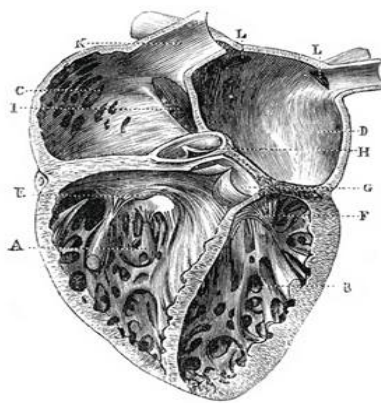


Open Heart

*A Cardiac Surgeon's Stories of
Life and Death on the Operating Table*



STEPHEN WESTABY

OPEN HEART

A Cardiac Surgeon's Stories *of*
Life *and* Death *on the* Operating Table

Stephen Westaby

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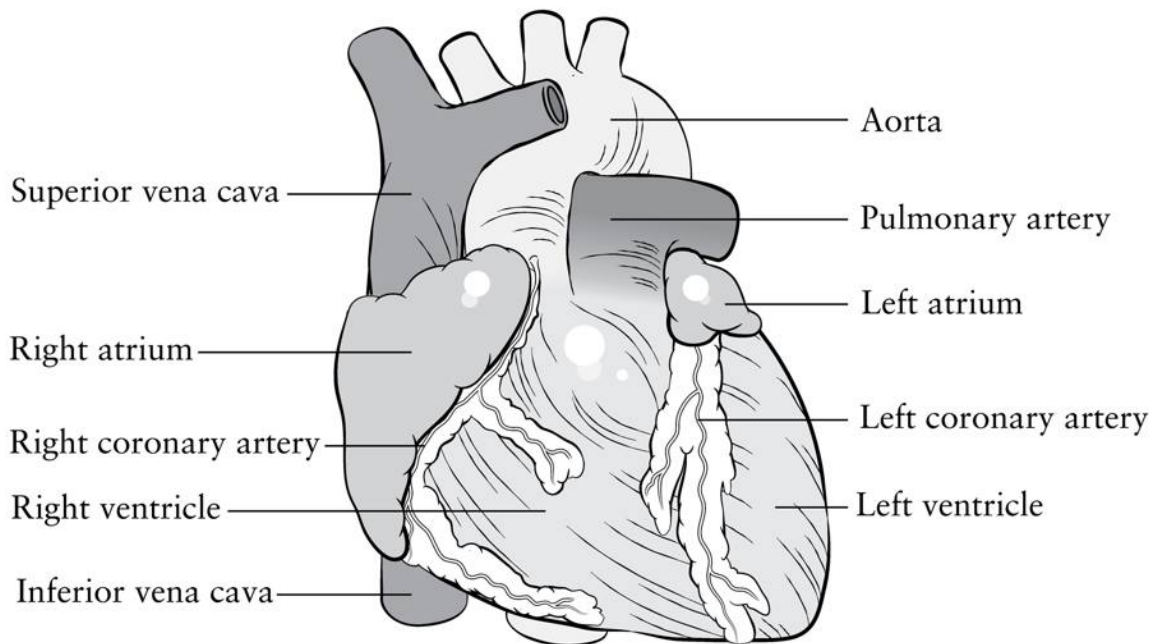
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*To my wonderful children, Gemma and Mark, and
granddaughters, Alice and Chloe*

Prologue

WOODY ALLEN FAMOUSLY SAID, “MY BRAIN: IT’S MY second-favorite organ.” I had the same affinity with the heart. Well, other people’s hearts. I liked to watch them. Stop them. Repair them and start them up again. Like a mechanic tinkering beneath the hood of a car. When I finally understood how the heart worked, the rest just followed. After all, in my younger days, I had been an artist. Both painting and heart surgery required precision and fine motor skills. I simply shifted from brush on canvas to scalpel on human flesh. More hobby than job. More pleasure than chore. It was something I was good at.

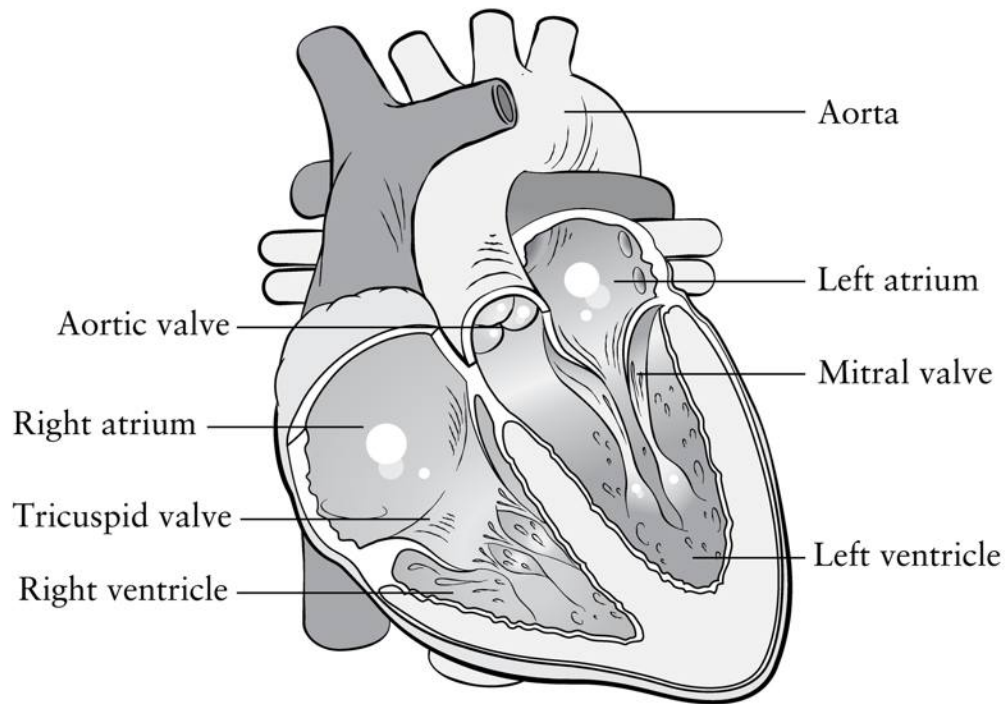
The heart had a pleasing symmetry to it, or at least I thought it did, initially. My school biology classes described it as an organ of four parts. Two collecting chambers, the left and right atrium, and two pumping chambers, the left and right ventricle. Textbook diagrams show the atria and ventricles side by side. Like a house with two compact bedrooms, situated above a spacious sitting room and kitchen. The spongy, expansible lungs surround the heart, resembling the steeply pitched roof of an A-frame. The lungs continuously replenish blood oxygen levels and expel carbon dioxide and other chemicals into the atmosphere.



Heart Anterior

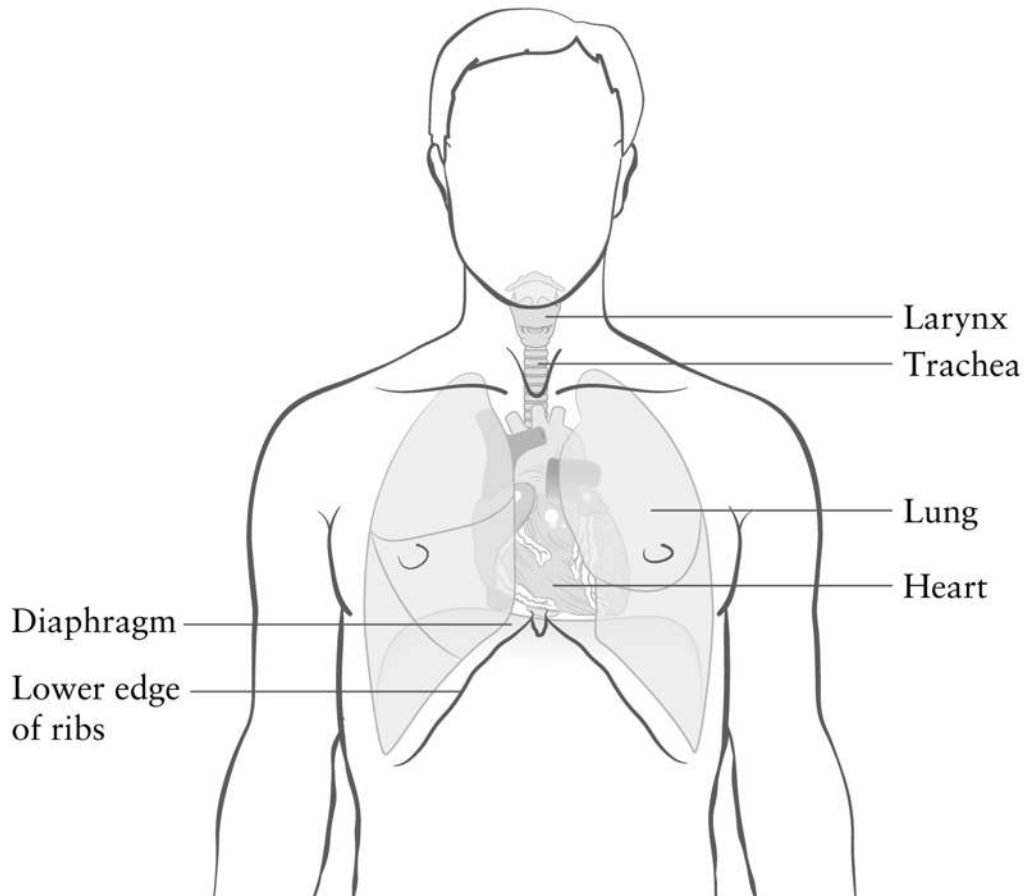
But is it all really that simple? My mother used to buy sheep hearts from the butcher. Inexpensive and tasty enough. Great for dissecting. It was then that I discovered that real hearts are more complex and idiosyncratic than the diagrams showed. Fundamentally, the shape and muscular architecture of the two ventricles are very different. Nor are they left and right. More front and back. The thicker left ventricle is conical in shape. It has circular muscle bands that constrict and rotate the chamber. Now we can visualize how the left ventricle really works. As the powerful muscle contracts and thickens (the systolic phase), its cavity narrows and shortens to expel blood through the aortic valve. Then during the heart's filling phase, or diastole, the left ventricle recoils and the aortic valve closes. The recoiling cavity widens and lengthens, sucking blood from the atrium into the ventricle through the mitral valve (so named for its likeness to the bishop's miter). During systole, the mitral valve closes again and the contents of the left ventricle are pushed onward around the aorta and the arteries of the body. Thus every coordinated cycle of contraction and relaxation involves narrowing, twisting, and shortening, followed by widening, uncoiling, and lengthening. A veritable Argentine tango, but with one difference. The whole process takes less than one second and the dance goes on for our

entire lives.



Heart Mitral Valve

Intriguingly, the right ventricle works in an entirely different way. Situated at the front of the heart between tricuspid and pulmonary valves, it is crescentic in shape and applied to the side of the left ventricle known as the interventricular septum. With this “new moon” shape, the right ventricle pumps like a bellows. The transverse free-wall fibers work against the powerful oblique muscle bonds of the septum—like lovers twisting and coiling their bodies.



Heart and Body

What was so fascinating about heart surgery was the movement, like watching a pianist's hands or a dancer's feet. The heart beats more than sixty times per minute to pump 5 liters of blood. This adds up to 3,600 beats an hour and 80,000 in twenty-four hours. It beats 31.5 million times in a year and 2.5 billion times in eighty years. The left and right sides of the heart circulate more than 6,000 liters of blood daily to the body and lungs. An incredible workload that requires a tremendous amount of energy. And when the heart fails, there are dire consequences.

Every cell in the body needs "life blood" and oxygen. Switch this off and the tissues die at different rates. Brain first, bone last. It depends upon how much oxygen each cell needs. When the heart stops, the brain and nervous system are damaged in less than five minutes. Brain death ensues.

It was the chance to potentially save these hearts (and minds) that compelled me to the British "surgical theater," the operating room (OR).

There I found that every heart is different. Some are fat, some are lean. Some are thick, some are thin. Some are fast, some are slow. Most that I worked with were desperately sick. Twelve thousand of them, all causing misery. Crushing chest pain, interminable fatigue, terrifying breathlessness.

This book tells the stories of those hearts, and of the attempts my team and I made to save their owners. Replacing sick pumps with machines or even a dead person's heart. It's a glimpse at the edges of mortality where we operate—where breath becomes life.

one The Ether Dome

For this relief much thanks; 'tis bitter cold. And I am sick at
heart.

—*Hamlet*

THE FINEST OF MARGINS SEPARATES LIFE FROM DEATH, triumph from despair, hope from extinction. A few more dead muscle cells, a fraction more lactic acid in the blood, a little extra swelling of the brain. The Grim Reaper perches on every surgeon's shoulder. Death is always definitive. No second chances.

November 1966. I was age eighteen, a week into my first term as a student at the Charing Cross Hospital Medical School in the center of London. Having been underwhelmed with a slimy piece of lifeless muscle on the dissection table, I was impatient to see a vibrant, beating heart. I learned from a hall porter at the school that heart surgery was done across the road in the hospital on Wednesdays. Look for the Ether Dome, he told me, an antiquated leaden glass dome above the operating theater in the old Charing Cross Hospital. Find the green door on the top floor under the eaves where nobody goes. But don't get caught. Pre-clinical students were not allowed up there.

It was late in the afternoon and already dark. Drizzle was falling on the Strand. I set out to find this hidden viewing spot. Not since my entrance interview had I entered the hallowed portals of the hospital itself. We

students had to earn that privilege by passing exams in anatomy, physiology, and biochemistry. So I walked quickly by the Grecian portico of the main entrance. I sneaked in through the Casualty (or Emergency) Department, under the blue light, and found an elevator—a rickety old cage used to take equipment and bodies from the wards to the basement. Inconspicuous enough.

I worried that I would be too late, that the operation would be finished. But to my delight the green door was still unlocked. Behind it, a dark, dusty corridor. Unchanged for one hundred years or more. This was a depository for obsolete anesthetic machines and discarded surgical instruments. Ten yards away I could see the glow of the operating lights beneath the dome itself. It was an old operating theater viewing gallery respectfully separated by glass from the drama below. My hand found a handrail and I lowered myself onto one of the curved wooden benches worn smooth by the restless backsides of would-be surgeons. I found myself no more than ten feet above the operating table.

I sat quietly clutching the handrail and peered through glass hazy with condensation. As the porter had promised, it was a heart operation. The chest was still open. I shifted to find the best view and settled directly above the surgeon's head. He was famous—at least in our medical school. Tall, slim, and imposing, with long fingers. In the 1960s, heart surgery was still relatively new, and its practitioners were in short supply. Few had been properly trained in the specialty. Often they were skilled general surgeons who had visited one of the pioneering heart centers, then volunteered to start a new program at their home institution. There was a steep learning curve, the cost measured in human life.

The two surgical assistants and the scrub nurse were huddled over the gaping wound, frantically shuttling instruments between them. I squinted, trying to get a closer look. And there it was, the focus of their attention and my fascination. A beating human heart. More squirming than beating. Still attached by cannulas and tubing to the heart-lung machine. Cylindrical discs were spinning through a trough of blood bathed in oxygen. A crude roller pump squeezed the tubes and accelerated this life blood back to the body. I could only see the heart. The rest of the patient was covered by green drapes and therefore anonymous, a relief to all concerned.

The surgeon restlessly shifted his weight from boot to boot, those big

white operating boots that surgeons used to wear to keep blood off their socks. On the wall behind me I spotted a box labeled “Intercom.” I threw the switch. Now the drama had a sound track. I learned that they had replaced the patient’s mitral valve, but the heart was struggling to separate from the bypass machine. This was the first time I had seen a beating human heart, but even to me it looked feeble. Blown up like a balloon, pulsating but not pumping. Against the din of amplified background noise, I heard the surgeon say, “Let’s give it one last go. Increase the adrenaline. Ventilate, and let’s try to come off.”

There was silence as everyone watched the desperate organ fight for its life.

“There’s air in the right coronary,” the first assistant said. “Give me an air needle.” He shoved the needle into the aorta. Frothy blood fizzed into the wound. The blood pressure started to improve. Sensing the window of opportunity, the surgeon turned to the perfusionist—the specialist responsible for the heart-lung machine—and said, “Come off now! This is our last chance.”

“Off bypass,” came the tentative reply.

The heart-lung machine was switched off. The heart was now free-standing. Left ventricle pumping blood to the body, right ventricle to the lungs. Both struggling. The anesthetist stared hopefully at the screen, watching the jagged lines indicating blood pressure and heart rate. Understanding that this was the last attempt, the surgeons silently withdrew the cannulas from the heart and sewed up the holes. All willing it to get stronger. For a while it fluttered feebly, but the pressure drifted down. There was bleeding somewhere. Not torrential but persistent. Somewhere at the back. Somewhere inaccessible.

Lifting the heart caused it to fibrillate. It was now squirming, not contracting. Wriggling like a bag of worms. Incoordinate electrical activity. Wasted energy. It took the anesthetist a while to spot this on his screen. “VF,” he shouted. I would learn that it meant ventricular fibrillation. “Shock it.” The surgeon already knew. He was holding the defibrillating paddles hard against the heart expectantly. “30 joules”—zap. No change. “Give it 60”—zap. This time it defibrillated but went still, stunned and devoid of electrical activity. Asystole as we call it. Blood continued to fill the chest. The surgeon poked it with a finger. The ventricles responded by

contracting. He poked it again and the rhythm returned. “Too slow—give me a syringe of adrenaline.” The needle was shoved unceremoniously through the right ventricle into the left. The syringe squirted in clear liquid. Then he massaged the heart with his long fingers to push the powerful stimulant into the coronary arteries.

The grateful heart muscle responded rapidly. Straight out of the textbook, the heart rate accelerated, then the blood pressure soared. The barometer rose. Up and up, dangerously testing the stitches. Then, as if in slow motion, the cannula site in the aorta gave way. Whoosh. The crimson fountain hit the operating lights, sprayed the surgeons, soaked the green drapes. Someone murmured, “Oh shit.” An understatement. The battle was lost.

Before a finger could plug the hole, the heart was empty. Rivulets of blood streamed across the white marble floor and dripped from the lights overhead. Rubber soles stuck to it. The anesthetist frantically squeezed bags of blood into the veins, but to no avail. Life ebbed away. As the injected slug of adrenaline wore off, the turgid heart simply blew up like a balloon and stopped. Stopped for good.

The surgeons stood silent. Despairing as they did week after week. Now the senior surgeon walked out of my view. The anesthetist turned off the ventilator and waited for the electrocardiogram (ECG) to flatline. He removed the tube from the patient’s windpipe. Then he left. The brain was already dead.

Just yards away, mist descended on the Strand. Commuters rushed into Charing Cross Station to avoid the rain. Late lunches were finishing at Simpson’s and Rules. Cocktails were shaken in the Waldorf and the Savoy. That was life, this was death. A lonely death on the operating table. No more pain, no more breathlessness, no more anything.

The perfusionist wheeled out his machine. It would take hours to disassemble, clean, restore, and sterilize for the next patient. Only the scrub nurse lingered. Then she was joined by the anesthetic nurse who had comforted the patient in the anteroom. They took off their masks and stared at the body. Unconcerned by the sticky blood that covered every surface. Unconcerned by the chest still splinted open. The anesthetic nurse searched for the patient’s hand beneath the drapes and held it. The scrub nurse pulled away the blood-soaked covering from the face and stroked it. I could see it

was a young woman.

They were oblivious to the fact that I was watching from above. No one had seen me there. I gingerly shifted along the bench to look at the patient's face. The eyes were wide open, staring into the dome. She was ashen white but still beautiful. Fine cheekbones and jet-black hair.

Like the nurses, I couldn't leave. I needed to know what happened next. They peeled back the bloodied drapes from her naked body. My brain was screaming for them to take out that hideous metal retractor cranking open her breastbone. Let her heart go back where it belongs. They did. The ribs recoiled and the poor lifeless organ was covered again. It lay flat, empty and defeated in its own space, now just a fearsome deep gash separated her tender, swollen breasts.

The intercom was still switched on. The nurses started to talk. "What will happen to her baby?"

"Adopted, I guess. She wasn't married. Her parents were killed in the Blitz."

"Where did she live?"

"Whitechapel. I think maybe the London don't do heart surgery yet. She got really sick during the pregnancy. Rheumatic fever. She nearly died during the delivery. Might have been for the best."

"Where is the baby now?"

"On the ward, I think. Matron will have to deal with it."

This was so matter of fact. A young woman had died. Her baby left without a relative in the world. No more love. No more warmth. Gone amid that tangled blood-soaked technology in the operating theater. This was what I aspired to. Was I ready?

Two student nurses came to wash the body. I recognized them from the Friday night freshers dance. They were respectful public schoolgirls. They brought a bucket of soapy water with sponges and set about scrubbing the body. They removed all of the tubing but were visibly upset by the wound and what lay beneath. Blood kept dripping out of it. "What did she have done?" said the girl I had danced with. "Heart operation, obviously," came the reply. "Valve replacement, I guess. Poor kid. She's only our age. Bet her mum's upset." They covered the wound with gauze and tape to soak up the fluid.

The scrub nurse returned and called back the surgical resident to close

over the wound before the move to the mortuary. All deaths on the operating table are referred to the coroner for autopsy. She would be sliced open again, so there was no point in closing the breastbone or bringing together the different layers of the chest wall. The resident took a big needle and stitched the opening temporarily with thick braid. But the wound edges still gaped and oozed serum.

It was now 6:30 p.m. I was supposed to be in the pub down the road getting pissed with the rugby team. But something compelled me to stay. I was attached to this empty shell. This skinny corpse I had never met but now felt I knew intimately. I had been with her at the single-most-important event of her life.

The three nurses manhandled her into a starched white shroud with a ruff around the neck. Tied at the back. They then secured her ankles with tape. She was beginning to stiffen with rigor mortis. The students had done their job with kindness and respect. I knew that I would meet them again. Maybe ask them how they felt.

There were just the two of us left. The corpse and me. The operating lights still shone on her face. She was staring straight up. Why hadn't they closed her eyes like they did in the movies? I could see through those dilated pupils to the pain etched on her brain. From the fragments of conversation and with a little medical knowledge, I could evoke her life story. She was in her twenties. Born in the East End. She could only have been a small child when her parents were killed in the bombing. As a child she carries the scars of those sights and sounds. The fear of being alone as her world disintegrates. Brought up in poverty, she develops rheumatic fever. A simple sore throat that triggers a devastating inflammatory process. Rheumatic fever was common in areas of deprivation and overcrowding. Perhaps she had painful swollen joints for a few weeks. What she didn't know was that the same process was happening in her heart valves. There was no diagnostic test in those days.

She develops chronic rheumatic heart disease and is known as a sickly child. Perhaps she develops rheumatic chorea. Involuntary jerky movements, unsteady gait, and emotional turmoil. She gets pregnant. Perhaps that's an occupational hazard. This makes things worse. Her wounded heart must work that much harder. She becomes breathless and swollen but makes it through to term. Maybe the London Hospital delivers

her safely but recognizes heart failure. A murmur. A leaking mitral valve. They prescribe the heart drug Digoxin, but she doesn't take it. Soon she is too tired and breathless to look after the baby. She cannot lie flat. With worsening heart failure, her outlook is grim. They send her to the city to see a surgeon. A real gentleman in a morning suit, pinstripe trousers. He is kind and sympathetic. He says only surgery on her mitral valve can help. But it didn't. It terminated her brief, hard life and left another orphan in the East End.

When the porters came, the operating lights were switched off. The mortuary trolley, a tin coffin on wheels, was drawn up alongside the operating table. By now her limbs were rigid. The body was unceremoniously dragged into this human sardine can. Her head bounced with a sickening thud, but nothing could hurt her anymore. I was relieved to lose eye contact. A green woolen blanket was folded over the top of the box to make it resemble an ordinary trolley. Then away they went to put her in the fridge. Her baby would never see her again, would never have a mother again. Welcome to cardiac surgery.

I sat there, arms on the rail, chin on my hands, staring at the black rubber surface of the empty operating table. Staring down from the Ether Dome as generations had before me. The Ether Dome was a gladiatorial arena. People came here to look down on a spectacle of life or death. Perhaps if others had witnessed it alongside me, it might have seemed less brutal. Someone to share the shock of this poor girl's death, the misery for her child.

Auxiliary nurses appeared, with mops and buckets. There to wipe away the last traces. Her blood now dry on the floor. Bloody footprints heading toward the door. Blood on the anesthetic machine, blood on the operating lights. Blood everywhere now meticulously cleaned away. A slip of a girl reaching up to clean the operating light saw me in the dome. My pale face and staring eyes against the gloom. It frightened her. My cue to leave. But one spot of dried blood remained on top of the light where no one could see. Adherent and black. It said, part of me is still here. Remember me. The green door closed behind me and I walked away. Down the shuddering lift where her body had been taken to lie in a cold fridge in the mortuary.

Notices of autopsies were posted on a board in the entrance hall of the medical school. Usually the patients were elderly. Young ones were either