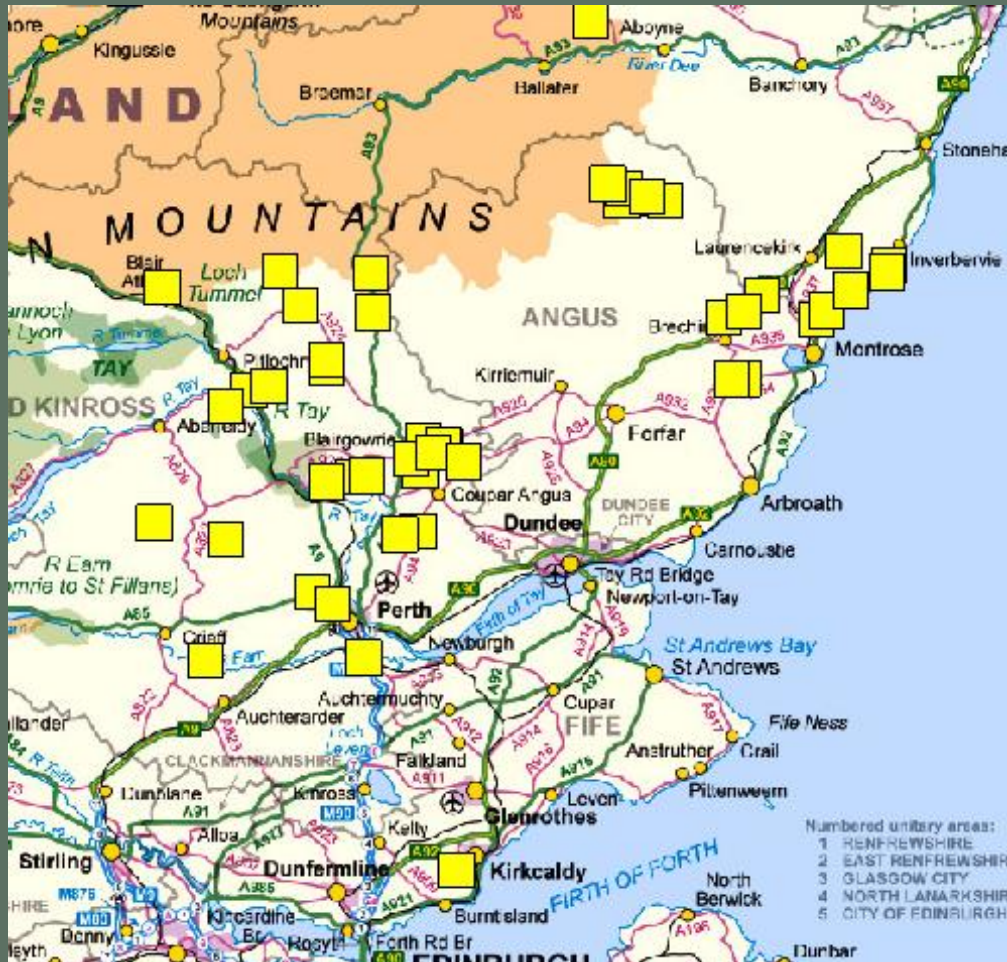


**Spores live for over 60 years!!**

# Foulbrood in East of Scotland

## EFB - 2021

## AFB - 2021





# So what can you do?

Carry out disease specific brood inspections



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## Practice good biosecurity

- ❖ Clean gloves and equipment
- ❖ Regular frame replacement and box cleaning
- ❖ Quarantine swarms or new colonies (or inspect last)
- ❖ Keep strong colonies with queens who lay well
- ❖ Source bees from reputable sellers
- ❖ Report any suspicion of foulbrood disease

# Reporting Foulbrood

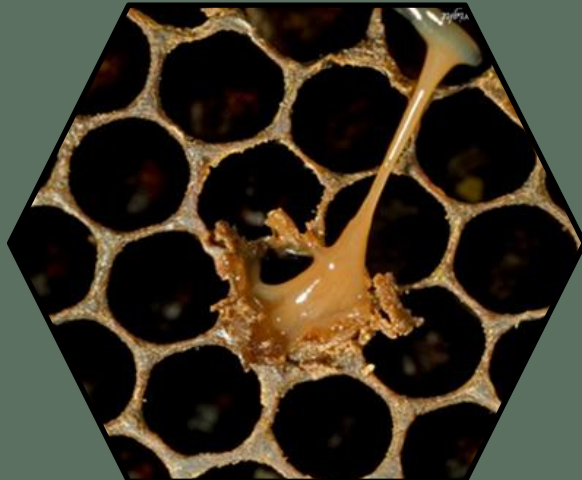
- ❖ Reduce entrance of suspect colony
- ❖ Clean all equipment thoroughly before continuing
- ❖ [Bees\\_mailbox@gov.scot](mailto:Bees_mailbox@gov.scot)
- ❖ An inspector will arrange a visit
- ❖ If foulbrood is suspected the apiary is put under standstill
- ❖ Sample/s sent to SASA for confirmation
- ❖ If EFB – treat or destroy?





# Summary

- ❖ Minor brood disorders
- ❖ 'Statutory notifiable' brood diseases
- ❖ How to report suspicion of notifiable disease



## Further Information

- ❖ Beebase info leaflets and image gallery
- ❖ Attend a Bee Health Day
- ❖ SASA website
- ❖ Scottish Government website



## CONTACTS – KEEP IN TOUCH!

- [mairi.carnegie@sasa.gov.scot](mailto:mairi.carnegie@sasa.gov.scot)
- 0131 244 8817 – SASA Zoology lab
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- Luis Molero, Lead Bee Inspector
  - [graeme.sharpe@sruc.ac.uk](mailto:graeme.sharpe@sruc.ac.uk)
- 01290 552015 – Apiculture advisor
- <http://www.nationalbeeunit.com/>