

### *Case introduction*

A dead woman's body was found rolled in a carpet along I-95 in Greenwich, Connecticut, around 4 p.m. on September 21, 1986. The investigator called on Dr. William Krinsky at the Yale University Medical School on September 22, and asked him to examine the insect evidence from the carpet and to help determine approximate time of death (postmortem interval, PMI) of the woman.

### *Gathering evidence*

Dr. Krinsky started his work on the case on the afternoon of September 22 and visited the Westport State Police Barracks around 1:20 PM to examine the materials left on the carpet from the victim's body. He collected a large maggot mass, a number of puparia (insects in a non-feeding stage between the larva and adult form where their last larval skin hardens), and few damaged adult blow flies (*Diptera*-order, *Calliphoridae*-family) identified as black blow flies (*Phormia regina*-species). He found neither eggs nor empty puparia. Only a small number of puparia (approximately 1 %) were collected compared to the maggots (99%). He also noted that most of the maggots were large 3rd instar larvae (the last of the 3 larva stages).

On the afternoon of September 24, Dr. Krinsky visited the site where the body was found with one of the police detectives working on the case. At the site, Dr. Krinsky collected additional insect evidence as well as made other environmental observations including the vegetation where the body was placed, the direction of the sunlight, etc. Dr. Krinsky noted his observations and took the insect evidence to the laboratory for detailed examination and analysis.

### *Asking other important questions*

In determining the postmortem interval (PMI, time since death) of the victim, Dr. Krinsky needed more than entomological information. He developed the following questions and sought the answers to them in order to verify, adjust, and support his analysis:

1. Question: How tightly was the body rolled in the carpet? Was it bound with anything?  
Answer: Quite tightly; the carpet was rolled, folded at both ends, and tied with a rope.
2. Question: How was the carpet handled after it was opened?  
Answer: The carpet was opened in the presence of a medical examiner, then was placed in plastic bags and kept in a car.
3. Question: Did the vegetation or any staining of the ground indicate how long the body was on the ground where it was found?  
Answer: During the site visit on September 24, Dr. Krinsky found the vegetation where the body was found damp, darkened and depressed. He also noted the odor still remaining at the site. Making this observation, he estimated that the body might have been there approximately 7 days.
4. Question: Where was the body placed in relationship to the environment—e.g., direct sunlight, shade, blockage etc.?  
Answer: The site of the body was damper than its surroundings. He noted heavy mite infestation on the site as well as sunlight dappling on the right side of where the rug had been found in the late afternoon.
5. Question: Were any of the roaches found alive?  
Answer: No
6. Question: What were the weather conditions during the month of September?  
Answer: Dr. Krinsky requested and received a record of local weather data in order to calculate the accumulated degree hour, ADH—see section 3 in the Laboratory Work Section below).
7. Question: What were the autopsy findings?  
Answer: Dr. Krinsky spoke with the medical examiner prior to receiving the requested final autopsy report which stated the cause of death and noted the presence of many maggots in the various openings of the victim's body.

### *Laboratory Work*

At the laboratory, Dr. Krinsky processed the collected insects differently. Some were pinned or preserved in ethanol as examples; some were made into slides to study the biological structures; and others were reared—i.e., kept in a set environment to further develop into adults. The following laboratory work was done to identify and calculate the accumulated degree hour (ADH, see item 3 below) in order to estimate the postmortem interval:

1. Rearing and identifying the insects: Dr. Krinsky needed to know when the adult flies would emerge from the puparia in order to identify the insects and to estimate the postmortem interval (time since death) by calculating earliest possible time of oviposition (depositing of eggs, esp. by insects). He processed the collected maggots and puparia from the carpet on September 22, in the following manner:
  - a) Small larvae of about 2nd and young 3rd instars were preserved in 70% ethanol liquid after killing them in a hot water.
  - b) Some larvae were transferred from hot water to 10% ethanol liquid for microscope slide preparation in order to help identify the insect species.
  - c) About 10 large larvae were reared by placing them in 25 C (=77 F) environment for further development.
  - d) All collected puparia—66 dark, 7 pale brown and 7 intermediate reddish brown—were reared at 25 C (=77 F) environment for further development.
2. Emerging flies: Dr. Krinsky observed the following adult fly emergences from the puparia being reared at 25 C (=77 F):
  - a) 2 flies emerged at 1:30 PM on September 25
  - b) 6 flies emerged in the morning of September 26
  - c) 2 flies emerged around 4 PM on September 26
  - d) 25 flies emerged at 4 PM on September 27
  - e) 10 flies emerged at 3:30 PM on September 28
  - f) 6 flies were in the process of emerging at 5:25 PM on September 29
  - g) Among the large larvae placed in the chamber on September 22, 2 flies were in the process of emerging on September 30.
  - h) Among the reared larvae group, 2 flies were in the process of emerging on October 1.

3. Calculating accumulated degree hour (ADH): Studies of insects have provided evidence that an insect requires a given amount of thermal energy (heat) to develop from one stage to the next in its life cycle. The total thermal energy (ambient temperature multiplied by hour or day) is called the accumulated degree hour (ADH). Forensic entomologists calculate ADH in order to count back and estimate the age of the insect or the time when the eggs were first deposited. Dr. Krinsky combined his laboratory data and the weather data to calculate ADH of the reared puparia and large larvae, then counted backwards to estimate the first possible time of egg deposits on the body.

### *Conclusion & Outcome*

On February 2, 1987, Dr. Krinsky sent a letter to Dr. Henry Lee, Director of State Police Forensic Laboratory in Connecticut, stating his conclusion of the most likely date and time of oviposition and outlining his forensic entomological analysis. Dr. Krinsky testified for the prosecution as an expert witness on August 1990, which corroborated other evidence and witness statements against the suspect on trial. The case resulted in a guilty verdict and the defendant was sentenced to 60 years in jail, equivalent to the life sentence in Connecticut.