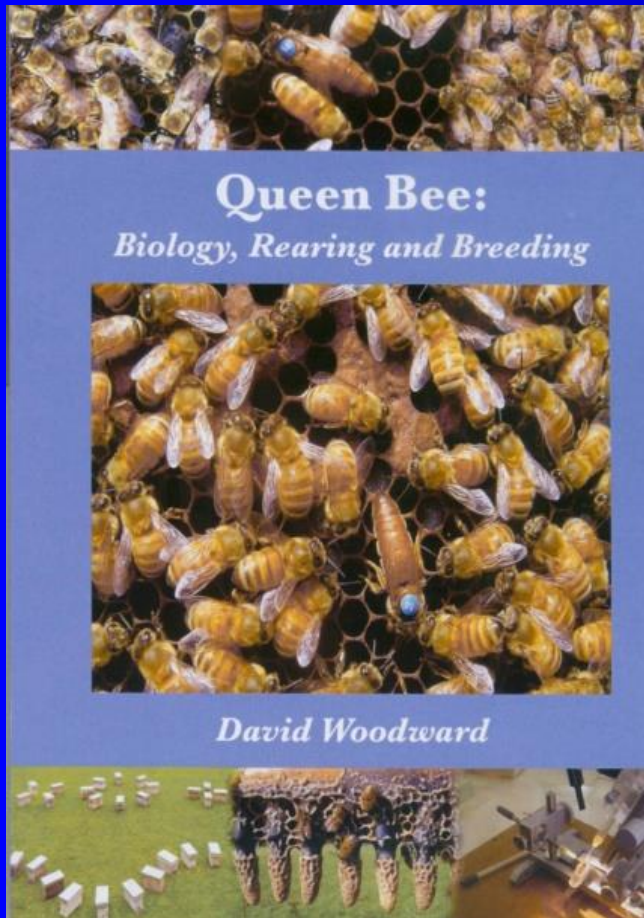


Queen Bee: Biology, Rearing, and Breeding



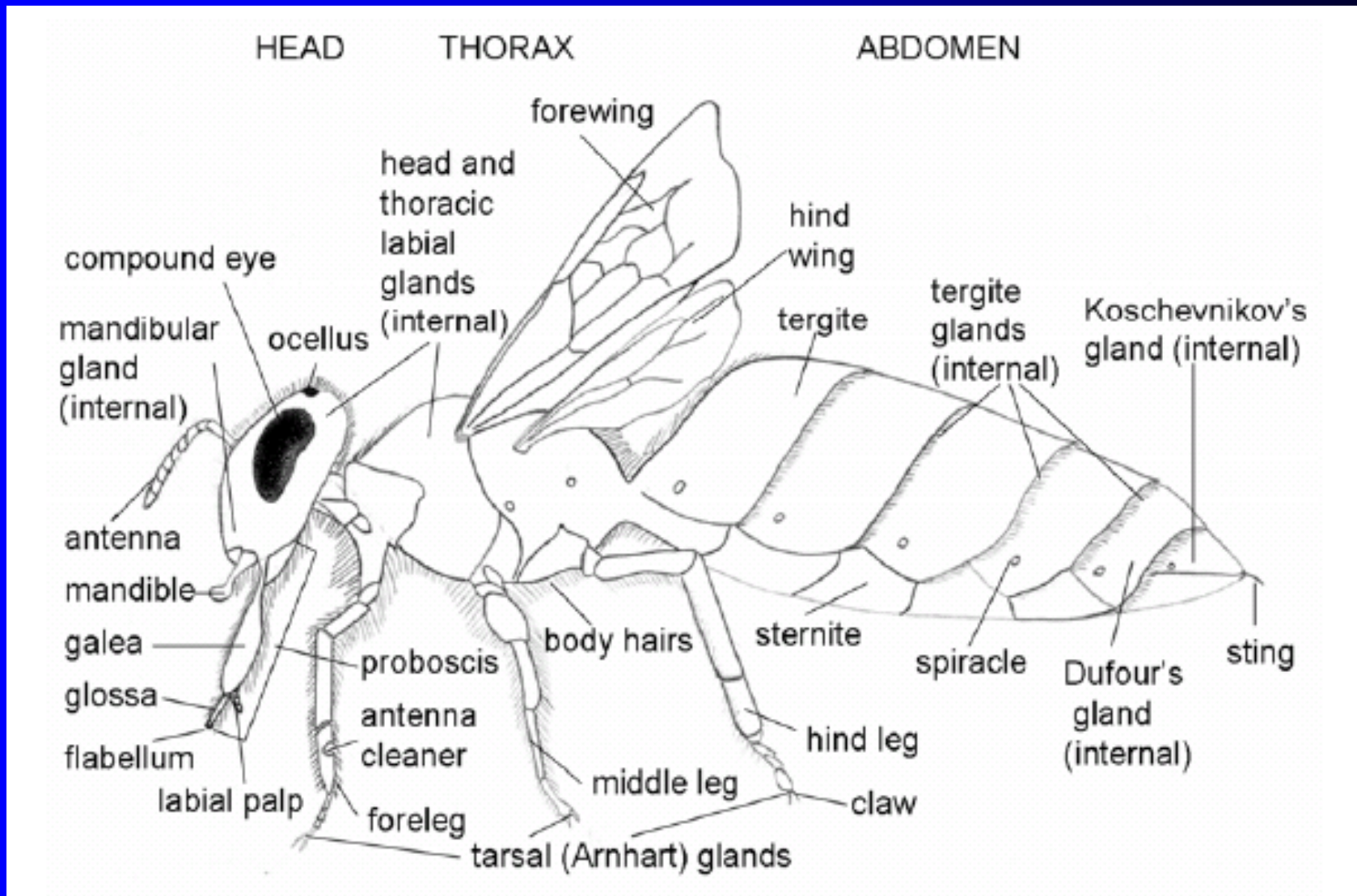
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Pollination Lab Ltd
Dunedin

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Part 1: Queen Bee and Drone Biology



Anatomy of the Queen



Honey Bee Development Stages

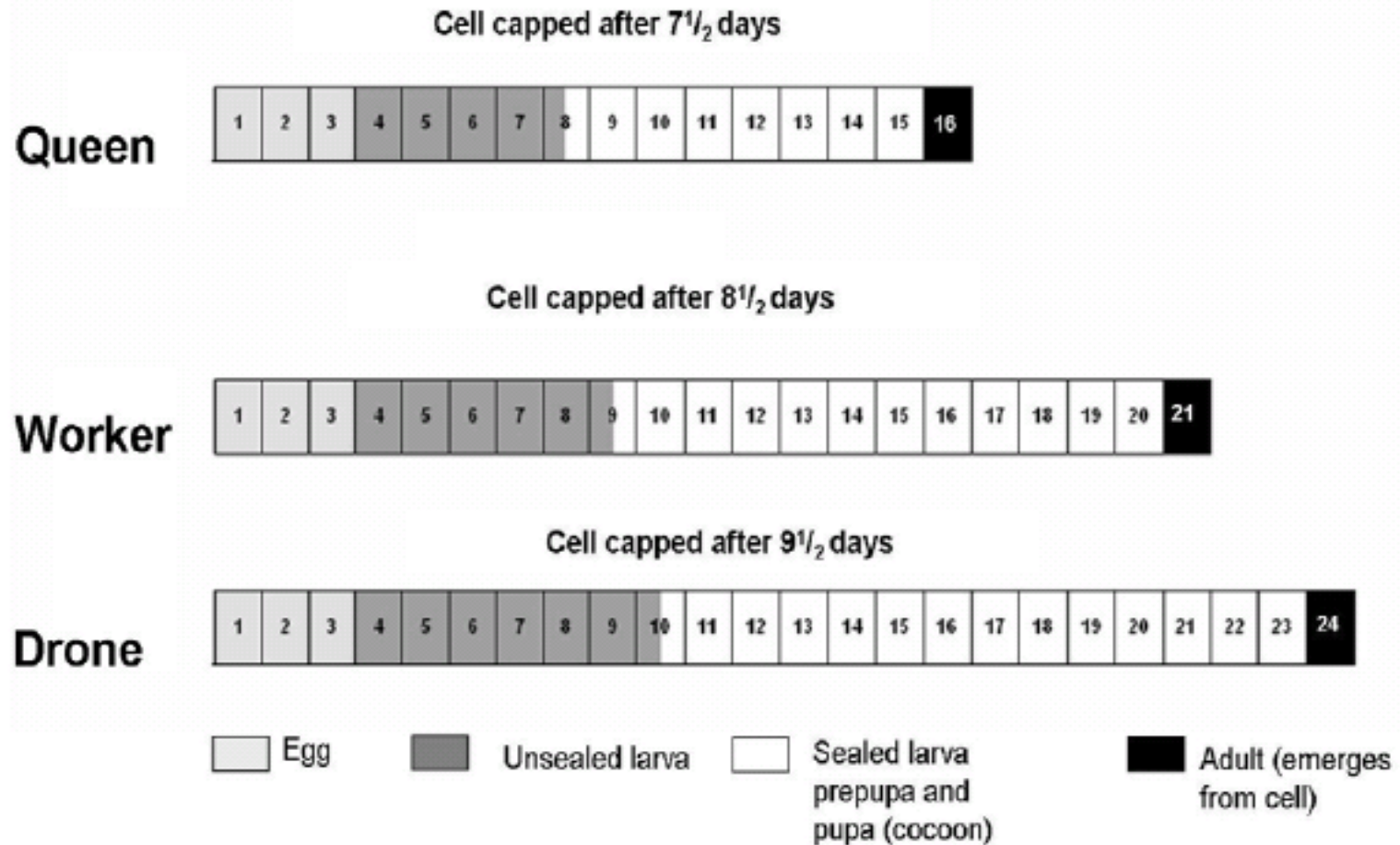
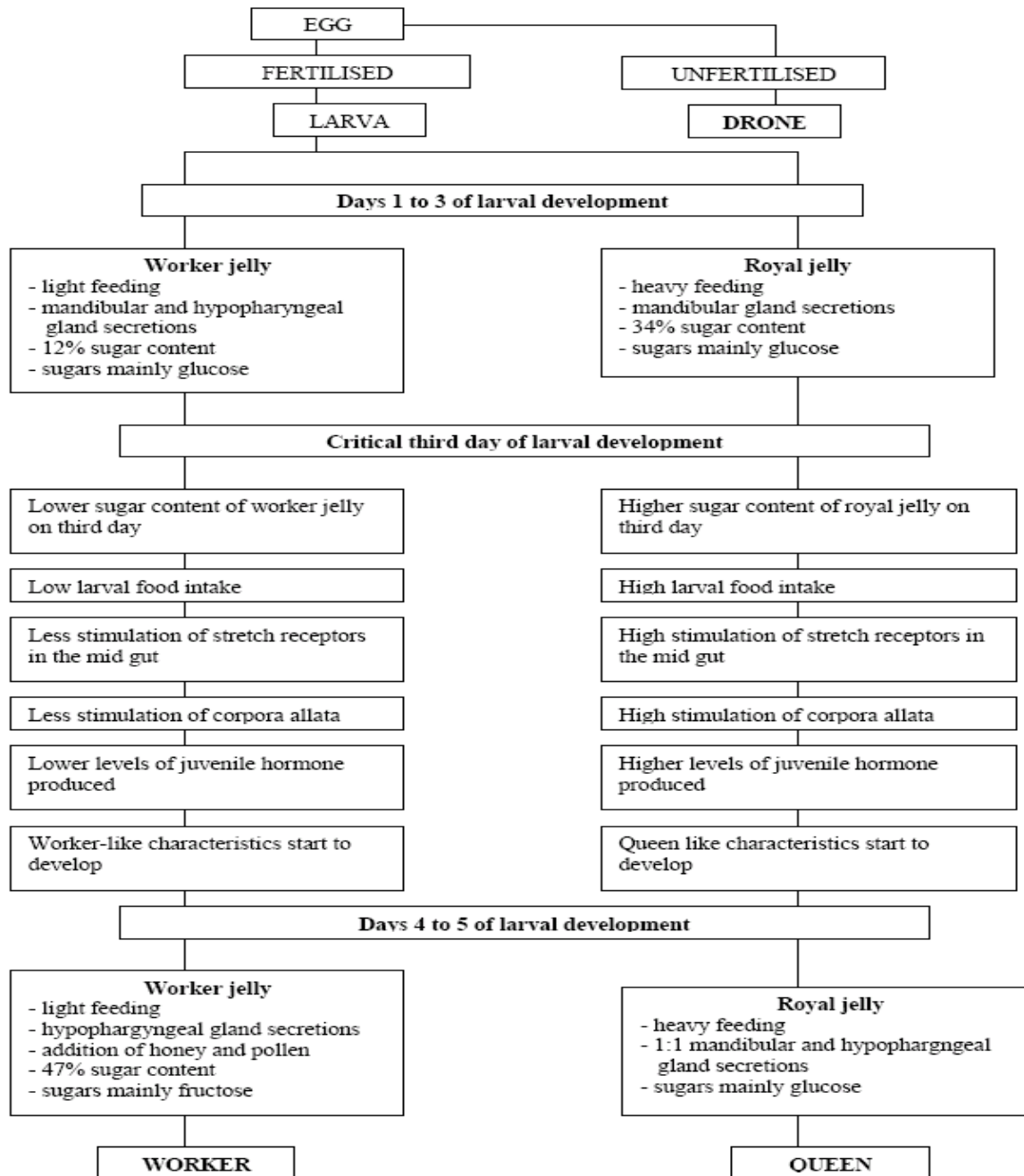
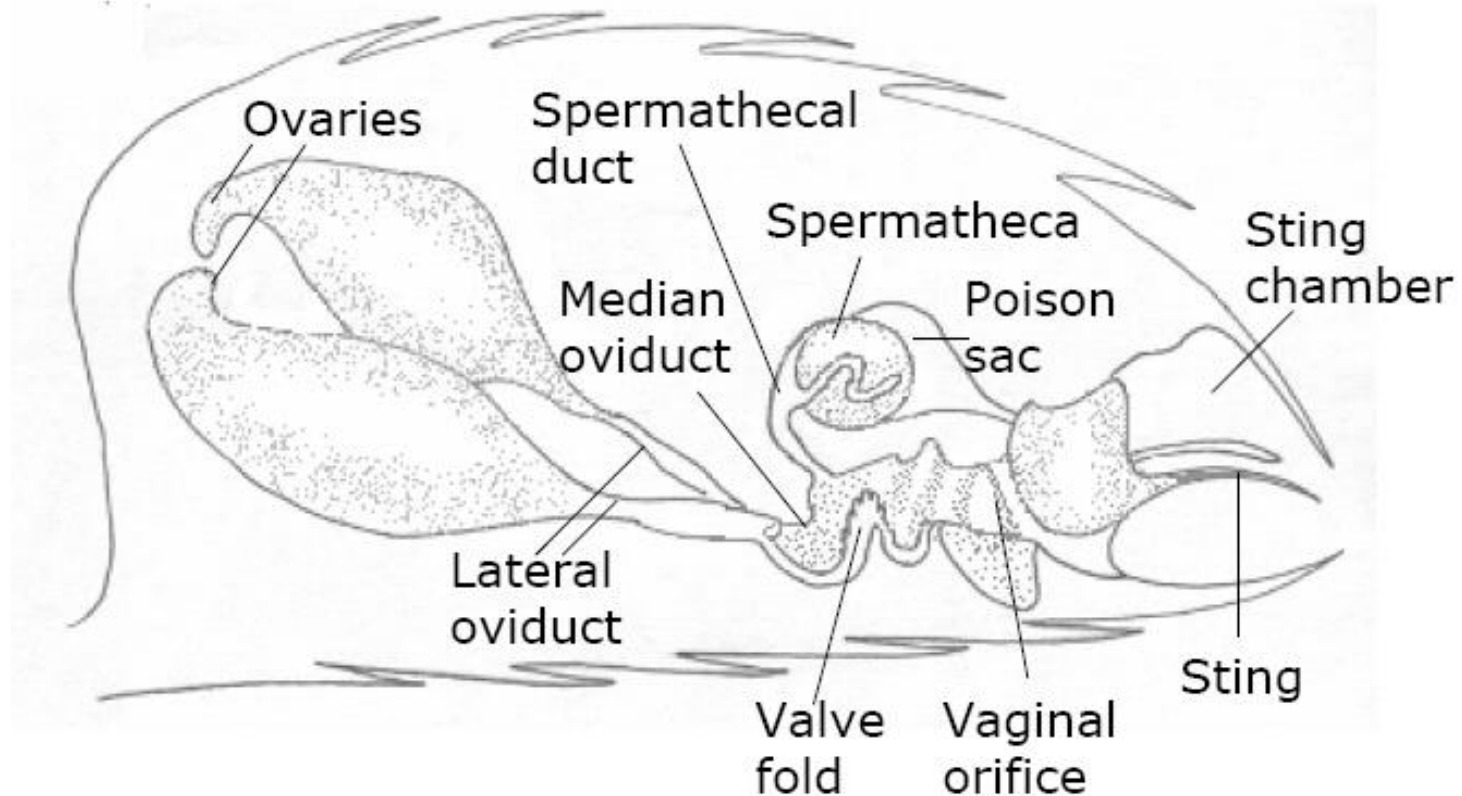


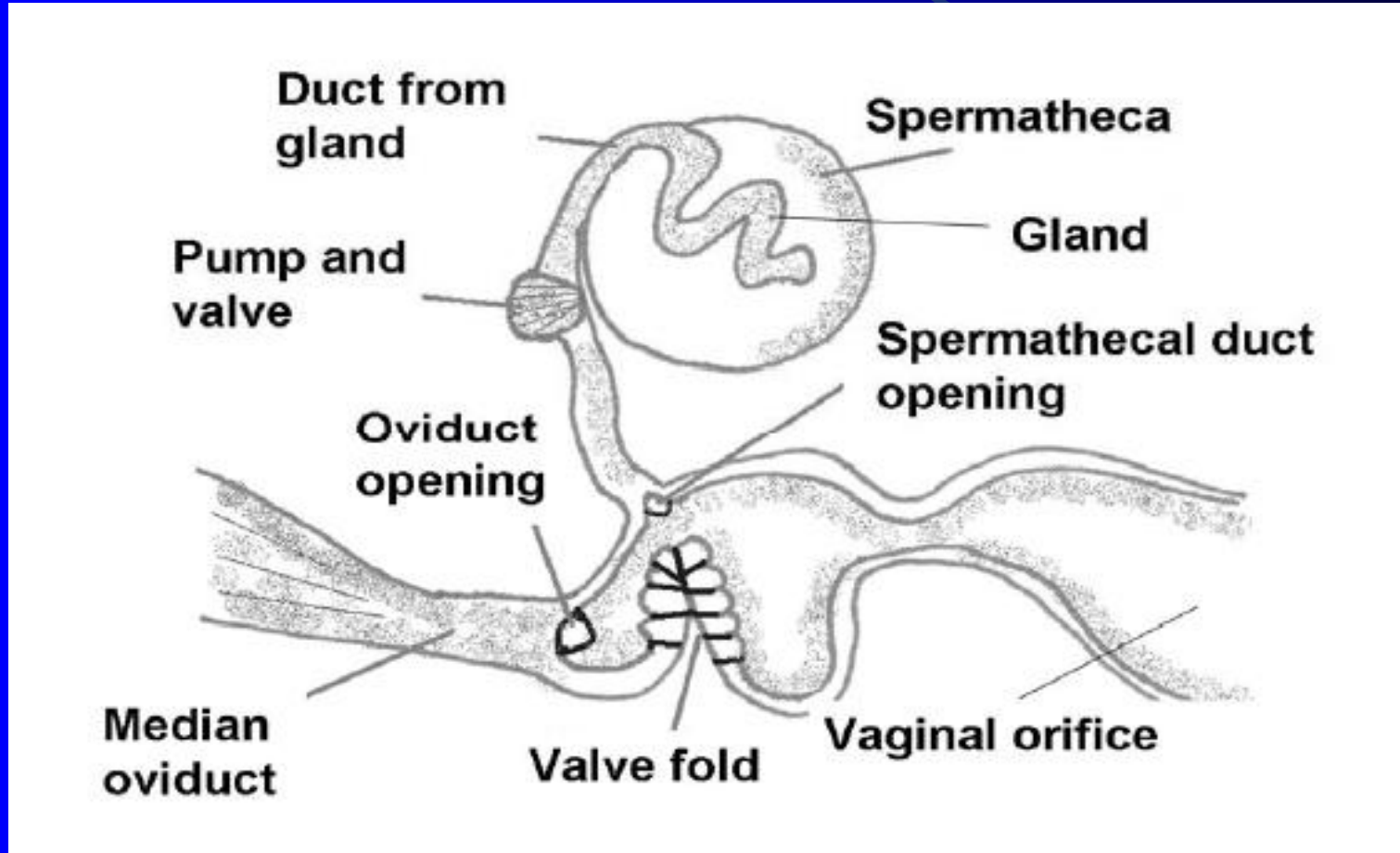
Figure 1.4 Factors determining development of the worker, queen and drone.



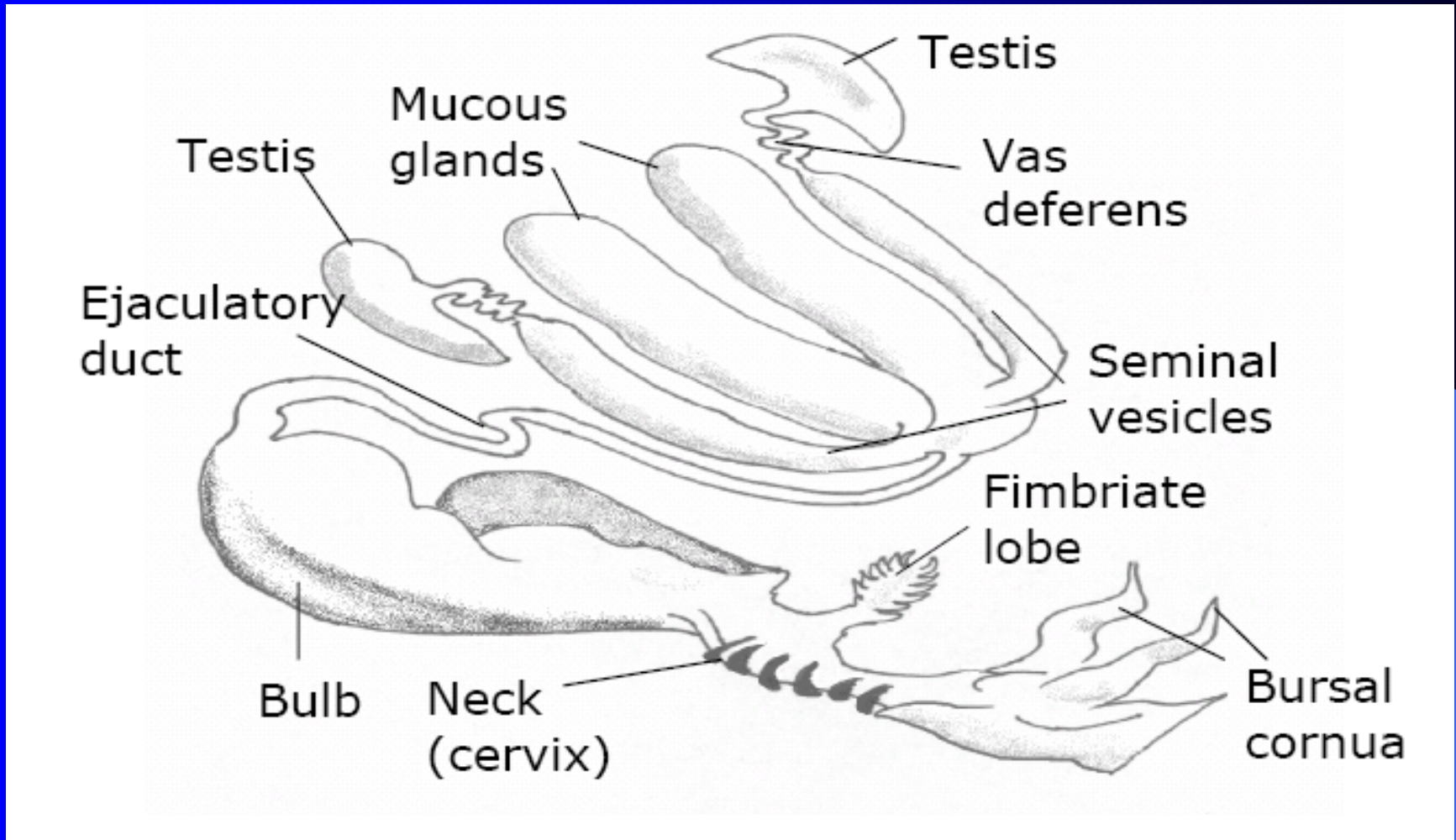
Reproductive System of the Queen



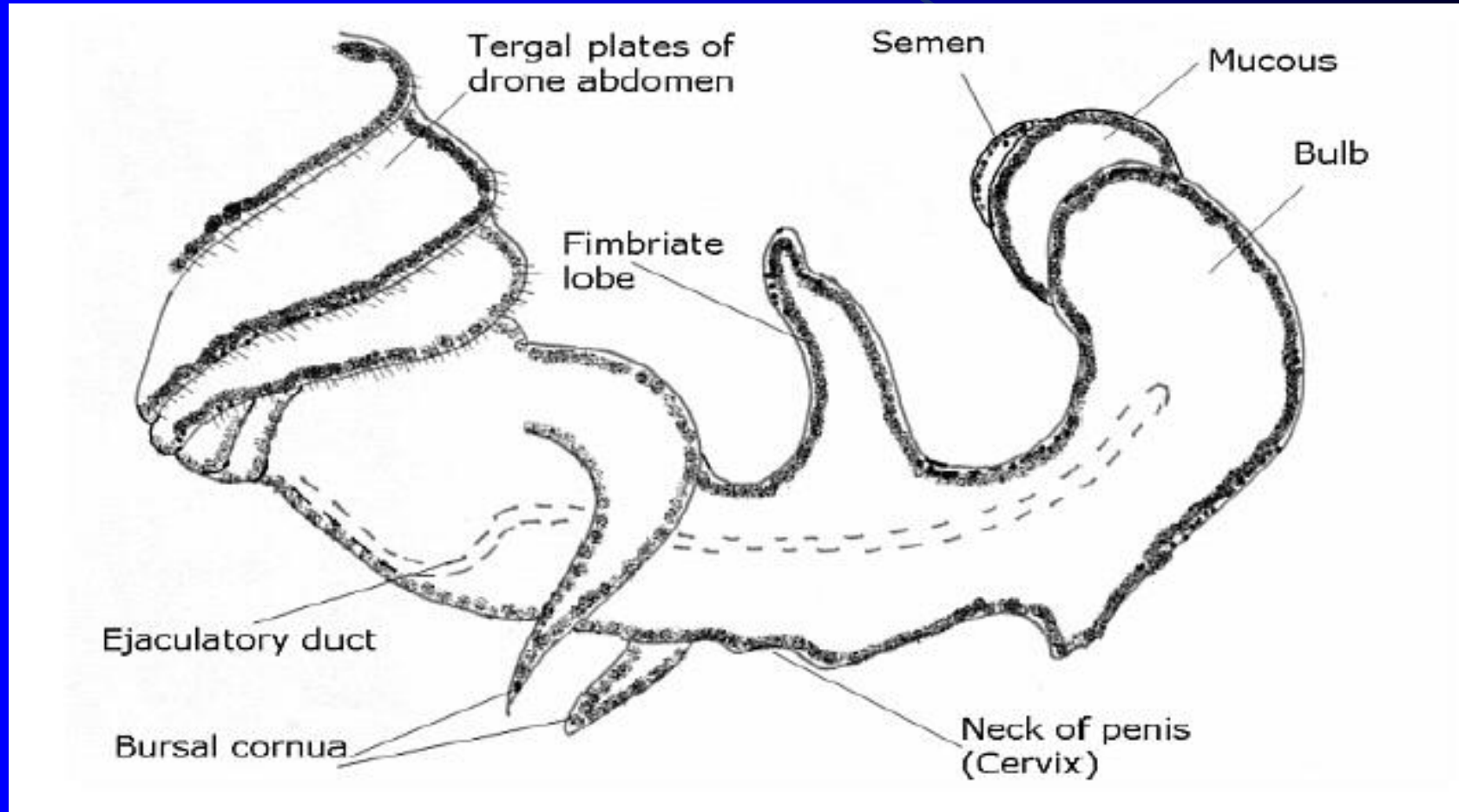
Reproductive system of Queen Spermatheca (enlarged)



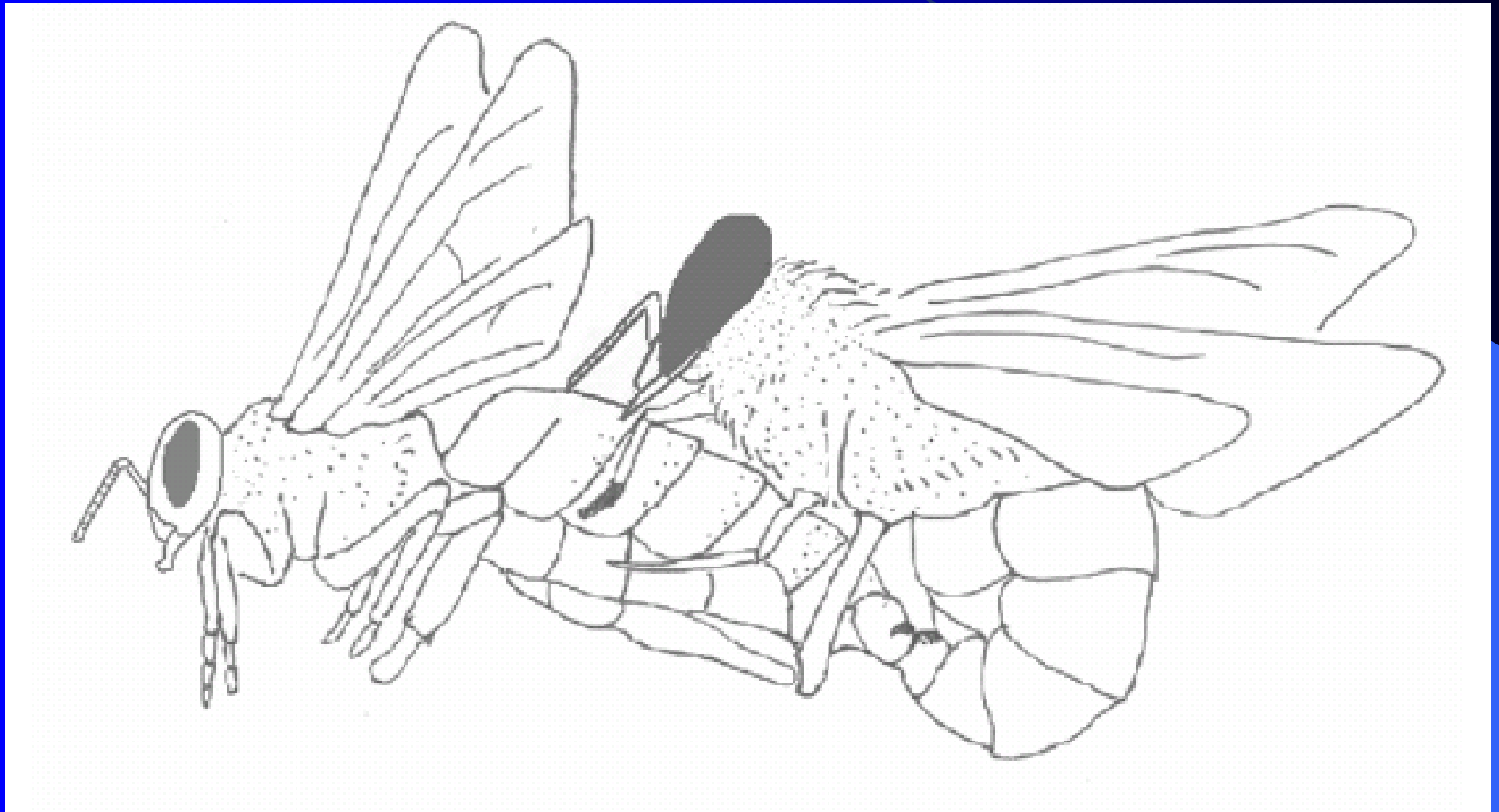
Internal Reproductive System of the Drone



External reproductive system of Drone



Mating of queen and drone

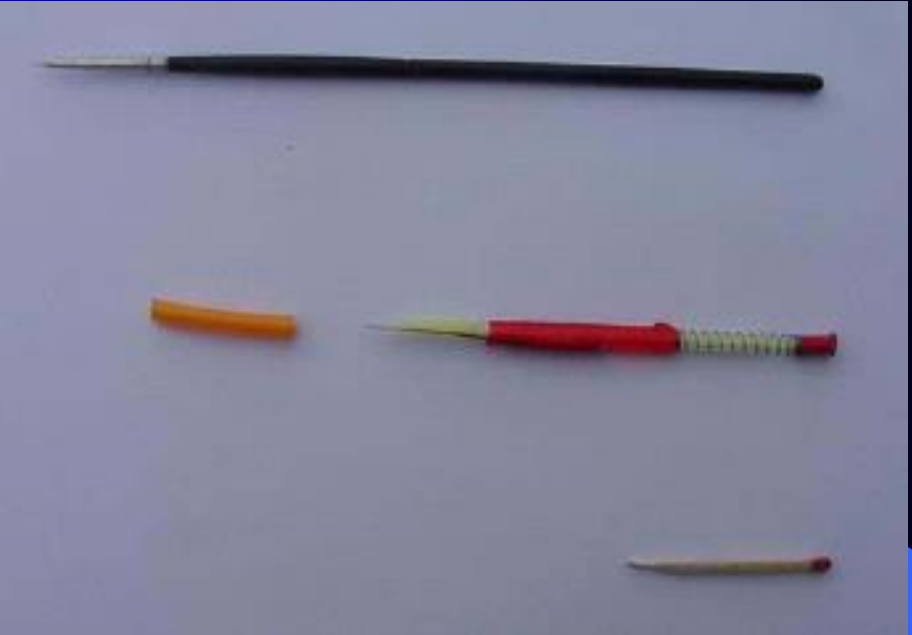


Part 2: Queen Bee Rearing:

Queen Bee Rearing Impulses

- Queen substance
 - Mandibular glands
 - Tergite glands
- 1) Emergency
 - no queen, no queen substance
- 2) Supersedure
 - old queen, decline in concentration of queen substance
- 3) Swarming
 - Overcrowding, older queen, amount of queen substance per bee decreases

Queen Rearing Equipment



Queen Rearing Equipment continued....



Cloake Board Queen Rearing System

1) Preparing cell bars

- Remove royal jelly from inside of old cell cups
- Sterilise cups in hot water
- Pour wax over cell bar
- Push plastic cups into wax, about 20-25 per bar
- Or use metal bar and slide cups into position
- Dip end cups in wax
- Fit bars on frame



Cell bars and frame with long and short Bozi cell cups



2) Priming cell cups

- Place frame with cell bars into hive 1-7 days before grafting
- Place between two brood frames above queen excluder
- Workers will polish, warm and place wax around rim of each cup
- Failure to place wax around tip indicates weak hive



3) Selecting cell raiser hives

- Strong 2-3 storey hive, disease free
- Workers should feed larvae with plenty of royal jelly
- Plenty of pollen and honey stores
- One year old active queen



4) Finding queen



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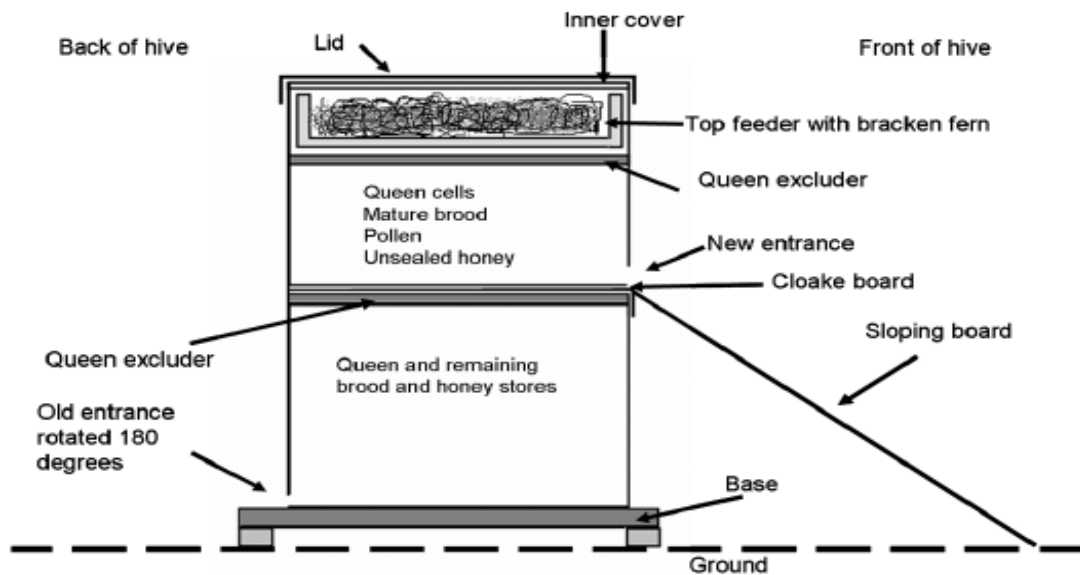


5) Preparing cell raiser hives

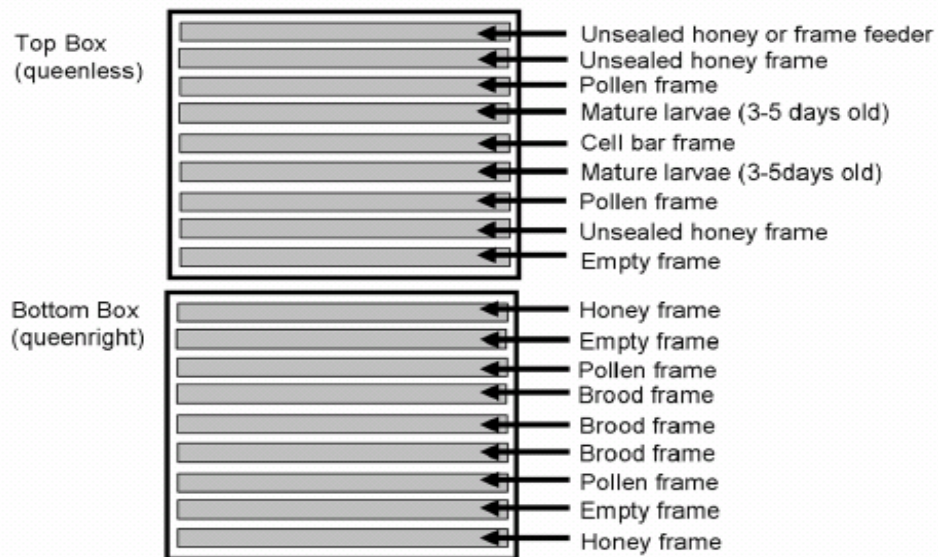
- Locate queen and remove or cage
- Prepare top brood box
- Cell bars in middle, mature brood, pollen, unsealed honey
- Reverse entrance
- Cloake board introduced
- Queen and remaining frames in bottom
- Leave for 5 hours in emergency response



Set up of Cell Builder Hive using a Cloake Board



Top View



6) Grafting larvae

- Select 12-24 hour old larvae from frame of breeder hive
- Remove cell bars from roaring queenless cell builder
- Use warm (20°C) room overhead light, high humidity
- Sloping board, Chinese grafting tool or 000 paint brush
- Return cell bar to hive soon after graft



7) Feeding hives

- Feed for 1-2 weeks prior to grafting
- Feed 50:50 sugar:water before and after grafting
- Feed pollen substitute patties near cell bar
- Feed for 4-5 days



8) Hive manipulations 12-24 hours after grafting

- Remove Cloake board to produce supersedure response
- Check percentage acceptance (aim for 70-95%)
- If using metal bar move smaller cells into middle with larger cells on outside transfer surplus to another cell builder hive, 20-25 cells max per hive
- Block back entrance
- Check feeder add syrup for 4-5 days



8) Monitoring hives

- Check for rogue queen cells on brood frames after 5 days
- Check for crowning after 9 days
- Cage or remove any cells likely to emerge

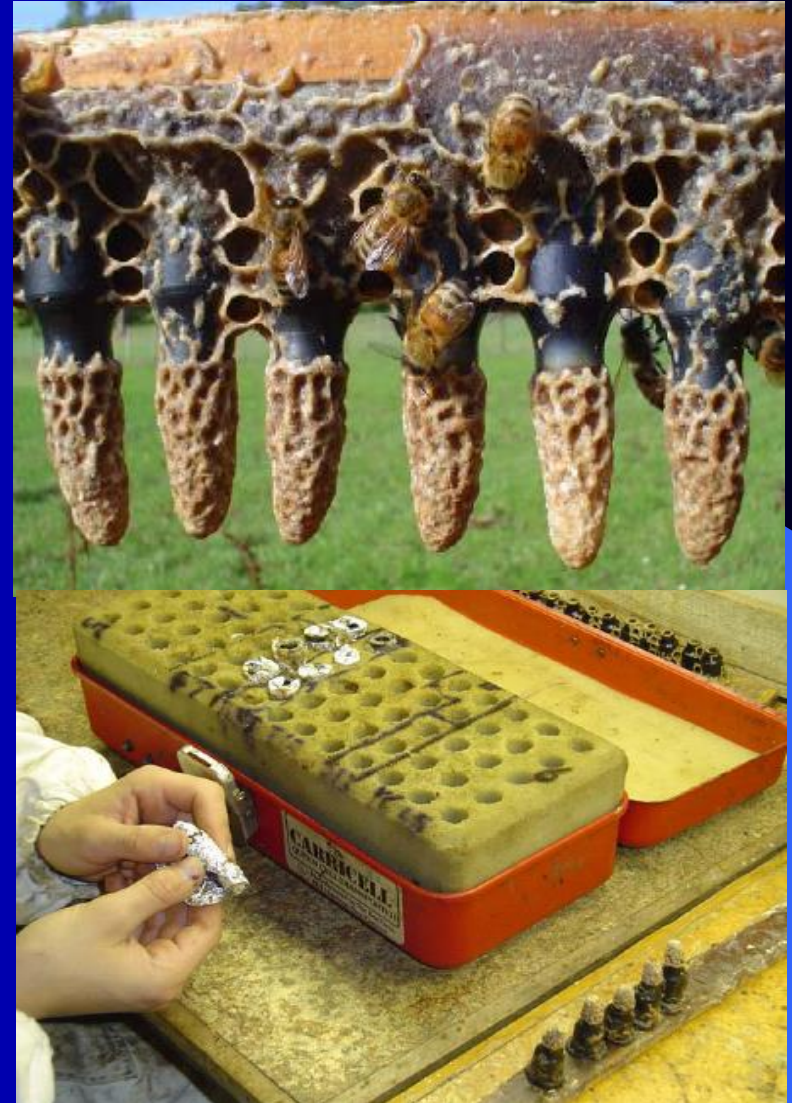


Monitoring hives continued...



9) Removing cells to hives

- Ten days after grafting remove queen cells from hives, brush bees off
- Warm up portable incubator to 34°C
- Carefully break cells off cell bar check for BQCV
- Wrap cells in tin foil leaving end exposed, place into incubator
- Use hive cracker to lift supers and queen excluder
- Place cell into queenright hives under queen excluder



Part 3: Queen Bee Breeding or inheriting desirable characteristics

Need to assess following characters of hives using a Yard sheet (score 1-5)

- Drone colour
- Worker uniform colour
- Brood viability –use a rhombus to cover 100 cells
- Disease resistance including SMR for varroa
- Temperament
- Swarming tendency
- Pollen stores
- Honey stores

Problems with breeding

- Queen can mate with many (10-17+) drones
- Colony made up of one mother (queen), up to 17 or more dead fathers (drones queen mated with), thousands of half-sisters (workers) and hundreds of sons (drones)
- Queen may mate with drones from hives up to 16km away

Honey production data

- Label all supers with an apiary and hive number as they are removed e.g. A1
- Remove supers above the excluder to standardise
- Weigh the supers before extraction
- Label all frames on top bar e.g. A1 and return to the appropriate super after extraction
- Weigh empty boxes or calculate average empty weight
- Determine the amount of honey (and wax) removed for each super
- Determine the total amount of honey removed per hive



Drone colour

- Determines the genetic makeup of queens parents
- Look back two generations
- Drones are haploid – developing from non-fertilised eggs have 16 chromosomes, one set)
- Phenotype is a reflection of genotype



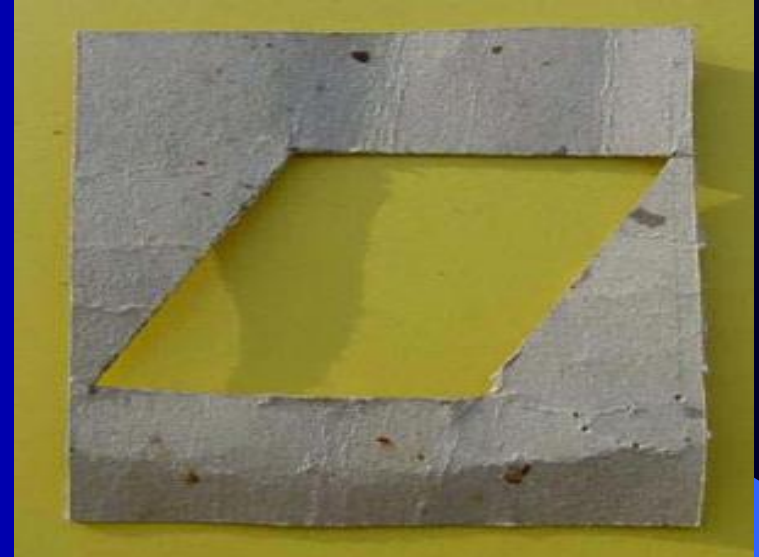
Worker uniform colour

- Uniform worker abdominal markings
- Indication of variation in worker colour suggests queen mated with different races of drones
- Workers are diploid develop from fertilised egg, are diploid have 32 chromosomes, 2 sets.



Brood viability

- Make up a rhombus to cover 100 worker cells
- Place rhombus over best brood (uncapped or capped)
- Count number of cells that have not been laid in
- Subtract figure from 100 to give percentage brood viability



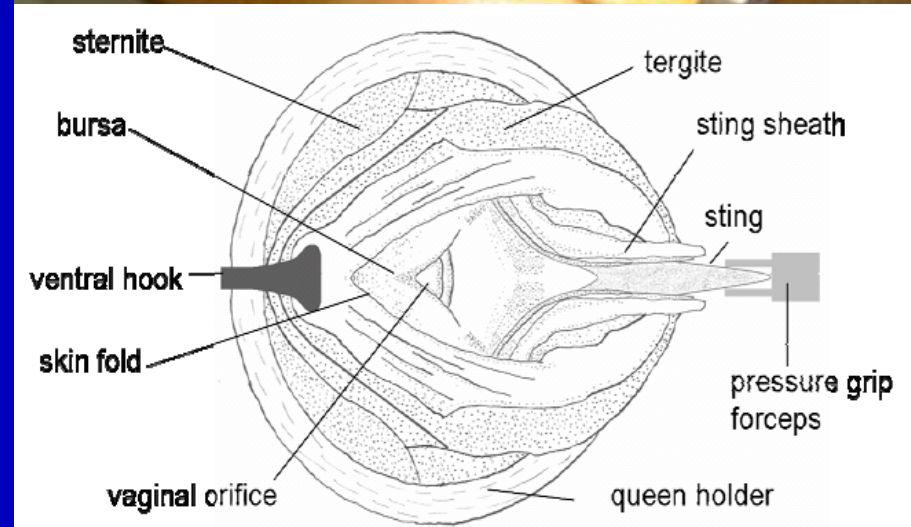
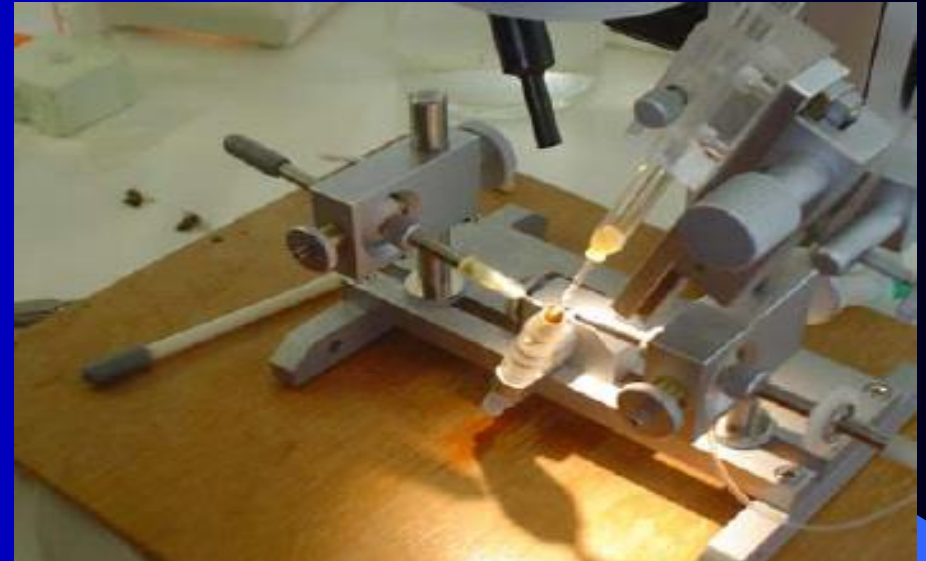
Hygienic behaviour and varroa tolerance test

- Select the best capped brood available in hive
- Place rhombus over capped brood
- Kill pupa by pricking with fine pin, mark position on frame with colour pin
- Place frame into centre of brood box, check every 24 hours for 2 days
- Workers with uncapping and removal genes will have emptied cells in rhombus, repeat test
- Suppressed Mite Reproduction (SMR) assessed by selecting 20 mite infested purple-eye worker pupae. Determine the percentage of cells with mite infertility



Instrumental insemination

- Rear virgin queens
- Rear virgin drones
- Collect 8 microlitres of drone semen
- Anaesthetise queen with CO₂
- Mount queen in holder open sting chamber with hooks
- Insert syringe with semen
- Allow queen to recover
- Give queen second dose of CO₂ 24 hours later



Where to Get More Information

- Woodward, D.R. (2007). *Queen Bee: Biology, Rearing and Breeding*, \$46 available from author, Beeline Supplies, Ceracell Beekeeping Supplies, Ecrotech.
- Dr David Woodward 027 418 2385
davidwoodward022@gmail.com
- Otago Polytechnic NZ certificate in Apiculture (Level 3) course run from Cromwell (David Woodward), Dunedin (Brice Horner ph 027 4410344) and Christchurch, South Springston Memorial hall (Martyn Wheeler ph 027 3069653)
- Reproduction of any part of this Powerpoint may not be made without permission of author David Woodward