Queen Rearing

Jim Sack

Queen Rearing and Biology

Slides by Lizette Dahlgren

Why rear queens in the north

- Majority of Queens & Pkgs reared in southern states, including California
- Migratory beekeepers transport at least 500,000 colonies every year
- Africanized bees survive in South
- May inadvertently transport to North

Goal of this presentation

- Africanized bees in North?
- Alternative source of bees
- Encourage you to rear your own queens
- Augment existing queen sources, not replace them

When to Rear Queens (Artificially)

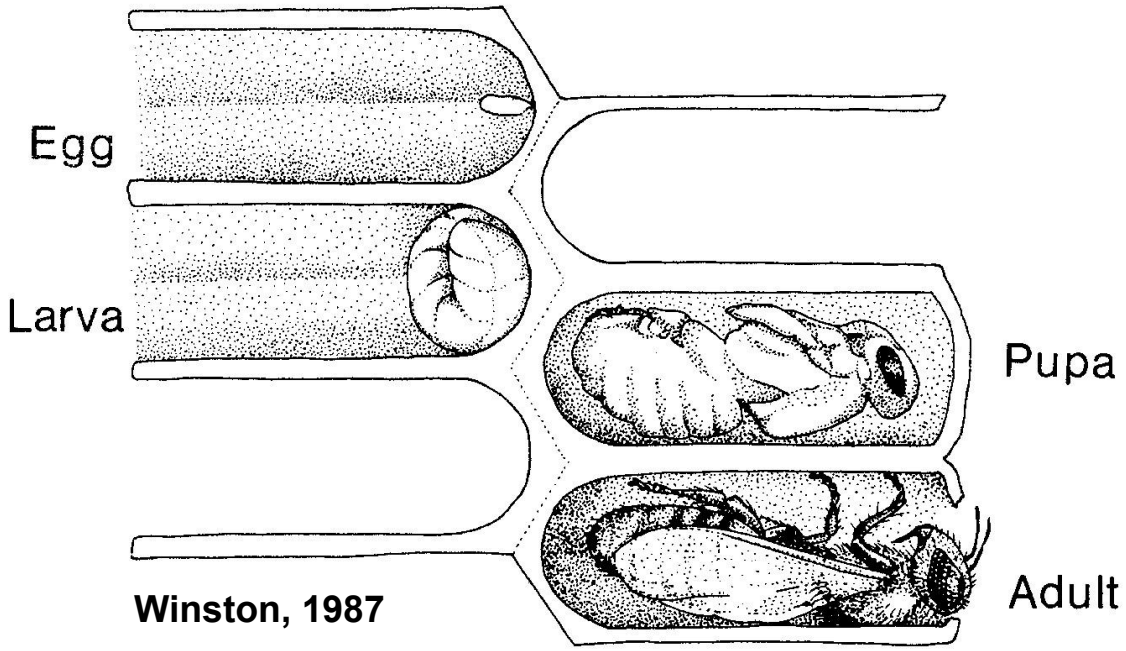
- When drones are sexually mature
  - to mate with your queens
- When colonies can feed brood
  - pollen/nectar resources
- To sell
  - Not before drone brood is capped
  - Nebraska: after May 15
- When you want to replace your queens
  - anytime

When to Rear Queens (Artificially)

- During honey flow
  - mid June
- After honey flow
  - mid July
- After extraction to prepare for winter
  - mid August

Development

Caste	Egg	Larva	Pre-pupa	Pupa	Total
Queen	3	4	3.5	5.5	16
Worker	3	5-6	4	8-9	21
Drone	3	6	5	10	24



Winston, 1987

Development of Female Castes

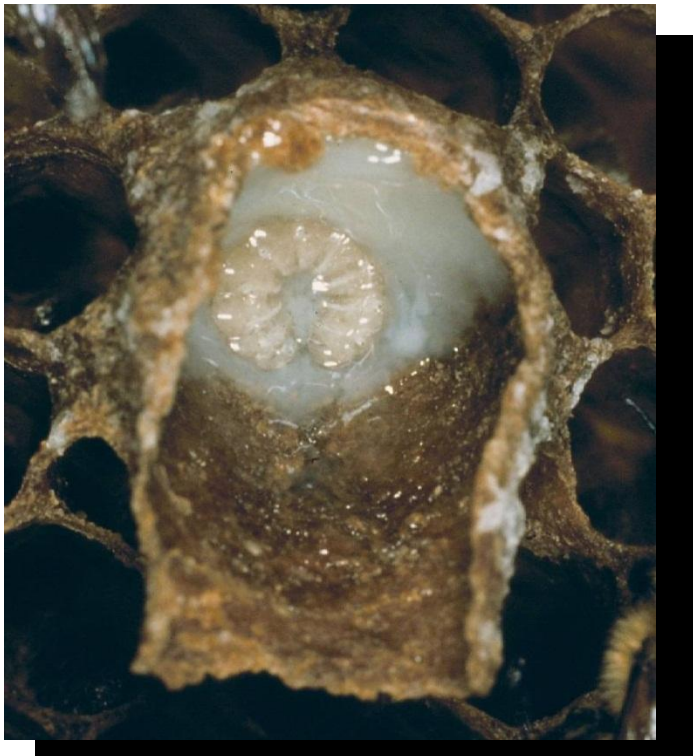
- Queens and workers, the female castes, develop from fertilized eggs
- The larvae that hatches from the egg is neither caste – it is simply female
- Female larvae respond to nutrition, becoming a worker or a queen
- After the third day, caste is irreversible, or at most, partly reversible resulting in intercastes

Grafting Larvae

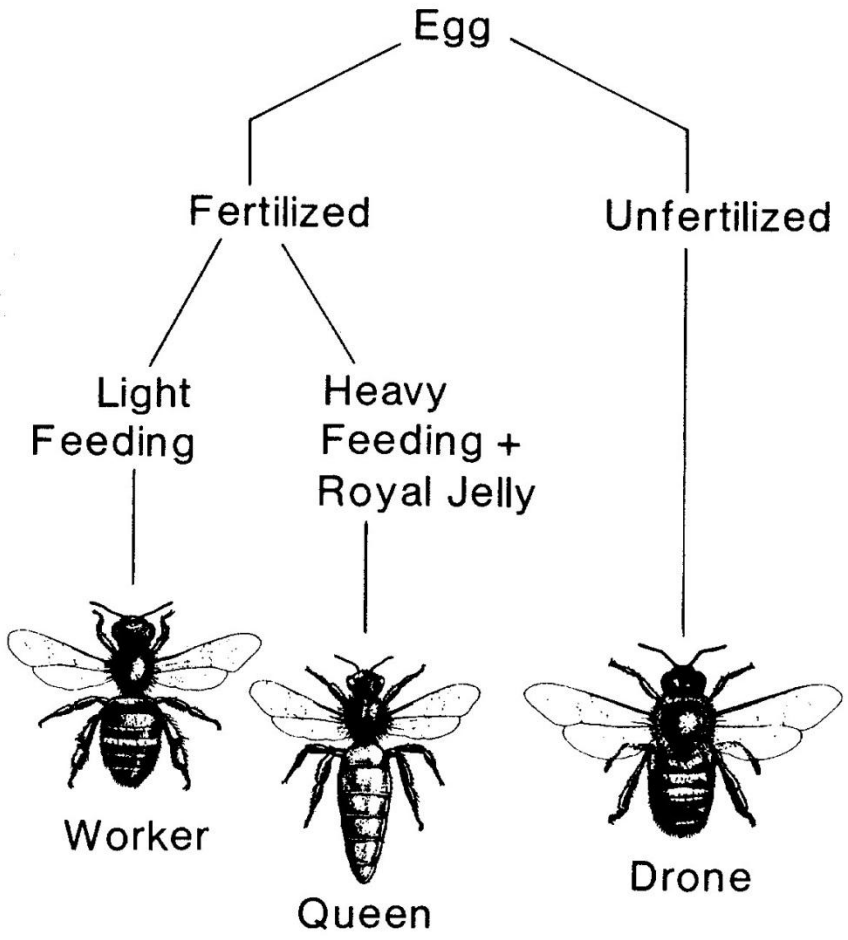
24 Hours Later

Pre-Pupa and Pupal Stage

- The queen cell is provisioned by nurse bees for only 4 days before it is sealed.
- The queen eats voraciously for 6 days

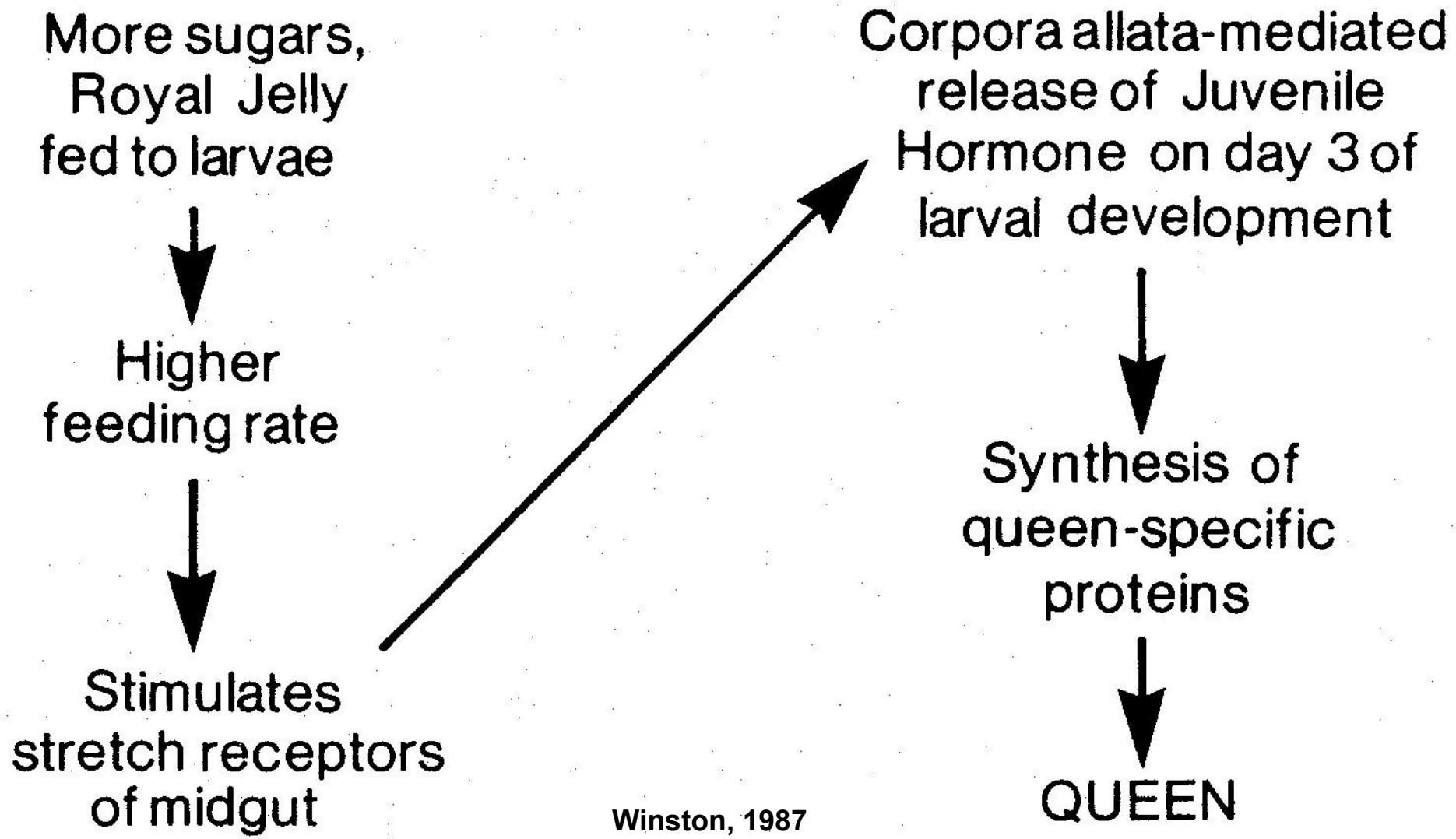


Nutrition (up to 3 days old)



Winston, 1987

Caste determination



Winston, 1987

$$ Royal Jelly $$

Pollen

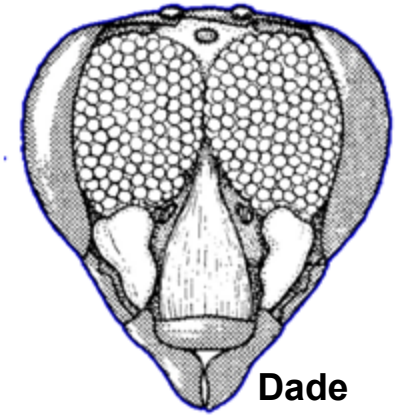
Need to Feed – Pollen Patties

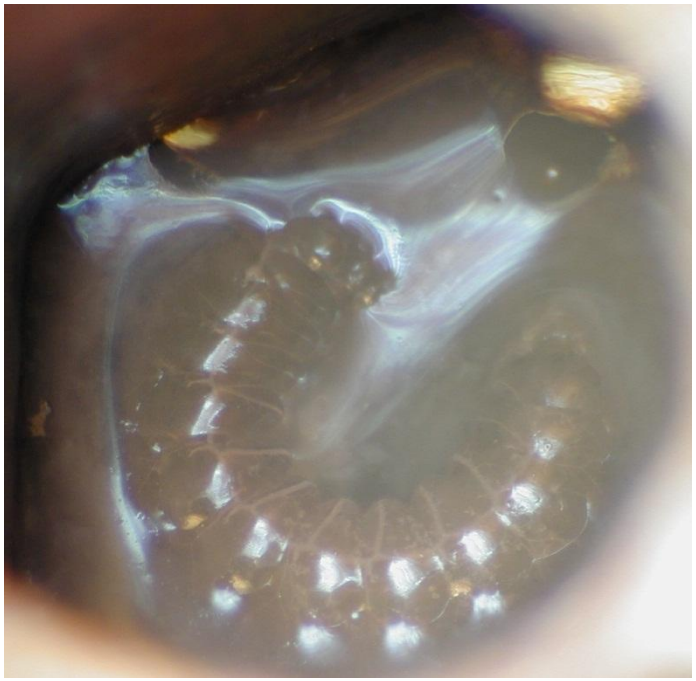
- Rarely in eastern Nebraska
- Boost colonies for brood rearing
- Score wax paper

David Baumbauer

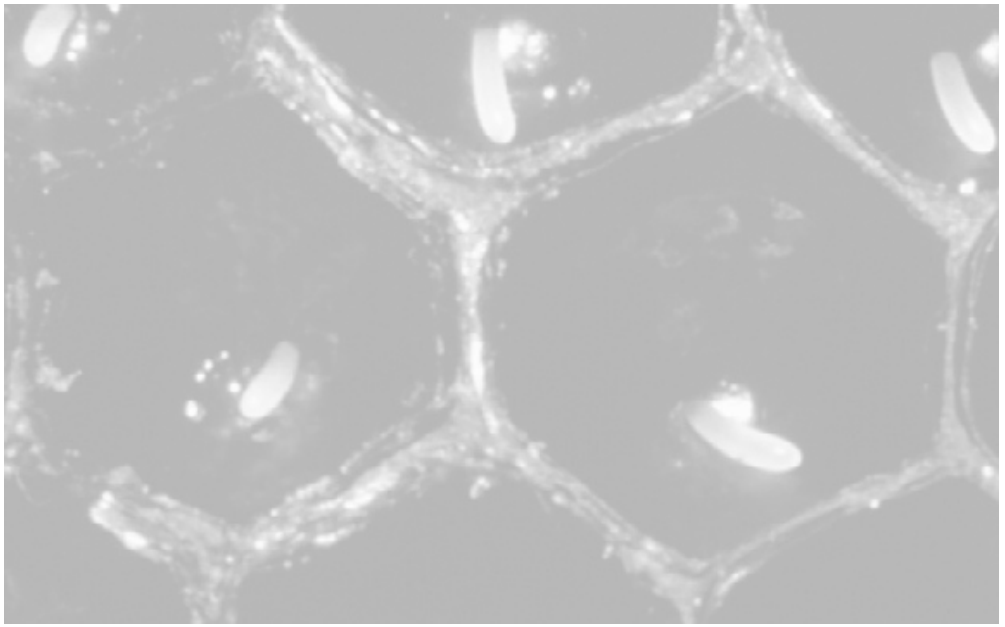
Pollen

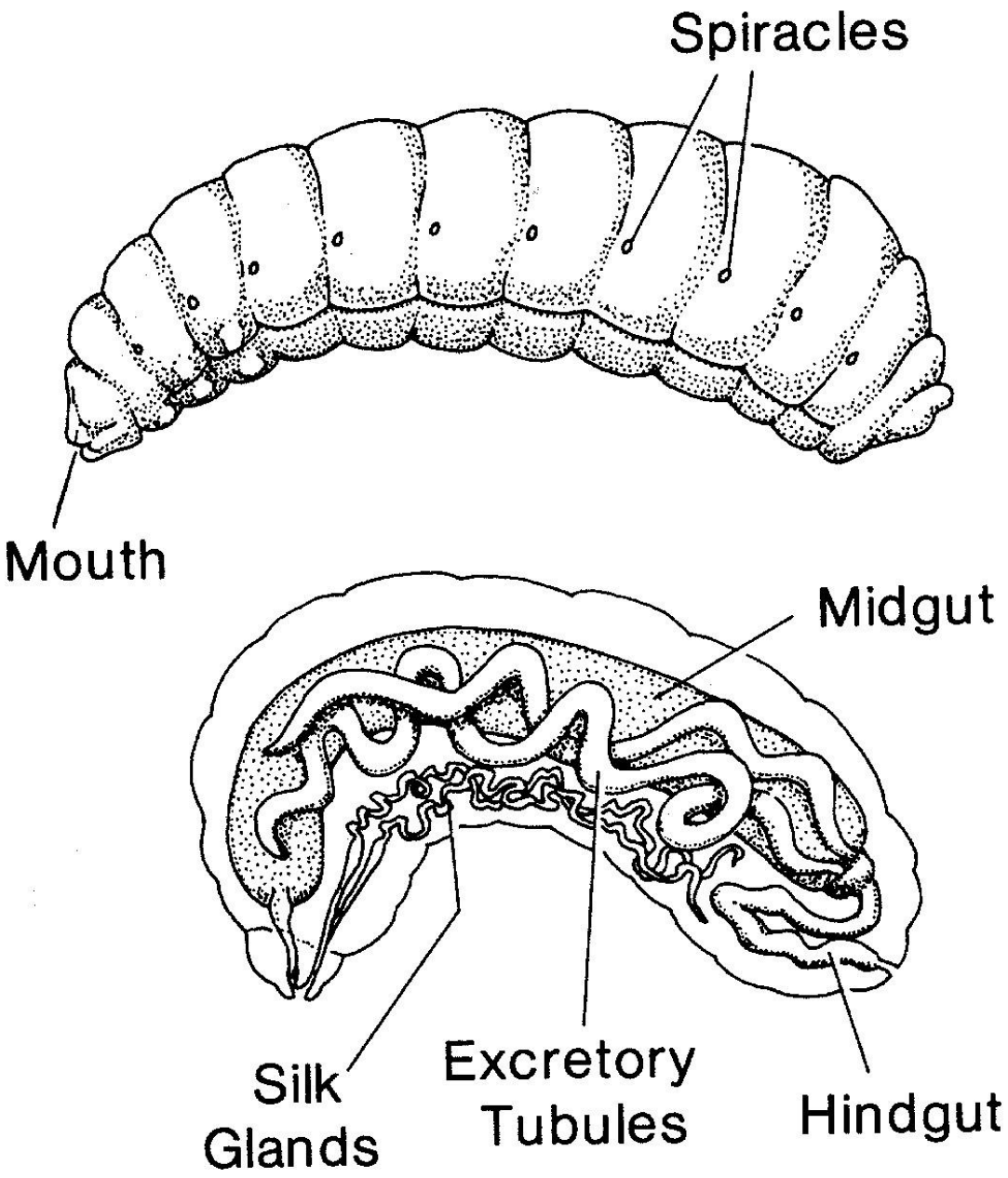
- Protein, lipids, vitamins, minerals
- Consumed mainly by:
  - Larva via Nurse Bees
    - Tend to brood
    - Usually 7-14 d
- Converted by glands into:
  - Brood food
    - Produced by mandibular and hypopharyngeal glands
    - Provisioned to larvae


Dade

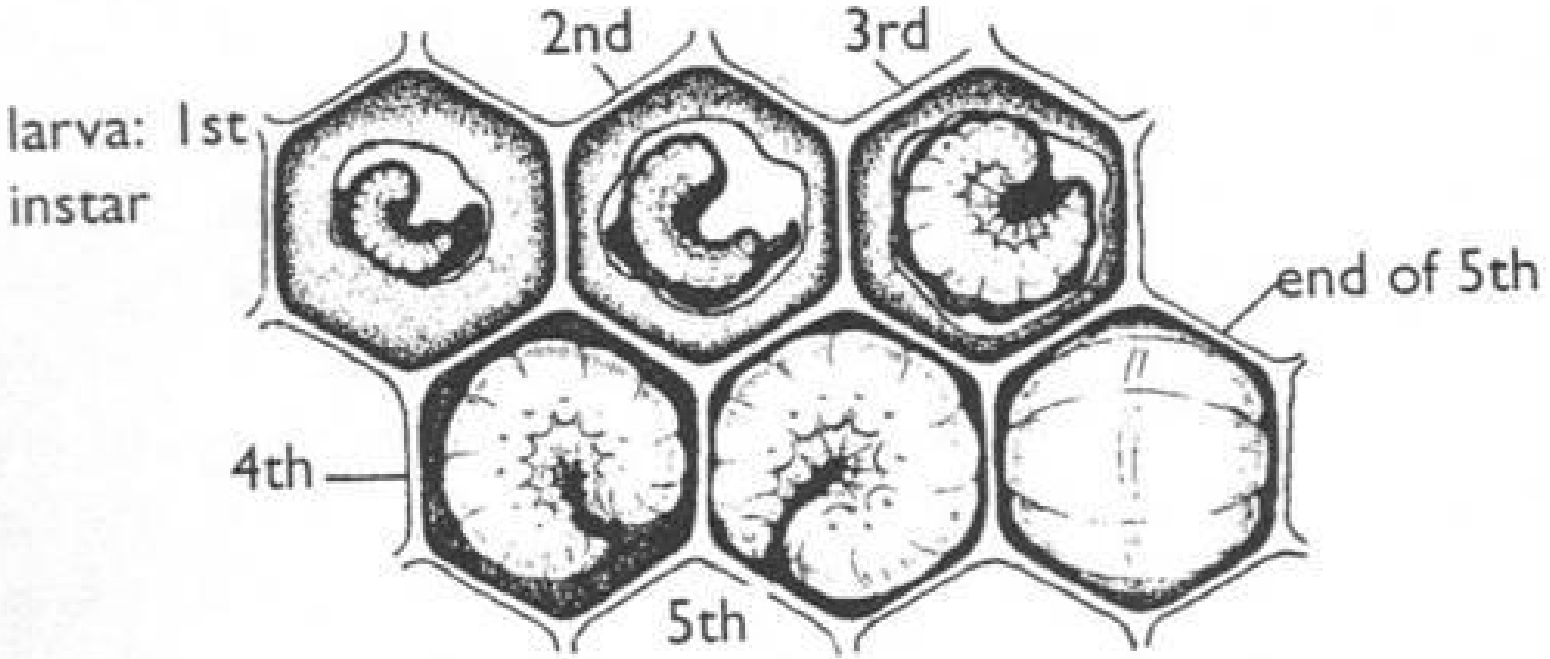


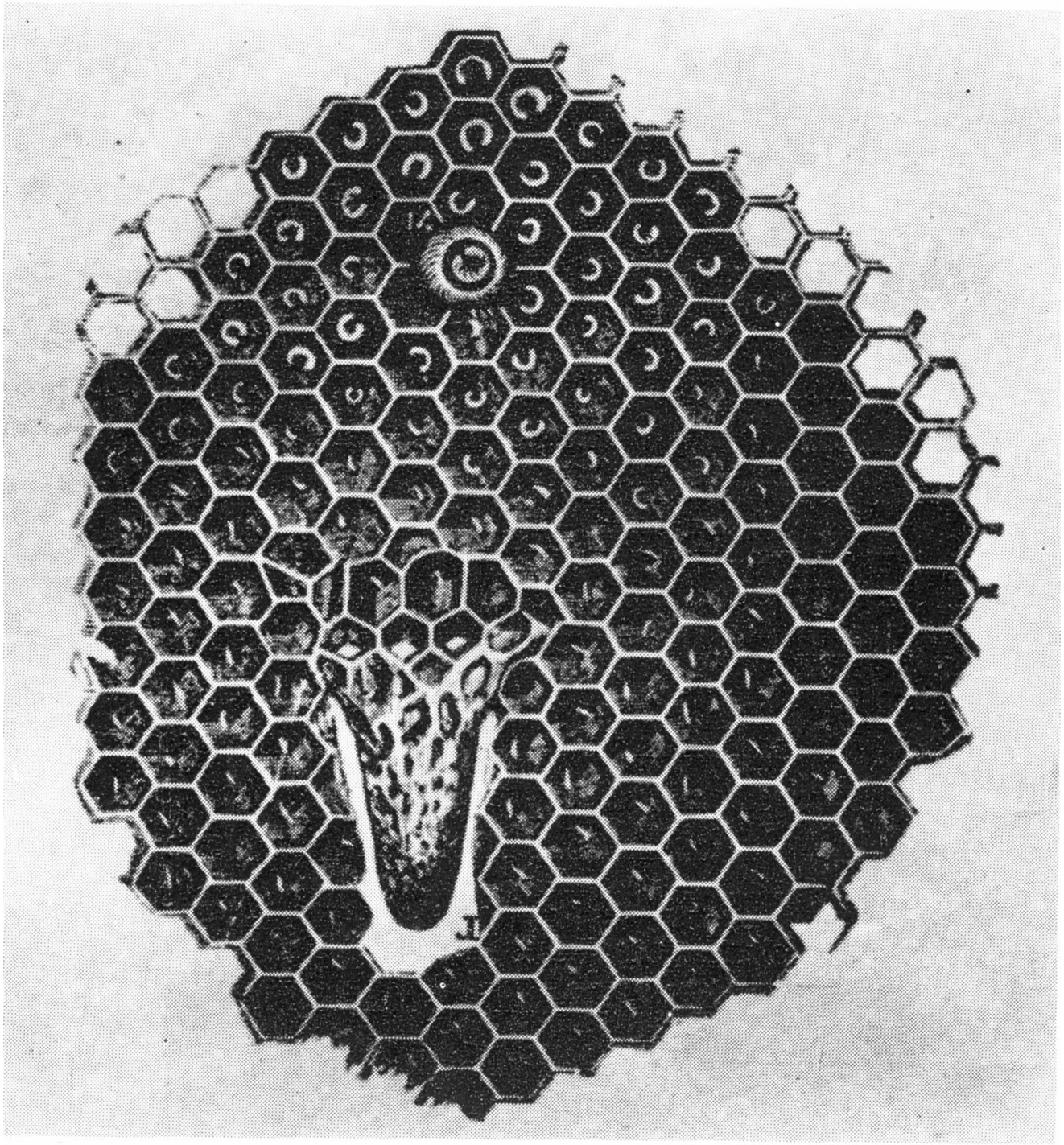
While female larvae as old as 3 days can develop into adults that are morphologically queens, there is evidence that divergence of queen and worker characteristics occurs soon after the larva hatches from the egg

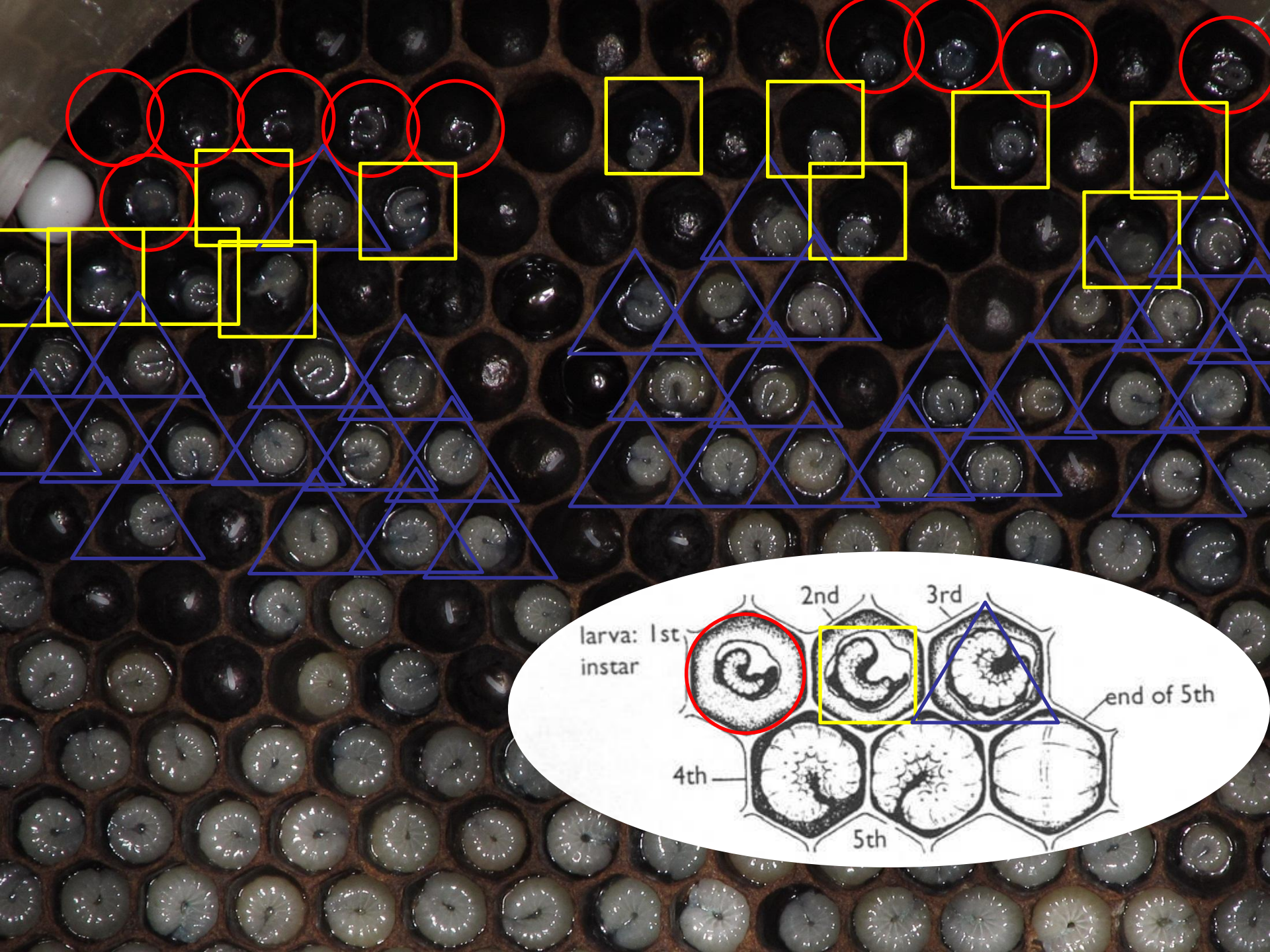


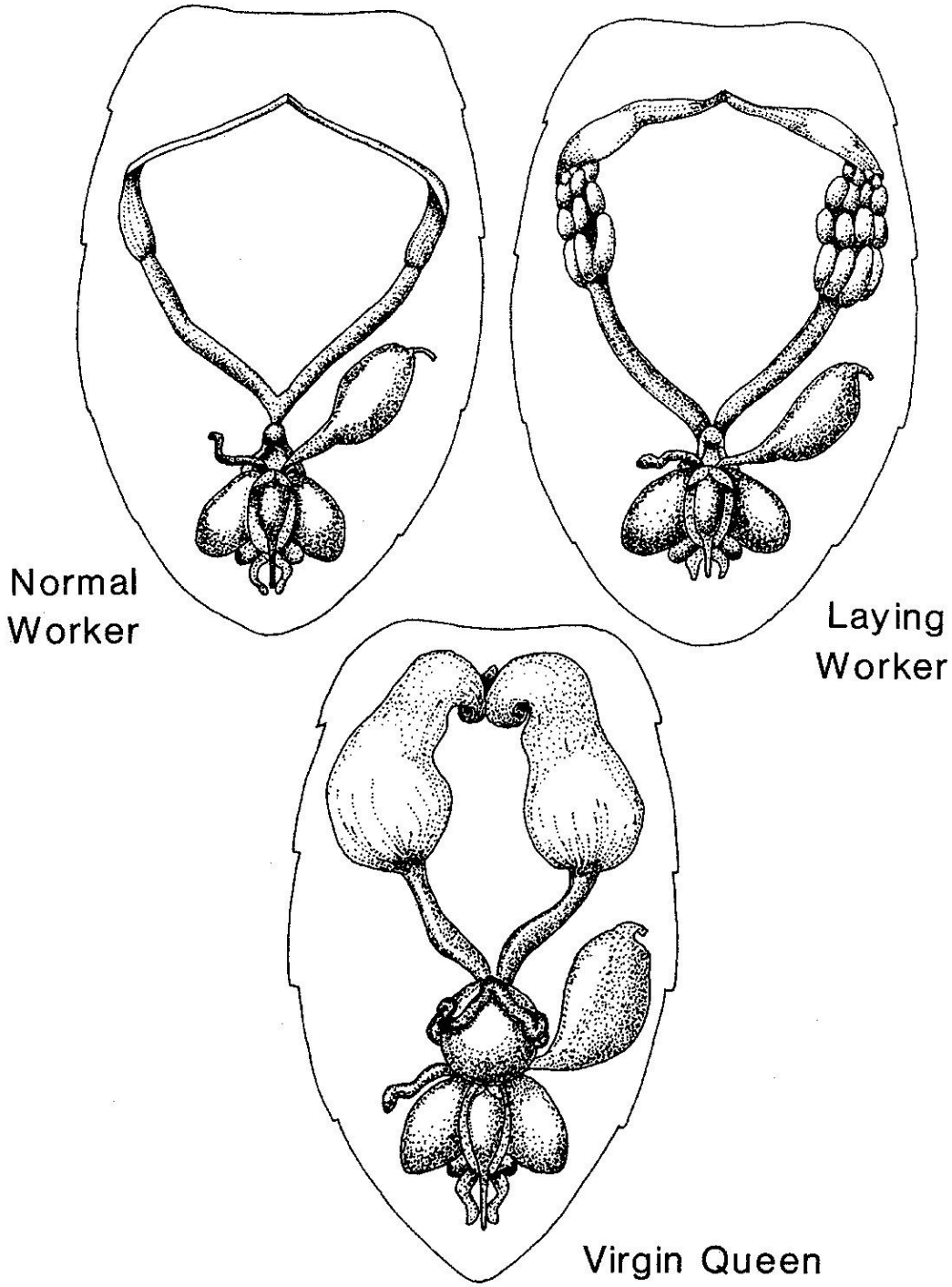

Spiracles
Mouth
Midgut
Silk
Glands
Excretory
Tubules
Hindgut

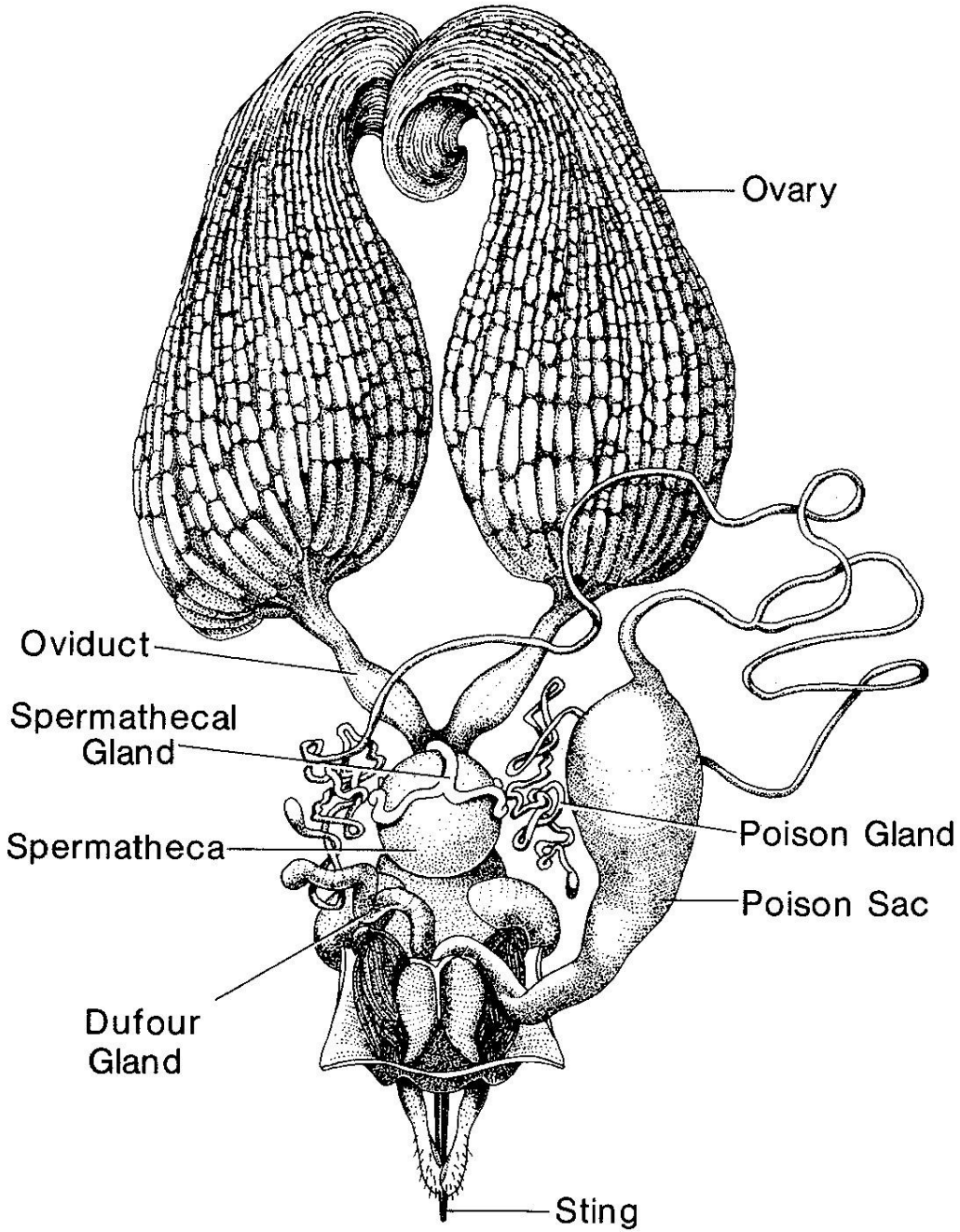
Worker Instars






2nd
3rd
larva: 1st
instar
end of 5th
4th
5th


Normal
Worker
Laying
Worker
Virgin Queen



- **The number of ovarioles determines the egg laying capacity of a queen- the eggs laid per day and per lifetime**
- **Queens properly fed from the moment they hatch from an egg will have more ovarioles**

Poorly-reared queens of productive stock will always be inferior to well-reared queens of less productive stock

C.L. Farrar

Minimum Number of Colonies

- **2-3 colonies:**
  - **Breeder colony**
  - **Cell starter; finisher (1 or 2 colonies)**
  - **Drone colony (optional)**

Breeder Colonies

- Good honey production
- Good wintering ability
- Gentle temper and ease of management

Breeder Colonies

- **Maintain precise records**
- **Breeder colonies should pass criteria over a year's time**

Drone Mother Colonies

- **Drone congregation areas**

How to avoid inbreeding

- Use different breeding queens each year
- Do not requeen your colonies with all sister queens
- Form cooperatives with other queen rearers
- Keep accurate records

General Overview of Doolittle Method of Queen Rearing

- Grafting
- Swarm box
- Finishing colony
- Mating nucs

Queen Calendar

Caste	Egg	Larva	Pre-pupa	Pupa	Total
Queen	3 days	4 days	3.5 days	5.5 days	16 days

9 days

	Average Age	Days after grafting	Days after emergence	Notes
Graft larvae	12-24hr old	-	-	Graft 12-24 hr old larvae, 3 d after egg laid
Queen emerges	11-14 days	11-14 days	-	Remove queens from finisher on day 10
Virgin mates	7-14 days after emerging	18-28 days	7-14 days	Largely depends on weather
Laying queen	3-7 days after mating	21-34 days	10-28 days	Queen ready to ship/install after she lays eggs

10 Days After Grafting

Hinged Opening= Successful Emergence; May be Delayed by Workers

Virgin Queens

- Piping-vibrate thorax against comb using flight muscles, helps queens locate each other, kill all other queens-emerged or unemerged
- Runny, hide under workers, more active than a mated queen, fly from comb
- At 3-5 days old, orientation flights
- At 7-14 days old, will take nuptial flight

Queen Homicide

Mating Nuclei

Unsuccessful Mating

- After 3 weeks of confinement, virgin queens will lay unfertilized eggs (drones)
- After 2 weeks, sperm storage limited
  - Reduces long term fecundity
- All queens are capable of outliving their stored sperm

Laying Queens

- Queens start to lay 3-6 days after mating; usually, 10-14 days after emergence
- Forelegs used to measure cell for drone/worker choice
- Queen able to lay unfertilized egg by choice, measures cell with forelegs then thought to lower valve fold for unfertilized eggs
- May have sporadic laying pattern initially

Queen Reproductive System

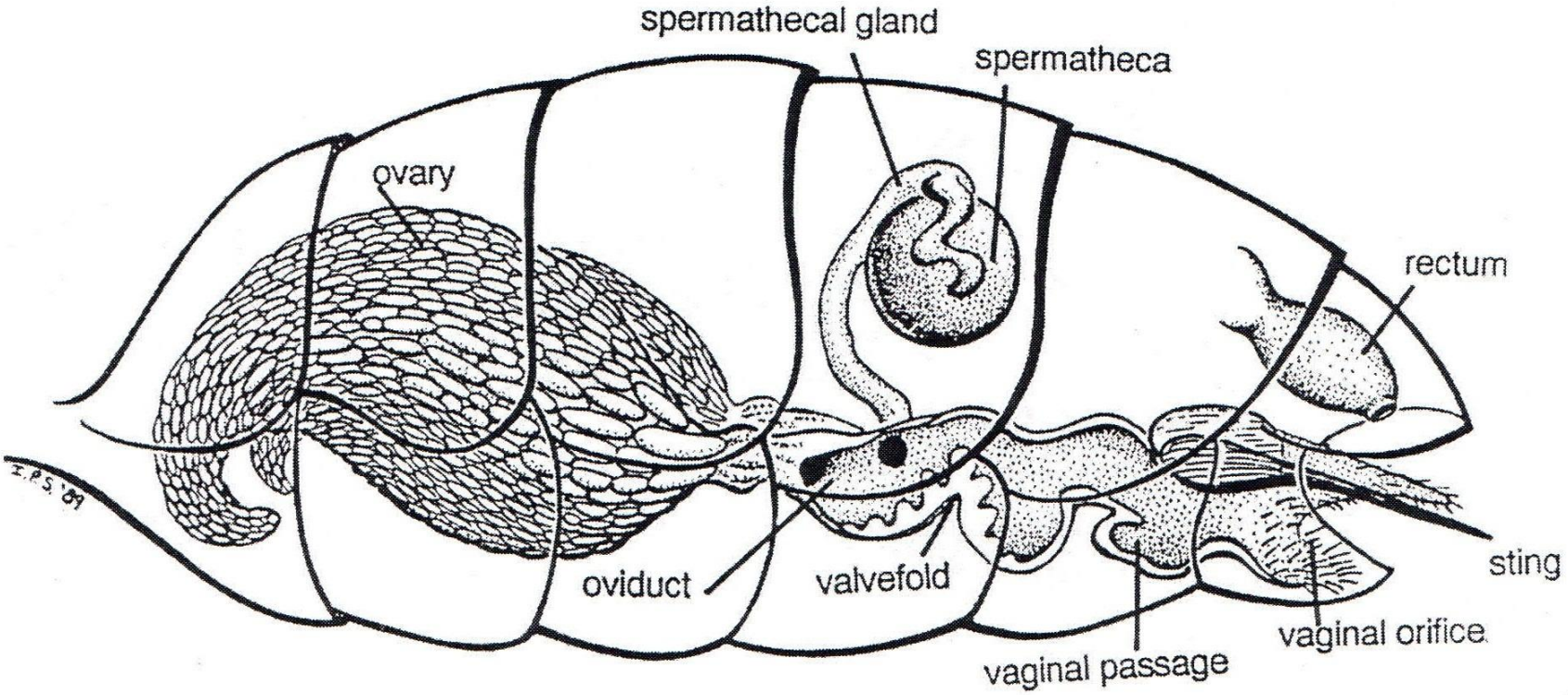
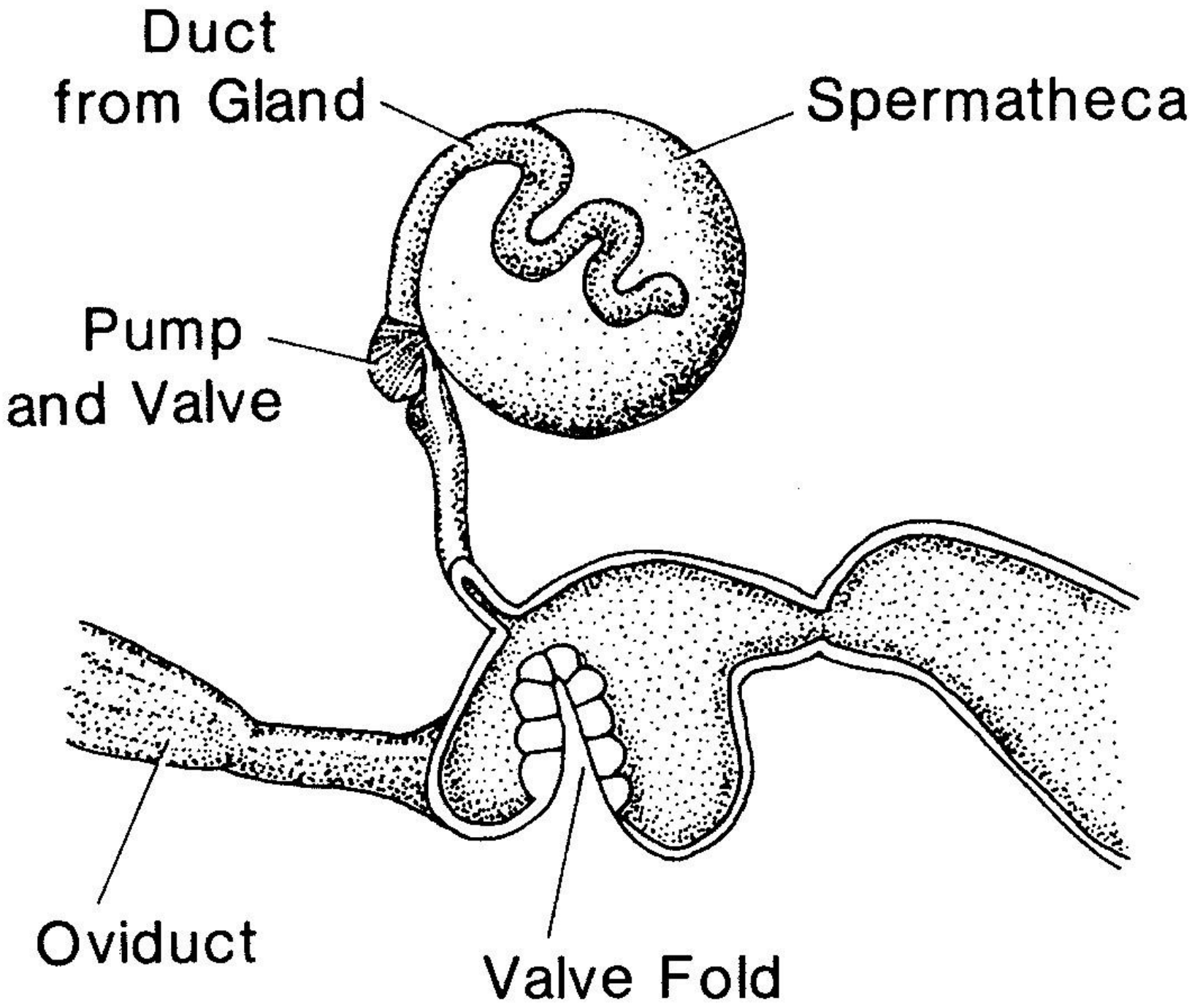


FIGURE 1.
Queen reproductive system. Source: Scott-Dupree, C. et al., 1993. *Ontario Beekeeping Manual*, University of Guelph, 174 pp.

Spivak, 2006; Queen Rearing Short Course


Duct
from Gland
Spermatheca
Pump
and Valve
Oviduct
Valve Fold

Marking and Handling Queens

International Queen Marking Code	
Color	Year Ending
White	1 or 6
Yellow	2 or 7
Red	3 or 8
Green	4 or 9
Blue	5 or 0

Banking Queens

Shipping Queens

Queen Candy- Good Recipe

In two separate dishes on the stove:

- **powdered sugar**
- **honey (raw, of known non-diseased source, that won't granulate easily)**

Warm until still comfortable to the touch (want ideal consistency on a hot day in a shipping container), then remove, add honey to center of sugar. Knead until it does not run, don't be afraid to add plenty of powdered sugar as queens are more likely to die of sticking to the sugar than not being able to eat the candy.

Battery box for shipping queens

Koehnen style queen cages

Introducing Queens

- **Un-emerged queen cell**
  - **Usually accepted if queenless**
- **Virgin queens**
  - **notoriously difficult**
  - **Cells and first 3 days of life, easier**
  - **after this, a colony that had been queenless long enough to have their queen-cells capped, would accept a Virgin Queen under almost any condition (Doolittle).**
- **Mated queens**
  - **best to cage on comb until workers are no longer aggressive towards queen, or caged-lengthwise between two brood frames, check every 2-4 days**

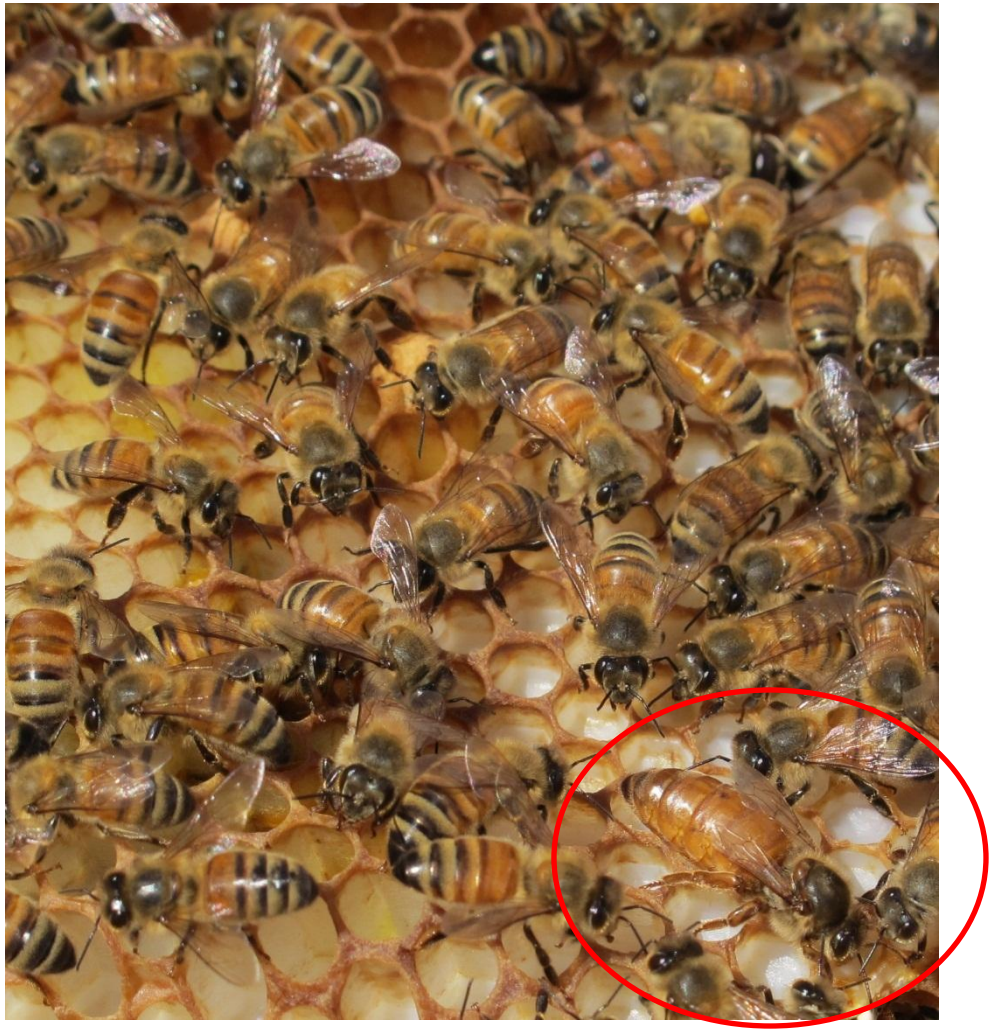
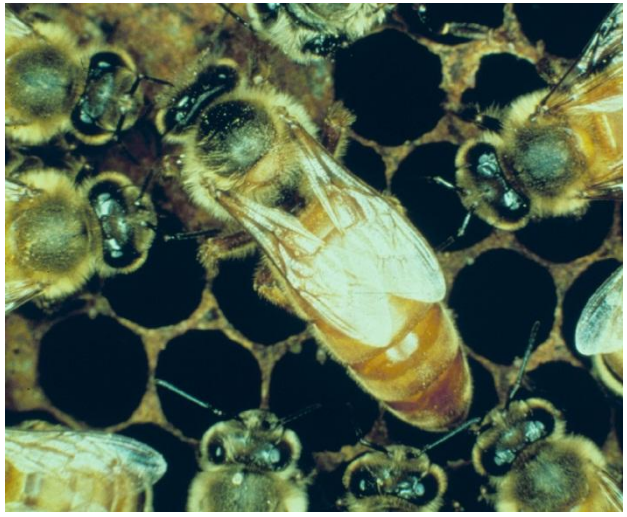
Queen Cell

Releasing the Queen

Locating the Queen

- Lightly smoke
- Separate boxes
- Concentrate on frames with eggs and young larvae

Locating the Queen



- Bald thorax
- Large abdomen
- Trail of no bees
- Retinue