

This book describes events between 1967 and 1993. The incubation period of the viruses in this book is less than twenty-four days. No one who suffered from any of the viruses or who was in contact with anyone suffering from them can catch or spread the viruses outside of the incubation period. None of the living people referred to in this book suffer from a contagious disease. The viruses cannot survive independently for more than ten days unless the viruses are preserved and frozen with special procedures and laboratory equipment. Thus none of the locations in Reston or the Washington, D.C. area described in this book is infective or dangerous.

The second angel poured his bowl into the sea, and it became like the blood of a dead man.
Revelation 16:3

APOCALYPSE PART ONE

THE SHADOW OF MOUNT ELGON SOMETHING IN THE FOREST 1980 NEW YEAR'S DAY

CHARLES MONET was a loner. He was a Frenchman who lived by himself in a little wooden bungalow on the private lands of Nzoia Sugar Factory, a plantation in western Kenya that spread along the Nzoia River within sight of Mount Elgon, a huge, solitary extinct volcano that rises to a height of fourteen thousand feet near the edge of the Rift Valley. Monet's history is a little obscure. As with so many expatriates who end up in Africa, it is not clear what brought him there. Perhaps he had been in some kind of trouble in France, or perhaps he had been drawn to Kenya by the beauty of the country. He was an amateur naturalist, fond of birds and animals but not of humanity in general. He was fifty-six years old, of medium height and medium build, with smooth, straight brown hair, a good-looking man.

His job was to take care of the sugar factory's water-pumping machinery, which drew water from the Nzoia River and delivered it to many miles of sugar-cane fields. They say that he spent most of his day inside the pump house by the river, as if it pleased him to watch and listen to machines doing their work.

People who knew him recalled that he was affectionate with wild monkeys, that he had a special way with them. They said that he would sit holding a piece of food while a monkey approached him, and the animal would eat from his hand. When his Christmas vacation arrived, he formed a plan to go camping on Mount Elgon, and he invited one of the women from the town Eldoret to accompany him. No one seems to remember her name.

The mountain is a biological island of rain forest in the center of Africa, an isolated world rising above dry plains, fifty miles across, blanketed with trees, bamboo, and alpine moor. It is a knob in the backbone of central Africa. The volcano grew up seven to ten million years ago, producing fierce eruptions and explosions of ash, which repeatedly wiped out the forests that grew on its slopes, until it attained a tremendous height. Before Mount Elgon was eroded down, it may have been the highest mountain in Africa, higher than Kilimanjaro is today.

It is still the widest. A small part of Mount Elgon is a national park.

On New Year's morning, sometime after breakfast--a cold morning, air temperature in the forties, the grass wet and cold--they drove up the mountain along a muddy track and parked in a small valley below Kitum Cave. Herds of elephants go inside Kitum Cave at night to obtain minerals and salts. The cave is large enough to hold as many as seventy elephant at a time. They spend the night inside the cave, dozing on their feet or mining the rock with their tusks. They pry and gouge rocks off the walls, and chew them to fragments between their teeth, and swallow the broken bits of rock. Elephant dung around the cave is full of crumbled rock.

Monet and his friend had a flashlight, and they walked back into the cave to see where it went. The mouth of the cave is huge--fifty-five yards wide--and it opens out even wider beyond the entrance. They crossed a platform covered with powdery dry elephant dung, their feet kicking up puffs of dust as they advanced. The light grew dim, and the floor of the cave rose upward in a series of shelves coated with green slime. The slime was bat guano, digested vegetable matter that had been excreted by a colony of fruit bats on the ceiling. Bats whirred out of holes and flicked through their flashlight beams, dodging around their heads, making high-pitched cries. Their flashlights disturbed the bats, and more bats woke up. Hundreds of bat eyes, like red jewels, looked down on them from the ceiling of the cave. Waves of bat sound rippled across the ceiling and echoed back and forth, a dry, squeaky sound, like many small doors being opened on dry hinges. Then they saw the most wonderful thing about Kitum Cave. The cave is petrified rain forest. Mineralized logs stuck out of the walls and ceiling. They were trunks of rain-forest trees turned to stone--teaks, podo trees, evergreens. An eruption of Mount Elgon about seven million years ago had buried the rain forest in ash, and the logs had been transformed into minerals like opal and chert. The logs were surrounded by crystals, white needles of minerals that had grown out of the rock. The crystals were as sharp as hypodermic syringes, and they glittered in the beams of the flashlights.

Monet and his friend wandered through the cave, shining their lights on the petrified rain forest. Did he run his hands over the stone trees and prick his finger on a crystal? They found petrified bones of ancient hippos and ancestors of elephants. There were spiders hanging in webs among the logs. The spiders were eating moths and insects. They came to a gentle rise, where the main chamber widened to more than a hundred yards across--wider than the length of a football field.

Monet and his friend continued deeper into the cave, descending a slope, until they came to a pillar that seemed to support the roof. At the back of the cave, they found another pillar. This one was broken. Over it hung a velvety mass of bats, which had fouled the pillar with black guano--a different kind of guano from the green slime near the mouth of the cave. These bats were insect eaters, and the guano was an ooze of digested insects. Did Monet put his hand in the ooze?

Charles Monet returned to his job at the pump house at the sugar factory. He walked to work each day across the burned cane fields, no doubt admiring the view of Mount Elgon, and when the mountain was buried in clouds, perhaps he could still feel its pull, like the gravity of an invisible planet. Meanwhile, something was making copies of itself inside Monet. A life form had acquired Charles Monet as a host, and it was replicating.

THE HEADACHE BEGINS, typically, on the seventh day after exposure to the agent. On the seventh day after his New Year's visit to Kitum Cave--January 8, 1980--Monet felt a throbbing pain behind his eyeballs.

He decided to stay home from work and went to bed in his bungalow. The headache grew worse. His eyeballs ached, and then his temples began to ache, the pain seeming to circle around inside his head. It would not go away with aspirin, and then he got a severe backache. His housekeeper, Johnnie, was still on her Christmas vacation, and he had recently hired a temporary housekeeper. She tried to take care of him, but she really did not know what to do. Then, on the third day after his headache started, he became nauseated, spiked a fever, and began to vomit. His vomiting grew intense and turned into dry heaves. At the same time, he became strangely passive. His face lost all appearance of life and set itself into an expressionless mask, with the eyeballs fixed, paralytic, and staring. The eyelids were slightly droopy, which gave him a peculiar appearance, as if his eyes were popping out of his head and half-closed at the same time. The eyeballs themselves seemed almost frozen in their sockets, and they turned bright red. The skin of his face turned yellowish, with brilliant star like red speckles. He began to look like a zombie. His appearance frightened the temporary housekeeper. She didn't understand the transformation in this man. His personality changed. He became sullen, resentful, angry, and his memory seemed to be blown away. He was not delirious. He could answer questions, although he didn't seem to know exactly where he was.

When Monet failed to show up for work, his colleagues began to wonder about him, and eventually they went to his bungalow to see if he was all right. The black-and-white crow sat on the roof and watched them as they went inside. They looked at Monet and decided that he needed to get to a hospital. Since he was very unwell and no longer able to drive a car, one of his co-workers drove him to a private hospital in the city of Kisumu, on the shore of Lake Victoria. The doctors at the hospital examined Monet, and could not come up with any explanation for what he might have some kind of bacterial infection, they gave him injections of antibiotics, but the antibiotics had no effect on his illness.

The doctors thought he should go to Nairobi Hospital, which is the best private hospital in East Africa. The telephone system hardly worked, and it did not seem worth the effort to call any doctors to tell them that he was coming. He could still walk, and he had to get to Nairobi. They put him in a taxi to the airport, and he boarded a Kenya Airways flight. A hot virus from the rain forest lives within a twenty-four-hour plane flight from every city on earth. All of the earth's cities are connected by a web of airline routes. The web is a network. Once a virus hits the net, it can shoot anywhere in a day-Paris, Tokyo, New York, Los Angeles, wherever planes fly. Charles Monet and the life form inside him had entered the net.

The plane was a Fokker Friendship with propellers, a commuter aircraft that seats thirty-five people. It started its engines and took off over Lake Victoria, blue and sparkling, dotted with dugout canoes of fishermen.

Monet became airsick.

The seats are narrow and jammed together on these commuter airplanes, and you notice everything that is happening inside the cabin. The cabin is tightly closed, and the air recirculates. If there are any smells in the air, you perceive them. You would not have been able to ignore the man who was getting sick. He hunches over in his seat. There is something wrong with him, but you can't tell exactly what is happening. He is holding an airsickness bag over his mouth. He coughs a deep cough and regurgitates something into the bag. The bag swells up.

Perhaps he glances around, and then you see that his lips are smeared with something slippery and red, mixed with black specks, as if he has been chewing coffee grounds. His eyes are the color of rubies, and his face is an expressionless mass of bruises. The red spots, which a few days before had started out as starlike speckles, expanded and merged into huge, spontaneous purple shadows; his whole head is turning black-and-blue. The muscles of his face droop. The connective tissue in his face is dissolving, and his face appears to hang from underlying bone, as if the face is detaching itself from the skull. He opens his mouth and gasps into the bag, and the vomiting goes on endlessly. It will not stop, and he keeps bringing up liquid, long after his stomach should have been empty.

The airsickness bag fills up to the brim with a substance known as vomit negro, or the black vomit. The black vomit is not really black; it is a speckled liquid of two colors, black and red, a stew of tarry granules mixed with fresh red arterial blood. It is hemorrhage, and it smells like a slaughterhouse. The black vomit is loaded with virus. It is highly infective, lethally hot, a liquid that smell of the vomit negro fills the passenger cabin. The airsickness bag is brimming with black vomit, so Monet closes the bag and rolls up the top. The bag bulging and softening, threatening to leak, and he hands it to a flight attendant.

When a hot virus multiplies in a host, it can saturate the body with virus particles, from the brain to the skin. The military experts then say that the virus has undergone "extreme amplification". This is not something like the common cold. By the time an extreme

amplification peaks out, an eyedropper of the victim's blood may contain a hundred million particles of virus. During this process, the body is partly transformed into virus particles. In other words, the host is possessed by a life form that is attempting to convert the host into itself. The transformation is not entirely successful, however, and the end result is a great deal of liquefying flesh mixed with virus, a kind of biological accident. Extreme amplification has occurred in Monet, and the sign of it is the black vomit.

He appears to be holding himself rigid, as if any movement would rupture something inside him. His blood is clotting up-his bloodstream is throwing clots, and the clots are lodging everywhere. His liver, kidneys, lungs, hands, feet, and head are becoming jammed with blood clots. In effect, he is having a stroke through the whole body. Clots are accumulating in his intestinal muscles, cutting off the blood supply to his intestines. The intestinal muscles are beginning to die, and the intestines are starting to go slack. He doesn't seem to be fully aware of pain any longer because the blood clots lodged in his brain are cutting off blood flow. His personality is being wiped away by brain damage.

This is called depersonalization, in which the liveliness and details of character seem to vanish. He is becoming an automaton. Tiny spots in his brain are liquefying. The higher functions of consciousness are winking out first, leaving the deeper parts of the brain stem (the primitive rat brain, the lizard brain) still alive and functioning. It could be said that the who of Charles Monet has already died while the what of Charles Monet continues to live.

The vomiting attack appears to have broken some blood vessels in his nose-he gets a nosebleed. The blood comes from both nostrils, a shining, cloudless, arterial liquid that drips over his teeth and chin. This blood keeps running, because the clotting factors have been used up. A flight attendant gives him some paper towels, which he uses to stop up his nose, but the blood still won't coagulate, and the towels soak through.

When a man is ill in an airline seat next to you, you may not want to embarrass him by calling attention to the problem. You say to yourself that this man will be all right. Maybe he doesn't travel well in airplanes. He is airsick, the poor man, and people do get nosebleeds in airplanes, the air is so dry and thin ... and you ask him, weakly, if there is anything you can do to help. He does not answer, or he mumbles words you can't understand, so you try to ignore it, but the flight seems to go on forever. Perhaps the flight attendants offer to help him. But victims of this type of hot virus have changes in behavior that can render them incapable of responding to an offer of help. They become hostile, and don't want to be touched. They don't want to speak. They answer questions with grunts or monosyllables. They can't seem to find words. They can tell you their name, but they can't tell you the day of the week or explain what has happened to them.

The Friendship drones through the clouds, following the length of the Rift Valley, and Monet slumps back in the seat, and now he seems to be dozing ... Perhaps some of the passengers wonder if he is dead. No, no, he is not dead. He is moving. His red eyes are open and moving around a little bit.

The plane lands at Jomo Kenyatta International Airport. Monet stirs himself. He is still able to walk. He stands up, dripping. He stumbles down the gangway onto the tarmac. His shirt is a red mess. He carries no luggage. His only luggage is internal, and it is a load of amplified virus. Monet has been transformed into a human virus bomb. He walks slowly into the airport terminal and through the building and out to a curving road where taxis are always parked. The taxi drivers surround him--"Taxi?" "Taxi?" "Nairobi... Hospital," he mumbles.

One of them helps him into a car. Nairobi taxi drivers like to chat with their fares, and this one probably asks if he is sick. The answer should be obvious. Monet's stomach feels a little better now. It is heavy, dull, and bloated, as if he has eaten a meal, rather than empty and torn and on fire.

In the hospital Monet sits down in the waiting room. It is a small room lined with padded benches. There is always someone in Casualty who has a cut and is waiting for stitches. People wait patiently, holding a washcloth against the scalp, holding a bandage pressed around a finger, and you may see a spot of blood on the cloth. So Charles Monet is sitting on a bench in casualty, and he does not look very much different from someone else in the room, except for his bruised, expressionless face and his red eyes.

A sign on the wall warns patients to watch out for purse thieves, and another sign says:

PLEASE MAINTAIN SILENCE
YOUR COOPERATION WILL BE APPRECIATED.
NOTE: THIS IS A CASUALTY DEPARTMENT.
EMERGENCY CASES WILL BE TAKEN IN PRIORITY.
YOU MAY BE REQUIRED TO WAIT FOR SUCH CASES
BEFORE RECEIVING ATTENTION

Monet maintains silence, waiting to receive attention. Suddenly he goes into the last phase. The human virus bomb explodes. Military biohazard specialists have ways of describing this occurrence. They say that the victim has "crashed and bled out". Or more politely they say that the victim has "gone down".

He becomes dizzy and utterly weak, and his spine goes limp and nerveless and he loses all sense of balance. The room is turning around and around. He is going into shock. He leans over, head on his knees, and brings up an incredible quantity of blood from his stomach and spills it onto the floor with a gasping groan. He loses consciousness and pitches forward onto the floor. The only sound is a choking in his throat as he continues to vomit while unconscious. Then come a sound like bedside being torn in half, which is the sound of his bowels opening and venting blood from sloughed his gut. The linings of his intestines have come off and are being expelled along with huge amount of blood. Monet has crashed and is bleeding out.

The other patients in the waiting room stand up and move away from the man on the floor, calling for a doctor. Pools of blood spread out around him, enlarging rapidly. Having destroyed its host, the agent is now coming out of every orifice, and is "trying" to find a new host.

JUMPER

1980 JANUARY 15

NURSES AND AIDES came running, pushing a gurney along with them, and they lifted Charles Monet onto the gurney and wheeled him into the intensive care unit at Nairobi Hospital. A call for a doctor went out over the loudspeakers: a patient was bleeding in the ICU. A young doctor named Shem Musoke ran to the scene. Dr. Musoke was widely considered to be one of the best young physicians at the hospital, an energetic man with a warm sense of humor, who worked long hours and had a good feel for emergencies. He found Monet lying on the gurney. He has no idea what was wrong with the man, except that he was obviously having some kind of massive hemorrhage. There was no time to try to figure out what has caused it.

He was having difficulty breathing-and then his breathing stopped. He had inhaled blood and had a breathing arrest. Dr. Musoke felt for a pulse. It was weak and sluggish. A nurse ran and fetched a laryngoscope, a tube that can be used to open a person's airway. Dr. Musoke ripped open Monet's shirt so that he could observe any rise and fall of the chest, and he stood at the head of the gurney and bent over Monet's face until he was looking directly into his eyes, upside down.

Monet stared redly at Dr. Musoke, but there was no movement in the eyeballs, and the pupils were dilated. Brain damage: nobody home. His nose was bloody and his mouth was bloody. Dr. Musoke tilted the patient's head back to open the airway so that he could insert the laryngoscope. He was not wearing rubber gloves. He ran his finger around the patient's tongue to clear the mouth of debris, sweeping out mucus and blood. His hands became greasy with black curd. The patient smelled of vomit and blood, but this was nothing new to Dr. Musoke, and he concentrated on his work. He leaned down until his face was a few inches away from Monet's face, and he looked into Monet's mouth in order to judge the position of the scope. Then he slid the scope over Monet's tongue and pushed the tongue out of the way so that he could see down the airway past the epiglottis, a dark hole leading inward to the lungs. He pushed the scope into the hole, peering into the instrument. Monet suddenly jerked and thrashed.

Monet vomited.

The black vomit blew up around the scope and out of Monet's mouth. Black-and-red fluid spewed into the air, showering down over Dr. Musoke. It struck him in the eyes. It splattered over his white coat and down his chest, marking him with strings of red slime dappled with dark flecks. It landed in his mouth.

He repositioned his patient's head and swept the blood out of the patient's mouth with his fingers. The blood had covered Dr. Musoke's hands, wrists and forearms. It had gone everywhere - all over the gurney, all over Dr. Musoke, all over the floor. The nurses in the intensive care unit couldn't believe their eyes, and they hovered in the background, not knowing quite what to do. Dr. Musoke peered down into the airway and pushed the scope deeper into the lungs. He saw that the airways were bloody.

Air rasped into the man's lungs. The patient had begun to breathe again.

The patient was apparently in shock from loss of blood. He had lost so much blood that he was becoming dehydrated. The blood had come out of practically every opening in his body. There wasn't enough blood left to maintain circulation, so his heartbeat was very sluggish, and blood pressure was dropping toward zero. He needed a blood transfusion.

A nurse brought a bag of whole blood. Dr. Musoke hooked the bag on a stand and inserted the needle into the patient's arm. There was something wrong with the patient's veins; his blood poured out around the needle.

Dr. Musoke tried again, putting the needle into another place in the patient's arm and probing for the vein. Failure. More blood poured out.

At every place in the patient's arm where he stuck the needle, the vein broke apart like cooked macaroni and spilled blood, and the blood ran from the punctures down the patient's arm and wouldn't coagulate. Dr. Musoke abandoned his efforts to give his patient a blood transfusion for fear that the patient would bleed to death out of the small hole in his arm. The patient continued to bleed from the bowels, and these hemorrhages were now as black as pitch.

Monet's coma deepened, and he never regained consciousness. He died in the intensive care unit in the early hours of the morning. Dr. Musoke stayed by his bedside the whole time. They has no idea what had killed him. It was unexplained death.

They opened him up for an autopsy and found that his kidneys were destroyed and that his liver was dead. His liver had ceased functioning several days before he died. It was yellow, and parts of it had liquefied-it looked like the liver of a three-day-old cadaver. It was as if Monet had become a corpse before his death. Sloughing of the gut, in which the intestinal lining comes off, is another effect that is ordinarily seen in a corpse that is days old. What, exactly, was the cause of death?

It was impossible to say because there were too many possible causes.

Everything had gone wrong inside this man, absolutely everything, any one of which could have been fatal: the clotting, the massive hemorrhages, the liver turned into pudding, the intestines full of blood. Lacking words, categories, or language to describe what had happened, they called it, finally, a case of "fulminating liver failure". His remain were placed in a waterproof bag and, according to one account, buried locally. When I visited Nairobi, years later, no one remembered where the grave was.

1980 JANUARY 24

NINE DAYS AFTER the patient vomited into Dr. Shem Musoke's eyes and mouth, Musoke developed an aching sensation in his back.

African doctors found something very queer in Musoke's blood: "He's positive for Marburg virus. This is really serious. We don't know much about Marburg."

A medical textbook entry was brief. Marburg is an African organism, but it has a German name. Viruses are named for the place where they are first discovered. Marburg is an old city in central Germany, surrounded by forests and meadows, where factories nestle in green valleys. The virus erupted there in 1967, in a factory called the Behring Works, which produced vaccines using kidney cells from African green monkeys. The Behring Works regularly imported monkeys from Uganda. The virus came to Germany hidden somewhere in a series of air shipment of monkeys totaling five or six hundred animals. As few as two or three of the animals were incubating the virus. They were probably not even visibly sick. At any rate, shortly after they arrived at the Behring Works, the virus began to spread among them, and a few of them crashed and bled out. Soon afterward, the Marburg agent jumped species and suddenly emerged in human population of the city. This is an example of virus amplification.

The human victims developed headaches at about day seven after their exposure and went downhill from there, with raging fevers, clotting, spurts of blood, and terminal shock. For a few days in Marburg, doctors in the city thought the world was coming to an end. Thirty one people eventually caught the virus; seven died in pools of blood. The kill rate of Marburg turned out to be about one in four, which makes Marburg an extremely lethal agent: even in the best modern hospitals, where the patients are hooked up to life- support machines, Marburg kills a quarter of the patients who are infected with it. By contrast, yellow fever, which is considered a highly lethal virus, kills only about one in twenty patients once they reach hospital.

Marburg is one of a family of viruses known as the filoviruses. Marburg was the first filovirus to be discovered. The word filovirus is Latin and means "thread virus". The filoviruses look alike, as if they are sisters, and they resemble no other virus on earth. While most viruses are ball-shaped particles that look like peppercorns, the thread viruses have been compared to strands of tangled rope, to hair, to worms, to snakes. When they appear in a great flooding mess, as they so often do when they have destroyed a victim, they look like a tub of spaghetti that has been dumped on the floor.

Not long after Charles Monet died, it was established that the family of filoviruses comprised Marburg along with two types of virus called Ebola. The Ebolas were named Ebola Zaire and Ebola Sudan. Marburg was the mildest of the three filovirus sisters. The worst of them was Ebola Zaire. The kill rate in humans infected with Ebola Zaire is nine out of ten. Ninety percent of the people who come down with Ebola Zaire die of it.