

## INTRODUCTION

Since the beginning of domestication, the history of humans and that of animals have been closely intertwined. From Antiquity onwards, numerous authors recognized that animals are endowed with sentience. Animal welfare can be defined as a dynamic equilibrium between an animal and its environment, covering both its internal and external conditions. The animal must frequently make significant efforts to maintain or restore this balance, which can lead to physical and mental suffering that may ultimately compromise its health and productivity.

Consideration of the welfare of animals-whether farm animals, animals used for research, animals housed in zoos and circuses, or companion animals-has become one of the major concerns of consumers and citizens. This evolution is manifested in the media, regulations, research, the growth of products more respectful of animals, as well as the development of training programs in educational institutions and for professionals.

Improving animal welfare requires increased involvement and mobilization of all stakeholders: farmers and professionals in daily contact with animals, veterinarians, public veterinary health inspection services, industry professionals, scientists, as well as animal protection associations. It necessitates the production of increasingly precise scientific knowledge and its dissemination, improved dialogue among stakeholders, as well as better training for professionals and better information for civil society.

This request for improved living conditions for farm animals and new scientific knowledge, particularly concerning animal sentience, needs the evolution of practices at every level of the production chain, on the farm, during transport, and at slaughter. This change must certainly be part of an inclusive approach that does not pit different stakeholders against each other and that allows for the welfare of farmers as well as environmental preservation. This is the concept of "one welfare" (obtained from the one health concept), characterized by a comprehensive approach beneficial to animals, humans, and the environment, all three of which are closely interrelated.

A large portion of research conducted in the field of animal welfare aims to develop welfare indicators (or conversely, indicators of poor welfare) and to assess the level of welfare provided by animals' living conditions. Welfare indicators are varied because welfare is not a unitary concept. On the contrary, it is composed of independent dimensions.

Therefore, the Farm Animal Welfare Council lists five principles (or freedoms) that must be respected to reach welfare:

- **Freedom from hunger and thirst;**
- **Physical comfort ;**
- **Good health and freedom from injury or pain;**
- **The ability to express normal species-specific behaviors;**
- **Freedom from fear and distress.**

These five principles establish the foundation of the majority of regulations focused on ensuring the welfare of farm animals.

Assessing animal welfare, however, is not straightforward. It typically relies on four categories of measures — zootechnical, semiological, physiological, and ethological — each capturing a different dimension of the animal's state. None of them is sufficient on its own, which is why they are used together.

The latter present numerous advantages and are increasingly used, as they allow for the study of animal adaptation, behavioral disorders, as well as their motivations and preferences. All of these assessment methods will be developed in this handbook.

This handbook aims to provide you with the scientific and regulatory foundations necessary for understanding and assessing animal welfare in your future veterinary practice.

## 1. ANIMAL WELFARE: CONCEPT AND FUNDAMENTAL PRINCIPLES

Research on the welfare of farm animals serves primarily to provide objective arguments for the societal debate on the protection of these animals. Scientific findings contribute to the development of regulatory texts aimed at protecting animals.

The development of industrial farming in the 1960s triggered a movement in favor of animal protection on farms, and subsequently initiated extensive **research on the behavior of these animals, in order to better understand their welfare needs.**

The question of animal welfare has taken on increasing importance, particularly in the context of animal production, and is at the heart of concerns about the future of livestock farming. Animal welfare is attracting growing interest from civil society and constitutes one of the priorities of the World Organization for Animal Health (WOAH).

This chapter places the question of welfare in its historical and conceptual context, proposes a definition that takes into account the latest knowledge on the sentient and conscious nature of animals, and considers the practical implications for livestock farming.

The concept of **One Welfare** considers that the welfare of animals, the welfare of people, and the environment are closely interconnected.



**Figure 1:** One Welfare

Animal welfare, particularly that of farm animals, has become a strong societal issue that is present at all levels of society and therefore involves many stakeholders. Farmers, being in daily contact with their animals, experience the pressure exerted on the livestock farming sector.

Today, animal welfare is increasingly taken into account by farmers. Some even consider it a quality criterion for their products.

This concern for welfare can manifest itself in different ways:

- ✓ For some, it primarily involves **reducing** sources of **suffering or discomfort** as much as possible.
- ✓ For others, it rather needs **encourage the natural behaviors of the species**, or even the individual preferences of each animal, by adapting the environment to reach this objective.

Animal welfare is a **complex notion** because it relates on how **the animal perceives** its environment, which makes it difficult to evaluate objectively.

Animal welfare accord with to what the animal experiences in relation to its environment.

Some definitions highlight **the sentience of animals**, that is, their capacity to experience emotions such as **pain, suffering, frustration, or pleasure**.

- In general, an animal is "**well**" when it is **in harmony** with its environment.
- Each animal has physiological and behavioral needs, and when **these needs are reached**, it is in accord with its environment and, its **welfare is achieved**. Contrarely, when **its needs are not reached** or when it experiences suffering, it is no longer in accord with its environment and its welfare is included—"**the animal will be in a state of poor welfare.**"
- **"Welfare is a state of complete mental and physical health, where the animal is in harmony with its environment."**
- The relation between humans and animals has developed alongside humanity, particularly through domestication, which suggests a profound relationship between humans and their animals; therefore, this relationship is part of human history.
- Considering the sentience of animals needs paying **particular attention** to the subject of their welfare.

- Historically, reflection on the theme of animal welfare has been at the junction of a multitude of factors: **philosophical and moral, scientific, technological and economic, regulatory, and societal.**
- These multiple approaches impact individual perceptions and **lead to sometimes different definitions of animal welfare.**

**Note:** Welfare applies to animals that live under human dependency—farm animals, companion animals, animals used for scientific purposes (laboratories), or zoo animals, hunting animals, sport animals—and is taking on an increasingly important place in our society. It therefore does not apply to wild animals in freedom, which do not depend on humans.

### 1.1. DEFINITIONS OF ANIMAL WELFARE

There are numerous definitions of animal welfare. Only those officially recognized are as follows:

Based on scientific considerations, ANSES (French Agency for Food, Environmental and Occupational Health & Safety) proposes the following definition:

**Definition 1:** The welfare of an animal is the positive mental and physical state related to the satisfaction of its physiological and behavioral needs, as well as its expectations. This state varies according to the animal's perception of the situation.

- This definition concerns the welfare of an animal, that is, the welfare of an individual in a given environment, and not animal welfare in a group of animals.
- This notion is important because, since each individual is different due to its cognitive capacities and experiences, and since each environment impacts the individual differently, its welfare is individual and different from that of its conspecifics.
- A level of welfare is therefore determined for **a particular individual in a given environment.**
- Furthermore, welfare is defined here by the physical state, but also by the mental state of the animal: it is not sufficient to consider that the animal must be in good health, have good production, and not undergo stress; aspects related **to suffering or pleasure must also be taken into account.**

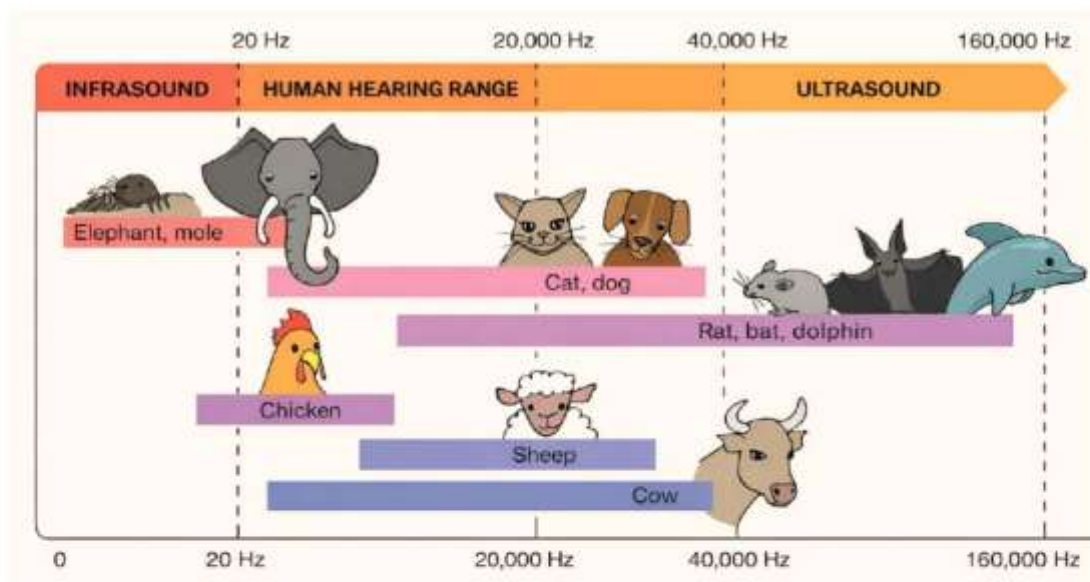
The ANSES definition emphasizes that the animal's welfare depends on how **it perceives the situation**.

## 1.2. PERCEPTION

This refers to the ability to experience sensations (**sensory dimension**), made possible through the development of the five senses (**hearing, sight, smell, taste, touch**), which adapt to the animal's living environment.

Their sensory capacities play a role particularly in structuring their social behavior and in communication with other individuals. They can vary considerably depending on animal species. For hearing, auditory spectra can range from a few hertz to several tens of thousands.

For hearing, auditory spectra can range from a few hertz to several tens of thousands. The human acoustic range lies between 20 Hertz and 20,000 Hertz. Below that are infrasounds (perceived by elephants, chickens), and above are ultrasounds (perceived by cats, dogs, sheep, and cattle), both inaudible to the human species.



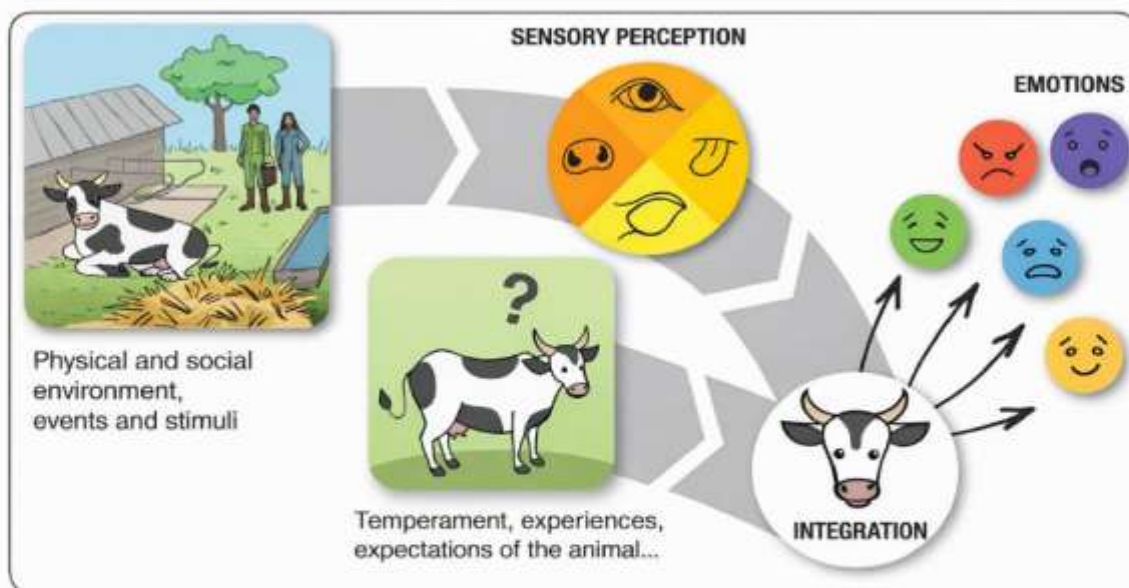
**Figure 2:** Very different auditory spectra according to species

The sensory capacities of animals differ according to species and determine the stimuli perceived. This explains why species **living in the same environment do not perceive it in the same way**.

Farm animals have a much **wider field of vision than humans**. Unlike us, who see at 180° favor to our forward-positioned eyes, **the lateral eyes of farm animals** provide them with **panoramic vision**: pigs see at 310°, chickens at 330°. This expanded vision allows them to detect dangers, a typical characteristic of prey species. However, their binocular vision (three-dimensional vision) is more limited than ours.

Domestic mammals possess **an extremely developed sense of smell**, unlike humans. They can perceive odors left several days earlier and at a distance. They are capable of using their sense of smell to explore their living environment, but also to recognize each other socially, or even individually. For example, a goat is able to recognize the scent of her young. This is referred to as an olfactory signature, unique to each individual. The sense of smell also contributes to bringing together sexual partners or interspecific partners.

Each species for that reason perceives its environment differently following to its sensory capacities. We must then take into account another filter, that of the brain's integrative processes. Because the brain also plays an important role in interpreting this sensory information. It connects the sensory information perceived with the individual's past experiences, knowledge, and current state. These integrative processes enable the individual to produce a response adapted to the sensory stimulation it perceives, based on its experience and the other information available to it. In this way, it adapts to the complexity and constant changes of the surrounding environment it must continuously face.



**Figure 3:** The animal's perception of the environment

The animal perceives and interprets its environment based on its sensory capacities and the integrative functions of the brain, which depend notably on its experience and temperament.

The most widely applied definition of animal welfare is that of the "**five individual freedoms or five fundamental needs of the animal.**"

**Definition 2:** "Animal welfare" can be defined as a state of dynamic equilibrium (homeostasis) between the animal and its environment (internal and external).

**The five freedoms are:**

Freedom from hunger and thirst, through unrestricted access to fresh water and a healthy diet to maintain good health and vigour;

Freedom from discomfort by providing an appropriate environment, including shelter and a comfortable resting area;

Freedom from pain, injury and disease through prevention or rapid diagnosis, followed by appropriate treatment;

Freedom to express normal behaviour by providing sufficient space, suitable facilities and the company of conspecifics;

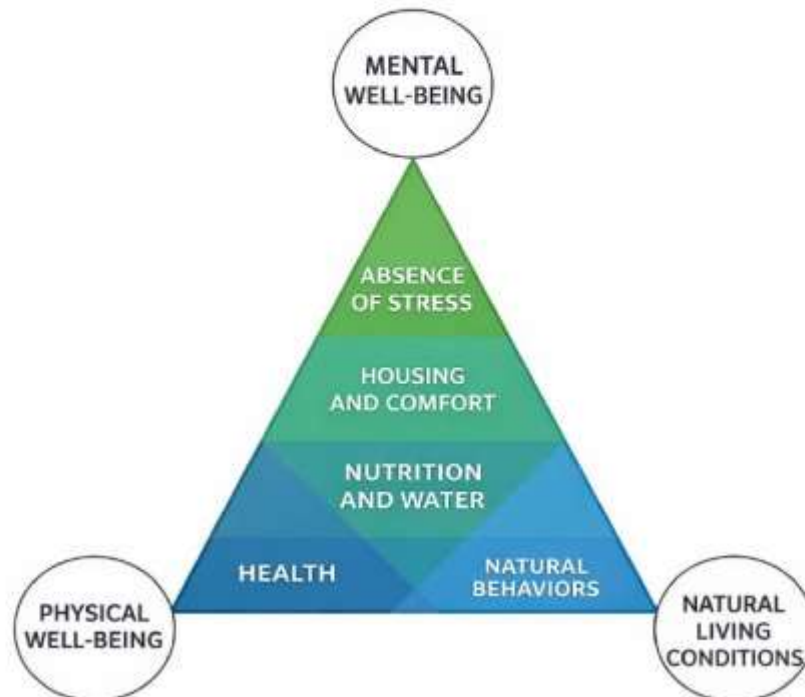
Freedom from fear and distress by ensuring living conditions and animal handling that avoid any form of mental suffering.

**Note:** For that reason, animal welfare refers to the way an animal adapts to its environment.

An animal is in a good state of welfare if, as explained by scientific, it is in good health, comfortable, well fed, safe, able to display its natural behavior, and does not suffer from pain, fear, or distress.

Guarantying animal welfare means preventing disease, offering veterinary care, appropriate shelter, good nutrition, proper management, and humane slaughter.

Protecting an animal's welfare therefore consists of guarantying its physical and mental needs.



**Figure 4:** The concept of animal welfare includes three elements: physical welfare (which presupposes, among other things, that animals are healthy and well fed), mental welfare (particularly the absence of negative emotions such as pain or chronic fear and the presence of positive emotions), and the ability to express certain normal species-specific behaviors

**Definition 3:** According to the OIE Terrestrial Code, animal welfare "**refers to the way an animal copes with the conditions in which it lives.**"

The OIE guiding principles on animal welfare also refer to the universally recognized "five fundamental freedoms," to describe the rights of animals under human responsibility.

### 1.3. THE DIFFERENCE BETWEEN WELFARE - GOOD TREATMENT - BENEVOLENCE

It is important to differentiate between the notions of benevolence, good treatment, and animal welfare.

#### 1.3.1. The difference between animal welfare and good treatment

- Good treatment focuses on how animals are treated by humans. This suggests a commitment to **ethical and respectful practices that raise animal welfare**.
- Good treatment includes a set of measures that humans apply to satisfy the physiological and behavioral needs (welfare) of animals.
- It agrees to actions taken to meet the needs of animals, such as **housing them, feeding them, and caring for them**, according to the human understanding of these needs.
- This attitude is **centered on human perception** and **does not directly consider what the animal feels or its positive emotions**.
- Good treatment is crucial for animal welfare, but the animal's point of view should also be considered to guarantee that the actions applied are really effective.
- Good treatment is an **obligation of means**, it's important, but it doesn't assure the animal's welfare, which depends on how it perceives things, making it **an obligation of result**.
- Moreover, in certain extreme environments, such as slaughterhouses, it may be difficult to ensure genuine welfare for animals, which does not prevent all good treatment actions aimed at their protection.

**Table 1:** Difference between welfare and good treatment

Welfare	Good Treatment
The animal's perception of the environment in which it is located	Means implemented by humans to satisfy the animal's physiological and behavioral needs
Obligation of result	Obligation of means
Analysis of the consequences of the environment on the animal	Analysis of the means implemented
Assessment through animal-based indicators	Assessment through environment-based indicators

### 1.3.2. The difference between animal welfare and benevolence

- Benevolence is a comprehensive concept that covers the attitude and action of caring for others, including animals. It thus refers to **human discourse** or **intentions expressing the will to do what is good for animals**.
- This reflects an intention of sympathy or empathy towards animals, respect for them, as well as the willingness to meet their needs or respect their interests, without this necessarily having a direct impact on their welfare.
- Benevolence is therefore primarily **a state of mind**. It is essential to ensure respectful treatment of animals, **but it does not ensure their welfare nor does it guarantee their actual state**.

### 1.4. DEFINITION OF SENTIENCE

The expression "feelings of animals" has been translated as "sensibilité des animaux" (sentience of animals), a term adopted in French law: "Every animal being a sentient being must be placed by its owner in conditions compatible with the biological requirements of its species."

"Animals are living beings endowed with sentience." The French term "sensible" has two dimensions:

- A strictly sensory dimension: capable of experiencing sensations, able to perceive impressions. Claude Bernard (1878) writes, for example, "All living beings are sentient, even plants."
- A dimension related to its psychic content: capable of experiencing emotions.

"Sentience, this capacity to feel (and express) mental states such as pain and pleasure, suffering and satisfaction, common to humans and animals, precedes in the former what distinguishes them from the latter (speech, reason, symbolization...)."

### 1.5. DEFINITION OF AN EMOTION

- Welfare is closely linked to mental states, including emotions.
- The psychological sentience of animals allows them to experience emotions.
- An emotion can be defined as an affective response following the evaluation that an individual, human or animal, makes of the situation in which it finds itself (novelty, suddenness, valence, correspondence with expectations, controllability...).
- An emotion is **an intense but brief emotional reaction** in response to a triggering event and is associated with specific physical and physiological changes.
- It generally includes three elements: **two expressive elements** (motor activity/physiology and behavior) and **one subjective element** (experience).

**Note:** Interpreting emotions is difficult, especially in animals. To evaluate these emotions, **scientists analyze physiological animal reactions like the secretion of adrenaline or cortisol.**

- **Emotions are temporary reactions**, while **animal welfare** is an **emotional state that persists over time.**
- Sentience contains both sensory capacities (perception through the senses) and cognitive capacities (information processing).
- An emotion is traditionally defined by three components: the behavioral reaction, the associated physiological activation, and the subjective experience corresponding to the emotional feeling.

#### 1.5.1. Two expressive components

**A. Motor activity/behavior:** what the individual shows to others: movements, facial expression.

*Example: Facial expressions and behaviors*

- Chimpanzees and humans bare their teeth and furrow their brows when threatening.
- A goat being petted or a cow rubbing against a brush have expressions similar to those of a human experiencing pleasure.

**B. Physiology:** modification of the body's functioning (secretion of cortisol or changes in heart rate).

**Example:** Physiological reactions.

When an animal is stressed, its body reacts exactly like that of a human:

- **Rapid reaction:** the adrenal glands (near the kidneys) release adrenaline to cope with immediate danger.
- **Sustained reaction:** production of cortisol to manage persistent stress.

→ These hormones are identical in humans and animals, whether the emotion is positive (joy) or negative (fear).

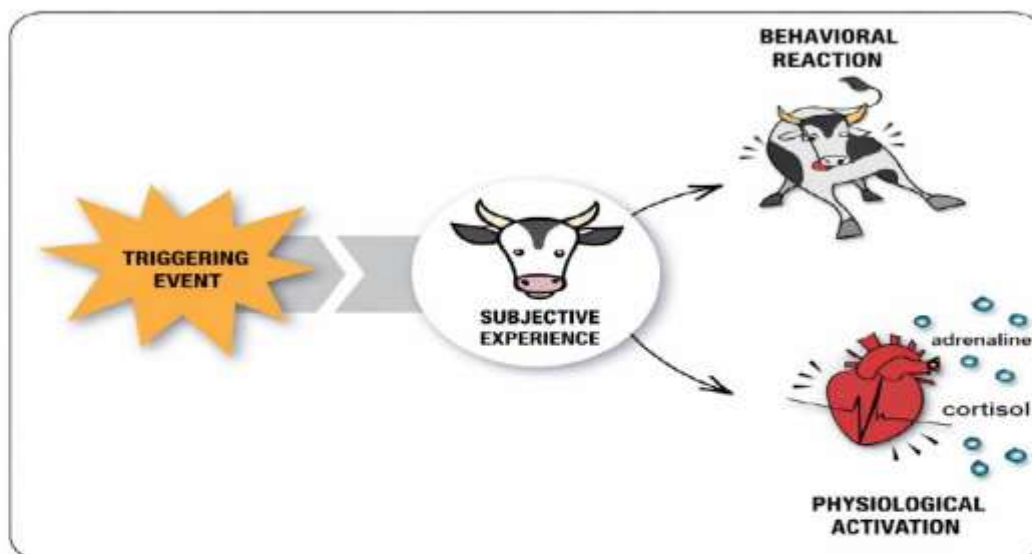
The **behavioral component** constitutes the reaction itself and aims to minimize the triggering event either by approaching the desired object (example: food in the case of a hungry animal), or by avoiding it (example: a predator for prey).

The **physiological component** corresponds to the body's preparation for a motor response represented by the secretion of hormones / an increase in heart rate... etc.

### 1.5.2. A subjective component

*A. Subjective experience:* what the individual feels (feeling).

The subjective experience of the individual relates to its emotional feeling proper; this is a component to which **we have no direct access** and which **can only be inferred from the animal's behavioral and physiological reactions**.



**Figure 5:** The three expressive and subjective components of emotions in animals

**Note:** We can only understand what an animal feels (subjective experience) by **observing its behavior and physiological reactions**.

- Therefore, to study emotions in animals, an inferential approach (by deduction) must be adopted.
- In psychology, this consists of accessing an individual's subjective experience from its behavioral and physiological reactions.
- Indeed, **the absence of verbal language** makes scientific analysis of animal emotions more difficult.
- Animals cannot tell us what they feel. And faced with the same danger (a lion), different species react very differently:
  - The quail remains **motionless** (paralyzed)
  - The zebra **flees**
  - The elephant **charges**

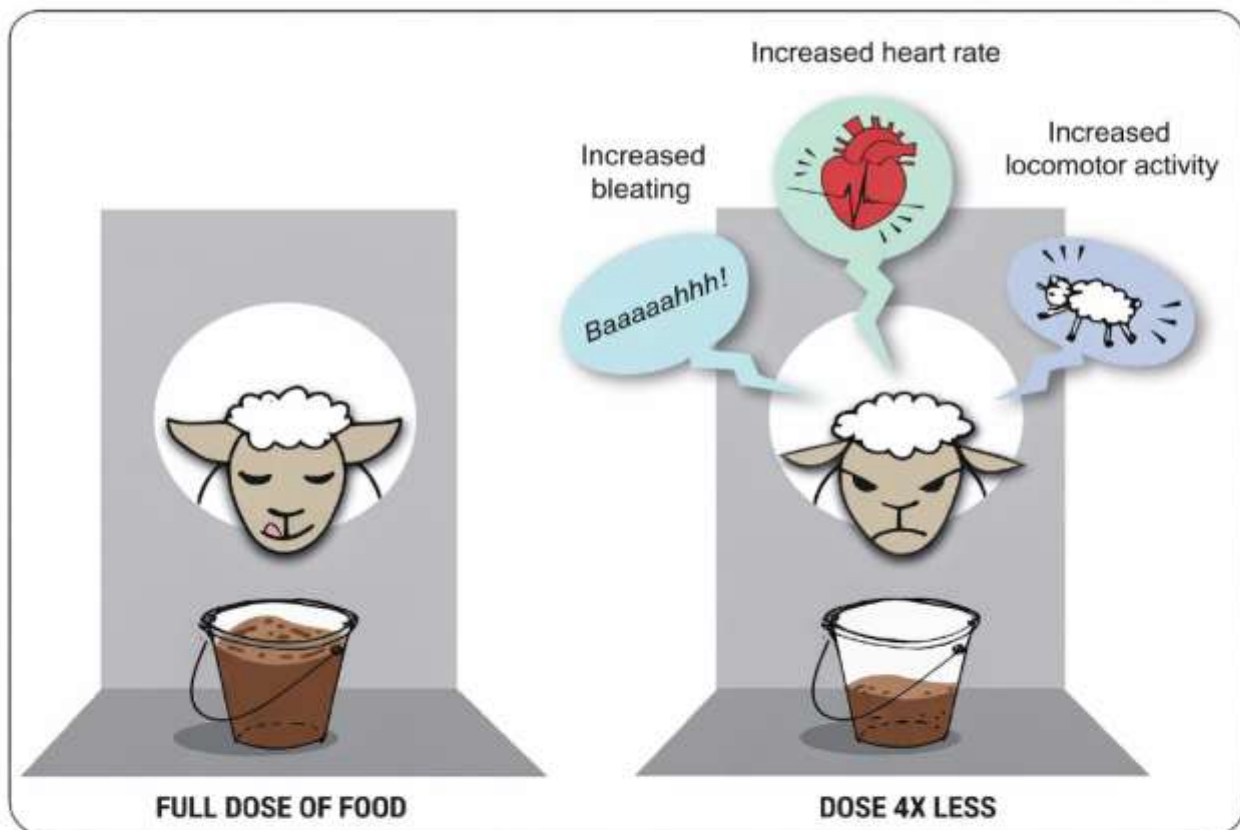
## 1.6. DEFINITION OF AN EXPECTATION

- An expectation is a mental process where one **imagines what will happen**. The animal uses this expectation to judge whether **the event will be pleasant or unpleasant**.
- Expectations manifest through **anticipatory behavioral and physiological responses**. Depending on the level of satisfaction of its expectations, **the individual experiences positive or negative emotions**.
- This idea of expectation in animals, well studied in experimental psychology, remains difficult to understand in practice.

**Example:** This involves experimentally examining the relevance of the expectation matching process in sheep.

- In a first phase, the individual (sheep) is taught to pass its head through an opening to trigger the distribution of a fixed quantity of familiar food.
- This situation is repeated so that the animal clearly associates its action with the food distribution.

- In a second phase, some animals receive **four times less food than the others**, who continue to receive the usual quantity of food each time they perform the learned behavior.
- In these animals that received a **smaller quantity** of food, an **increase** is observed in both the **number of bleats** (sheep vocalizations), their **locomotor activity**, and their **heart rate**.
- This suggests a negative emotion related to the fact that **the new reward does not match their expectations**, unlike the animals that continued to receive the reward in the usual quantity and did not express negative emotions.
- This clearly shows that animals are capable of forming expectations in the case of a repeated situation, and that they engage in action with a determined goal.
- From the moment the goal expected by the animal, "here obtaining a given quantity of food, is not achieved," a **negative mismatch** occurs between what is expected and what is received, resulting in a feeling of frustration.



**Figure 6:** Negative emotion due to mismatch with the animal's expectations

## 1.7. DEFINITION OF A NEED

Every animal has physiological and behavioral needs, and when **these needs are met**, it lives in **harmony with its environment** and its well-being is achieved. Conversely, when its needs are not met or it experiences suffering, it is no longer in harmony with its environment and its well-being is compromised.

To meet the physiological and behavioral needs of the animal so that it lives in harmony with its environment and thus achieves a state of well-being, three principles must be respected:

### 1.7.1. Normal functioning of the organism

The animal must maintain normal physiological function and not suffer from diseases, injuries, or malnutrition.

### 1.7.2. Expression of normal species behaviors

The environment must allow the animal to express its entire behavioral repertoire. This very important principle takes on its full meaning, particularly in regulations, when emphasizing the social nature of farm animals.

### 1.7.3. Absence of suffering

The environment must not generate physical or mental suffering (pain, fear, hunger, thirst...) in the animal. On the contrary, the animal must experience positive experiences in which aspects related to comfort are notably taken into account.

Needs vary according to several parameters, namely:

**A. Species:** animal needs differ from one species to another;

**B. Breed:** Rustic animals doesn't necessarily share the same needs as high-production animals;

**C. Age:** young animals do not have the same needs as adults;

**D. Sex:** females have different needs from males;

*E. Physiological stage:* a pregnant female has different needs from a non-pregnant female.

**Note:** We also need to know what the animal wants to experience or wants to avoid, as well as assess its mental state. Here we are moving towards taking into account the animal as an individual with its own motivations, preferences, and expectations.

**Definition 4:** According to Article 7.1.1 of the Terrestrial Animal Health Code, animal welfare is defined as: **Animal welfare signifies to the physical and mental state of an animal in relation to the conditions in which it lives and dies.**

An animal's welfare is considered satisfactory when the following criteria are met: good health, sufficient comfort, good nutritional status and safety. The animal must not be in a state that generates pain, fear or distress, and must be able to express the essential natural behaviors for its physical and mental state.

Animal welfare requires the following elements: disease prevention, appropriate veterinary care, suitable housing, herd management and feeding, a stimulating and safe environment, and handling and slaughter or killing carried out under decent conditions. While the concept of animal welfare refers to the state of the animal, the treatment an animal receives is covered by other terms such as care, husbandry conditions and humane treatment.

The recognition of the sentient nature of animals, capable of experiencing pain and suffering, and, more recently, of their conscious nature, forms the basis of moral considerations towards them.

Animal protection policy is based on three fundamental principles:

- The animal is a sentient being that must live in conditions respecting its biological needs.
- It is prohibited to inflict mistreatment on animals.
- Abusive use of animals is prohibited.

## 1.8. RECOGNITION OF ANIMAL INDIVIDUALITY

The welfare of an animal, that is, **the welfare of an individual in a particular environment**, and not animal welfare in general.

This notion is important because, because **each individual is different** due to **its cognitive capacities** and **experiences**, and **since each environment effects the individual differently**, its welfare is individual and different from that of its conspecifics.

It is not enough to consider that the animal should be in good health, have good production, and not undergo stress; elements associated with suffering or pleasure should also be considered.

Therefore, the mental and physical state must be positive for the animal to be in a state of welfare. It is no longer enough not to suffer from hunger or not to be afraid.

The satisfaction of the animal's needs in relation to its survival and a certain quality of life (water, bedding, exploration, interaction with conspecifics...) is also necessary, and the non-satisfaction of these needs can lead to poor welfare.

## 1.9. OVERALL ASSESSMENT OF ANIMAL WELFARE (WELFARE QUALITY PROJECT)

The "Welfare Quality®" project was a vast initiative funded by the European Union (EU) that integrated the multiple dimensions of animal welfare. It is a common assessment method in Europe to help improve welfare.

The project involved more than 200 partners from 13 European countries and 4 Central and South American countries.

The partners developed welfare assessment methods, establishing **12 criteria** derived from **4 principles** that give rise to multiple measures used in practice.

The welfare criteria were developed from the "five freedoms"; they include individual measurements performed on the animal and an assessment of resources (environment).

The objective is to assess farms objectively and quantitatively, then identify concrete actions to improve welfare.

In accordance with *Welfare Quality*® Protocols, animal welfare assessment must take into account four principles:

- **Are the animals properly fed?**
- **Are the animals adequately housed?**
- **Is the animals' health status correct?**
- **Does the animals' behavior reflect an adequate emotional state?**

(This last one, bringing together in the same principle the freedom "to express normal behavior" and "freedom from fear and distress").

These principles aim to **minimize negative emotional states** and promote positive experiences in animals, whether in captivity or on farms.

Qualitative behavioral assessment (criterion number 12) is an attempt to go beyond the five "freedoms" by integrating the assessment of **a positive emotional state**.

Apart from assessing the satisfaction of animals' expectations, the different aspects of this definition are therefore taken into account in this approach.

The measures are combined to provide an **overall welfare score for the farming unit**. It has been recognized that a farm could only be considered as respecting animal welfare if all the "dimensions" (Table 2) of welfare reached an "acceptable" score (value established in the "Welfare Quality®" project).

There is no compensation between principles. Often, animal-based measures (**output measures**) take more time and are more complex than resource-based criteria (environment) (**input measures**).

**Table 2:** Correspondence between the five freedoms and welfare assessment according to the Welfare Quality® protocol

5 Freedoms	4 Principles	12 Criteria
Freedom from hunger and thirst	Appropriate feeding	Absence of prolonged hunger Absence of prolonged thirst
Freedom from discomfort	Appropriate housing	Comfort around resting Thermal comfort Ease of movement
Freedom from pain, injury and disease	Good health	Absence of injuries Absence of diseases Absence of pain (husbandry practices)
- Expression of species-specific behavior - Freedom from fear and distress	Appropriate behavior	Expression of social behaviors Expression of other species-specific behaviors Good human-animal relationship Positive emotional state

The "Welfare Quality®" assessment grid is currently considered a reference framework that is adapted into simplified and operational forms suited to the various conditions in which welfare is assessed.

**Table 3:** Principles, criteria, and measurable parameters at the basis of welfare assessment protocols: application in dairy cattle according to results from the European "Welfare Quality Research Project"

4 Principles	12 Criteria	Measurable Parameters
<b>Appropriate feeding</b>	Absence of prolonged hunger	<b>Body condition score</b>
	Absence of prolonged thirst	<i>Water availability, cleanliness of water points, water flow, functioning of water points</i>
<b>Appropriate housing</b>	Comfort around resting	<b>Time needed to lie down</b> <b>Collisions with equipment during lying down</b> <b>Animals lying partially or completely outside</b>

		<b>the resting area</b> <b>Cleanliness of udder, flanks, hind limbs</b>
	Thermal comfort	<i>No measures currently</i>
	Ease of movement	<i>Are animals tethered?</i> <i>Access to an outdoor exercise area or pasture</i>
<b>Good health</b>	Absence of injuries	<b>Lameness (number and severity), skin lesions</b>
	Absence of diseases	<b>Respiratory problems (coughing, nasal or ocular discharge, difficult breathing)</b> <b>Digestive problems (diarrhea)</b> <b>Reproductive problems (vulvar discharge, somatic cell count in milk, dystocia)</b> <b>Mortality</b>
	Absence of pain (husbandry practices)	<i>Dehorning, tail docking (procedures, age of animals, use of analgesics)</i>
<b>Appropriate behavior</b>	Expression of social behaviors	<b>Aggressive behaviors</b>
	Expression of other species-specific behaviors	<i>Access to pasture</i>
	Good human-animal relationship	<b>Flight/avoidance distance</b>
	Positive emotional state	<b>Qualitative behavioral assessment</b>

**Note:** In bold: animal-based measures; in italics: resources available to animals.

### 1.10. THE 5 DOMAINS MODEL FOR ANIMAL WELFARE

In a constant effort to improve animal care, they decided to go beyond the five fundamental needs by adopting an approach that also takes into account the mental health of animals, known as **the five domains**.

This approach defines the positive and negative experiences that animals live through and serves as a guide so that positive experiences increasingly occupy a fundamental place in the welfare of our animals.

The model consists of five domains, which focus attention on specific factors or conditions likely to impact an animal's welfare. These include **four physical/functional domains**: nutrition, physical environment, health, and behavioral interactions, and a **fifth domain**, that of mental or affective state.

The five domains of animal welfare include:

**1.10.1. Good Nutrition:** animals have access to food and water in sufficient quantity, of varied quality, and healthy.

**1.10.2. Good Environment:** temperature, air quality, odors, sounds, space, and predictability give a comfortable environment for animals.

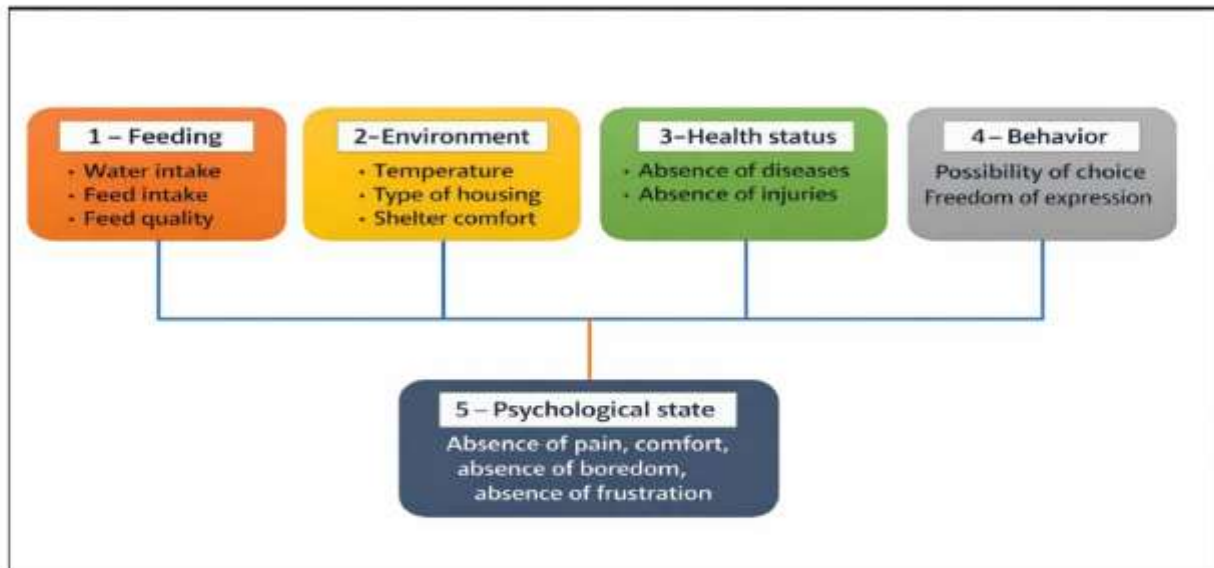
**1.10.3. Good Health:** animals are in good health, and do not suffer from diseases and injuries, which should be prevented or treated immediately and appropriately.

**1.10.4. Expression of natural Behavior:** Animals are capable of expressing a full range of natural behaviors such as exploration, foraging, bonding, play, withdrawal, and others.

**1.10.5. Mental state:** by experiencing positive situations or solutions related to the four preceding functional domains, animals can enjoy a generally positive mental state characterized among other things by pleasure, comfort, or vitality, and a reduction or elimination of negative states such as fear, frustration, hunger, pain, and boredom.

The **first four domains** focus on factors that can contribute to negative or positive emotions and experiences, which influences the animal's mental state, assessed with **the fifth domain**.

For example, if an animal has access to a wide variety of food, it can experience different flavors, smells, and textures—a positive welfare state. Conversely, if an animal has restricted access to food, it might become bored due to lack of stimulation or even experience hunger—a negative welfare state.



**Figure 7:** The five domains of action for animal welfare

From the early 2000s, animal welfare scientists have given increasing attention to positive affective experiences, which cannot be limited to avoiding suffering. The Model was therefore revised extensively to include, in each of the first four domains, the internal and external circumstances that may give rise to positive affects, which, as with the negative affects referred to above, were assigned to the fifth (mental) domain for consideration. Expressed in general terms, the associated welfare enhancing affects likely include various forms of comfort, pleasure, interest, attachment, confidence, and a sense of being in control.

**Table 4:** Domain 1: Nutrition. Examples of nutritional imbalances and opportunities and their associated negative and positive affects attributed to Domain 5: Mental State

Nutritional conditions and their associated affects	
Negative Conditions	Positive Conditions
<b>Nutritional inadequacies: Negative affects</b>	<b>Nutritional opportunities: Positive affects</b>
Restricted water intake → Thirst	Drinking correct amounts of water → Wetting/quenching, Pleasures of drinking
Excessive water intake → Water intoxication	
Restricted food intake → Hunger (general), Hunger (salt), Starvation weakness	Eating sufficient food → Postprandial satiety, Pleasure of salty taste

Poor food quality, Low food variety → Malaise of malnutrition, Food-related boredom	Eating a balanced diet, Eating a variety of foods → Pleasures of food tastes/smells/textures, Masticatory pleasures
Voluntary overfeeding → Feeling of bloating or excessive satiety	Eating correct amounts of food → Comfort of satiety
Force-feeding, excessive energy intake → Gastrointestinal pain, nausea/malaise	(Absence of force-feeding) → Gastrointestinal comfort

**Table 5: Domain 2:** Physical Environment. Examples of unavoidable and improved physical conditions and their associated negative and positive affects attributed to Domain 5: Mental State

<b>Physical environmental conditions and their associated affects</b>	
<b>Negative Conditions</b>	<b>Positive Conditions</b>
<b>Unavoidable physical conditions → Negative affects</b>	<b>Improved physical conditions → Positive affects</b>
Close confinement; overcrowding → Forms of discomfort: Physical: general stiffness, muscle tension	Space for spontaneous locomotion → Forms of comfort: Physical comfort
Inappropriate substrate, wet/muddy floor → Physical: musculoskeletal pain, pain, skin irritation	Appropriate substrate, well-drained floor → Physical comfort
Atmospheric pollutants: NH <sub>3</sub> , CO <sub>2</sub> , dust, smoke → Respiratory: breathlessness, respiratory tract irritation/pain	Fresh air dissipates contaminants → Respiratory comfort
Aversive odors → Olfactory: repulsion to foul or repulsive odors	Foul odors are dissipated by fresh air and good hygiene → Olfactory comfort
Thermal extremes → Thermal: shivering, suffocation, overheating	Effective shelter and shade available → Thermal comfort
Loud or otherwise unpleasant noise → Auditory: impaired hearing or ear pain	Effective noise control measures are in place → Auditory comfort
Light: inappropriate intensity → Visual: eye strain due to flickering, glare, or darkness	Light intensity maintained at tolerable levels → Visual comfort
Monotony: ambient, physical, light → Malaise due to unnatural constancy	Environmental variability maintained throughout the day → Pleasant variety and predictability

Unpredictable events → Anxiety, fear, hypervigilance	Predictability achieved through establishment of routines → Ease and calm based on relaxation
Physical constraints on rest and sleep → Exhaustion	Conditions conducive to rest and sleep → Well rested

**Table 6: Domain 3:** Health. Examples of negative and positive health conditions and their corresponding affects attributed to Domain 5: Mental State

<b>Health conditions and their associated affects</b>	
<b>Negative Conditions</b>	<b>Positive Conditions</b>
<b>Presence of pathology → Negative affects</b>	<b>Minimal or Absence of pathology → Positive affects</b>
Injury: acute, chronic, husbandry mutilations → Pain (numerous types), breathlessness, debility, weakness, sickness, malaise, nausea, dizziness	Injury → Comfort of good health and functional capacity
Disease: acute, chronic → [same affects as above]	Disease → Comfort of good health and functional capacity
Functional impairment: due to limb amputation, other therapies; genetic, pulmonary, cardiac, vascular, renal, intestinal, neurological, or other problems → [no affects listed in this section]	Functional impairment → Comfort of good health and functional capacity
Obesity or emaciation: physical and metabolic consequences → Affects of being too fat or too thin and of physiopathological and metabolic sequelae	Extreme body condition scores → Comfort of good health and functional capacity
Poisons → Numerous affects due to mode of action	Poisoning → Comfort of good health and functional capacity
Poor physical condition, muscular deconditioning → Physical weakness and exhaustion	Poor physical condition (good fitness level) → Vitality of physical fitness and pleasantly vigorous exercise

**Table 7: Domain 4:** Behavioral Interactions. Examples of interactions with the environment, other (non-human) animals and humans, where animals' capacity to exercise their behavioral agency is impeded or enhanced, and examples of corresponding affects attributed to Domain 5: Mental State. Also provided for human-animal interactions are examples of negative and positive attributes that influence human behavior towards animals

<b>Behavioral interactions and their associated affects</b>	
<b>Negative Conditions</b>	<b>Positive Conditions</b>
<b>INTERACTIONS WITH THE ENVIRONMENT</b>	
<b>Exercise of "agency = Acting autonomously" is impeded</b>	<b>Exercise of "agency" is facilitated</b>
Invariant, barren, confined environment (ambient, physical, biotic) → Negative affects: Boredom, helplessness, Depression, withdrawal	Varied, novel environment → Positive affects: Interested, pleasantly occupied
Inescapable sensory inputs → Various combinations: elicited by unexpected events, neophobia, hypervigilance, anger, frustration, negative cognitive bias	Congruent sensory inputs → Appreciates novelty, post-inhibitory rebound
Markedly restricted choices, Closed environment, constrained activity, Impeded foraging behavior → [same affects]	Engaging choices available → Calm, in control
	Free movement → Engaged by activity
<b>INTERACTIONS WITH OTHER ANIMALS</b>	
Constrained animal-animal interactive activity → Loneliness, depression, Longing for companionship, Thwarted desire to play, Sexual frustration, Thwarted hunting drive	Bonding/reaffirming bonds, raising young → Affectionate sociability, Maternal, paternal or group rewards
	Play → Excitement/playfulness
	Sexual activity → Sexually gratified
	Hunting → Satisfied motivation, highly stimulated
Significant threats, limits on threat avoidance, refuge or defensive activity, Limitations on sleep/rest → Anger, anxiety, fear, panic, insecurity, neophobia, Exhaustion	Absence of threats, use of refuges, retreat or defensive attack, Sufficient sleep/rest → Secure, protected, confident, energized, refreshed, rebounding inhibitory behavior

<b>INTERACTIONS WITH HUMANS</b>	
<b>Negative human attributes and animal behaviors and negative affects:</b>	<b>Positive human attributes and animal behaviors and positive affects:</b>
Attitude: uncertain, fearful, indifferent, insensitive, impatient, oppressive, belligerent, dominant, coercive, vindictive → Behaviors (e.g.): flight/flight distance, hypervigilant, attack/combat, hyper-reactive, recourse to avoidance, trembling, cowering, submission, withdrawal, non-compliant	Attitude: confident, caring, sensitive, patient, kind, empathetic → Behaviors: alert in flight, orientation, vigilance, ease with imposed proximity of hands on or around body, compliance reactivity, vocal approach to humans, seeking contact, validated bonding with humans
Voice: hesitant, angry, yelling, screaming → [same behaviors]	Voice: confident, calm, clear, encouraging, pleasantly rhythmic → [same behaviors]
Aptitude: inexperienced, untrained, unskilled → [same behaviors]	Aptitude: experienced, skilled, trained → [same behaviors]
Handling/control: erratic, abrupt (slap, hit, kick, whip, blow, smack), excessively energetic, violent; punishment/negative reinforcement; negative pressure greater than necessary for training objective → Affects: anxiety, fear, panic, terror, neophobia; insecurity, confusion, uncertainty; persistent suffering; helplessness; pain-induced injuries; negative cognitive bias	Handling/control: skillful, gentle (stroking, touching, pushing, guiding); tempered, restrained; reward-focused; firm but sensitive with conspecifics; use of subtle pressures just above threshold; reinforces and releases aversive stimuli in timely manner → Affects: calm, confident, comfortable, feels in control; enjoys being touched; being bonded with humans rewarding

## 2. IMPACT OF ANIMAL WELFARE ON FARMING PERFORMANCE

Animal welfare (AW) is a fundamental concept for farmers and scientists, as it directly influences animal performance, particularly in the dairy production, reproduction, and zootechnical sectors. In this context, improving animal welfare proves to be not only an ethical act but also a lever for economic performance in agricultural operations.

### 2.1. IMPACT OF ANIMAL WELFARE ON DAIRY CATTLE PERFORMANCE

Studies show that cows that obtain high welfare scores produce larger quantities of milk compared to cows whose welfare is considered poor. Indeed, stress reduces milk production capacity and can be caused by factors such as poor nutrition, an unsuitable environment, or lack of comfort in resting areas. For example, according to one study, the comfort of lying areas significantly influences milk production.

### 2.2. IMPACT OF ANIMAL WELFARE ON REPRODUCTIVE PERFORMANCE

Reproductive performance, such as fertility, fecundity, and prolificacy, is also influenced by animal welfare. A stressful or poorly adapted environment can alter reproductive cycles and reduce fertilization capacity.

**Example:** optimal welfare conditions in cattle significantly improve fertility and fecundity rates, in addition to reducing complications at birth.

### 2.3. THE LINKS BETWEEN ANIMAL WELFARE (AW) AND FARMING PRODUCTIVITY

**2.3.1. Improvement of profitability:** Well-treated animals are more profitable, as a favorable environment reduces stress, which improves overall productivity. For example, in cattle farms, a healthy and calm environment promotes higher milk production, which generates additional profits for operations.

**2.3.2. Reduction of operating costs:** Healthy animals require less veterinary care and medical treatments, thus reducing operating costs. Animal welfare, by reducing disease risks, limits financial losses related to treatments and absences of sick animals.

**2.3.3. Increased handling and meat yield:** Respectful handling of animals reduces pre-slaughter stress, which improves meat yield and quality. Studies show that stress before slaughter leads to quality losses (see practical work chapter 3), while gentle handling techniques contribute to more tender meat less likely to contain texture defects.

### 3. TYPES OF FARMING AND STRESS FACTORS

#### 3.1. TYPES OF FARMING

Farming systems are often distinguished by their level of production intensity and the environment in which they operate.

**3.1.1. Classification according to environment:** The three main types of farming are: intensive, semi-intensive, and extensive, which differ in their characteristics in terms of animal population density, infrastructure, and management practices, thus influencing productivity, costs, and environmental impacts.

##### *A. Intensive farming (housed livestock)*

- Intensive farming relies on modern infrastructure, optimized nutrition, and technological monitoring, allowing high animal density on small surfaces.
- This type of farming, often practiced in confined environments, aims to maximize productivity and is widespread in regions where demand for animal products is high.
- Production conditions, such as specialized nutrition and automated management, ensure rapid production of meat, milk, or eggs, but may raise issues regarding animal welfare and environmental impact.
- These are systems where animals live in confinement and depend entirely on humans, on a daily basis, for their essential needs such as food, shelter, and water.

##### *B. Extensive farming (outdoor)*

- Extensive farming is based on low animal density practices, where animals graze freely over large areas.
- This type of farming, often practiced in areas of low human population density (e.g., grasslands, mountains), minimizes human intervention.

- Although productivity per unit area is lower, extensive farming promotes animal welfare by providing a more natural living environment.

### C. Semi-intensive farming

- Semi-intensive farming is an intermediate form that combines elements of intensive and extensive farming.
  - This type of farming allows animals to benefit from outdoor grazing while receiving supplementary feeding.
  - Generally practiced in rural or peri-urban areas, it offers a balance between production and animal welfare.
  - This system promotes reduced environmental impact compared to extensive farming, while maintaining relatively high productivity.
- Intensive, semi-intensive, and extensive farming types each present advantages and limitations.
  - Farming system choices depend on production objectives, economic constraints, available natural resources, and social requirements, particularly regarding animal welfare and environmental sustainability.
  - While intensive farming allows for improved yield, extensive farming positively affects product quality.
  - The first farming mode (intensive) is therefore a quantitative model, while the other (extensive) is a qualitative model.

#### 3.1.2. Classification according to species raised

Nevertheless, of the type of animal production, the classification centers on the type of species elevated, the large animals including: cattle, sheep, goat, equine and camel farming, however the small animals including poultry, bees, fish, and rabbit farming.

## 3.2. STRESS AND STRESSORS

### 3.2.1. Definition of stress

Stress is the set of **reactions of an organism subjected to constraints** caused by **external aggressions related to its environment**. It constitutes the state of an animal that is subjected to conditions that may have unfavorable consequences for it and **that force it to react**.

Stress can have harmful consequences on the animal's health and its zootechnical performance.

### 3.2.2. Types of stress

#### A. Acute stress

Which depends on **the punctual variation of a stressor**, of **limited duration in time**; that is, **the stress diminishes rapidly with the disappearance of the cause**.

#### Examples:

- Sudden drop or increase in temperature,
- Sudden noise,
- Unexpected appearance of a predator.

#### B. Chronic stress

When the action of **the stressor on the animal's environment lasts a long time or is repeated**.

In a stressful situation that lasts over time, a pathology may occur and sometimes cause the animal's death.

#### Examples:

- Repeated attacks from a dominant conspecific,
- Chronic thermal stress,
- Lack of food,
- Long-duration transport.

### 3.2.3. Stress factors

A stressor can be defined as any stimulation likely to alter the body's equilibrium (or homeostasis) and that requires a certain adaptation in order to regain equilibrium.

The causes of stress are multiple; they may be related to environmental factors, social factors, poor farming practices, and various pathologies (Table 8).

**Table 8:** The different stress factors on a farm, example "sheep" (developed from Tahenni, 2018).

Environmental Factors	Social Factors	Factors Related to Farming Practices	Factors Related to Pathologies
Temperature variation (heat, cold, rain, wind)	Grouping	Feed (insufficient, excessive, unbalanced) Lack of water Unsuitable water	Pathogenic organisms: Parasites, bacteria, viruses
Humidity	Isolation (separation of the animal from its conspecifics)	Housing conditions Surface area relative to number of animals	Pain related to trauma
Ventilation	Density (number of animals)	Animal handling	Injuries (fractures...)
Luminosity	Weaning (separation of young from mother)	Transport	Metabolic disorders
Change of environment	Relationship with other animals (attacks by a dominant conspecific, predation)	Relationship with humans (approach, handling, various treatments, such as shearing)	-

### 3.2.4. The main stress actors

Faced with a stressful situation, the animal organism activates two complementary systems: a rapid response (acute stress) via the sympathetic nervous system and a slower response (chronic stress) via the hypothalamic-pituitary-adrenal axis (HPA axis).

**A. The central nervous system:** The prefrontal cortex plays a role in cognition (action planning), and the limbic system (including the amygdalae: the brain's fear center) play a role in emotion regulation.



**B. The autonomic nervous system:** Upon perception of the stress factor, the sympathetic nervous system is activated and leads to the release of adrenaline and noradrenaline (catecholamines) by the adrenal medulla.

**C. The Hypothalamic-Pituitary-Adrenal axis (HPA):** The HPA axis involves three main actors: the hypothalamus secretes CRF (Corticotropin Releasing Factor), which activates the pituitary gland, which in turn releases ACTH (Adrenal Corticotrophic Hormone) into the blood. ACTH then stimulates the synthesis and release of cortisol (glucocorticoids) by the adrenal glands.

**D. The immune system:** Release of pro-inflammatory cytokines during acute stress to activate immune defenses. In chronic stress, cortisol causes immunosuppression, increasing susceptibility to infections.

Stress hormones such as **adrenaline** and **cortisol** are **responsible for the animal's reaction during stress**.

### 3.2.5. Evaluating the effects of moderate chronic stress on the emotional state of lambs

**Example:** In a study conducted on sheep (Destrez et al., 2013), researchers sought to understand what the effects of moderate chronic stress, induced by an accumulation of unpleasant situations, were on the emotional state of lambs.

#### Experimental protocol

To know if stress makes lambs pessimistic.

#### Step 1 - Learning (training the lambs):

- The researchers taught the lambs to recognize 2 situations ("go/no go" test):
  - Bucket on the left = Good news (there is food in it) → **the lamb approaches**.
  - Bucket on the right = Bad news (no food + a scary flag) → **the lamb avoids**.

#### Step 2 - Create stress in some lambs (for 6 weeks):

- Stressed group: the lambs were subjected to a moderate chronic stress protocol including delays in food distribution, unpredictable noises, and uncontrollable situations such as wet bedding.
- Control group: the lambs were raised under normal conditions.

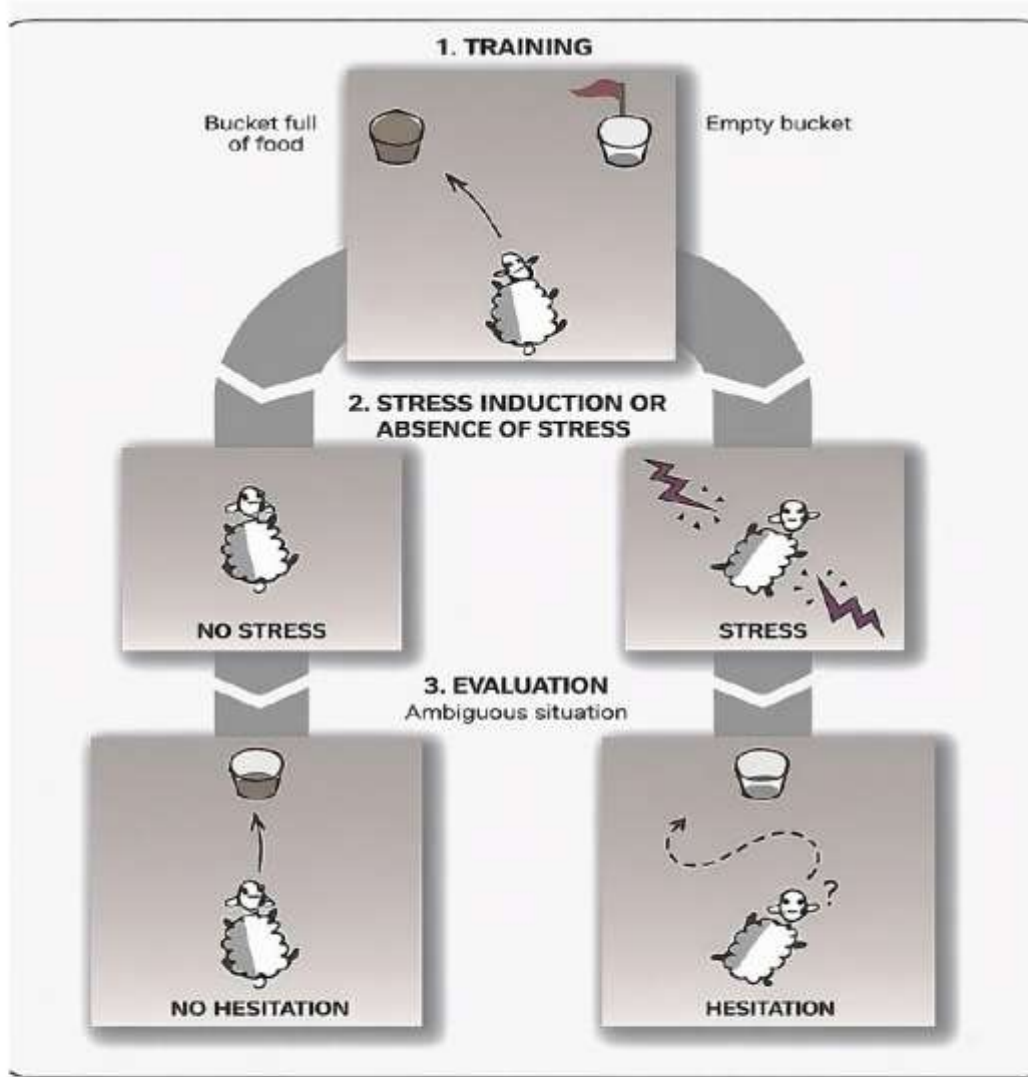
**Step 3 - The final test:** All lambs were tested again with the "go/no go" test.

The bucket is placed again, but this time **IN THE MIDDLE** (neither left nor right). The lambs don't know if it's good or bad.

**Results:**

- **Non-stressed lambs:** They approach the middle bucket (**optimistic**, they take a chance).
- **Stressed lambs:** They approach the middle bucket less (**pessimistic**, they expect the worst).

**Conclusion:** Stress makes lambs pessimistic, even when faced with a neutral situation.



**Figure 8:** Experimental protocol of the cognitive bias test (negative perception) in lambs: effect of chronic stress on the interpretation of ambiguous situations

### 3.2.6. Welfare as adaptive capacity

Several scientists have defined animal welfare through the notion of adaptation to the environment. Carpenter (1980) proposes that "the welfare of farm animals depends on their ability to adapt without suffering to environments designed by humans," while Broom (1986) presents it as "the state of the animal as a function of its adaptation efforts to its environment."

These definitions introduce the central idea that animals possess adaptive capacities, both behavioral and physiological, that allow them to cope with variations in their environment.

According to this approach, welfare exists on a continuum. When the animal manages to adapt effectively to changes in its environment or to the non-satisfaction of certain needs through its adaptive capacities, its welfare is preserved.

For example, an animal exposed to slight temperature variations can easily adjust its behavior or physiology without affecting its welfare. Conversely, when environmental conditions or their variations exceed the animal's adaptive capacities, it shifts into a state of poor welfare. If temperature variations fall outside its thermal comfort zone, its adaptation mechanisms become insufficient and its welfare deteriorates.

### 3.2.7. Animal's stress adaptation capacity

Broom (1987) proposes to start from the concept of "coping" (from the English "I cope with it"), which he uses in the sense of adaptation.

- The adaptive capacities of a farm animal characterize its faculties (capacity) to adapt to its environment, in response to farming conditions.
- This capacity depends on the animal's **genetics, its experience, and its learning**.
- Then, adaptation processes (coping) occur, comprising neuro-hormonal and physiological mechanisms but also behavioral adjustments.
- Indeed, physiological and behavioral adaptation processes are triggered when the situation is perceived as a threat by the animal.

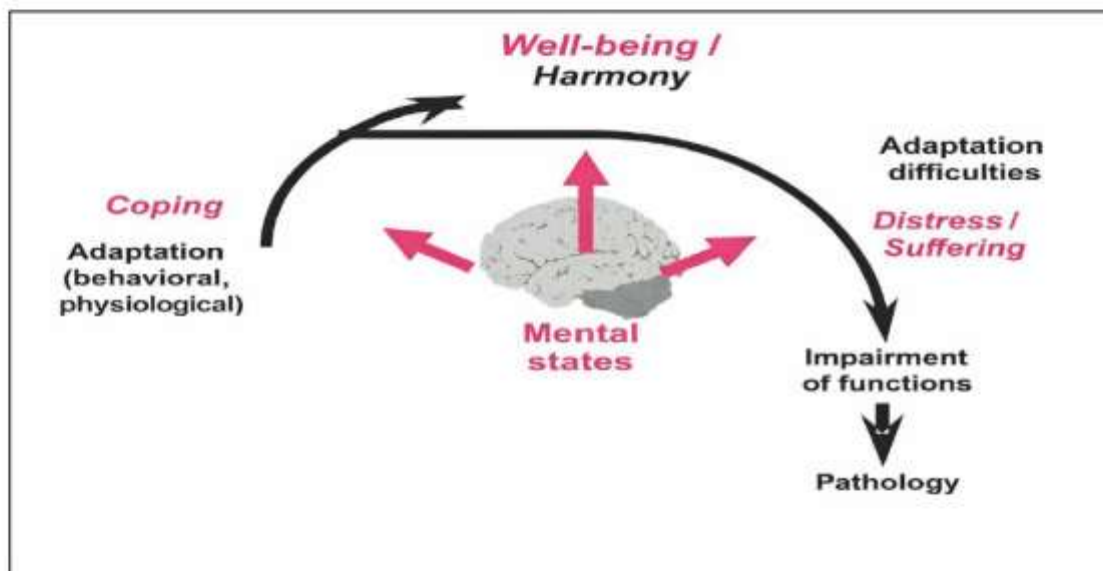
✓ **In case of success**, homeostasis leads to welfare.

✓ **In case of adaptation failure**, this leads to stress, increased susceptibility to pathology, suffering, and poor welfare.

**In conclusion**, the stress response depends on how the animal evaluates the situation.

If adaptation to the environment can be achieved at low cost, for example without significant energy expenditure, then the welfare level will be high.

If, on the contrary, the individual must draw heavily on its reserves to adapt (for example, if the outside temperature is too low), then the welfare level will be low.



**Figure 9:** Animal's adaptive capacity

An animal's welfare is a mental state that depends on how that animal perceives its environment.

- If it perceives that the environment satisfies all its motivations, then the mental state will be welfare.
- If the environment is not ideal (if the animal perceives the situation in which it finds itself as a threat) but the animal perceives that it will be able to adapt to it, then the mental state will correspond to a feeling of "coping" ("I cope with it").

- If, on the contrary, the animal perceives that it has difficulties adapting, then suffering can set in, biological functions may be disturbed (modification of behavior organization and functioning of physiological systems involved in stress, decrease in general condition that may lead to the appearance of pathologies), which leads to a state of poor welfare.

#### 4. ASSESSMENT OF ANIMAL WELFARE

Animal welfare is a major concern in modern farming systems and in animal protection programs.

To correctly assess animal welfare, it is crucial to rely on specific, measurable, and scientifically validated indicators. These are divided into two main categories:

- **Measurements performed on the animal's environment:** "input-based indicators" measure the living conditions offered to animals to assess whether they respect animal welfare, which include farming conditions and available resources.
- **Measurements performed on the animal:** there are two types of observation:
  - "Output-based indicators at the animal level" which focus on **direct observations** (physiological measurements, health status and animal behavior...) or
  - "Output-based indicators at the herd level" which focus on **indirect observations**, performance measurements (such as their production level and reproduction... etc.).

#### 4.1. ENVIRONMENTAL INDICATORS (INPUT-BASED)

Environmental indicators aim to assess whether facilities and living conditions offered to animals meet their biological and behavioral needs.

These indicators are primarily focused on evaluating resources and management practices in farming. Among these indicators, we find:

##### 4.1.1. The number of feeders and drinkers relative to the number of animals

To ensure animal welfare and minimize **aggressive behaviors** related to **food competition**, it is essential to adapt the number of feeding and watering points to the group size.

An insufficient ratio creates intense competition that generates stress, promotes the establishment of a rigid social hierarchy, and prevents subordinate animals from freely accessing vital resources. This situation can lead to growth delays, decreased production, and deterioration of the general health status of the herd.

#### 4.1.2. Access to feed and water

The quality, quantity, and frequency of feed distribution are essential for welfare.

Permanent and adequate access to feed and water constitutes a fundamental need on which animal welfare directly depends. The nutritional quality of feed must be adapted to the specific physiological needs of each species, growth stage, and production level, ensuring optimal balance in energy, proteins, minerals, and vitamins.

The quantity distributed must allow each animal to satisfy its hunger without excessive restriction, as underfeeding (limited or inappropriate access) generates frustration, stress, and abnormal behaviors such as aggressiveness or stereotypies.

Water, often neglected, must be permanently available, clean, fresh, and in sufficient quantity, as any water restriction rapidly compromises health and welfare.

Facilitated and non-competitive access to feed and water resources allows animals to express their natural feeding behaviors, reduces social stress, and optimizes their health status and performance.

#### 4.1.3. Available space (area/number of animals)

Animal welfare depends on freedom of movement, so the space allocated per animal is a key indicator.

Stocking density, expressed by the ratio between available area and number of animals, constitutes a determining factor in animal welfare. Studies show that **lack of space increases stress and aggressive behaviors.**

Insufficient space limits natural movements, prevents the expression of essential behaviors (rest, exploration, play), and significantly increases aggressive interactions and social stress.

Overcrowding also promotes disease spread, degrades air quality, and complicates the maintenance of acceptable hygiene conditions.

#### 4.1.4. Environmental conditions

Environmental parameters (temperature, humidity, ventilation, air quality, and light) play a crucial role in the welfare and health of farm animals.

*A. Ambient temperature* must be within the thermoneutral zone specific to each species to avoid thermal stress, whether hot or cold, which directly affects physiological performance and behavior. An unsuitable environment causes thermal stress, harming animal health.

*B. Excessive humidity* promotes the development of respiratory and skin pathogens, while too low humidity irritates mucous membranes.

*C. Adequate ventilation* is essential to renew oxygen, evacuate humidity, harmful gases (ammonia, CO<sub>2</sub>, H<sub>2</sub>S) and regulate temperature, thus preventing respiratory disorders and stress. Air quality directly influences pulmonary health and animal comfort.

**Note:** Environmental indicators are easy to measure.

## 4.2. ANIMAL-BASED INDICATORS (OUTPUT-BASED)

Animal-based indicators are the most revealing of welfare because they provide data on the animal's physical or body condition and psychological state.

They are divided into two subcategories: **direct indicators**, which are **immediately observable in the animal**, and **indirect indicators**, based on the **zotechnical performance of animals**.

### 4.2.1. Direct Indicators

Direct indicators directly measure the animal's behavior and condition:

*A. Good Feeding:* Body condition score (BCS) constitutes a direct and reliable indicator of the adequacy between feed intake and the animal's physiological needs. This assessment, performed by palpation and visual observation of adipose reserves on specific anatomical areas (ribs, lumbar vertebrae, tail base), allows rapid detection of underfeeding or overfeeding situations.

**A too low BCS** reveals chronic feed insufficiency that compromises health, weakens the immune system, and impairs reproductive functions, while an **excessive BCS** indicates a nutritional imbalance that can lead to metabolic and locomotor disorders.

Maintaining an optimal BCS, specific to each species and physiological stage, demonstrates satisfactory nutritional welfare and appropriate feed management.

**B. Proper Housing:** The cleanliness and moisture level of fleece, coat, or plumage directly reflect the housing conditions and hygiene of the living environment.

- **Clean and dry fleece** indicates a **well-managed** environment with quality bedding, efficient drainage, and appropriate stocking density.
- Conversely, **excessive soiling by fecal matter, urine, or mud**, as well as persistent moisture, signal failures in housing management and expose animals to permanent discomfort. These degraded conditions promote the development of skin pathologies (dermatitis, mange), parasitic and respiratory diseases, while generating chronic stress.
- Regular observation of this indicator allows rapid assessment of housing quality and adjustment of maintenance practices to ensure animal comfort and health.

**C. Good Health:** The animal's health status, assessed by the presence or absence of diseases and lesions, constitutes the direct indicator of welfare.

- Respiratory pathologies (coughing, nasal discharge, dyspnea) often reveal environmental and air quality problems, while digestive disorders (diarrhea, bloating) signal dietary imbalances or infections.
- Reproductive system diseases compromise fertility and indicate stress, infections, or nutritional deficiencies.
- Foot lesions (lameness, pododermatitis) indicate unsuitable floors, excessive humidity, or lack of care.
- The presence of wounds, abscesses, scratches reveals problems with facilities, social competition, or inappropriate handling.
- Rigorous and systematic health monitoring allows early identification of these disorders, rapid intervention, and correction of responsible environmental or management factors, thus ensuring an optimal welfare level.

**D. Social Behaviors and Behavioral Abnormalities:** Observation of social behaviors and detection of behavioral abnormalities provide valuable information on the psychological state and emotional welfare of animals.

- **Normal social interactions** (play, mutual grooming, appropriate communication) indicate **satisfactory social balance**, while **excessive aggressive behaviors**, repeated injuries, or

abnormal isolation signal **significant social stress**, often related to excessive density or inappropriate group composition.

- **Behavioral abnormalities** such as **stereotypies** (repetitive purposeless movements), apathy, self-mutilation, or escape behaviors reflect deep malaise resulting from **chronic frustration, an impoverished environment, or unsuitable living conditions**.
- These abnormal behaviors constitute early warning signals that require in-depth analysis of farming conditions and immediate adjustments to restore an environment favorable to the expression of natural behaviors and the psychological welfare of animals.

#### 4.2.2. Indirect Indicators: Performance measures, i.e., output-based indicators at the herd level.

##### A. Zootechnical Performance

Zootechnical performance constitutes indirect but revealing indicators of the welfare state of a herd or farm.

- High mortality rate signals serious failures in farming conditions, whether sanitary, nutritional, or environmental, and indicates severely compromised welfare.
- Morbidity rate, reflecting the proportion of sick animals, indicates increased vulnerability of the group to pathogens, often related to chronic stress that weakens the immune system.
- A decrease in production (milk, meat, eggs) reveals that animals cannot express their full genetic potential due to unfavorable conditions such as thermal discomfort, inadequate nutrition, or psychological stress.
- Abnormalities in reproductive cycles, decreased fertility, increased abortions, or complications at parturition (dystocia, neonatal mortality) are direct manifestations of physiological imbalance caused by insufficient welfare.

Indirect indicators, easily measurable and already monitored as part of technical farm management, allow the farmer to be alerted to welfare problems and guide the necessary corrective actions to simultaneously improve animal living conditions and farm profitability.

##### In summary

- **Environment-based indicators** → **assessment of good treatment** → **obligation of means**.
- **Animal-based indicators** → **assessment of welfare** → **obligation of results**.

### 4.3. OUTPUT INDICATORS ACCORDING TO ORDER OF APPEARANCE

It is useless to search for a single indicator to measure welfare. In practice, studies seeking to assess animal poor welfare (output indicators) include:

#### 4.3.1. Ethological (Behavioral) Measures

Behavioral indicators are very often **more sensitive and earlier than other indicators**.

Certain abnormal behaviors reflect the impossibility for the animal to express natural behaviors to which it is strongly motivated.

**Behavioral changes** are often **the first signs of poor welfare**.

Ideally, behavioral indicators should be analyzed individually for each animal.

#### *A. Assessment Methods*

Direct observations of behaviors on the animal.

➤ Behavioral tests, for example, measuring animals' reactions to humans.

**Negative states:** Abnormal (stereotyped) behaviors. Prolonged inactivity. Signs of agitation or pain. Animal isolation. Aggressiveness

**Positive states:** Play. Social contacts.

#### 4.3.2. Physiological Measures

Physiological indicators assess stress responses in animals, such as modification of the corticotropic axis functioning under the effect of chronic stress.

- A typical example is the increase in blood cortisol level, which is a sign of stress.
- These indicators often require direct intervention on the animal, such as a blood draw. For this reason, they are rarely used routinely and are mainly reserved for animal welfare research.
- Assessment of catecholamines (adrenaline) is difficult to measure because blood sampling triggers a rapid stress reaction that can distort results.
- Cortisol, the main corticoid, can be measured in: plasma (blood), saliva, urine.
- Cortisol assay is useful for detecting punctual stress (for example, during cage restraint or isolation).

**- Other physiological indicators (in case of acute stress):**

- Heart rate: increased heart rate indicates stress situations.
- Body temperature: Monitoring of the body's reactions.
- Respiratory rate: Reveals stress-related changes.

**Note:** These indices help complete the diagnosis of the animal's welfare state.

**4.3.3. Zootechnical "production" measures**

- This involves analyzing **variations in animal production** to assess their welfare.
- Stress reactions are generally energy-consuming. Moreover, when faced with a constraint, the animal will often eat less. These two combined parameters mean that **we can observe a decrease in production when faced with a constraint.**
- Among the main production indicators are milk production, egg production, animal growth, and reproduction parameters which can vary, among other things, if animals undergo chronic stress.
- Zootechnical measures, such as the animal's body condition score, allow visual estimation of whether an individual has an appropriate weight.
- These measures often serve as alerts for farmers.

**4.3.4. Health measures**

- Which report the presence of diseases and/or injuries which can cause discomfort or pain for the animal.
- Health indicators have low sensitivity and therefore change later in response to a constraint.
- Stress causes a decrease in the animal's immunity, which exposes it to the development of pathologies.
- For example, a lame animal will experience greater difficulty getting up or lying down, which can worsen its lameness.
- The health indicators most often used on farms are morbidity, mortality, lesions, or injuries.

**Note:** In general, behavioral indicators are the first to reveal a visible response, followed by physiological indicators. On the other hand, health and production indicators are, in most situations, less sensitive and undergo slower or less easily observable changes when faced with a constraint.

## 5. RESPECT FOR ANIMAL WELFARE AND CONSUMER REQUIREMENTS

### 5.1. STAKEHOLDERS INVOLVED IN ANIMAL WELFARE

Animal welfare, particularly that of farm animals, has become a strong societal issue that is present at all levels of society and therefore involves many stakeholders.

- Farmers, being in daily contact with their animals and experiencing the pressure exerted on the livestock farming sector.
- Citizens-consumers, who can influence developments through their purchasing decisions, but also through their involvement in animal protection associations.
- Animal protection associations, some of which play the role of whistleblowers and others work with other stakeholders to find positive improvement solutions.
- Industry professionals, who adapt their production to consumer demand.

### 5.2. IMPORTANCE OF WELFARE FOR QUALITY

- Since its creation, farmers have placed respect for animals at the heart of their quality system. Simply because animals treated with care, within a farming structure respecting strict specifications, constitutes the guarantee of being able to offer quality animal products and ensure food safety.
- Animal welfare is described as the quality of life of the animal at the individual level. This notion encompasses its health and physiological welfare, but also its psychological balance and its capacity to exercise species-specific behaviors.
- Respect for animal welfare in farms and animal production activities has a considerable impact on the production and quality of animal products.
- It is essential to respect animal welfare to ensure healthy and quality animal production. Improved livestock management and care provided to farm animals can, in many cases, increase productivity and food quality, while addressing food deficiencies and shortages and ensuring food safety.
- Operators involved in livestock farming and animal product production must therefore take this aspect into account and be supported by governments in this regard.

## **6. VETERINARY LEGISLATION: REGULATIONS ON ANIMAL WELFARE (FARMING, TRANSPORT, SLAUGHTER, EXPERIMENTAL ANIMALS)**

Animal welfare is a shared responsibility among governments, communities, people who own, care for, use, or interact with animals, the general public, educational institutions, veterinarians, and scientists.

Owners and producers of farm animals and aquatic animals are key stakeholders in this area and therefore play a crucial role in ensuring the welfare of their animals and avoiding their suffering.

However, it is essential to note that they face economic constraints and risks to animal health.

The recognition and constructive engagement of all stakeholders are essential to achieve sustainable improvements.

Respecting animal welfare and following veterinary laws improves production and farm efficiency, which increases farmers' income.

### **6.1. AT THE INTERNATIONAL LEVEL**

According to the WOAHA Terrestrial and Aquatic Codes, animal welfare "**refers to the way an animal copes with the conditions in which it lives.**"

The WOAHA guiding principles on animal welfare also refer to the universally recognized "five fundamental freedoms," set out in 1965 to describe the rights of animals under human responsibility.



**Figure 12:** International standards on animal welfare

The World Organization for Animal Health (WOAH) is the main structure intervening at the global level on animal welfare issues. Created in 2000, it now includes 180 member countries and plays the role of global leader in developing recommendations and guidelines covering animal welfare practices. WOAH reaffirms that animal health is a key component of animal welfare.

Organizationally, WOAH functions with an International Committee composed of one permanent technical representative per member country. Work is conducted by specialized commissions and expert groups that prepare draft texts intended to be integrated into health codes. The standards development process follows a rigorous cycle: drafts are first examined by the permanent working

group on animal welfare, then by the Code Commission, before being submitted to the 180 member countries for comments during two consultation cycles. At the end of this process, new standards can be adopted and integrated into health codes.

WOAH has developed two health codes: one for terrestrial animals and one for aquatic animals. The terrestrial animal health code consists of two volumes, the first being divided into seven titles, of which the seventh is entirely dedicated to animal welfare. This title contains recommendations covering all practices: from animal transport to slaughter, including different production systems and the use of animals in research and education. These standards are regularly updated taking into account new scientific knowledge.

Furthermore, FAO (Food and Agriculture Organization of the United Nations) complements this system by having launched in 2009 an animal welfare portal aimed at centralizing reliable and updated information on legislation, scientific results, standards, and practices. These two organizations have benefited from European Union expertise in establishing public policies promoting systems more respectful of animal welfare.

### **6.1.1. Guiding principles for animal welfare (Article 7.1.2)**

WOAH health codes for terrestrial and aquatic animals establish guidelines on transport, slaughter, and farming conditions.

1. There is a very strong relationship between animal health and animal welfare.
2. The universally recognized "five freedoms" (freedom from hunger, thirst and malnutrition, freedom from fear and distress, freedom from physical and thermal discomfort, freedom from pain, injury and disease, and freedom to express normal behavior patterns) provide valuable guidance for animal welfare.
3. The universally recognized "three Rs" (reduction in the number of animals, refinement of experimental methods, and replacement of animals with non-animal techniques) provide valuable guidance for the use of animals for scientific purposes.
4. Scientific assessment of animal welfare involves various elements that should be studied together; the selection and weighting of these elements often involve value-based assumptions that should be made as explicit as possible.

5. The use of animals for agriculture, education and research, and for companionship, recreation, and entertainment makes a major contribution to human welfare.
6. The use of animals carries the ethical responsibility to ensure the protection of these animals to the greatest extent possible.
7. Improving animal welfare on farms can often increase productivity and food safety, and therefore be a source of economic benefits.
8. Comparison of animal welfare standards and guidelines should be based on equivalence of outcomes relying on objective criteria rather than on similarity of systems using input criteria.

### 6.1.2. Standards and guidelines on animal welfare

WOAH has developed standards and guidelines concerning animal welfare, addressing the following issues:

- Transport of animals by sea (Article 7.2.), by land (Article 7.3.), and by air (Article 7.4.) of the Terrestrial Code;
- Slaughter of animals (Article 7.5.);
- Killing of animals for disease control purposes (Article 7.6.);
- Control of stray dog populations (Article 7.7.);
- Use of animals in research and education (Article 7.8.);
- Animal welfare in beef cattle production systems (Article 7.9.);
- Animal welfare in broiler chicken production systems (Article 7.10.);
- Animal welfare in dairy cattle production systems (Article 7.11.);
- Animal welfare in working equids (Article 7.12.);
- Animal welfare in pig production systems (Article 7.13.);
- Killing of reptiles for their skins, meat and other products (Article 7.14.).

## 6.2. AT THE EUROPEAN LEVEL

After the signing of the European Convention for the Protection of Animals kept for Farming Purposes by the Council of Europe Member States in 1976, several European directives were implemented.

These have regulated the use of animals for scientific purposes, the keeping of wild animals in zoos, as well as farming practices and the slaughter of animals intended for consumption or other uses, such as fur production.

A general directive imposes obligations on the living conditions of farm animals, **recognized as sentient beings**.

Other specific directives establish precise rules for the welfare of calves, pigs, and poultry (both for meat and eggs).

**Table 9:** Summary of main conventions (Council of Europe) and European directives (EU) on the protection of farm animals

Target	Text	Subject
<b>Control</b>	Regulation (EU) 2017/625 of the European Parliament and of the Council of 15 March 2017	Official controls for compliance with legislation
<b>Farming</b>	European Convention ETS No. 87 of 10 March 1976 Protocol of amendment ETS No. 145 of 6 February 1992 Council Directive 98/58/EC of 20 July 1998	Protection of animals on farms
<b>Transport</b>	European Convention ETS 65 of 13 December 1968, revised ETS No. 193 November 2003 Directives 90/425/EEC, 91/496/EEC, 91/628/EEC,	Protection of animals during transport and related operations

	95/29/EC Regulations EC No. 411/98 and EC No. 1/2005	
<b>Slaughter</b>	European Convention ETS 102 of 10 May 1979 Directive 93/119/EC of 22 December 1993, amended in 2003 and 2005, repealed in 2009 Regulation EC 1099/2009 of 24 September 2009	Protection of animals at the time of killing
<b>Laying hens</b>	Directives 86/113/EEC and 88/166/EC Revision Directive 1999/74/EC of the Council of 19 July 1999	Minimum standards for the protection of laying hens in cages
<b>Broilers</b>	Council Directive 2007/43/EC of 28 June 2007	Minimum rules for the protection of chickens kept for meat production
<b>Pigs</b>	Directive 91/630/EEC of 19 November 1991 Revisions: Directive 2001/88/EC of 23 October 2001, Directive 2001/93/EC of 9 November 2001, Directive 2008/120/EC of 18 December 2008	Minimum standards for the protection of pigs
<b>Calves</b>	Directive 91/629/EEC of 19 November 1991 Revision 97/2/EC of the Council of 20 January 1997 Revision Council Directive 2008/119/EC of 18 December 2008	Minimum standards for the protection of calves

### 6.3. AT THE NATIONAL LEVEL

The law, as well as ministerial orders and decrees, have been established concerning veterinary legislation on animal welfare, such as:

Law 88-08 of 26 January 1988 on veterinary medicine and animal health protection (Article 58 to Article 63).

## TITRE IV

**LES MESURES GENERALES DE  
PROTECTION DES ANIMAUX  
ET DE CONTROLE DE LA SANTE  
ANIMALE ET DES PRODUITS ANIMAUX**

## CHAPITRE I

**PROTECTION DES ANIMAUX ET  
PREVENTION SANITAIRE**

**Art.58.** - Il est interdit d'exercer de mauvais traitements envers les animaux domestiques ainsi qu'envers les animaux sauvages apprivoisés ou tenus en captivité .

Des dispositions réglementaires déterminant les mesures propres à assurer la protection de ces animaux contre les mauvais traitements ou les utilisations abusives et à leur éviter des souffrances lors des manipulations inhérentes aux diverses techniques d'élevage, de parcage, de transport et d'abattage des animaux .

Il en est de même en ce qui concerne les expériences biologiques, médicales et scientifiques qui doivent être limitées aux cas de stricte nécessité.

Les infractions au présent article sont punies conformément aux dispositions des articles 415, 449 et 457 du code pénal .

**Art.59.** - La prévention et la lutte contre les maladies animales contagieuses sont d'utilité publique .

**Art.60.** - Les personnes physiques ou morales, en qualité de propriétaires ou à tout autre titre, ont le devoir de maintenir en bon état sanitaire, les animaux dont ils ont la charge .

Ces personnes sont tenues de mettre en œuvre les mesures et injonctions édictées par l'autorité vétérinaire nationale, aux fins de prévention, de lutte et d'éradication des maladies animales, et de déclarer ces dernières, aux autorités administratives locales .

En cas d'inexécution des mesures et injonctions édictées dans les délais impartis, les opérations prescrites sont réalisées d'office sous l'égide de l'autorité vétérinaire nationale, sans préjudice d'autres poursuites pénales, notamment celles prévues aux articles 415 et 416 du code pénal .

Les dépenses encourues sont à la charge des assujettis contrevenants.

**Art.61.** - Les présidents des assemblées populaires communales (A.P.C ) doivent aviser, d'urgence, le wali et l'autorité vétérinaire nationale, de tous les cas d'épizootie qui leur sont signalés sur le territoire de leur commune.

Ils peuvent prendre les mesures provisoires qu'ils jugent utiles pour arrêter la propagation de la maladie .

**Art.62.** - L'exposition, la vente, la mise en vente ou le don des animaux atteints ou soupçonnés d'être atteints de maladie contagieuse sont interdites .

Le propriétaire ne peut se dessaisir de ces animaux que dans les conditions déterminées par voie réglementaire qui fixe, pour chaque espèce d'animaux et de maladies, le temps pendant lequel l'interdiction de vente s'applique aux animaux qui ont été exposés à la contagion .

**Art.63.** - Les entrepreneurs de transport qui ont transporté des animaux sont tenus, en tout temps, de désinfecter, dans les conditions prescrites par voie réglementaire, les véhicules qui ont servi à cet usage, ainsi que les étables, les écuries, quais et cours où les animaux ont séjourné .

**Figure 13** : Loi 88-08 du 26 janvier 1986- de l'article 58- 63.

## 7. ETHOLOGY AND WELFARE OF HERBIVORES, POULTRY, DOGS AND CATS

### 7.1. ETHOLOGY AND WELFARE OF HORSES

Equine ethology is the study of their natural behavior, taking into account their biological, social, and environmental needs. Understanding horse behavior is essential to ensure their welfare, as it allows adaptation of care and training to their instincts and natural lifestyle.

#### 7.1.1. Ethology of the horse

##### *A. Social behavior*

Horses are **social animals that live in groups**. In a natural group, they establish a hierarchy and strong bonds, particularly for protection against predators.

They communicate through subtle signals (**facial expressions, postures**, etc.) and use **body language** to **avoid conflicts**. Social bonds and the need for interaction are very important for their mental balance.

##### *B. Feeding behavior*

In nature, horses spend a large part of their day **grazing**, approximately 16 hours per day. Their digestive system is adapted to this prolonged and **continuous grazing behavior**.

In captivity, it is important to respect this feeding pattern by offering them forage in small quantities throughout the day to **prevent** digestive problems and stress.

##### *C. Locomotor behavior*

Horses need to **move regularly** to maintain their physical fitness and mental health. In nature, they cover **long distances** each day in search of food and water.

This need for movement is important for their welfare, as **sedentariness** can lead to **health problems** (colic, muscular disorders) and stereotyped behaviors.

***D. Flight behavior***

In nature, horses are considered **prey animals**; they have an **instinctive flight behavior** when they feel threatened.

Horses are **anxious animals**, very **sensitive to environmental stimuli**, and prefer to **avoid danger rather than confront it**.

This flight instinct influences their reaction during training or when facing stressful situations. Understanding this reflex is crucial to avoid undesirable behaviors and to build a relationship of trust with them.

***E. Stereotyped behaviors***

In captivity, some horses develop **stereotyped behaviors** (cribbing, wind-sucking...) in reaction to stress, boredom, or an inadequate environment (see practical work handbook AW-Chapter 4).

These behaviors are often signs of poor welfare and can be prevented or mitigated through improvements in their management (environmental enrichment, exercise, socialization).

Equine ethology is essential for improving their management in captivity, their training, and their general welfare.

***F. Communication***

Horses communicate with each other through various means: vocalizations (whinnying, grunting), body language (ears, tail, posture), and touch (scratching each other to reinforce social bonds, grooming).

***F.1. Visual communication***

Visual communication in horses is essential for their **social interactions** and **survival**. As prey animals living in groups, horses use complex body language to express their emotions, their intentions, and establish hierarchies without needing to resort to aggressive behaviors.

### *a. Ear position*

Ear position is one of the most significant visual signals in horses.

#### **Example:**

**Ears forward:** sign of curiosity, interest, or alertness.

**Ears backward:** sign of irritation or aggression, especially if they are pinned back against the head.

**Mobile ears:** when a horse moves its ears in different directions, this indicates that it is attentive to its environment and to different stimuli.



**Figure 14: Different ear positions**

1- Communication between conspecifics: 2 lively, interested, but confident horses.

2- Ears completely oriented backward: angry horse, be careful.

3- Ears laid back: wary horse, proceed gently.

4- Ears tilted forward: confident horse.

5- Ears pointed forward: the horse is focusing all its attention on what it is looking at.

### *b. Facial expression*

Horses communicate through subtle facial expressions that reflect their emotions and intentions.

**Dilated nostrils** are often an indicator of **stress** or **vigilance**.

A **closed mouth with tight lips** may indicate **discomfort**, **irritation**, or **anxiety**.

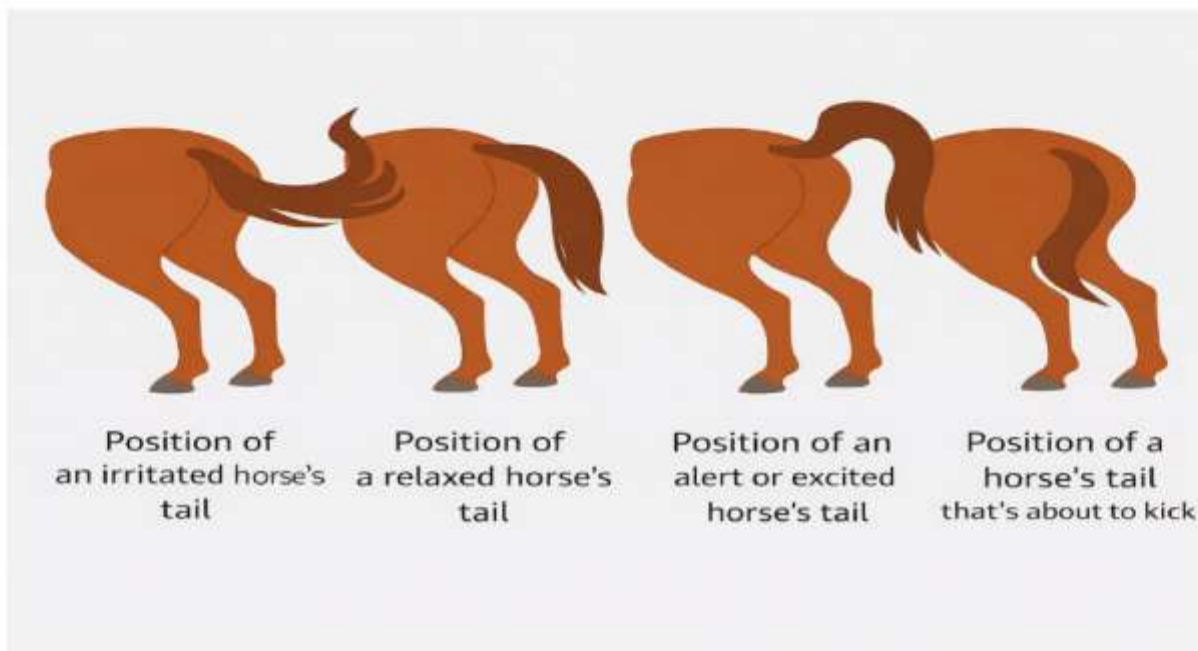
A **half-closed and relaxed eye** indicates **relaxation**, while a **fixed stare** or **wide-open eyes** signal **worry** or **excitement**.

### c. Body and tail posture

The general body posture (position) constitutes an important visual indicator.

A **tense body with head held high** often **reflects a state of alertness**, vigilance, or wariness.

In **excited or alert horses**, the **tail is generally held high**. In contrast, a **low and still tail** may signify a **state of calm**, while a **tail lowered between the legs** often indicates **fear or submission**.



**Figure 15:** Different positions of the horse's tail

### d. Body language during social interactions

In a group, horses communicate their position in the hierarchy through their body language. For example, a dominant horse may force another to move away by advancing directly toward it, while the subordinate horse moves away to avoid any conflict.

### F.2. Auditory communication

Sound communication in horses is crucial for their social life, safety, and interactions with humans, as it allows them to transmit important information, particularly at a distance. These vocalizations are specific to social contexts, alerts, or mare-foal interactions.

*a. Neighing or whinnying*

Neighing is one of the most recognizable vocalizations of horses. It can indicate **anxiety**, **loneliness**, or a **need to gather the group**. It is often emitted when **horses are away from their conspecifics** or **their habitat**.

*b. Snorting*

Snorting is a vocalization often associated with **curiosity** or **a form of excitement**. Horses often snort when they are in an **unfamiliar environment** or when they **encounter new stimuli**.

*c. Nicker (soft call or grunt)*

The nicker is a soft vocalization used by horses to interact with their companions or to communicate with humans, especially when they are expecting food, and it is frequently heard during reunions between familiar horses or between a mare and her foal.

*d. Blowing (strong breath)*

Blowing is a sound produced by rapid **expulsion of air through the nostrils**, often used to **express an emotional state** (frustration, anger) or signal **danger** (alert other group members of a potential threat, a stressful situation).

*f. Squeal*

The squeal is a **rarer** and **more intense vocalization**, often emitted **during confrontations**. They are often associated with **aggressive interactions** (rival horses), as a **warning** or **manifestation of pain**.

It is also heard when horses are competing, particularly during the **breeding season**.

*F.3. Olfactory communication*

Olfactory communication in horses plays a key role in **individual identification**, **territory recognition**, and **social interactions**, particularly in **sexual relationships** (assessing the reproductive status of females) and **hierarchical relationships**.

**a. Social identification**

Horses can recognize their conspecifics and identify individuals in their group through smell.

Each horse has a **unique body odor**, which is used to **distinguish group members, even at a distance**.

Horses have scent **glands on the forehead**, which **secrete substances** to communicate their identity and social status.

This olfactory recognition allows horses to greet each other, establish trust relationships, and maintain group cohesion.

**b. Flehmen behavior**

Flehmen behavior is a characteristic reaction in horses, which consists of **raising the upper lip to expose the teeth, while inhaling**.

- This behavior allows horses to direct odors toward **the vomeronasal organ** (Jacobson's organ), specialized in **detecting pheromones**.
- This behavior helps **gather information about the reproductive status of mares** and **the pheromones present in their urine**.
- Olfaction plays a **crucial role in sexual communication** in horses, particularly in **the recognition of females in heat (or estrus) by males**.
- Mares in heat emit specific olfactory signals (pheromones released in urine) that attract stallions.
- Therefore, stallions are capable of detecting these pheromones from afar, and they use Flehmen behavior to confirm the mare's status.
- Flehmen is also observed when a horse **encounters a new odor**, which suggests an **olfactory exploration function**.



**Figure 16 :** Flehmen behavior

***c. Territorial marking and space recognition***

Although horses are not as territorial as some other species, they use scent to mark and recognize spaces.

For example, horses leave olfactory traces by **urinating** or **defecating in certain areas**.

Horses often sniff the excrement of others to gather information, particularly about identity, sex, and even the social status of the individual.

This marking helps organize interactions within the group, allowing horses to inform themselves about the presence and passage of other individuals.

***d. Exploration and vigilance behavior***

Horses also use their sense of smell to explore their environment and detect potential threats. They often sniff objects, people, and unfamiliar places to ensure they do not present danger.

***F.4. Tactile communication***

Tactile communication is essential to social interactions in horses, as it reinforces social bonds and establishes hierarchy within the group.

Horses use different types of physical contact, such as **rubbing**, **head bumping**, and **gentle biting**, to express their emotions and intentions.

**a. Mutual grooming**

This behavior of gently nibbling the neck and back reinforces friendship bonds and helps reduce stress within the group.

**b. Touch during greetings and play**

Horses also use touch to greet their conspecifics. Gentle contact with **the muzzle** or **flanks** often serves to **establish a friendly bond** or to **invite another horse to play**.

**c. Hierarchy adjustment**

Physical contacts, such as **gentle bites and head bumps**, play an important role in defining group hierarchy by **signaling submission and dominance relationships**.



**Figure 17:** Tactile communication in horses

### 7.1.2. Equine welfare

The emergence of the notion of equine welfare appeared around the 18th century when emotionality increasingly came into account in relationships maintained with animals.

At the beginning of the 20th century, England experienced the "Horse Welfare" movement, which gave birth to the International League for the Protection of Horses.

Then in 1970, the United States developed the first law that criminalizes and penalizes painful acts toward horses through two civil and criminal sanctions. In recent years, the place occupied in society by the horse has been radically transformed.

Today, the horse is a living being whose dignity, intrinsic value, and natural needs are respected, but whose utility and use must, at the same time, fulfill human aspirations during leisure activities and equestrian competitions.

The assessment of animal welfare in horses is based on animal-based indicators (outputs) and environment-based indicators (inputs).

#### *A. Animal-based indicators*

##### *A.1. Physiological indicators*

Measuring cortisol in blood, which is an indicator of stress. Elevated levels may indicate suffering and poor welfare.

##### *A.2. Behavioral indicators*

✓ Observation of natural behaviors, such as grazing, play, and social interaction. ✓ Possibility for the horse to come into contact with its conspecifics, to touch them freely (visual, auditory, and olfactory contacts). ✓ Possibility for the horse to be free in its movements (able to trot, gallop...). ✓ Assessment of responses to environmental stimuli (sound, light, movement) to detect signs of anxiety or stress. ✓ Observation of abnormal behaviors (isolation, stereotypies) that may indicate frustration or distress.

##### *A.3. Health indicators*

Identification and management of common diseases in horses, particularly colic, digestive disorders, respiratory infections, and musculoskeletal problems. Observation of gait and physical activity to detect possible signs of pain or lameness.

#### ***A.4. Zootechnical indicators***

- Body condition score (BCS): Use of a scale to assess the horse's body condition, which indicates whether it is underfed, well-fed, or overweight. An appropriate BCS is essential to maintain good health.
- Monitoring of appetite and forage and water consumption. Changes in eating habits may indicate health problems.

#### ***B. Environment-based indicators***

##### ***B.1. Housing conditions***

- Sufficient space to allow free movement and the presence of enriching elements (toys, structures) that promote natural behaviors.
- The dimensions and height of stalls must be adapted to the horse's size.
- Clean bedding in sufficient quantity.
- Access to adequate shelter for protection from bad weather.
- Ensuring thermal comfort.

##### ***B.2. Feeding and watering***

- Quality and accessibility of food: Diet adapted to the horse's nutritional needs, constant availability of forage, and provision of clean water ad libitum.
- Feeding practices: Assessment of feeding practices to minimize stress and promote natural behavior (grazing rather than stall feeding).

**Table 10:** Welfare indicators usable in horses

<b>4 Main Principles</b>	<b>12 Criteria</b>	<b>Indicators</b>
<b>Appropriate Nutrition</b>	Adequate nutrition	Body condition score
	Absence of prolonged thirst	Water: available and clean
<b>Appropriate Housing</b>	Comfort for resting	Bedding: quantity, cleanliness, and stall size
	Thermal comfort	For horses kept outdoors
	Ease of movement	Frequency and duration of exercise
<b>Good Health</b>	Absence of injuries	Skin lesions, swollen joints, lameness, prolapse
	Absence of diseases	Coat condition, ocular/nasal/vulvar discharges; feces consistency; abnormal respiration, coughing
	Absence of pain	Facial grimace scale*, neglect of hoof care, injuries at the corners of the lips
<b>Appropriate Behaviour</b>	Expression of social behaviours	Social interactions
	Expression of other species-specific behaviours	Stereotypies; fear tests
	Good human–horse relationship	Human–animal relationship tests (voluntary approach, forced human approach)
	Positive emotional state	Qualitative behavioural assessment (currently under scientific evaluation)

## 7.2. ETHOLOGY AND WELFARE OF CATTLE

### 7.2.1. Ethology of cattle

Cattle ethology is the study of the behavior of these animals, which allows better understanding of their needs, their social interactions, and the factors influencing their welfare.

#### *A. Social behavior*

Cattle are gregarious animals: avoid completely isolating an animal from the rest of the herd (at minimum visual contact) in order to limit stress. Cattle are social animals that generally **live in groups**. They form social hierarchies based on interactions between individuals for behavior regulation, stress reduction, and maintenance of social bonds.

#### *B. Feeding behavior*

Cattle spend a **large part of their time grazing**. When they rest, they **practice rumination**. Their feeding behavior is influenced by food availability, grass quality, and environmental conditions.

#### *C. Flight and aggression behavior (Stress responses)*

Cattle can adopt **flight behaviors** when they **feel threatened**.

They can also **show aggressive behaviors** in response to **social or environmental challenges**.

#### *D. Communication*

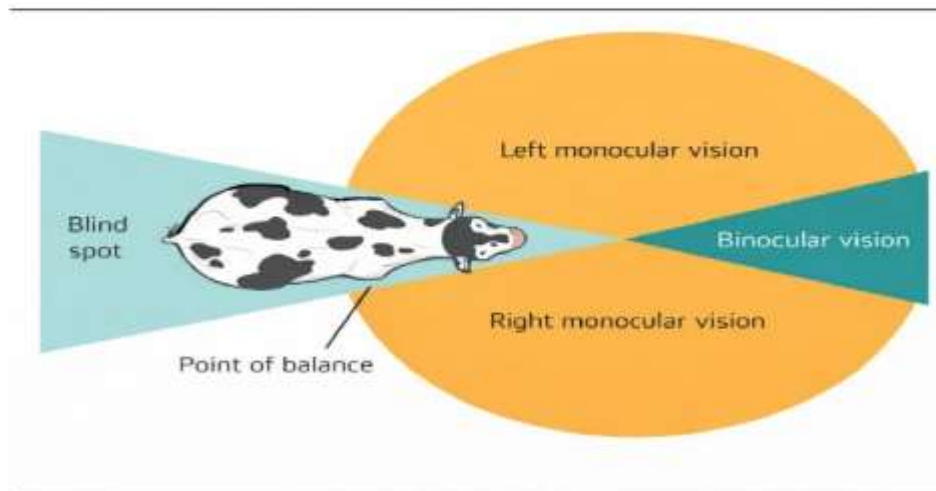
Communication in cattle relies on several channels, notably **visual, sound, and tactile communication**. Each of these modes of communication plays an essential role in social interactions, welfare, and herd behavior management.

##### *D.1. Visual Communication*

Visual communication in cattle manifests through various signals that can **transmit information** about the animal's **emotional state, its social status, and its intentions**.

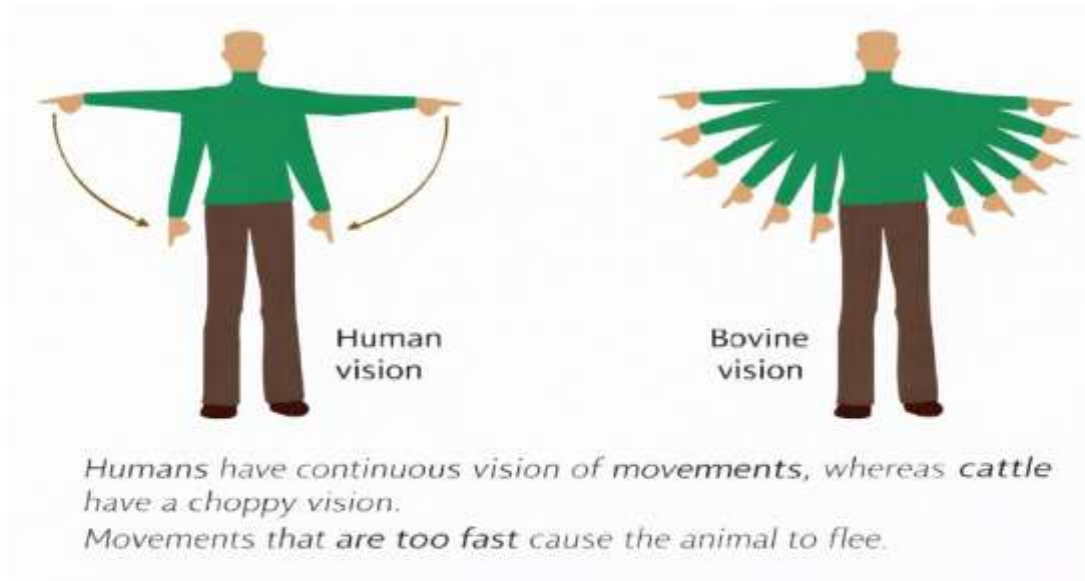
- Posture and movement: The way a bovine moves or positions itself can indicate feelings of dominance or submission.
- Facial expressions: Facial expressions, including ear orientation and eye opening, can indicate emotions such as fear, curiosity, or aggression.

- In cattle, 70% of sensory information comes from sight. However, their vision is different from ours, and they have two blind spots: one extends from **the back line to the hips** (forming a funnel at the rear of the animal) and the **other is located under the muzzle**. Moreover, these blind spots move with head movement.

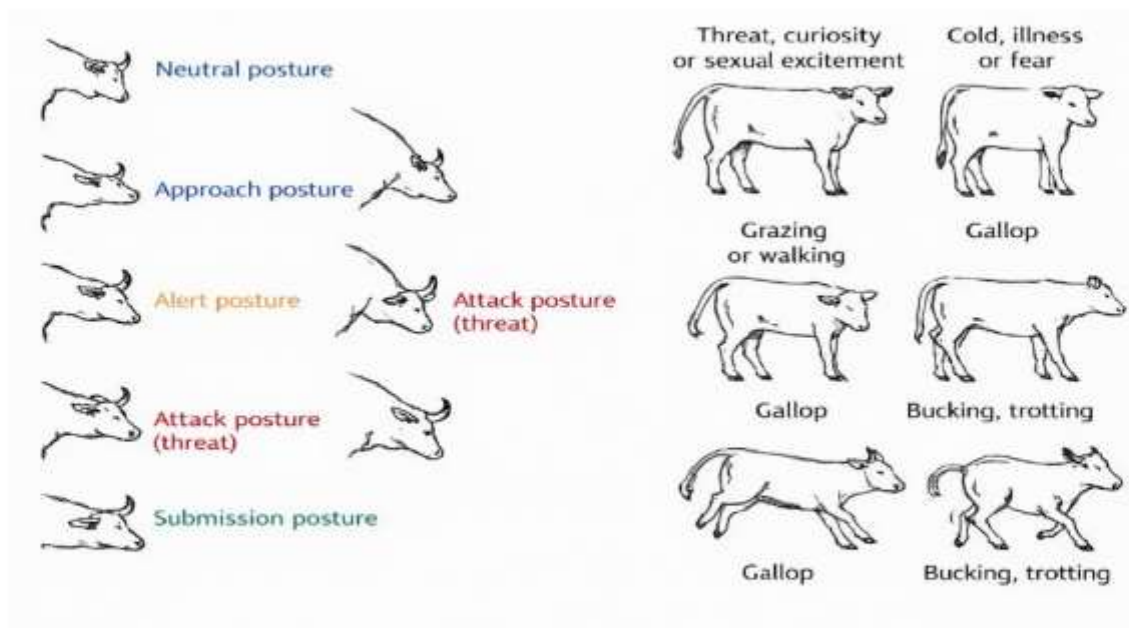


**Figure 18:** Field of vision in cattle

- Cattle see several successive images. Any rapid movement by the farmer, or even by the herding dog, will be a source of stress.



**Figure 19:** Perception of movements in humans and cattle (jerky vision, cattle perceive a series of images whereas humans perceive a film)



**Figure 20:** Head and tail posture in cattle

### ***D.2. Sound Communication***

- Cattle use a variety of vocalizations to communicate, which can express emotions, signal needs, or establish social relationships within the group.
- Cattle produce different types of sounds, such as **moos**, **grunts**, and **bleats**, each having a different meaning depending on the context.
- Stress or call vocalizations: Call cries can signal distress or separation from a group member.
- Cattle hearing is more acute than that of humans. They orient their ears toward the source of noise and are sensitive to ultrasounds. Also, their reactions to noise can be lively and unpredictable. The cow is capable of discerning sounds, voices, and quickly becomes accustomed to familiar sounds (tractors, gates, head locks, milking parlor...).

### ***D.3. Tactile Communication***

- Tactile communication can include behaviors such as licking, body contact, and affectionate gestures.
- Licking and grooming reinforce social bonds and reduce stress within the herd.
- Cattle can rub against each other to establish social connections or to ease tensions.



**Figure 21:** Grooming behavior

#### *D.4. Olfactory communication*

Cattle's sense of smell is **better developed than that of humans**. Olfaction is an important function for exploration and communication: **it allows recognition of conspecifics and the farmer by their body odors**. It also allows cattle to **be informed** about the **stress state of a conspecific**, through **pheromones secreted in urine and dung**.

The vomeronasal organ (Jacobson's organ) located in **the oral cavity** allows cattle to **detect other olfactory signals**, such as **chemical messenger pheromones** present in **urine, feces, and sweat**.



**Figure 22:** Flehmen response in a bull

### 7.2.2. Cattle welfare

The assessment of animal welfare in cattle is based on an integrated approach that takes into account both indicators related to the animal itself and to its environment.

#### *A. Animal-based indicators*

##### *A.1. Physiological indicators*

Assessment of **cortisol levels** and other hormones can provide information on the stress level in cattle. Elevated levels may **signal unsuitable living conditions**.

##### *A.2. Behavioral indicators*

Observation of social behaviors, such as grooming and play, which are indicative of good welfare. The presence of stereotyped behaviors, which can indicate welfare problems.

##### *A.3. Health indicators*

- Health-related parameters, such as the rate of respiratory and digestive diseases, as well as lameness, are also important welfare indicators.
- A **low disease rate** in cattle **often indicates a good level of welfare**, as healthy cattle show better resistance and increased capacity to produce.
- Example: Lameness is often associated with housing, feeding, or management problems that can cause stress and impair animal welfare.
- Morbidity rate and mortality rate.

##### *A.4. Zootechnical performance indicators*

Cattle welfare indicators based on zootechnical performance include several observable criteria related to weight, production, and reproduction.

- Body condition score (BCS): to assess whether the animal is feeding properly.

They are often used as indirect indicators of animal welfare; as optimal performance suggests that the fundamental needs of cattle are well addressed.

#### **- Production indicators (growth and milk yield):**

- Production indicators, such as growth rate, slaughter weight, and milk production, are fundamental parameters for assessing cattle welfare.

- **Rapid growth and high milk yield** generally indicate **that animals are well-fed and healthy**.
- Conversely, zootechnical performance **below average** may **signal nutritional deficiencies, stress, or inadequate living conditions**.
- Indeed, the living environment (temperature, stocking density, quality of care) directly influences cattle's ability to express their productive potential.

#### - **Reproduction indicators**

- Reproductive disorders, such as delayed conception and embryonic mortality, can indicate stress, inadequate nutrition, or non-optimal environmental conditions.
- Research shows that welfare conditions directly impact reproductive capacity, where unfavorable conditions can affect hormones responsible for reproduction.
- Optimal fertility often reflects favorable living conditions and balanced feeding.

### **B. Environment-based indicators**

#### **B.1. Feeding and watering**

- Verification of the quantity and quality of food provided and permanent accessibility to clean water.
- Sufficient number of feeders and waterers.

#### **B.2. Housing conditions**

- Available space: Assessment of living area per animal (number of animals/area), which must allow free movement and natural behavior.
- Air and floor quality: Monitoring of cleanliness and ventilation in livestock buildings, as well as access to appropriate flooring, bedding quality.

#### **B.3. Good farming practices and cattle handling**

Cattle handling, care, transport...etc.

### 7.3. ETHOLOGY AND WELFARE OF POULTRY

#### 7.3.1. Ethology of poultry

Understanding poultry behavior and communication is crucial for improving their welfare in farming environments.

These behaviors include complex social interactions, communication signals, as well as feeding and reproductive habits.

##### *A. Social behaviors and dominance hierarchy*

- Poultry, particularly hens, form structured social groups with a dominance hierarchy or "pecking order."
- This hierarchy helps minimize conflicts by establishing a clear social order, where each individual knows its position.
- This natural behavior is often disrupted in intensive farming systems, where restricted space prevents the stable formation of this hierarchy and leads to excessive aggression.
- These social conflicts, amplified by high stocking density, can cause stress and affect poultry productivity and health.

##### *B. Vocal and visual communication behaviors*

- Poultry use a range of vocalizations and visual signals to communicate with each other.
- The hen produces different calls depending on its mood: it clucks, cackles, and also uses various postures to show anger, dominance, fear, or curiosity.
- Hens produce different types of calls to alert others to the presence of a predator or to signal the discovery of food.
- Studies have shown that these vocalizations are specific and include "contact calls" and "warning cries," which help maintain group cohesion and ensure survival.
- Turkeys, for their part, also use vocal signals to establish their social position and reduce aggression.

**C. Exploratory and foraging behaviors**

- Poultry show natural exploratory behaviors, such as ground scratching and pecking, which allow them to search for food and explore their environment.
- These behaviors are essential for their psychological welfare, as they reflect survival instincts.
- In industrial farms, the absence of substrate to peck and confinement limit these natural behaviors, leading to abnormal pecking behaviors, such as feather pecking. For this reason, enriching environmental devices, such as scratching materials, are increasingly used to satisfy these natural needs.

**D. Hen postures**

- A hen searches for food by lowering its head toward the ground and raising it from time to time to watch for dangers around it.
- When taking a dust bath, it lies down, spreads its wings and feathers to cover itself with dirt and eliminate parasites.
- To protect its chicks, it spreads its wings and tail to hide them and lies down on them.

**E. Reproductive and nesting behaviors**

In laying hens, nesting behavior is a strong biological need. They seek a safe and isolated place to lay their eggs, and lack of access to nests can lead to stress and abnormal behaviors.

Studies show that hens stressed by the absence of suitable nests present signs of distress, such as vocalizing more frequently and moving erratically.

**7.3.2. Poultry welfare**

Poultry welfare indicators are divided into two main categories: those based on the animal, which directly measure the physical and psychological state of the birds, and those based on the environment, which assess living conditions and their adequacy to poultry needs.

**A. Animal-based indicators**

Animal-based indicators include physical and behavioral observations allowing assessment of poultry health, comfort, and psychological welfare.

- For example, assessment of body condition, injuries, and plumage problems are commonly used signs to identify welfare problems.
- Poultry presenting foot injuries, eye infections, or damaged plumage are often subjected to stress or overcrowding conditions.
- Moreover, natural behaviors, such as scratching, pecking, and dust bathing, are important indicators of poultry welfare.
- Their absence can be a sign of stress or frustration related to an inadequate environment.
- Social behaviors, such as feather grooming, can also be welfare indicators.
- For example, feather pecking, when excessive, is often caused by stress due to stocking density or lack of environmental enrichments.
- These behaviors, if frequent, can cause injuries and signal poor welfare.

## ***B. Environment-based indicators***

### ***B.1. Proper housing***

- Stocking density is a critical environmental factor: high density can cause stress, limit movements, and prevent expression of natural behaviors, which harms bird welfare.
- Air quality, particularly ammonia levels, also has a direct impact on poultry respiratory health.
- High ammonia levels, resulting from droppings degradation in poorly ventilated spaces, can irritate poultry eyes and respiratory tracts and lead to infections.
- Environmental enrichments, such as providing substrates for pecking, perches, and dust baths, allow poultry to perform natural behaviors, thus reducing signs of frustration and improving their welfare.

### ***B.2. Feeding and watering***

The availability and accessibility of resources, such as food, water, perches, and nests, are also essential for poultry welfare.

## 7.4. ETHOLOGY AND WELFARE OF CATS

### 7.4.1. Ethology of the cat

The ethology and communication of domestic cats, although less obvious than those of group animals, comprise a complex set of vocal, visual, and tactile behaviors that allow them to communicate with other cats, humans, and their environment.

Understanding these behaviors helps decode cats' emotions and needs, thus improving their welfare.

#### A. Social and territorial behaviors

- Cats are territorial animals that **establish personal domains**, where **they mark their space** through behaviors such as **rubbing, scratching, and urine spraying**.
- These markings have a communicative function, as they **deposit pheromones** that **signal their presence to other cats**.
- **Pheromones allow cats to distinguish their conspecifics**, recognize family members or intruders, and **assess the emotional or reproductive states of other cats**.
- Example: head rubbing against objects, humans, or other cats releases **facial pheromones** associated with calming messages, **signaling a secure environment**.
- **Scratching**: is a form of visual and olfactory marking, where paw glands release pheromones on the scratched surface to claim their territory.



**Figure 23:** Marking by cats

### B. Play behaviors and interactions with humans

- Cats often manifest their affection toward humans through behaviors such as rubbing, kneading, and play.
- Kneading, where the cat alternately presses its paws on a surface, is an instinctive behavior that goes back to childhood and often indicates comfort and attachment.
- Cats also form specific bonds with their owners and adapt their communication behaviors to capture their attention, thus reinforcing positive interactions between humans and cats.

### C. Body language

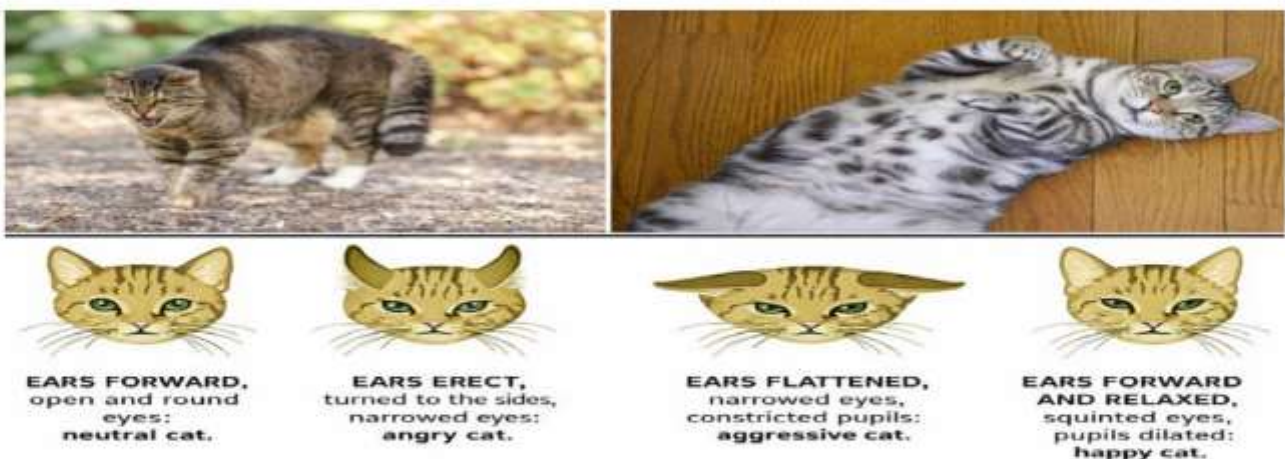
Body language is essential in feline communication.

Body postures, tail position, and facial expressions convey information about the cat's emotional state.

#### Examples:

- A high, straight tail often indicates a friendly approach, while a puffed-up tail in a low position may signal fear or aggression.
- Ears pointed forward and constricted pupils often show curiosity or relaxation, while flattened ears and dilated pupils signal fear or defensiveness.

This body language helps cats avoid direct conflicts and maintain a stable environment.



**Figure 24:** Body language and facial expression in cats

***D. Vocal communication***

- Cats use different sounds to communicate with humans and, to a lesser extent, with other cats.
- Meows, purrs, hisses, and growls are means for cats to transmit their needs, emotions, and intentions.
- Meows, although uncommon between cats themselves, are often used to attract human attention, indicating a request or need.
- Purring is a complex behavior that can signal comfort, but can also be a means of self-control or calming in stressful situations.

***E. Vision in cats***

**Night vision:** Cats possess excellent night vision, far superior to that of humans. Their retina contains a large quantity of rod cells sensitive to low light, allowing them to see well in darkness. A reflective layer called the tapetum lucidum amplifies captured light, improving their ability to detect faint movements in low-light conditions.

**Color perception:** Unlike humans, cats have limited color vision. Although they perceive certain colors such as blue and green, their ability to distinguish reds and oranges is weak, making them somewhat dichromatic.

**Wide field of vision:** Thanks to their large eyes and frontal position, cats have a field of vision of approximately 200 degrees, with good depth perception, useful for hunting and capturing prey. They perceive rapid movements well, even at a distance.

**Light adaptation:** Cats can adjust their vision to adapt to varying light levels thanks to a vertical pupil that contracts and dilates rapidly. This allows them to reduce glare in broad daylight and optimize their vision in dark places.



**Figure 25:** Types of pupils and their adaptation to light

#### ***F. Hearing in cats***

**Extended auditory capacity:** Cats have a hearing range from 20,000 Hz to 40,000 kHz, which allows them to hear sounds well beyond the frequencies perceived by humans and even beyond the range of dogs.

This ability is useful for detecting high-pitched sounds produced by small prey, such as rodents.

**Mobile ears and orientation:** Cats' ears can rotate 180 degrees, allowing them to precisely locate sounds coming from different directions.

This mobility allows better determination of the distance and location of sounds, thus improving their hunting abilities.

**Communication and specific sounds:** Cats produce high-frequency sounds, often inaudible to the human ear, such as purring.

These sounds play a role in their communication with other cats and even in capturing human attention.

## 7.4.2. Cat welfare

### *A. Animal-based indicators*

**A.1. Health indicator:** Good physical health is a key indicator of welfare. Signs of illness, such as change in appetite, vomiting, or behavioral problems, can indicate stress or poor welfare in cats.

**A.2. Natural behaviors:** Expression of natural behaviors, such as scratching, play, and grooming, is essential for assessing welfare.

The absence or reduction of these behaviors may signal welfare problems, often related to inadequate living conditions.

**A.3. Social behavior:** Social interactions with humans and other animals are also welfare indicators. A cat that actively seeks to interact or that manifests signs of pleasure (such as purring) generally indicates a good level of welfare.

**A.4. Stress reactions:** The way a cat reacts to stressful situations, such as loud noises or the presence of strangers, can be an indicator of its emotional welfare. Behaviors such as withdrawal, refusal to eat, or excessive vocalizations may indicate high stress.

### *B. Environment-based indicators*

**B.1. Habitat quality:** An appropriate environment, including secure resting spaces, hiding places, and climbing areas, is essential for cat welfare. Enriched environments promote expression of natural behaviors and reduce stress.

**B.2. Access to resources:** Access to essential resources, such as food, water, and clean litter boxes, is crucial. Studies show that dissatisfaction related to access to these resources can increase stress and affect cat behavior.

**B.3. Population density:** Population density in the home or environment is also a factor. Overcrowding can lead to conflicts between cats, increased stress, and undesirable behaviors, such as urine marking.

**B.4. Interaction with humans:** The quality of interactions between cats and their owners is an important indicator. Positive interactions, such as play and petting, can improve the cat's overall welfare, while isolation or negative interactions can harm its welfare.

## 7.5. ETHOLOGY AND WELFARE OF THE DOG

Dogs descend from wolves and were domesticated approximately 15,000 to 30,000 years ago. This domestication led to significant behavioral changes, making them more sociable and adaptable to life with humans.

### 7.5.1. Ethology of the dog

Dogs are social animals that often live in groups. Their social behavior is influenced by their social structure, which may include a hierarchy dominated by one or more individuals.

Dogs communicate with each other through a variety of signals, including vocalizations, body postures, and facial expressions. Submission and aggression signals are particularly important in their interactions.

#### *A. Dog communication*

**A.1. Vocalizations:** Dogs use different vocalizations, such as **barks, growls, and whines**, to communicate. Each type of vocalization can have various meanings.

Example: a high-pitched bark can signal excitement or alarm, while a growl can indicate a threat or discomfort.

**A.2. Body language:** Body signals play a crucial role in canine communication. **The position of ears, posture, and tail movement** are essential elements.

Example: A high, **wagging tail can indicate joy**, while a **tail between the legs can signify fear or submission**.

**A.3. Facial expressions:** Dogs can express a variety of emotions through their facial expressions.

Example: a dog showing its teeth may be threatening, while a dog with relaxed eyes and face may be happy and calm.

**A.4. Eye contact:** Eye contact is an important aspect of communication in dogs. Prolonged eye contact can be perceived as a challenge or threat, while more relaxed contact is often associated with friendly interactions.

#### *B. Appeasement behaviors*

Dogs use appeasement behaviors to reduce tensions and defuse conflicts. These behaviors can include lip licking, looking away, or turning to the side.

**C. Play behavior**

Play is an important form of communication in dogs, often used to establish social bonds and express excitement.

Play signals, such as tail wagging and joyful barking, often indicate an intention to play rather than to aggress.

**D. Interactions with humans**

Dogs are particularly skilled at reading human signals, including gestures and facial expressions. They can follow visual cues, such as finger pointing.

**7.5.2. Dog welfare****A. Animal-based indicators**

**A.1. Health indicators:** Good health is a fundamental indicator of welfare. Signs of illness, such as loss of appetite, lethargy (lack of activity), or behavioral changes, can indicate stress or health problems.

**A.2. Natural behaviors:** A dog's ability to express natural behaviors such as play, exploration, and grooming is crucial. A lack of activity or stereotyped behaviors can be indicators of poor welfare.

**A.3. Social interactions:** Positive interactions with other dogs and humans are welfare indicators. A dog that seeks to interact and displays friendly behaviors, such as play or physical contact, generally shows a good level of welfare.

**A.4. Stress reactions:** The dog's responses to stressful stimuli (such as loud noises or changes in environment) can indicate its level of emotional welfare. A dog that hides, barks excessively, or adopts flight/aggression behaviors may be in distress.

**B. Environment-based indicators**

**B.1. Adequate environment:** An enriched habitat, including toys, exploration areas, and social interactions with other dogs and humans, is essential for welfare. Enrichment reduces stress and promotes expression of natural behaviors.

**B.2. Access to essential resources:** Access to food, water, and appropriate resting places is fundamental. Inadequate living conditions, such as limited access to these resources, can lead to abnormal behaviors and increased stress.

**B.3. Personal space:** The need for personal space is crucial for welfare. An overcrowded environment can lead to conflicts between dogs, higher stress levels, and undesirable behaviors.

**B.4. Positive human interactions:** The quality of interactions with humans, such as play, petting, and training, is an important indicator of welfare. Positive interactions can strengthen the human-animal bond and improve the dog's quality of life.