

The Hot Zone by Richard Preston
Summary of "The Monkey House" (pp. 157-198)

In the second part of the book, the narrative shifts to a monkey house in Reston, Virginia in 1989. The monkey house, officially known as the Reston Primate Quarantine Unit, is owned by Hazelton Research Products, a company that coordinates the import and sale of laboratory animals. On October 4, the facility receives a shipment of 100 wild monkeys from the Philippines. Two of the monkeys are dead upon arrival at the facility, but the remaining animals are placed throughout 12 holding rooms in the building.

Less than four weeks after the shipment's arrival, the colony manager, Bill Volt, notices that a large number of the new monkeys are dying. Already 29 animals from the original shipment have died, with the majority of the deaths occurring in Room F. Bill Volt also notices that the heating and air-handling system in the monkey house is malfunctioning. He contacts Dan Dalgard, the consulting veterinarian for the facility, to see if he will examine and treat the monkeys.

When Dalgard arrives at the facility a few days later, he identifies two sick monkeys in Room F that seem to be feverish with droopy eyelids. Both monkeys die that night. When Dalgard returns to the facility to dissect the animals, he notices that both monkeys have enlarged spleens and blood in their intestines, but he is unable to identify a specific cause of death. Dalgard suspects that the monkeys may have died from an infectious agent such as simian hemorrhagic fever (SHF). Over the course of the next several days, several monkeys from Room F die nearly every night.

After dissecting one of the dead monkeys, Dalgard decides to send samples of the animal's spleen and throat mucus to USAMIRRD at Fort Detrick. He contacts Peter Jahrling, a virologist at the Institute who specializes in monkey viruses and agrees to examine the samples. Much to Jahrling's chagrin, the samples arrive packaged in nothing more than tin foil. However, after an initial examination of the samples, Jahrling provides Dalgard with a tentative diagnosis of simian hemorrhagic fever.

Determined to contain the outbreak, Dalgard euthanizes the remaining monkeys in Room F. When he dissects the animals, he is dismayed to discover that several of them appear to be perfectly healthy. Unsure if he has made the correct decision in killing the animals, Dalgard stores their bodies in the facility freezer.

Meanwhile, at the Institute, an intern named Tom Geisbert asks to examine the samples from the Reston facility. Geisbert enjoys sharpening his skills by looking at viruses, such

as Marburg, and is anxious to tackle a new specimen. When Geisbert examines the flask with cells from the Reston monkey, he notices that the cells seem to be unrecognizably sick. He takes the sample to Peter Jahrling for a second opinion, but Jahrling concludes that the flask must have been contaminated with bacteria. Both scientists sniff the contents of the flask, but neither can detect the odor associated with contamination. Still, Jahrling maintains his original diagnosis of SHF and calls Dalgard to confirm.

After a weekend hunting trip, Geisbert returns to the laboratory, determined to confirm Jahrling's diagnosis with visual evidence from the electron microscope. Using his diamond knife, he cuts tiny slices from the monkey sample, with each slice containing thousands of cells. When Geisbert examines one of the slices through the microscope, he is shocked to discover that each cell is crawling with a rope-like virus. His first thought is Marburg. Geisbert realizes that both he and Peter Jahrling may have sniffed a flask containing a deadly hot agent.

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Still reeling from his discovery, Tom Geisbert takes photographic evidence of the possible filovirus to Peter Jahrling. Jahrling and Geisbert both compare the photographs with textbook images of the Marburg virus, and they become convinced that they are dealing with a Level 4 hot agent. Jahrling decides to notify the chief of the disease-assessment division at the Institute, Colonel C. J. Peters. Peters is initially skeptical but admits that signs of a filovirus are present in the sample. Jahrling decides to confirm the virus by testing the cells with blood samples infected with Ebola and Marburg. In the meantime, Peters orders Geisbert to find proof that the agent is actually growing in monkey tissue from the Reston facility.

After Colonel Peters leaves, Geisbert and Jahrling privately discuss their possible exposure to the agent. Ten days have passed since they sniffed the flask, but the incubation period for the virus can last as long as 18 days. Rather than risk being isolated in the Slammer, they decide not to tell Colonel Peters about the incident. Instead, they will test their blood for the virus and hope for the best.

Geisbert collects some sterilized pieces of monkey liver from the same animal used for the initial test. After letting the samples sit overnight, Geisbert slices the pieces open with his diamond knife and takes photographs with the electron microscope. The photographs prove definitively that the unknown virus is replicating in the monkey tissue. Geisbert shows the photographs to Colonel Peters and Peter Jahrling; all three now wait for the results of Jahrling's test.

For the test, Jahrling uses blood serum from three individuals who were infected with a filovirus strain: Shem Musoke for Marburg, Mayinga N. for Ebola Zaire, and Boniface, a man who died from Ebola Sudan. Jahrling combines the monkey cells with blood serum from each individual. If the monkey sample tests positive for one of the three strains, the cells will glow under ultraviolet light. When Jahrling examines the slides, he is dismayed to see the Mayinga N. sample glowing brightly. He performs the test again, but with the same result. Jahrling immediately calls Colonel Peters, who decides to inform the commander of USAMRIID, Colonel David Huxsoll.

Anxious to contain a possible biohazard disaster, Huxsoll calls a meeting with Jahrling, Peters, Nancy Jaax, and Major General Philip Russell. Jahrling confirms that his test proves that the virus at the Reston facility is Ebola Zaire, or at the very least, closely related to the virus. Nancy Jaax also informs the group that the virus may have the ability to travel through the air, as she discovered during Gene Johnson's Ebola experiments. Without the possibility of a vaccine or cure, the only way to address the outbreak is through biocontainment.

The group decides on two options for biocontainment: first, to let the virus run its course, or second, to euthanize all of the monkeys in the facility. Both options require major field operations with SWAT personnel trained in biohazard work. Colonel Peters agrees to serve as team leader. While Major General Russell calls Frederick Murphy at the C.D.C. and the rest of the group members contact other official channels, Colonel Peters calls Dan Dalgard and sets a meeting for the next morning.

Dan Dalgard has never heard of the Ebola virus and is hesitant to give Colonel Peters full access to the facility until he can meet him in person. When Dalgard calls Bill Volt for an update on the monkeys, he learns that one of the animal caretakers, Jarvis Purdy, is the hospital after suffering a heart attack. Dalgard wonders if Jarvis Purdy might have been infected with Ebola. He orders Bill Volt to suspend all operations in the monkey house except for feeding, cleaning, and observation. He also calls the hospital and asks Purdy's doctor to contact Colonel Peters immediately if Purdy begins to exhibit any strange symptoms.

The next morning, Nancy Jaax accompanies Colonel Peters and Gene Johnson to meet Dan Dalgard at the Hazelton offices. Nancy examines a sample of monkey liver from the monkey house and identifies extreme virus amplification in the cells. Dalgard is still unwilling to take them to the monkey house but provides them with seven dead monkeys, all double-wrapped in plastic garbage bags. Back at the Institute, Nancy Jaax and Colonel Ron Trotter dissect the monkeys in a Level 4 laboratory, but the results are inconclusive. Nancy can only conclude that the monkeys are suffering from SHF, Ebola, or both.

Meanwhile, Colonel Peters calls a meeting with General Russell, Peter Jahrling, Dan Dalgard, Gene Johnson, Joe McCormick, and officials from the C.D.C. and the Virginia Board of Health. Upon the recommendation of General Russell, the group agrees to split management of the operation: while the C.D.C. will coordinate the potential human effects of the outbreak, the Army will manage the monkey house, beginning with the formation of a team to be led by Jerry Jaax. The following day, Jerry Jaax calls the first meeting of his team and outlines a plan to enter the monkey house, euthanize the monkeys in one of the rooms, and take tissue samples back to USAMRIID.

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Summary of "Smashdown" (pp. 285- 326)

The next morning, Jerry Jaax, Gene Johnson, and the rest of the team gather at USAMRIID to collect equipment before setting off for the monkey house. The front page story of The Washington Post that day reads: "Deadly Ebola Virus Found in VA. Laboratory Monkey." Colonel Peters is quoted extensively in the story, but he asserts that the military operation at Reston is nothing more than routine. To help maintain this image, the team members are all dressed in civilian clothing and do not put on space suits until they enter the monkey house.

Jerry Jaax is first to enter the facility, along with Captain Mark Haines, also a veterinarian in the Army. The two men move to the staging area, where they put on racal suits - field biological hazard suits that contain a battery-powered ventilation system. As they open the door into the hot zone, Jerry and Captain Haines see two Hazelton workers walking toward them wearing only basic respirators. Jerry realizes that all entrances to the hot area have not been sealed off as they previously thought. The workers direct Jerry and Captain Haines to Room H and then inform Dan Dalgard.

Dalgard is surprised to see Jerry and Captain Haines wearing space suits but proceeds with giving them a tour of the room.

Shortly after Jerry enters the building, Nancy Jaax arrives at the site. She reminds the soldiers to look out for any rips in their suits and also to be wary of aggressive monkeys who might bite. After suiting up, Nancy joins the group in Room H, where she selects four monkeys to euthanize and take back to Fort Detrick for testing. This time, when Nancy opens up the dead monkeys, she can clearly identify the signs of Ebola. Meanwhile, the rest of the team faces the arduous task of euthanizing the 65 remaining monkeys in Room H.

The next morning, Dan Dalgard arrives at the Reston facility and sees one of the monkey caretakers wearing a protective suit outside the building, against Dalgard's direct orders. Dalgard's anger quickly turns into fear as the caretaker, Milton Frantig, starts vomiting. Dalgard realizes that two of the employees at the facility are now sick. After helping Frantig into the building, Dalgard drives to the main Hazelton office where he recommends immediate evacuation of the facility. An ambulance is called to pick up Milton Frantig, which arrives at the Reston facility just as a television-news van pulls up.

After coordinating with the senior managers of Hazelton, Dalgard asks Colonel Peters and USAMRIID to assume legal responsibility for the facility. Colonel Peters is unwilling to have the Army assume full liability, but he and General Russell agree to sign a simple letter confirming military ownership of the monkey house. They agree that Jerry Jaax will need to lead a much larger team into the facility in order to euthanize all of the monkeys. Given this new directive, Jerry Jaax convenes a meeting with civilian staff and animal-care technicians at the Institute and asks for volunteers.

The next morning, the new recruits congregate behind the monkey house, where Jerry Jaax has already divided them into teams of two. Gene Johnson informs the group of the recent development with Milton Frantig and explains that the Ebola strain is likely airborne. Jerry and his partner, Sergeant Thomas Amen, are the first to suit up and cross into the hot zone. While the other teams are putting on their space suits, Jerry and Sergeant Amen go through each room of the building in order to feed the monkeys and visually track the spread of the outbreak. Jerry then divides the group into sub-teams, with one group collecting blood samples, one group euthanizing the monkeys, and one group performing necropsies.

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Summary of "Smashdown" (pp. 327- 371)

After hours of euthanizing monkeys, the group is exhausted, but none of the soldiers is willing to leave their post. One soldier, Specialist Rhonda Williams, develops a malfunction with her space suit and starts to lose air pressure. After an initial panic in the room, Williams is able to borrow a spare battery from one of the other soldiers. Still, Jerry Jaax decides to send her outside with Charlotte Godwin in order to take a break. During decontamination, Williams discovers that she has a hole in her suit.

Just as the two soldiers are leaving the building, a television news van pulls up. Gene Johnson orders both women to hide in one of the vans behind the facility. The television men wander around outside the building but do not see anything to pique their interest and soon leave. After exiting the van, Williams and Godwin go to relieve themselves in a nearby wooded area and discover a number of dirty hypodermic needles lying in the grass.

On the second day of the operation, Jerry Jaax and Sergeant Amen repeat their process of walking through each room of the facility to feed the monkeys and track the virus. After several hours of working in Room C, Jerry leaves for a short break, only to have a monkey escape its cage during his absence. The sergeants immediately exit the room, bar the door, and try to locate the animal by sight. Jerry decides that the safest option is to enter the room and try to capture the monkey with a net. He and Sergeant Amen are unable to catch the monkey and finally decide to leave the animal in the room overnight.

The other team members continue to euthanize the monkeys, which are growing increasingly agitated over the course of the day. Specialist Williams is first assigned to the euthanasia table, but Jerry later moves her to the bleed table to draw blood samples with Captain Haines. As Williams starts to take a blood sample from a monkey, she discovers that the animal is not fully unconscious. The monkey is about to bite Williams's hand when another soldier injects it with a double dose of sedative.

Meanwhile, Peter Jahrling is working long hours in his laboratory in an effort to isolate the strain and determine how it is spreading. If he and Geisbert are able to isolate the strain before another laboratory, they will have the right to name it. While on a break, Jahrling checks in with Geisbert to see if either of them has started to develop symptoms of Ebola. Since they sniffed the contaminated flask, Jahrling has continually tested samples of their blood, but none of the samples have glowed under ultraviolet

light. In a few days, they will both reach the end of the incubation period and know for sure whether or not they are infected.

On the third day of the operation, Nancy Jaax is awakened by a call from her brother, who tells her that their father is close to death. Nancy considers flying home to see her father but decides that she cannot leave her work in the middle of such an important outbreak. Her father dies later that day, while she is working in the hot area. By late afternoon, the team at the Reston facility has euthanized the last remaining monkey, including the monkey who escaped from Room C. While performing a final sweep of the building, Sergeant Klages discovers the freezer full with dead monkeys. Jerry orders him to leave the monkeys in the hallway for the decontamination team to destroy.

With the operation completed, the decontamination team scours the building with formaldehyde gas, effectively killing any remaining traces of the virus. Neither Peter Jahrling nor Tom Geisbert develops any symptoms, and Milton Frantig is diagnosed with nothing more than a bad flu and released from the hospital. Charged with finding the source of the virus, the C.D.C. identifies a monkey storage facility in the Philippines as the starting point for the Reston infection. As in Virginia, however, none of the human workers at the facility exhibit symptoms of Ebola.

Almost a month after the Reston outbreak, the virus reappears at another monkey facility operated by Hazelton Research Products. The C.D.C. and USAMRIID decide to isolate the facility in order to observe the progress of the virus. The virus travels between rooms through the air ducts and effectively kills the entire monkey population. As before, there are no human casualties. Even an animal caretaker named John Coleus who cuts himself with a contaminated scalpel ends up showing no symptoms of the virus. The USAMRIID later discovers that all four caretakers at the original Reston facility test positive for Ebola Reston. However, the strain is symptomless in humans.

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Summary "Kitum Cave" (pp. 376- 411)

In the fourth part of the book, the narrative shifts to the summer of 1993 and the author's own visit to Mount Elgon and Kitum Cave. At the beginning of his journey, Preston notes that the road he is taking to Mount Elgon is part of the Kinshasa Highway, also known as the "AIDS highway." The road cuts through the middle of Africa and, as the author recalls from his childhood, was a rarely used dirt road until it was paved in

the 1970s. Soon afterward, the AIDS virus started to appear in the towns running parallel to the highway.

For the trip to Mount Elgon, Preston hires Robin MacDonald as his guide. A professional hunter and safari guide, MacDonald is unconcerned about the threat of the Marburg virus inside Kitum Cave. He laughingly assures Preston that, if necessary, he will roll Preston up in a tent and drop him off at the entrance to Nairobi Hospital. However, more seriously, MacDonald notes that he has a gallon of bleach in his Land Rover.

In addition to Robin's wife, Carrie, and their two sons, the expedition to Kitum Cave includes three professional safari men and two of Preston's close friends. Unbeknownst to his friends, Preston has prepared a list of instructions in case he breaks with the Marburg virus after visiting the cave. At the end of the first day, the group reaches the town of Kitale at the base of Mount Elgon. They decide to make camp in the same meadow where Charles Monet had camped more than 13 years before.

The next morning, the expedition hikes to the mouth of Kitum Cave. Because of problems with poachers from Uganda, the group is escorted by an armed guard, per government order. As they approach the cave, the author realizes that everything he sees is a potential transmitter for the Marburg virus: every moth, every insect, even the stinging nettles. The trail leading to the cave is also covered with animal dung, another possible host for the virus, and the author becomes increasingly nervous about his mission.

Before entering the cave, Preston puts on a neutral-pressure body suit with a hood and respirator, as well as gloves and boots. He closes all of the seals in his suit with sticky tape. As Preston finishes suiting up, one of the professional safari men named Okuku asks how many people have died in the cave. Preston admits that two people have died, but both deaths happened several days after they visited the cave. Okuku remembers hearing about an expedition of American scientists who came to the cave in the late 1980s.

Preston finally begins his journey into the cave. Aided by a map drawn by an elephant expert who studied Kitum Cave, Preston passes through a zone of bat roosts to a dry, dusty area with remnants of a petrified rainforest. With each step, he wonders if he is inadvertently stepping on or through the hidden source of the Marburg virus. When Preston reaches the back wall of the cave, he turns off his light and briefly stands in the darkness, trying to feel if he can sense the presence of a viral predator.

Back outside the cave, Preston removes his makeshift space suit and immediately experiences the uncanny fear that he has been exposed to the filovirus. He tries to remind himself of the many people who have entered Kitum Cave without ever developing the Marburg virus. Finally, he remembers the advice of Joe McCormick, who told him that the only treatment for exposure to a filovirus is a bottle of scotch.

In the final few pages of the book, Preston visits the abandoned monkey facility in Reston, Virginia. As he looks through the glass door, he can see the airlock corridor used by Jerry Jaax's SWAT team and a bucket that carried bleach for the decontamination team. Other than a few cobwebs and creeping vines, the building shows no signs of life, not even of the ancient organism it once hosted. However, Preston knows that the virus will be back.

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