PSYCHIC STRESS AND ANIMAL WELFARE IN DAIRY CATTLE PRODUCTION

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Abstract:

The animal welfare, the animal protection organizations claim to be sustained, is treated as a psychical state induced by the psychic stress. Understanding of animal psychic stress requires a sensible treatment of the knowledge concerning the brain physiology. The answers to stress differ with the species, the breed, the category, the physiological state and the nervous type of the individuals. In dairy cattle psychical stress may cause alterations of the animal welfare associated with poor health and conducting to financial losses and lower labor productivity. But it is very difficult to appreciate how costly is dairy cows to experience the psychical stress. There are also claims that the organic synthesis taking place under stress condition is resulting in undesirable components for a safe human food. So, some causes of psychic stress and the way to avoid it in dairy cattle are discussed. It is concluded that animal welfare in dairy production is more a veterinary medicine question than a humanitarian one.

Key words: *central nervous system; dairy cattle; farm management; housing system; stress;*

INTRODUCTION

"Animal protection" is a social movement initiated mostly by old ladies fond of their company animals. They thought, and they were right, that having a brain, dogs, cats, cage birds and generally speaking all vertebrate animals suffer like humans of pain, distress, fear or invalidity. Since some bad educated people don't understand these true, they have fought to have good laws obliging for animal protection.

To ask for good laws it is easy but to write such laws is rather difficult. There for veterinarians and other people involved in animal sciences (3, 4, 5) developed the concept of "animal welfare" intending to show and if it is possible to grade or measure the physiological processes causing animals to suffer pain, distress, fear or invalidity in a given moment.

In order to understand the concept of "animal welfare" knowledge about the relation function of superior animals with the environment and the control of central nervous system upon the inner organism functions have to be considered. Among this knowledge special attention must be given to Seyle's theory of stress.

GNOSEOLOGIC FOUNDATION OF "RELATION FUNCTION" IN SUPERIOR ANIMALS

There is three of the objective reality existing outside human mind: Information, Energy and Substance.

Information is *perishable and reproduces*. The *contrary* is its unit of existence and the *bit* is unit of measure.

Energy means *movement* and has *entropy* (lost of movement) when transforms from one type of energy in other one. The *quanta* are its unit of existence and the Joule is unit of measure.

Substance has *mass*. The mass is conserve when kinds of substances are transformed in other kinds of substances (Lavoisier's law). The *molecule* is the unit of substances existence defining their quality and the gram is unit measuring their quantity of mass.

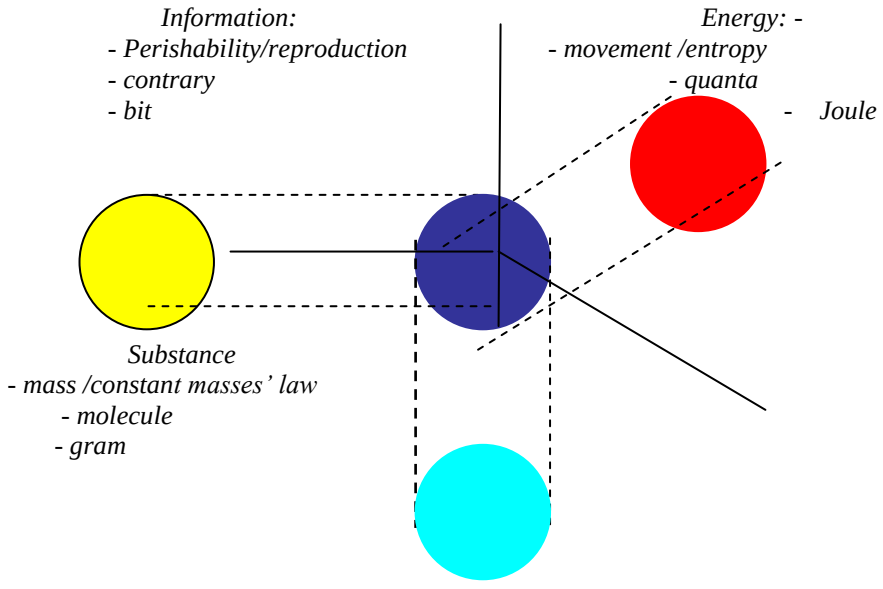
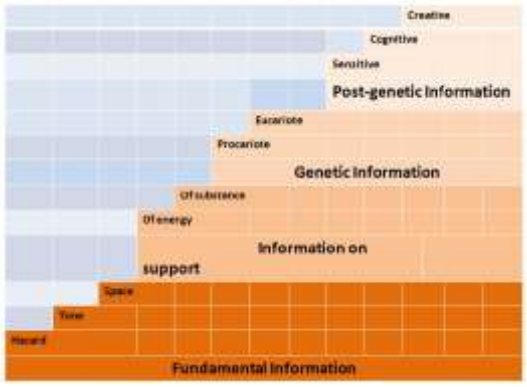


Fig. 1. Unity of existence (objective reality) in triadic thinking mode



Information has no movement and no mass and can exist both without and on energy or substance support. Energy is support of information but has no mass. Substance is support of information and is depositing energy both in their molecules and in the atoms formatting the molecule.

Figure 2. Evolved types of information

Information has evolved from the fundamental type of time and space to the information on support of energy or lifeless substance which perishes and reproduces by hazard together with its support and afterward to genetic information has as support kinds of organized
live substance whose perish and reproduction is done under the supported genetic information control. For a more precise reproduction of their live support cognitive information has been developed by the highly evolved genetic species. In humans information evolved up to the creative stage.

ABOUT THE NERVOUS ACTIVITY IN SUPERIOR ANIMALS

In order to save the live support of animal genetic species and to favor its reproduction, genetic information includes organisms' sensitivity as function of the nervous system. Thus organisms *fell* what is good or bad for its sake. There is sensitive information in cattle unperceived by the cognitive information, and there is also sensitive information recognized by the cognitive information able to *know* what is happening around.
The cognitive information of the cattle is a conscious one. It is made of associated reflexes part of them being innate, hereditary transmitted, as instincts and part of them formatted during the life as conditioned reflexes. The first ones are imprinted in the genetically information at the genom level. The last ones are fixed by the memory and are loaded as the individual knowledge. There are decent hypothesis supposing the memory mechanism at the cerebral neuron level is of the same kind with that of the genetic imprinting phenomenon consisting in methylization and dismethylization of some component bases of nucleotides.

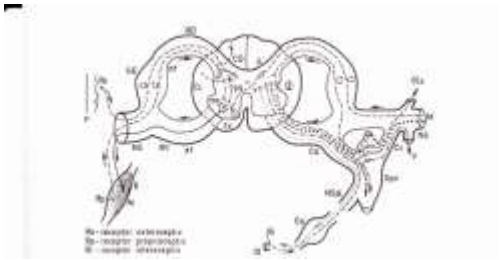


Fig.1. Vegetative and somatic reflex act (CD,CL,CV = dorsal,, lateral and ventral cords. mn – somatic motor neuron, v-vegetative effectors neuron, ps – polysynaptic reflex arc, RD- dorsal rachidian root, af – afferent way, RV – ventral rachidian root, ef – efferent way, NS – rachidian nerve, Ca – white communicant branch, Gpv – paravertebral ganglion, CC – gray communicant branch, Gls – from skin glands, V – to shin vessels, P – skin, M – muscle, Nspl – splanchnic nerve, OI – internal organ, GE – spinal ganglion, Gs – splanchnic ganglion GE – spinal ganglion 1.ventral horn, 2. – lateral horn) (after N. Constantin)

Thus there is a mental activity of fixing by memory new conditioned reflexes and using the innate and after birth obtained reflexes in the current life. There are so called motor reflexes inducing actions and inhibitor reflexes braking action. Reflexes might be expressed quickly or lately after stimulus action, they can be expressed strongly or feebly and with the same intensity both for motor and inhibitor reflexes or unbalanced in favor of one or other of them. These traits differ with individuals and determine the nervous types of animals (see table 1.)

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Nervous activity requires efforts and fatigue is inherent. The rest of the nervous system is received by sleep and by the satisfaction resulting at the end of some reflex acts. But there are also reflex acts finishing with unpleasant sensation like sour or fear. Thus in animal minds states of content or states or discontent install.

Table 1

Table1, Nervous types in superior animals

Nervous type	**Mobility**	**Intensity**	**Balance**	**Ability for life**
Choleric	*good*	*high*	*good*	+
Phlegmatic	*small*	*low*	*good*	±
Lymphatic	*small*	*low*	*inhibition*	-
Sanguine	*good*	*high*	*excitation*	±

Causes of animal mind discontent were disclosed by Seyle in his theory of stress. According to Seyle stress is a shock received by the nervous system. There is sensitive stress received a part of one or other of the sensitive organs. Stress of this type is caused by pain, sour, noise, dazzle, body balance lost. There is also psychic stress, received on the mind level, caused by distress, anxiety, unrest, anger. Effects of stress modify the physiological metabolic and hematological parameters of organisms. This is the scientific approach to evaluating animals' welfare.

CONCEPT OF ANIMAL WELFARE

"Animal welfare" concept is a new one and normally is not fully understood. Three main function are involved in animal physiology: the function sustaining relations of organisms with the environment by means of nervous system, the nutrition function covering the exchange of substances between organisms and the surrounding medium (metabolism) and the reproduction function ensuring the genetic species existence along the time. "Animal welfare" has to serve all of them. A non specific alteration of these functions might be caused by stress. Seyle, which has created the stress theory, has considered *stress as the sum of nonspecific alterations in animal physiology caused by functional disturbances or injures at organism level* (9). Also he said *intensity of stress could be appreciated by the degree of suffering and worn out state of organism (9).* That means stress intensity can be measured and found out. D. M. Broom (1, 2,3,4) has published valuable papers in this respect.

THE DAIRY CATTLE CASE

Dairy cattle are superior animals. They are vertebrates, homeostatic, mammals, herbivorous animal descendants of the wild biological species *Boss Taurus*, now disappeared that was support of a distinct genetic species. Dairy cattle, as well as beef cattle, preserved the molecular mechanism able to close their reproduction as genetic species but have changed the quantitative traits of their biological production as result of artificial selection they undergone. Dairy cattle are specialized to produce much milk as excreted production, beef cattle are specialized to produce meet (muscles) as deposited biological production. There are at present a multitude of dairy cattle breeds. Breeds are artificial biological populations created by humans by artificial selection and reproductively isolation with artificial means (caging, territorial insulation, herd book).

In time breeders of dairy cattle have changed the habitat of dairy cattle as well. In principle there two farming systems to produce cow milk, the extensive system with grazing cattle and the intensive system with cattle fed from manger. For a long time before the intensive system acted with chained animals in 4 walls closed barns. The system is still in use in many parts of the world as combined system with grazing animals in the summer and chained animals in the winter.

Feeding animals from the stock, keeping them chained in closed barns, watering them at fixed time and milking the cows induce great shock on the animal's behavior formatted in nature as a systemic ensemble of innate and memorized conditioned nervous reflexes of cattle. Natural behavior had to be changed. Animals should accommodate to the new habitat but some needs had to be satisfied. Among these the need for rest is the most important. Cows have to lay and to sleep. But cattle are animals of heavy bodies and their leg joints have evident bones that must be protected when cows lay down. If the barn floor is hard the leg joints have to suffer and the hoofs as well. The wet floor will be bad for animals' skin.

The wrong floor produces sensitive stress to animals. Sensitive stress is produced by high temperature in the barn, by thirst or famine, by noise of the barn's machines as well and may be some time by insects. As psychic stress agents, proper to cattle, is the "fear of abyss". That means cattle refuse to pass over ditches. Cattle are afraid of unknown animals. They are able to recognize up to six herd mates and remember one recognized herd

mate no longer then 6 days. Both sensitive and psychic stress agents can produce animals to be sick or hurt and to alter its welfare. Thus organism physiological, metabolic and hematologic parameters are modified and the degree animal welfare degradation might be appreciated.
In dairy cows most of stress agents are of artificial nature, caused by breeders and it is a question of bioethics to avoid their actions.

BAD BIOETHICAL PRACTICES

Most frequent causes of dairy cows welfare deterioration refer to barns. Here chained animals, high density of heads, altered air composition, hard, cold or slippery floor and poor bed for rest should be mentioned. Grill floor on the access alleys is not recommended since cows hesitate to walk on it. Underfeeding or insufficient water are frequently met. Beat or strike cows so as to hurt them is a very bad practice and should be punished by law.
But the mentioned bad practices are not only acts of bad bioethics. Such practices result in alterations of mental state of animals and, par consequence they indulge welfare deterioration and misbalance of homeostatic condition of organisms. Organisms will do efforts to compensate them up to homeostasis using important quantities of energy. The metabolic efforts to remake homeostasis will take energy out of the energy dedicated to milk production. That gives important financial loses that aren't yet properly evaluated. Even the compensate homeostasis is adding energy consummation to the needed one for the basic metabolism.

GOOD BIOETHICAL PRACTICES

The main good bioethical practices referring to dairy cattle address to the housing of cows. The best recommended one is the free stall housing. In the free stall barn must exist three areas: resting area, feeding area and milking area. There is also necessary to have access alleys from one area to the other areas.
The largest and the most important is the resting area. It is build up from rows of individual stalls where cows may lay, ruminate and sleep. One stall must look as a open berth 1½ longer than the cow and narrow, the width measuring half of the stall length. Berth are separated one from the other by bars impeding cows to live the stall other way then retiring back. This way

the bedding of the berth will stay clean and dry. Cows like to have clean, dry, soft and warm bedding. The best bedding is made of 30 cm sick layer of straws. The next one preferred is the sawdust. Rubber bed is not warm enough and the sand bedding is cold.

The feeding area is done out of a low manger along the alley for bringing fodder. The manger is separated from the access alley to the feeding area by a fence permitting cow heads to pass trough and eat. The access alley to manger is the place where their feces and urine are eliminated. The accumulated manure is get of better with a mechanic plough. Hydrolith remove of the manure is most costly, and requires grill floor of the access alley not pleased to cows. Cows might have free access to feed and clean water. They will be never over fed except the case when they are under stress influence. Control of the metabolic energy intake can be done by the energy concentration in the cows' diets, when necessary.

The best air composition inside the barn is given by three walls open buildings limiting the air droughts at the animals' level and permitting free air droughts at the upper levels of barns to have good ventilation;

Keeping on the same herd mates as long as possible in a barn section is good for the psychic of cows. Usually cows are group in the free stall barn in three or four groups according to the time from parturition. There is a group of recent parturient cows, less than 3 month from the calving that need the highest energy concentration of diets and a superior protein / energy rate being also supervised for showing heats. There is group of cows in the high lactation losing in body weight because they could not ingest enough energy, there is a third group of milking cows with decreasing daily milk production and the group of weaned cows which are not milked. The second of the mentioned before group may be absent. This grouping of cows helps the correct feeding of cows and it is good to be respected, but grouping of cows must be done not more frequently than once at four wicks. It is better if the group size is smaller. That will protect against the psychic stress of changing the herd mates.

Milking area is better to be ensured by a milking parlor as a special space dedicated to this purpose. That will help cows to fill the need for the udder discharge and to have better hygiene of milking. One group of cows has to be milked in almost 1 hour including the waiting time to enter the parlor. From the psychical point of view cows will fill better than in case of milking them in the resting area as is done in case of chained animals.

Such practices will ensure animal welfare and good benefit for breeders. The nearby figures present models of modern facilities helping cow protection against psychic stress.

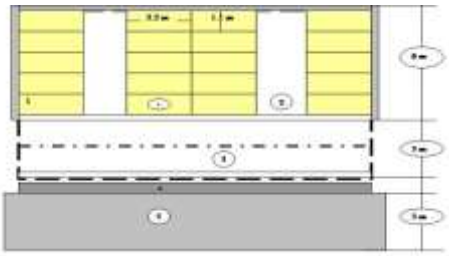

Figure 4. Free stall barn for 20 dairy cows (Legend: 1stall (berth), 2 access alley resting area, 3 manure cleaner, 4 manger 5 – feed transport alley)

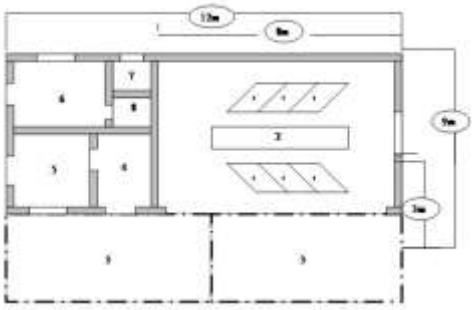

Figure 5. Milking parlor and filter (Legend:1 milking stands, 2 milkier place, 3 waiting pens, 4 washing room, 5 milk room 6milkier room, 7 pumps' room, 8 toilet

FUTURE

Dairy cattle organisms are pressed to support huge efforts apart from the genetic progress induced by artificial selection for more and more milk production.

The body type in dairy cows has be of large stature for much ingesta of feeds, the support offered by the legs must be strong, the vertebral column should be straight indicating good suspension for internal organs and the udder has to be strongly attached to the sacral bones doesn't descend under hocks .

Cows need comfort. They must be left in peace, dispose any time of water and feed, have the possibility of laying down on a convenient clean, dry, soft and warm bedding and be milked regularly.

Research has demonstrated existing liaisons between bioethics standards and animal welfare. Psychic stress alters animal welfare. Since animal welfare influences the necessary metabolic energy for body's maintenance the new technical concepts require to respect the good bioethical practice when dairy cattle farms are planed and managed.

Bioethics principles have to be spread by education in families and in schools.

Dairy cattle breeders have to learn and apply good bioethical practices in order to save time and money.
Animal protection rules against psychic stress are more questions of veterinary medicine than questions of moral.

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