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## **Biological View: What Do Dying People Feel?**

*In the end, it's about brain death*

Have you ever wondered what a dying person feels? It sounds morbid, but science and accounts from lucky survivors have helped us make an idea about it. Still, only the dead know exactly how it feels and the sensations you experience at that moment. A [report](#) released by *New Scientist* earlier this month answered to some questions related to the feelings and sensations a person experiences in various ways of dying. But what's the medical/biological support for all these aspects? Read on! Generally, a person is considered dead when blood circulation (translated in heart activity) has stopped. This is the clinical death, but in many cases, modern technology has permitted the restart / recovery of heart activity - such methods include cardiopulmonary resuscitation (CPR), defibrillation, epinephrine shots. So perhaps it would be more biologically correct to say that the person has died when the brain is dead. Still, the only way to instantly kill the brain is by shooting a bullet into someone's head. There are other ways in which the brain is killed more slowly, mainly by stopping its blood supply. The brain can function for a while without nutrients, but the brain cells (neurons) die in a matter of seconds when they lack oxygen. In fact, this is called a stroke: the death of some brain portions. In most cases of death, the victim's brain is killed ... 'indirectly' (so to say), by stopping the heart (the so-called heart attack). The heart attack can be spontaneous, caused by heart coronary disease (when the heart muscle is deprived of its circulation, and portions of it die). The main symptom is angina pectoris, the famous chest pain, a sensation of pain and squeezing radiating mainly to the left arm but also to all the surrounding areas, accompanied by massive sweating, nausea and palpitations. The asphyxiated brain loses consciousness in a maximum of 10 seconds, and minutes later the brain dies. Decapitation was believed to be rapid and painless, but it takes about 7 seconds for the brain to lose consciousness. Eye and facial expressions (grimaces) still persist for 30 seconds after the head has been cut off, which leads us to probably the most famous such case in world history, that of the French queen Marie Antoinette - what could the grimace on the face of this unlucky queen (guillotined during the French revolution) mean? That famous smile was surely not one of happiness. Lethal injection is considered a 'humane' alternative to the electric chair and attempts to stop the heart while stopping the functions of the brain through three active principles: an anesthetic (like sodium thiopental), a paralytic agent (like pancuronium bromide) and potassium chloride (ultrashort-acting sedative). A mixture of these should be redundant: if one chemical does not kill the inmate, one of the other two will do it. Many people believe that the potassium chloride injection causes burning pain, but the paralyzed convicted cannot show what he/she feels. If the dosage is not the right one, or if the one performing the injection misses the vein, the victim will not only feel a burning sensation caused by the chloride, but it will take him up to 9 minutes to die of asphyxiation due to the blocked breath muscles. Hanging should be an unconsciousness asphyxiation, occurring in 10 seconds: the convicted should be left unconscious and paralyzed by choking, having the neck broken from the first cervical vertebra, and death should come in a matter of seconds, maximum 2 minutes. The reality is more shocking: over three quarters of the convicted die after a torture of many minutes, during which they desperately try to breathe. Judicial hangings, opposed to suicides, cause a significant damage to the spinal cord. When the fall is longer than predicted, the victim may even be decapitated. Sometimes, intense fear can induce a cardiac arrest to the convicted. It was quite an offence for royalties to be hanged, as the victim loses control of its sphincters (anal and urethral). Drowning is in the end also a type of asphyxiation. The panicked victim tries to hold his breath, but they generally live up to 90

seconds without breathing, and even diving champions cannot resist over 6 minutes. The human brain is highly intolerant to the accumulation of carbon dioxide (a result of the cell respiration) in the blood irrigating the brain, and the urge for breathing cannot be stopped. Drowning survivors described a "tearing and burning" sensation when water floods the lungs, followed by a feeling of tranquility, as the brain can no longer sustain high activity. What's next is the same scenario: the lack of oxygen leads to consciousness loss, heart attack, and brain death. Blood loss, called hemorrhagic shock in medicine, produces in the end the same effect: no oxygen for the cells. That's why victims that are massively bleeding breathe so heavily: the lungs are trying to send more oxygen to the oxygen-hungry body. A 70 kg (180 pounds) man has about 5.6 liters of blood (8% of the body weight). Losing 1.5 liters of blood makes the individual feel weak, since all the blood has gone from the organs (including muscles) towards the lungs and heart, which try to compensate for the oxygen deficit. The adrenalin released to increase blood pressure in the arteries causes anxiety. Arginine vasopressin released to keep the water in the kidneys (the organism loses a lot of water through blood) makes the individual feel thirsty. If the blood loss is not stopped, and the body has already lost 2 liters of blood, these compensating mechanisms fail. The ion balance is destroyed, and the blood flow through capillaries is constricted. The cells can no longer function, and fluid and protein leakage out of the cells occurs. At this stage, even if the victim receives blood, the prolonged vasoconstriction has caused irremediable damage. The unoxygenated brain falls into dizziness and confusion, followed by unconsciousness. If the aortic or pulmonary artery dissection has taken place, pain similar to heart attack can occur. Electrocutation through a household device can paralyze the heart (heart attack), interfering with its own electric signal coordinating the contraction of the heart muscle. Much powerful shocks go beyond electrical impairment of the body, destroying tissues. Damage to the heart tissue means heart attack, but to the brain it causes rapid unconsciousness, if not instant death. Those executed on the electric chair can even experience tissue burning and paralysis of the breath muscles, of course, through asphyxiation. When falling from a height, the heart does not stop, it breaks into pieces. Usually, the ribs break in many pieces, which stab all the organs around. The thoracic shock, causing instant death, prevails amongst suicide jumpers. Survivors of such incidents describe the feeling of time slowing down. Burning the heretics was believed to be the worst kind of death during the Medieval Ages. But a sufficiently big fire kills the victims before them being touched by the flames, as the smoke gases, especially carbon monoxide, combine with the hemoglobin - the blood's red pigment carrying oxygen to tissues. The hemoglobin can no longer transport the oxygen to the tissues, and even if the victim is taken out of the burning building, or saved by firemen, he/she will die since the brain cannot be oxygenated. If the flames touch the skin of the conscious victim, they will induce tremendous pain, which slowly decreases with the destruction of the skin nerves, but persists, as inner tissues have pain sensors too. Carbon monoxide is also the main culprit for sleep asphyxiation death cases caused by broken stoves (the gas is the result of incomplete burning of wood or any other fuel). This is perhaps the less painful death, also employed by suicidal people using car smoke generated in a closed room. Explosive decompression means a sudden (less than 0.1 seconds) air pressure drop, caused by violent explosion, like in the case of a contained system (inner airplane) exposed in a moment to outer atmosphere or explosions caused by gas accumulation. No, people do not ...explode... in such cases. The exposure to low pressure causes swelling, but our skin is elastic and resistant and can cope with a drop of one atm. (the required drop for killing a person is of about 8 atmospheres). Survivors of such events reported chest pain, similar to the one you feel when someone hits you hard (due to the swelling of the lungs), and even the feeling of air going out of the lungs. If oxygenation is impeded, the individual loses consciousness in 15 seconds and dies of asphyxiation.