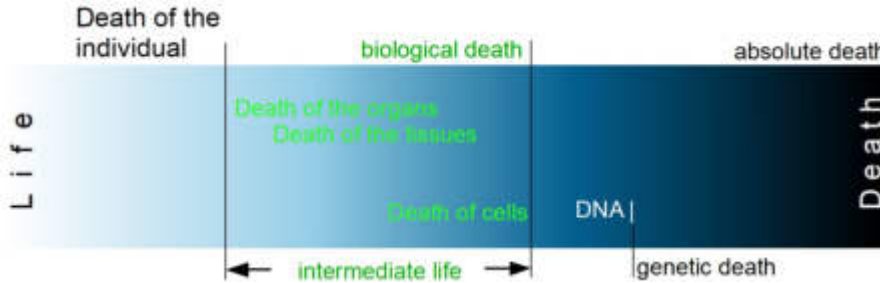
Klaus Schäfer

10 Axioms on Dying and Death



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0 Opening credits

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0.2 Foreword

An axiom, postulate, or assumption is a statement that is taken to be true, to serve as a premise or starting point for further reasoning and arguments. The word comes from the Ancient Greek word (axíoma), meaning 'that which is thought worthy or fit' or 'that which commends itself as evident' (Wikipedia: Axiom)

In articles in newspapers, magazines and specialist journals, in books and textbooks, even in academic works (university theses, dissertations, master's and bachelor's theses), attentive readers will find factually incorrect formulations in connection with dying and death such as this one:

- Someone is "declared brain dead" - doctors always „determine“ death, including brain death.
- Death is described as a process - dying is a process, death is an irreversible state.
- An adjective belonging to dying is attributed to death, e.g. "He had a painless death." - Death is always painless. Dying can be painful.

For this reason, these 10 axioms have been drawn up. They are a summary of the most important basic rules for expressing oneself correctly about dying and death.

These 10 axioms on dying and death should be known by all people who work in the healthcare sector and who write about dying and death, thus serving as multiplyers. By applying these 10 axioms, they contribute to correct language about dying and death and thus also to a better understanding of dying and death.

1 Death is certain.

mors certa est hora incerta

(Death is certain, the hour uncertain.)

We can only contemplate death from within life as living beings. The dead can no longer contemplate death. So we can only say: „mors certa est hora incerta“.

The death of the living

All living things die at some point. Nothing living escapes death. Even single-celled organisms, which reproduce by cell division and are therefore considered immortal by some authors, will die in 3-4 billion years at the latest. By then, our sun will have used up most of its hydrogen supply. As a result, it will inflate so much that it will swallow up Mercury and Venus. Temperatures of over 1,000°C are expected on Earth. This means that even the last drop in the ocean will have evaporated. Life on Earth will then become completely impossible. The last single-celled organism on Earth will also die.

Death is an inexplicable fact

We can analyze the dying process and determine death, but we do not know what death means for the individual in question. Only when we ourselves are dead do we know death, but we cannot tell anyone living about it.

If there is life after death, the question arises: did we also have a life before we were conceived? We certainly can't remember it. Will we then remember this life on earth when we are dead? Do we only move from one room (living space) to another with conception and death and lose our entire memory of the previous life? These and other questions arise in connection with death. No one can give us an answer to this in a scientific sense. As religious people, we can only say, I believe ...

The death of the suns

Stars are also referred to as "star birth" and "star death", as they are also subject to the process of formation, existence and death. In the case of our sun, a dwarf star (yellow dwarf), which is in the developmental stage of the main sequence, it began nuclear fusion around 4.57 billion years ago. Since then it has used up about half of its hydrogen supply. In 3-4 billion years, it will blow up into a red giant and then shine as a white dwarf for many more billion years in its old age. Finally, it will end up as a black dwarf that no longer emits any radiation.

The death of the universe

Our universe will also die in 10^{50} to 10^{1000} years. Astronomers agree on this. What they disagree on is the state of death. The first three hypotheses are discussed:

1. Big Freeze

   The universe continues to expand and cool down more and more. The final state is a large, dark space with some matter and a temperature of 0 Kelvin. This heat death of the universe was already postulated by Rudolf Clausius in 1867.

2. Big Crunch

   The universe expands to its maximum size. The expansion slows down like a wave on the beach before returning to the sea. In this way, the universe would contract again due to gravity. A new big bang would then be the result.

   However, the idea of a pulsating universe must be rejected, as the universe expands at an accelerated rate. This means that the centrifugal force is greater than gravity, which holds the universe together.

3. Big Rip

   The universe is expanding faster and faster. In the process, all elementary particles are ultimately torn apart. Beyond this "wall", matter simply dissolves.

4. black holes

   The Big Freeze already includes black holes in the hypothesis, which are destroyed by Hawking radiation at the end of the universe after around $10^{1,000}$ years.
   In the era of black holes, another end of the universe is also conceivable: gravity causes the black holes to attract each other and eventually merge into a single black hole. A critical mass could then be exceeded, which would ultimately lead to a new Big Bang.

Humanity will not experience the death of the universe. However, it is clear to scientists that the universe will also die. So we can say:

Everything that exists will die its own death. Nothing, not even the universe, will last forever.

Death as a normal state

If you look at nature and the universe, you realize that death is the normal state. Life is a temporary special form that stands out from death, but which falls back into death again. It is only a question of time.

We not only detect life on Earth, but also at least basic forms of life on asteroids and comets. It is probably only a matter of time before we can also detect the basic building blocks of life on expoplanets.

Whether on the earth or in the earth, whether in the water or in the air, whether in the waters or in the deep sea, whether in the desert or on the polar ice caps, we come across life everywhere. Life has even been found in nuclear reactors. Extremophiles are found in places where no life was initially suspected because this habitat was considered hostile to most life forms.

It can be assumed that we will also come across life in the universe, even if it will mostly be microorganisms and simple creatures.

However, all this life is a temporary rise from death that will fall back into death. Therefore, death is the basic state from which life only stands out for a limited period of time.

2 There is only one definition of death.

There is only one definition for the death of an individual: individual death. This also applies to human beings. Even if there are various meaningful word combinations with "death", there is always only one death: individual death

There are various ways of determining death

Although there is only one definition of death, there are various ways to determine the death of an individual. In the case of higher organisms, this is done via the certain signs of death, which are

- rigor mortis
- livor mortis
- brain death
- unsuccessful attempt at resuscitation
- injury incompatible with life,
  e.g. if the head has been separated from the torso.
- Decomposition

3 Death is a state opposite to life.

This means that there are only these two states, without a smooth transition. Just as a switch only knows the states "on" and "off", there are only the states "life" or "death". Dying is still part of life. It comes to an end with death.

Statistical analysis

For a meta-analysis of 1,009 university theses (habilitations, dissertations, master's and bachelor's theses) with "brain death" or "brain dead" in the text, 375 different adjectives for "death" were counted.

Explanation	*Quantity*	*%*
meaningful adjective	97	25,9
Open sense - it can be discussed	96	25,6
nonsensical adjective	68	18,1
violates 3rd axiom: separation of life and death	104	27,7
violates 4th axiom: irreversibility of death	10	2,7

Tab. 1 – Evaluation of the adjectives (Klaus Schäfer: ... für hirntot erklärt)

The result is very sobering:

- For 97 adjectives, the connection to death makes sense, e.g. "a sudden death".
- For 96 adjectives, the use with "death" is debatable or requires an explanation, e.g. "anthropogenic death".
- For 68 adjectives, the connection with "death" is nonsensical, e.g. "the famous death."
- For 104 adjectives, the use of the adjective in conjunction with "death" violates the 3rd axiom, e.g. "a painless death".
  Here, all adjectives were assigned that would have been appropriate for dying but are inappropriate for death. For this example: Death is always painless. The dead cannot feel pain, not even the brain-dead. It should

therefore correctly read "a painless dying". This would make the assignment of adjective and noun correct.

- With 10 adjectives, the use of the adjective in conjunction with "death" violates the 4th axiom, e.g. "the final death". Death is always final or there is no death.

It is alarming to note that even in German-language university publications with "Hirntod" (brain death) or "hirntot" (brain dead) in the text, 27.7% of the adjectives used in connection with "death" violate the 3rd axiom. This makes it clear how little attention is paid to this axiom even in the scientific literature.

Death as a state

In iconography, death is usually depicted as a grim reaper who mows people down en masse like grass, i.e. kills them. This gives the impression that death is the transition or the trigger of the transition from life to death.

This view is wrong, because the dead person remains dead. Death therefore does not denote the transition from life to death, but the irreversible state of death that begins with the onset of death.

4 Death is an irreversible condition.

Death is an irreversible state or there is no death. No dead person has ever come back to life, apart from stories from mythology and theology. Whoever is dead remains dead.

As the above study shows, 2.7% of the adjectives used in the context of "death" in university publications with "brain death" or "brain dead" in the text violate the 4th axiom.

You can only die once.

Once you die, you never come back to life. Therefore, you can only die once.

Life after death - whether as eternal life or in the form of rebirth (reincarnation) - can neither be proven nor disproven in a scientific sense. It is purely a belief and therefore belongs to the realm of religion. In the scientific sense, the dead remain dead.

The resuscitation attempt

This violation of the 4th axiom is fueled by the term "resuscitation". Even some doctors see a successful resuscitation attempt as bringing a dead person back to life. With this view, they violate the 4th axiom.

An attempt at resuscitation is not an attempt to bring a dead person back to life. This is made clear by these two statements, in which the initial situation is always the same. Someone is found with cardiac and respiratory arrest. Is he dead or still alive? There are only 2 ways to answer this question with certainty:

- Wait idly for the next 30 minutes.

If the heart has not beaten for more than 30 minutes at temperatures around 20°C and the unconscious person has not received any medical help, the heart of an adult can no longer be stimulated to beat on its own.

After a few more minutes, the certain signs of death - death spots and rigor mortis - can be recognized. It is now clear that this person has died.

- A resuscitation attempt is started.

  During the resuscitation attempt, the focus is on chest compressions. This pumps the blood through the body. The brain is very sensitive to a lack of blood flow (ischemia). Just 10 minutes without blood flow to the brain leads to irreversible brain damage. With every additional minute of cerebral circulatory arrest, the risk of brain death increases.

  There are 3 possible outcomes to a resuscitation attempt:

1. successful resuscitation attempt

   The unconscious person's heart begins to beat again. He regains consciousness and can continue to live without physical or mental limitations; or he can continue to live with minor to severe physical and/or mental limitations.

2. Brain death

   Although the heart could be stimulated to beat independently by the resuscitation attempt, the brain was so severely damaged that brain death was finally determined in the hospital despite all countermeasures - e.g. cooling the whole body to 33°C for 24 hours (artificial hypothermia). This means that the patient has died.

3. Unsuccessful resuscitation attempt

   In an out-of-hospital resuscitation attempt at a normal ambient temperature of approx. 20°C, an adult's heart should start beating independently again within 30 minutes of chest compressions and artificial respiration. If the independent heartbeat is not achieved within

this time window, the resuscitation attempt is aborted as unsuccessful. The date and time of the termination is recorded as the time of death.

Sometimes the heart beats independently for a short time, but then stops again. Each independent heartbeat with subsequent cardiac arrest prolongs the 30-minute resuscitation attempt. Sometimes a stable independent heartbeat is achieved later, sometimes such a patient is taken to hospital under resuscitation conditions. The outcome is uncertain, but usually ends in death.

There is a principle among paramedics:

No one is dead until warm and dead.

This principle is based on the experience that a person can survive for a surprisingly long time in the cold. In winter, for example, avalanche victims could be successfully resuscitated even after being buried in the snow for several hours. However, the rigidity of the body should not be interpreted as rigor mortis. It is rigor mortis. A person can be successfully brought back to life even hours later.

These unconscious people with cardiac and respiratory arrest show more signs of death than of life. They are therefore easily ascribed to the realm of death. However, this attribution violates the 4th axiom that death is irreversible. Where are they if not in death? Under these conditions, they can hardly be attributed to life.

"Reanimation", "resuscitation", "bringing back to life", these are our terms. From what state are these people brought back to life? - There is only one answer to this: they are in an unclear state.

Their condition is so life-threatening that they will die within a few minutes if they do not receive an immediate resuscitation attempt. The resuscitation attempt serves not only to save life (successful resuscitation attempt), but also to determine death (in the event of an unsuccessful resuscitation attempt).

The resuscitation attempt makes it clear that a person must be considered alive until their death has been determined by a doctor (5th axiom) or - if

the body is missing, the person is missing - declared dead by a judge at the competent district court (6th axiom).[1]

Symmetry with brain death

Some critics of the brain death concept (brain death = death of the human being) point to a symmetry with the beginning of life. These critics argue that if a brain-dead person is considered a dead person because of his or her dead brain, an embryo must be considered dead until the brain is formed (around the 8th week of pregnancy).

In their arguments, these critics overlook the 4th axiom of death: while the state of a brain-dead person is unchanging, the state of an embryo is constantly changing. Therefore, the embryo must also be regarded as alive until the brain is formed.

The irreversibility of death and a waterfall

In a river, we can swim in all directions as long as the current is not greater than our swimming speed. If the current increases, we can no longer swim against it. We can only swim diagonally towards the bank.

1 No judge can take action on their own initiative. The next of kin must apply to the competent district court for a declaration of death.

If the current in front of a waterfall continues to increase, we will no longer be able to escape the waterfall. This is where the unstoppable dying process begins, so to speak. We may still be alive, but we can no longer escape death.

When we reach the cliffs, we no longer swim, we fall. The companion on the shore could still accompany us as far as the cliffs of the waterfall, after which we are gone. He can't say anything about the rest of our existence. We are dead.

The irreversibility of death and black holes

The irreversibility of death can be described very well using the example of black holes in the universe. Black holes are the remnant of large stars after a supernova, if this remnant is more than 3 solar masses.[2] This remnant then collapses into a black hole.

Black holes have such strong gravity that nothing can escape them, not even light. If planets or suns come too close to them, they are torn apart and swallowed up. A bright glow can still be seen from them in the accretion disk around the black hole before they disappear into the black hole from the event horizon.

The accretion disk can be compared to the death of a human being. A person can be accompanied through the entire dying phase. With the onset of individual death (leaving the event horizon), accompaniment is no longer possible because the person is now dead.

2 A black hole can also form when a neutron star becomes heavier than 3 solar masses due to an increase in matter. It then collapses to form a black hole. - A neutron star is the remnant of a supernova with a residual mass of less than 3 solar masses.

5 The determination of death is the task of a doctor.

It is the doctor's task to determine the death of a person. It is the last duty they have towards the deceased patient. - Doctors always determine death on the basis of the corpse; only judges declare a person dead.

According to the Burial Act, every doctor is obliged to determine the death of a person. This obligation exists in the burial laws of all 16 federal states of Germany.

5.1 Death can be recognized by the sum of individual signs.

Death can only be recognized by the sum of various certain signs of death, the only exception being an injury that is incompatible with life.[3] Even decay on its own is not a certain sign of death. For example, there are people whose limbs (usually their feet) rot off, although these people are still very much alive.

5.2 Death can only be determined after it has occurred.

Death can only be determined after it has occurred. This becomes clear when a person dies with gasping for breath. After a very long pause in breathing, one thinks that this was the last breath, but then another breath comes, indicating that the dying is not yet over. Death is only considered to have occurred when no breath or heartbeat can be detected and no more will come.

Death is only considered to have occurred if it can be said with certainty that this was the last heartbeat. It is possible to state the time of the last detected heartbeat, but this is in the past.

You can never say "This is the last heartbeat", but only "This was the last heartbeat". Therefore, death can only be determined after it has occurred.

3 For example, if the head and torso have been separated.

5.3 The doctor's duty to treat ends with the determination of death.

The doctor's duty to treat ends with the determination of death. This becomes clear in the case of brain death: once this has been established, the doctor must - with the exception of the two cases mentioned below - end the treatment, even if the surviving dependants demand that the treatment be continued.

The insurance relationship between the health insurance company and the patient ends with the determination of death. This means that the health insurance company will not pay for further treatment of the brain-dead, unless

- The brain-dead person becomes an organ donor.

  If healthy organs and consent to organ donation are available, the brain-dead person will receive further intensive medical treatment until organ donation. These costs are covered by the organ recipient's health insurance. - This further treatment is about the life of the organ recipient.

- The brain-dead person is pregnant.

  If there is a pregnancy, intensive medical treatment is continued until the child is born. The costs are covered by the brain-dead person's health insurance. - This further treatment is about the life of the unborn child.

6 A declaration of death is the task of a judge.

If there is no corpse, but it must be assumed that a person is died (e.g. an airplane has crashed over the sea), the surviving relatives can apply to the competent district court for a declaration of death. In accordance with the Missing Persons Act, a judge can then declare a person dead. This means that the missing person is legally dead, even if there is no corpse.

With this declaration of death, all measures that take effect when a person dies become effective, including

- The will can be opened.
- Widows or widowers can remarry.
- Widows and widowers receive a widow's or widower's pension.

The expression - a standard phrase in the press - that someone has been "declared brain dead", which is even used in specialist literature and scientific papers, is nonsense, as brain death always involves a corpse on which the doctor determines brain death. A declaration of death, on the other hand, is only made if there is no corpse. However, this is incorrect in the case of brain death.

The expression "declared brain dead" brings together two words that do not belong together,[4] such as a "square circle" or a "round triangle" or a "flat tower".

4 "brain dead" = there is a body that can be examined
"declared" (declaration of death) = there is no body that can be examined.

7 The essence of death

7.1 Death knows no time out.

Death knows no time out. No living being is safe from its own death, at any time and in any place. Death is our constant companion. Like our shadow, we can only get rid of it by going into the shadow ourselves. We can only escape our death in death, because those who are dead cannot die (9th axiom).

As long as we are alive, we are never safe from death. We become particularly aware of this when death occurs in situations that we did not expect, for example when a child dies,[5] when a previously healthy person dies[6] or when death occurs completely unexpectedly.[7]

5 E.g. due to an accident.

6 For example, a fatal heart attack or a fatal cerebral hemorrhage.

7 For example, people get together for a party and during the party one of the participants suddenly passes away.

7.2 Death is the great transformer.

Death is the great transformer, which we express linguistically accordingly:

living	dead
people	corpses
patients	deceased
relatives	bereaved
wife	widow
husband	widower
child	orphan
experience	memory

Tab. 1 Death as the great transformer

Aristotle (384-322 BC) defined man as a rational being (zoon logon echon). Boethius (480-526) defined the person as the individual substance of a spiritual nature (naturae rationabilis individua substrantia).

When death occurs, the dead - including the brain dead - lack the substantial basis for reason and spirit. Therefore, the dead can no longer be spoken of as human beings. After death, it is a human corpse. People only exist alive.

A patient is a physically or mentally ill or injured person who is undergoing medical (medical and/or nursing) treatment. Once they have recovered (convalescent) or died (deceased), they lose their "patient" status. This means that patients only exist when they are alive.

There are therefore neither "dead people" nor "dead patients". However, it can be said that the person or patient is "deceased", as this event is in the past and has been completed. However, the statement "dead person" or "dead patient" refers to the present and is therefore incorrect.

7.3 Death is the great equalizer.

Death is the great equalizer. It levels out all differences between rich and poor people, between young and old, between healthy and sick people. In death, everyone is dead.

7.4 Death is a great teacher.

If there was no death, we would not be able to appreciate our lives. We would take life for a granted condition and not appreciate it. Nor would we need to protect life, as it would not be threatened by death.

Since death exists, we can appreciate life, explore its origins and strive to make life worth living for all people - including future generations!

Death teaches us that life is also worth protecting. There are professions that are dedicated to the lives of individuals in a very special way: Rescue workers,1 emergency paramedics, doctors and nurses.

Legislation creates the social framework that every life is worth protecting, including the lives of criminals.

Hunger makes bread so precious.
Thirst makes water so precious.
Death makes life so precious.

8 Death means saying goodbye.

8.1 Relatives have to say goodbye to a dying person, the bereaved have to say goodbye to a dead person

When a person dies, the relatives, friends and acquaintances have to say goodbye to this **one** dying person. If this person has already died, the bereaved have to say goodbye to a dead person.

There is usually **one** person to say goodbye to at the time of death. It is rare for two or more people in a family to die at the same time. This usually happens in the case of accidents[8] or natural disasters.[9]

In the course of our lives, the number of people we had to say goodbye to increases. But no matter how high this sum is, we always said goodbye to to dying person or a deceased died. This letting go of loved ones can be seen as a rehearsal for our own dying when, as dying people, we have to let go of everyone and everything.

8 e.g. in the event of an airplane crash or the sinking of a ship.
9 e.g. in the event of a tsunami, a strong earthquake or a flood.

8.2 The dying person has to say goodbye to everyone.

When a person is dying, they have to say goodbye to **all** their relatives, friends and acquaintances.

As a dying person, they have to say goodbye to this world and everything associated with it: to animals and plants, to the mountains and the sea, to hobbies and interests, to favorite foods and drinks, to favorite music and pictures.

"Shrouds have no pockets", as the saying goes, expressing the fact that no nothinn can be taken from this world with them into death or the afterlife.

For atheists, their own existence ends with their own death. No consciousness and no soul survive their own death. The body decays rapidly. The bereaved will keep them in memory for a while until this too fades away.

For believers, you move from this world to the afterlive, just as you move from one room to another. Apart from yourself, you can't take anything with you. You leave everything behind. Therefore, as a dying person, you have to say goodbye to everything that belongs to this world, including all your loved ones.

8.3 The dying die, the living have to live with it.

The dying die, whether slowly or suddenly. When they are dead, they experience neither joy nor suffering. The dead takes no part in this world.

Religious people believe that there is an afterlife in which the dead live on in some way (eternally). However, this is purely a matter of faith. In a scientific sense, survival in the afterlife[10] can neither be proven nor disproven.

The living must live on after the death of their loved one.

10 There is no "after death", as it is often colloquially called, because after death would mean that the dead person has left their state of being dead and returned to life. As this is not the case, it must be "in death".

9 Only that which lives can die.

What does not live cannot die. Therefore, no stone can be killed, not even a virus. Only living beings can die.

It is not death that one should fear, but that one will never begin to live. (Marcus Aurelius (121-180))
He did not live and yet he died. (Manfred Hinrich (1926-2015))

In the figurative paraphrase, Manfred Hinrich is certainly right for some people. In the medical and biological sense, this statement is a violation of the 9th axiom. But Manfred Hinrich does not want these words to be understood in the medical or biological sense.

In connection with switching off artificial ventilation in the brain dead, the violation of the 9th axiom is a standard occurrence in the media, sometimes also in university publications. The wording in these cases is usually: "After the determination of brain death, the devices were switched off. The patient was then allowed to die" or "After the birth of the child, the artificial respiration was switched off. The woman was then allowed to die."
These people hhad lived. That is indisputable. But with the determination of brain death, the death of the person was established. Further treatment did not keep a person artificially alive, but rather maintained the functions of a body that was in intermediate life.
In medicine, the term "intermediate life" refers to the life of organs, tissues and cells after the death of the individual. Since individual death is established with the determination of brain death, this marks the beginning of intermediate life. It is no longer the life of the person, but the life of organs, tissues and cells.

Since the brain-dead are dead in the medical, legal and - at least according to Catholic doctrine - theological sense, they can no longer be allowed to die. This would be a violation of the 9th axiom.

Dying is the privilege of all living things.

10 Dying is a process, death follows the end of this process.

In the literature - even in the medical literature and in university publications - one comes across the statement that death is a process. In doing so, these authors make the mistake of many others. They write "death" where "dying" should properly be written. This gives the impression that the authors are more afraid of dying than of death. Many seriously ill patients and dying people say that they are not afraid of death, but that they are afraid of dying. This confirms the assumption made above about the authors.

Dying is the last phase of life - or it was not dying.

Sometimes a person feels terminally ill. The doctors treating him also fear that he is now dying. But then the body recovers. The patient regains his strength and finally leaves the hospital as a convalescent. This makes it clear that although the patient had gone through a very critical phase, he was not in the process of dying. This should have ended with the patient's death. As this did not happen, it was not a dying process.

Dying process

Although various processes take place in the body of the deceased after the individual's death, none of these change the state of the individual's death. - Even a rock changes due to the weather. Nevertheless, it does not die as a result, but remains dead.

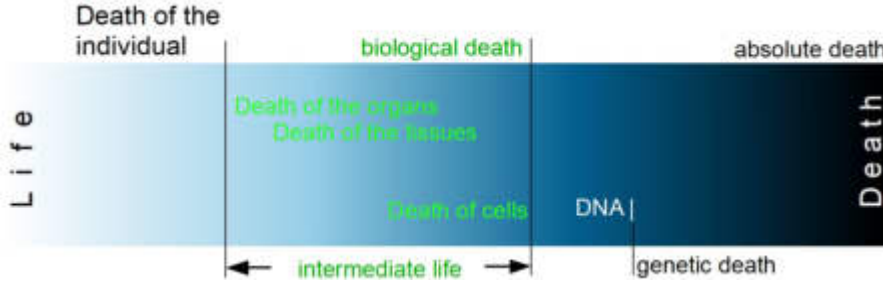
Physical decay usually begins before the actual dying process. We grow older. During the dying process, physical decay increases in scope and intensity and continues after the onset of individual death. It ends with absolute death, the dissolution of the last existing body cell. In the case of an urn burial, this occurs through cremation.

As a social agreement, death is a cut in the process of physical decay - which also has mental effects - at which point a person is considered dead. Worldwide, this has been regarded as brain death since the 1970s. Once the certain signs of death have been established, which all prove brain death, the death of the person has been determined.

The dying process can be divided into different stages depending on what is taken into consideration during the dying process:

- Individual death

  The determination of the certain signs of death always indicate the death of the person as an individual. "Cardiac death" and "brain death" basically only indicate how the death of the person has been determined.
  Individual death marks the beginning of "intermediate life", the life of organs, tissues and cells in the dead individual. It ends with biological death, the death of the last body cell.



  After individual death, these supravital reactions (Latin supra = "above", vitalis = "alive", => surviving) of a body can be determined:

h	***Supravital reaction***
8	Muscles can be stimulated to contract by electrical or mechanical shocks.
10	Pupils react to the addition of atropine.
72	Corneas of the eyes still have sufficient metabolism be transplanted.

Tab. 1 Supravital reactions

Dying is a process, death follows the end of this process.

What is perceptible as "life" in the brain-dead - digestion, excretion, healing wounds, blood circulation in the body, continuation of pregnancy, ... - are not signs of life of the individual but are "intermediate life". Medicine also calls this life of organs, tissues and cells "supravitality". Brain dead people are therefore dead people with the greatest possible proportion of "supravitality" and "intermediate life", the life of organs, tissues and cells after the death of the individual.

- Biological death

  Biological death cannot be determined. It is purely hypothetical and refers to the death of the last body cell. For example, 72 hours (= 3 days) after the last heartbeat, the cornea of the eye still has such a good metabolism that it can be transplanted. It can therefore be said that in the case of burial, biological death occurs more than a week after individual death.

- Genetic death

  Genetic death cannot be determined. It occurs when there is no functioning cell nucleus from which a clone can be produced.

  In permafrost, genetic death can occur after thousands of years. For example, Japanese and Korean researchers are trying to create a clone from well-preserved body cells from one of the mammoths that died out around 4,000 years ago. This would allow a mammoth to live again in the present.

- Absolute death

  Absolute death is reached when no body cell indicates the former existence of this individual. In the case of cremation, biological, genetic and absolute death occur simultaneously.

The "life" of the brain dead

As already described above: Clear "signs of life" are perceptible in the brain dead, even for medical laypersons: Brain dead people digest and excrete, wounds heal, their heart beats, their body is supplied with blood, pregnancies can continue until the child is born. Certain signs of death such as livor and rigor mortis are not recognizable.

It can be argued that these are not signs of life in the sense of life of the individual, but rather "intermediate life". However, for critics of the brain death concept (brain death = human death), this does not conclusively demonstrate that the brain dead are dead. Therefore, this will be discussed further:

In every cerebral infarction (stroke), a small thrombus (blood clot) blocks a small blood vessel in the brain. As a result, the brain cells in this region are no longer supplied with oxygen and die. After a few days, the brain cells dissolve. The remaining "holes" in the brain can be used to detect this cerebral infarction with a CT scan or an MRI, even decades later.

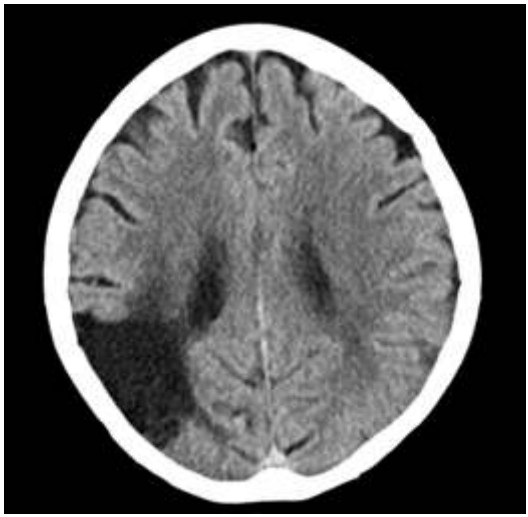


Image of a brain with a right-sided cerebral infarction.
(Department of Radiology at the UKR)

In brain death, the cerebrum, cerebellum and brain stem are no longer supplied with blood. This lack of blood supply to the brain can be proven in different ways. As with a cerebral infarction, the brain cells die and disintegrate after a few days. What a brain-dead person would need to "recover" would be a new brain.

Even medical science was capable to grow a new brain from a cell of the brain-dead person's body and insert it into the brain-dead person in a fully functional state, a completely new person would wake up from this operation. Like a newborn, he would have to learn everything. He would have no memory of his previous life.

The reason for this is that the brain cells not only process our senses and enable us to think. They are also the "database of our life". Everything that we have learned and experienced and that we can remember is stored in our brain cells. With brain death, this information is physiologically destroyed and therefore lost forever. It is therefore logical to regard the brain-dead as dead.

11 Appendix
Statements by the Pontifical Academy of Sciences

In 1985, 1989, 2006 and 2012, the Pontifical Academy of Sciences (PAS) dealt with the question of whether brain death should be equated with human death. In all of these final documents, this question is clearly affirmate.

The "Scripta Varia 110" is the 552-page final paper of the PAS from the 2006 meeting. The "Extra Series 31" is a 56-page abridged version of this, in which the common arguments against equating brain death with human death are refuted on pages 5 to 13, including the following:[11]

The Notion of Brain Death

The notion of 'brain death' was introduced to refer to a new criterion for the ascertainment of death (able to go beyond the criteria relating to the heart and breathing and the criteria relating to the destruction of the soma) that had become evident with new discoveries about the working of the brain and its role within the body, as well as necessary with the changed clinical situations brought about by the use of the ventilator and the possibility of sustaining human organs despite the loss of the unity of the organism as a whole.

Brain Death is Death

Brain death has been a highly important and useful concept for clinical medicine, but it continues to meet with resistance in certain circles. The reasons for this resistance pose questions for medical neurologists, who are perhaps in the best position to clarify the pitfalls of this controversial issue. To achieve consistency, an important initial clarification is that brain death

11 https://www.pas.va/content/dam/casinapioiv/pas/pdf-volumi/extra-series/es31pas.pdf - This chapter was signed by:
A. BATTRO, J.L. BERNAT, M.-G. BOUSSER, N. CABIBBO, CARD. G. COTTIER, R.B. DAROFF, S. DAVIS, L. DEECKE, C.J. ESTOL, W. HACKE, M.G. HENNERICI, J.C. HUBER, CARD. A. LÓPEZ TRUJILLO, CARD. C.M. MARTINI, J. MASDEU, H. MATTLE, J.B. POSNER, L. PUYBASSET, M. RAICHLE, A.H. ROPPER, P.M. ROSSINI, M. SÁNCHEZ SORONDO, H. SCHAMBECK, E. SGRECCIA, P.N. TANDON, R. VICUÑA, E. WIJDICKS, A. ZICHICHI

is not a synonym for death, does not imply death, or is not equal to death, but ‘is’ death.

‘Coma’, the ‘Persistent Vegetative State’, and the ‘Minimally Conscious State’ are not Brain Death

The inclusion of the term ‘death’ in brain death may constitute a central problem, but the neurological community (with a few exceptions) acknowledges that something essential distinguishes brain death from all other types of severe brain dysfunction that encompass alterations of consciousness (for example, coma, vegetative state, and minimally conscious state). If the criteria for brain death are not met, the barrier between life and death is not crossed, no matter how severe and irreversible a brain injury may be.

Brain Death is the Death of the Individual

The concept of brain death does not seek to promote the notion that there is more than one form of death. Rather, this specific terminology relates to a particular state, within a sequence of events, that constitutes the death of an individual. Thus brain death means the irreversible cessation of all the vital activity of the brain (the cerebral hemispheres and the brain stem). This involves an irreversible loss of function of the brain cells and their total, or near total, destruction. The brain is dead and the functioning of the other organs is maintained directly and indirectly by artificial means. This state results solely and specifically from the use of modern medical techniques and, with only rare exceptions, it can only be maintained for a limited time. Technology can preserve the organs of a dead person (one appropriately prnounced dead by neurological criteria) for a period of time, usually only hours to days, rarely longer. Nevertheless, that individual is dead.

Death is the End of a Process

This process begins with an irreversible fact of health, namely the beginning of the failure of the integrative functions exerted by the brain and brain stem on the body. It ends with brain death and thus the death of

the individual. Generally, this process involves an uncontrollable and progressive brain edema, causing the intracranial pressure to rise. When the intracranial pressure exceeds the systolic blood pressure, the heart is no longer capable of pumping blood through the brain. The swollen brain becomes compressed within its rigid 'shell', the skull, and herniates through the tentorium and the foramen magnum, which eventually totally blocks its own blood supply. Brain death and the death of the individual takes place as the end of this process. There is a second process which begins with the death of the individual and involves the decomposition of the corpse and the dying of all the cells. The ancients were aware of these two processes and knew, for example, that hair and nails continue to grow for days after death. To think today that it is necessary to maintain the sub-systems of a corpse receiving artificial support, and to wait for the death of all the cells in the body before pronouncing the death of an individual would be to confuse these two processes. This latter approach has been termed 'exaggerated treatment' or, more specifically, the slowing down of the inexorable decomposition of a corpse through the use of artificial instruments.

The Consensus on Brain Death

The criterion of brain death as the death of an individual was established about forty years ago and since that time consensus on this criterion has increasingly grown. The most important academies of neurology in the world have adopted this criterion, as have most of the developed nations (the USA, France, Germany, Italy, the UK, Spain, the Netherlands, Belgium, Switzerland, Austria, India, Japan, Argentina and others) that have addressed this question. Unfortunately, there is insufficient explanation by the scientific world of this concept to public opinion which should be corrected. We need to achieve a convergence of views and to establish an agreed shared terminology. In addition, international organisations should seek to employ the same terms and definitions, which would help in the formulation of legislation. Naturally, public opinion must be convinced that the application of the criterion of brain death is carried out with the maximum rigour and efficacy. Governments should ensure

that suitable resources, professional expertise and legislative frameworks are provided to ensure this end.

Statistics on Brain Death

In the USA, most of the statistics on cases of the diagnosis of recognised brain death since its full definition, its application, and the clinical histories involved are generally available in organ procurement offices. The Mayo Clinic has information on about 385 cases (years 1987-1996). Flowers and Patel (Southern Medical Journal 2000; 93:203-206), reported on 71 individuals who met the clinical criteria of brain death and then were studied by the use of radionuclide brain scans. No blood flow was demonstrated in 70 patients and in 1 patient arterial blood flow was present on the initial evaluation but disappeared 24 hours later. The authors concluded that using established medical criteria the accuracy of the diagnosis of brain death was 100%. The famous Repertinger meningitis case ironically demonstrates that it is possible to keep a body and organs perfused for a long period of time. One possibility is that this patient may not have been brain dead for a longperiod of time (cf. the detailed discussion on this possibility during the meeting and question 15, p. LXIX ff.). Another possibility is that this represents a valid case of brain death since all of the clinical tests were performed to ascertain brain death except the apnea test. The absent evoked potentials and the flat EEG were consistent with brain death. If this was a validly documented case of brain death, it makes the point that in extraordinarily rare exceptions this kind of case occurs. However, many years have passed since this case, there is a great deal of uncertainty about it, and one cannot generalise from it to invalidate the criteria for brain death. With the technologies available in modern intensive care units, we may see more of such prolonged cases, as technological capacity develops to reproduce some of the functions of the brain stem and hypothalamus in the integration and coordination of all the sub-systems of the body. The neurological community does not believe that this case disturbs the conceptual validity of brain death as being equivalent to human death.

A Counterintuitive Reality

The history of science and of medicine contains many discoveries that are contrary to our perceptions and seem counterintuitive. Just as it was difficult for common sense to accept, at the time of Copernicus and Galileo, that the earth was not stationary, so it is sometimes difficult now for people to accept that a body with a pumping heart and a pulse is 'dead' and thus a corpse; 'heart-beating death' appears to defy our common sense perceptions. In part, this is because the dead brain, like the moving earth, cannot be seen, conceptualised, or experienced by the onlooker. Indeed, the common man does not easily accept that a deep sleep-like state with a heartbeat, accompanied by electrocardiogram activity, is death. Since the use of medical technology is so ubiquitous, it is easy to fail to comprehend that a ventilator machine is a necessary intermediary in maintaining this state. This may give rise to a deep-seated reluctance both to abandon brain-dead individuals and to accept the removal of organs from their bodies for the purposes of transplantation.

Organ Transplantations

The concept of brain death has been at the centre of a philosophical and clinical debate, especially after advances made in the field of transplantations. In particular, it has been asked whether this criterion – and this is the view, for example, of Hans Jonas – was introduced to favour organ transplantations and is influenced by a dualistic vision of man that identifies what is specific to man with his cerebral activities. Yet, as emerged during discussions of the meeting, the criterion of brain death is compatible at a philosophical and theological level with a non-functionalist vision of man. St Augustine himself, who certainly did not identify the brain with the mind or the soul, was able to say that when 'the brain by which the body is governed fails', the soul separates from the body: 'Thus, when the functions of the brain which are, so to speak, at the service of the soul, cease completely because of some defect or perturbation – since the messengers of the sensations and the agents of movement no longer act –, it is as if the soul was no longer present and was not [in the body], and it

has gone away' (De Gen. ad lit., L. VII, chap. 19; PL 34, 365). Indeed, the criterion of brain death is in conformity with the 'sound anthropology' of John Paul II, which sees death as the separation of the soul from the body, 'consisting in the total disintegration of that unitary and integrated whole that is the personal self'. Thus, in relation to the criterion of brain death, the Pope was able to declare: 'the criterion adopted in more recent times for ascertaining the fact of death, namely the complete and irreversible cessation of all brain activity (in the cerebrum, cerebellum and brain stem) if rigorously applied, does not seem to conflict with the essential elements of a sound anthropology' (Cf. Address of 29 August 2000 to the 18th International Congress of the Transplantation Society).

From a clinical point of view, almost the whole of the medical community agrees that the concept of brain death as death should not serve an ulterior purpose (specifically: organ transplantation). Indeed, the ascertainment of brain death, which in historical terms was the result of the independent study of the brain, preceded the first transplantation procedures and thus was (and therefore is) unconnected with the related subject of transplants (cf., e.g., S. Lofstedt and G. von Reis, 'Intracranial lesions with abolished passage of X-ray contrast throughout the internal carotid arteries', PACE, 1956, 8, 99-202). Few physicians are convinced that the removal of organs from brain-dead individuals amounts to murder, and there is no reasonable legislation that adopts this point of view. The advent of cardiac and hepatic transplantation in the 1960s, and the need for organs from heart-beating donors to ensure successful results, generated an evident relationship between brain death and transplants. In the future, it is possible and to be hoped, that this relationship will diminish with new discoveries in the use of natural non-human and artificial organs.

Unsound Arguments

Most of the arguments against brain death are not sustainable and are incorrect diversions when scrutinised from a neurological perspective. For example, the erroneous or imprecise application of the criteria of brain death, the fact that the neurological examination in individual cases may be

misinterpreted, or variations in the criteria chosen by specialist groups, can all too easily be used as spurious arguments against the concept.

The Apnea Test

The claims that apnea testing poses a risk to the patient are largely invalid when the testing is performed properly. Authorities should ensure that apnea testing is always carried out with the maximum of professional and technological expertise, and dedicate resources to this end.

Irreversible Situations: All Death is Brain Death

Assertions as to the existence of ‘awakenings’ from brain death have been used to discredit the concept and to prolong artificial ventilation, feeding and medical support in the hope of a recovery. A small number of cases of brain-dead individuals maintained in this state with ventilators and other medical measures for weeks, or even years, have given rise to unfounded claims that these subjects were in conditions other than death. In reality, as observed above in the section on ‘statistics on brain death’, where the proper diagnostic criteria have been employed all such assertions are not valid.

Pregnancy

Pregnancies have been carried to term in brain-dead mothers. These cases are exceptional and do not involve potentially reversible conditions different from brain death. The mother’s uterus and other organs are being supported as a technical vessel for pregnancy, in much the same way that the heart or the kidneys are kept perfused. Thus, it is possible for an individual who is brain dead to give birth, if maintained with a ventilator, or other measures, for a certain period.

Antidiuretic and Other Pituitary Hormones

Other spurious arguments, such as the residual excretion of antidiuretic and other pituitary hormones in some cases of brain death, refer to transient phenomena, and are technical arguments that can be dealt with on apractical level. There is no need for every single cell inside the cranium to be dead for brain death to be confirmed.

Axon Regeneration

Recent reports of axon regeneration in patients with severe brain damage (which require corroboration and more study) are not pertinent to brain death.

Recovery Excluded

It follows, as mentioned earlier, that there is no chance of recovery from brain death and that discussions regarding recovery from various states of coma must be distinguished from brain death.

The Need for an Expert Neurological Examination

If the criteria of brain death are correctly applied, and if the neurological examination is carried out correctly by an experienced physician, then full reliability can be achieved. As mentioned above, there have been no documented exceptions. The neurological examination evaluates consciousness and reflexes to confirm death of the neurons involved in these functions.Although every neuron in the central nervous system is not assessed during the examination, as stated earlier it is not necessary for absolutely all neurons to be dead for brain death to be reliably diagnosed. In a sedated or previously sedated patient, the lack of perfusion of the brain must be demonstrated for brain death to be ascertained beyond all doubt.

The Loss of Heart Activity

When the cardiologist pronounces death as a result of cardiac standstill, the diagnosis is less certain than in the circumstance of brain death. Many documented cases exist of patients pronounced dead after failure of cardiac resuscitation who have subsequently been discovered to be alive. It should be further stated that the traditional definition of natural loss of heart activity as ‘death’ is not satisfactory because it is now possible to keep the heart beating by artificial means and blood circulation to the brain can be maintained artificially to a brain that is dead. Confusion arises from the presence of mechanical systems that artificially replace the role of the brain as the generator of the functioning of essential organs. Therefore, brain death is a much more certain diagnosis than heart death. The

reluctance to accept brain death may be mostly related to the fact that it is a relatively new concept (the invention of the ventilator by Ibsen took place fifty-six years ago) compared to the traditionally accepted notion of cardiac and respiratory arrest.

The Loss of Breathing

If one proposes that the loss of spontaneous breathing defines death, then all brain-dead patients are, by definition, ‘dead’. When the patient has been pronounced dead after the application of the appropriate criteria of brain death, the decision to continue with ventilation can only be justified with reference to the life and wellbeing of another person.

No Ventilator, No Heart Activity

If one removes the ventilator from a brain-dead patient, the body undergoes the same sequence of events and physical dissolution as occurs in an individual who has undergone loss of heart activity.

Artificial Instruments

Thus, it is as illogical to contend that death is the loss of heart activity as it is to affirm that the loss of kidney activity is death. Indeed, both renal activity (through dialysis) and heart activity (with a non-natural instrument) can be supported artificially, something that is impossible in the case of the brain: no artificial instrument exists that can reactivate or replace the brain after it has died.

No Circulation to the Brain Means Brain Death

One does not have to be a Cartesian to assert the central importance of the brain. Today, after advances in our knowledge of the workings of the brain, it is the medical-philosophical view that the body is 'directed' by that marvellous organ, the brain. Certainly, we are not a 'brain in a vat' but it has to be recognised that the brain is the receiving centre of all sensory, cognitive, and emotional experiences and that the brain acts as the neural central driving force of existence. We must acknowledge that the loss of circulation to the brain causes death. This loss of circulation can be documented in virtually all cases of brain death if tests are performed at the proper time.

The Camouflaging of Death

In reality, the ventilator and not the individual, artificially maintains the appearance of vitality of the body. Thus, in a condition of brain death, the so-called life of the parts of the body is 'artificial life' and not natural life. In essence, an artificial instrument has become the principal cause of such a non-natural 'life'. In this way, death is camouflaged or masked by the use of the artificial instrument.

Education and Brain Death

One of the tasks of physicians in general and neuroscientists is to educate the public about discoveries in this field. As regards the concept that all death is brain death, this task may be difficult, but it is our duty to continue in such an endeavour.

At a specific level, the relatives of brain-dead individuals should be told that their relative has died rather than that he is 'brain-dead', with the accompanying explanation that the support systems produce only an appearance of life. Equally, the terms 'life-support' and 'treatment' should not be employed because in reality support systems are being provided to a corpse.