Laughter: Interdisciplinary View

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ABSTRACT

The article intends to answer the following questions: 1) Do animals laugh, or it is a human characteristic? 2) What are the forms of laughter phenomena? 3) Do we know the mechanism, genetics and biochemistry of laughter? 4) Are there sexual implications of the laughter? 5) What is the pathology of laughter? 6) What is the story of the laughter therapy and its models?

Keywords: Laughter, Biochemistry, Mechanism, Therapeutic effect, Laughter pathology.

Introduction

Man is a social being who lives in couples and/or groups, hence the permanent need to communicate. Communication evolved in parallel with tools. Over the millennia, the first isolated sounds and cry of joy of the Homo Neanderthal changed into a sophisticated language and laughter of Homo Sapiens.

Laughter considered a banality, called the attention of neurosciences when it became clear that, besides its manifestation of joy, it is also an expression of humor by way of reasoning. Joy and humor may be a product of the intellect and the emotional cleansing.

In ancient time, according to the philosopher Isidore of Alexandria, laughter (*hilaris* in Latin, *ilaria* in Greek) was celebrated without fail. The custom, borrowed by the Romans from the Greeks, according to Maximus Monachus, was an integral part of the celebrations related to wedding, birth, and coronation. During the *hilaria*, people indulged in dance and merriment, and it was forbidden to manifest one's sadness, anger or expose one's troubles. Herodian tells that one day of the festival, *feria stativa*, dedicated to the celebration of the equinox to honor

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Cybele, the Great Mother, a plot set up by Maternus against the emperor Commodus. This led to the permanent closure of the festival of *hilaria* by the Romans (Roos AG 1915).

The evogram of laughter

Do animals laugh? Was one of the preoccupations of anthropologists? The specific expression similar to laughter in some animals generated the false belief that some inferior animals can actually laugh. Thus, the laughing call of the green woodpecker provided the bird with the nickname "the laughing bird"; and a domestic variety of pigeon is known as the "laugher" (Lockard, 1977).

Rats emit short ultrasounds resembling vocalizations, perceived as chirps, during play, when they tumble, or when tickled. The chirp cannot be detected by human beings without special recording equipment. It seems that rats, just like people, react to tickling and some regions of their body are more sensitive to touch than others. Laughter is associated with positive emotions with a social character. Rats can be also conditioned, i.e. in order to be tickled, they repeat some exciting movements. Those that respond better to tickling associate more easily with one another than those with moderate reactions. As they grow old, this manifestation decreases in rats, as does their wish to be tickled. Jaak Panksepp and Jeff Burgdorf were unable to prove that rats have a sense of humor (Panksepp & Burgdorf, 2003).

In his studies, Brian Knutson of the National Institutes of Health shows that rats chirp when they wrestle, get morphine, or mate, and this is interpreted as a kind of reward (Knutson B. 2004).

Dogs give a gasp whose frequency, analyzed by a sonograph, varies. When a certain frequency is reached, it is similar to laughter. Recorded on tape in a closed room and played back, it can make the dog play, reducing its stress. A study by Simonet, Versteeg and Storie on 120 dogs from 4 months of age to 10 years of age revealed that stress decreases when the dogs hear the "dog-laugh" playback (Simonet et. al. 2005).

Primates like chimpanzees, gorillas and orangutans emit sounds that sometimes resemble laughter upon physical contact, when they wrestle, play hide-and-seek, or are tickled. Interestingly, the laughter of both free and captive chimpanzees is a series of alternating

inhalations and exhalations that sounds rather like panting. The difference between the chimp's laughter and human laughter may be the result of adaptation that goes hand in hand with the evolution of language. In some situations, primates express joy during the panting. A study analyzed the recorded sounds emitted by human and bonobo (pygmy chimpanzee) newborns when they are tickled. The laughter of bonobos has the frequency, spectrographic characteristics, and facial expression of human babies who are tickled. The same regions of the body – the armpits and the belly – are sensitive to tickling in both humans and chimpanzees. Unlike man, chimps do not manifest less joy when tickled as they grow old. One may conclude that, although their way of laughing is not human, primates display primitive forms of laughter.

Surprisingly, decoding the human and the chimpanzee's genome respectively has shown a great resemblance between the 32,000 genes of the two species, with differences limited to 2%. The finding thrilled geneticists, who are now attempting to look more deeply into the substratum of this minimal distinction. Geneticists claim that seven million years ago, a genetic variation generated the hominid mutation in chimps.

This hominid mutation took shape in the Neanderthal man two million years ago to finally gain supremacy over all other animals, hence rule the entire planet in the last 50,000 years.

Man's laughter and its mysteries have preoccupied philosophers and physicians alike, not without breeding controversy. Aristotle thought that man was the only animal endowed with laughter and Plato considers it a rational reaction meant to conceal a deficit of knowledge.

Laughter is a characteristic of human beings, a gift from nature (H. Makart's 1870).

In *Gargantua* and *Pantagruel* (1532), Rabelais in his triple quality as a doctor, writer and monk, and convinced of the tight bond between a state of wellbeing and humor, described laughter as an emotional reaction.

Evolutionist philosophers like Spencer and Bergson regarded laughter as a form of relief of energy provocked by humor (Spencer, 1860; Bergson, 1911). Over two centuries ago, Kant thought of humor- laughter as the transformation of an intense wait into nothing. In 1905, Freud elaborated on the psychological aspects of laughter as a form of release of energy. Psychoanalysis sees the discharge of psychical energy as the result of a lengthy state of

inhibited stress triggered by cognitive satisfaction. There is a similarity between the definitions and explanations of laughter and humor respectively, which is only understandable, as laughter is the final product of the latter.

Analyzing the explosive effect of laughter produced by jokes, Freud believes that the mechanism that sets it off is a result of the contrast between the solemnity imposed by the natural evolution of facts and the suddenness of the unexpected surprise that upsets the expectations (Keith-Spiegel, 1972). Various other researchers emphasized the importance of surprise in the mechanism of laughter (Hayworth, 1928).

The magnitude of the contrast depends on the range of the variance, with a maximum in fields such as logic, morals and society. In children, even a lesser magnitude of the contrast may provoke laughter, due to the presence of two premonitory conditions that in adults are attenuated, i.e. the exploration reflex and curiosity (Rothbart, 1973).

The affirmation that it is a complex function calls for the analysis of yet another aspect of laughter, i.e. aggressiveness. The more primitive the person, the more can laughter provoke or intensify aggressiveness.

In the Bible, the word "laughter" appears 29 times, and in 13 cases (45%) it is associated with violence (Ziv, 1978).

Man's laughter and crying have had an essential contribution to the outlining of the notion of emotional brain as an integral part of the human brain. In this age of continual stress which modern society traverses, the laughter of a healthy person is a means of survival. The silent or resounding, noisy or stormy, frothy or softly snoring laughter of the said person instills and maintains a state of wellbeing, owing to its power to eliminate tension and replace it with an optimistic view.

Laughter is the consequence of a process taking place in a network of nervous cells with many participants: multiple anatomic areas located in the cortex and in the amygdaline, thalamic and hypothalamic nuclei, in the hippocampus, limbic and autonomic system, and in the cerebral trunk. The segment of the periaqueductal gray area of the cerebral trunk seems to play an important role in the algorithm of laughter.

Forms of laughter

Laughter can be triggered either by tickling a sensitive area *"reflex laughter"* or by the humor in a joke, grimace or memory *"cognitive laughter".* Tickling triggers laughter by the light excitation of the sensitive areas of the skin: the soles, the armpits, the intercostal area, the abdomen. Tickling is a primary, instinctual reaction to the touching of the skin. The laughter obtained in this way may be pleasant or unpleasant. Mack Sennett analyzed various techniques of generating cognitive hilarity to obtain laughter.

Both forms, so different by meaning are although different in the topography of the excitement of laughter, but are assumed to reach the same coordinating center in the reticulate substance of the cerebral trunk.

The mechanism of laughter

Laughter is mainly the result of the contraction of the mouth and facial muscles.

The activity of the mouth and of the face is the result of millions of years of evolution from a digestive-respiratory function to a verbal-cantatory function capable of carrying out the multitude of motor acts required by orofacial expression. Transformations in the muscular and nervous system contributed to achieving this function of rare complexity. The nuclei of the brainstem control the movement of the head, neck and shoulder muscles, as well as the senses of pain, taste, smell and touch at the head and neck level, and are numbered from I to XII.

The motor nucleus of the facial nerve is made of a population of neurons located in the pons section of the brain stem. The cranial nerve VII is the facial nerve that enables the motility of the mouth, the facial expression, the oral digestive-respiratory activity, and the verbal activity in their entirety, with the minor contribution of the trigeminal nerve (nerve V). It ensures the neuromotility of the face and mouth with its five branches: auricular (controlling the movements of the ears), palpebral and scalp (the movements of the eyelids and frowning), nasal (the dilation of the nostrils), oral (the activation of the mouth and separate lips, smile, etc.), palatine (the movements of the soft palate and of the uvula).

All the functions of the facial and trigeminal nerves are under the voluntary-rational and emotional control of neocortex (visual, auditory, olfactory, gustative, and tactile sectors), limbic

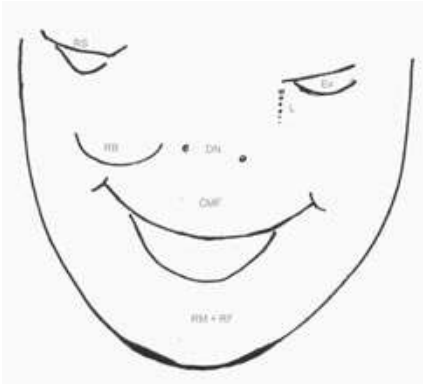
and autonomic systems, explaining the almost infinite range of emotional expressions of the mouth. The sympathetic fibers of the autonomic system originate in the superior cervical ganglion as axons entering the deep petrosal nerve (nervus petrosus profundus) to reach the sphenopalatine ganglion, and from there branching out to various muscles through the branches of the facial nerve.

The parasympathetic fibers reach Meckel's (or the pterygopalatine) ganglion through the greater petrosal nerve, so that their ramifications enable the complex functions of perspiration, salivation and lachrymation.

The nucleus of the facial nerve activates the muscles : quadratus labii superioris, quadratus labii inferioris, caninus, triangularis, zygomaticus, buccinator, mentalis, orbicularis oris and risorius. It is assumed that the function of the risorius muscle which is present only in humans,is proof that the function creates the organ. The second, more frequent way of smiling is produced by the contraction of the zygomatic major and minor muscles and of the eye orbicular muscle. Another very important muscle contributing to laughter is the buccinator muscle. Its quadrilateral shape fills the area of the face between the maxilla and the mandible. Many other muscles may participate in laughter, such as thoracic, respiratory and diaphragmatic muscles, controlled by the same algorithm that functions harmonically, allowing the normal activity of respiration, of the heart, and of blood circulation.

The laughter expression of the face is the result of a set of acts concerning shape, orientation, position, degrees and angles of contracture, vascularization, in permanent dynamic, of the above mention muscles.

In conclusion, we may say that physiognomy of laughter depends on genetic characteristics, behavior, temperament, and the surrounding emotional conjunctures. Repeated contractions of the diaphragm and facial muscles that raise the corners of the eyes and eyebrows, dilate the nostrils, lift the cheeks, cause the retraction of the lower jaw and extension of the head, exophthalmia, tears, vasodilatation in the cheeks, neck and hands.



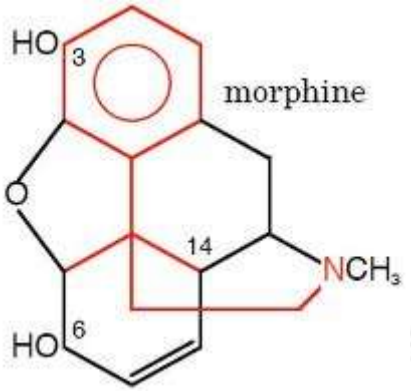
The broad participation of the structures in the peripheral and central nervous system produces a repertoire consisting of rhythmic-harmonic bursts of laughter, visible in the jerky movement of the intercostal muscles, heartbeats, and inspiration and expiration of the lungs. It is clear that such symptoms require the participation of a wide area of the central and peripheral nervous system, including the emotional brain, aside from the reticulate network of the cerebral trunk. Laughter is a psychophysiological reaction to humorous situations or to tickling that sets off a specific biochemical constellation.

Laughter has a genetic background, decreed Robert R. Provine, after having studied it for several decades. Laughter is part of the universal human vocabulary. There are thousands of languages and hundreds of thousands of dialects, but everyone laughs in a similar way. Every individual has the capacity to laugh, and babies laugh before learning to speak. Babies born blind or deaf also have the capacity to laugh. Laughter, according to Provine, is a primitive, unconscious vocalization. The examination of two girls, known as the "giggle twins", with a predisposition to laughter, evidenced the role of heredity. Separated at their birth, they met again at 40. Provine says that neither of them had ever met a person who laughed more than themselves, although they had been raised by different parents. The twins laughed in very similar ways, and both were visibly prone to humor.

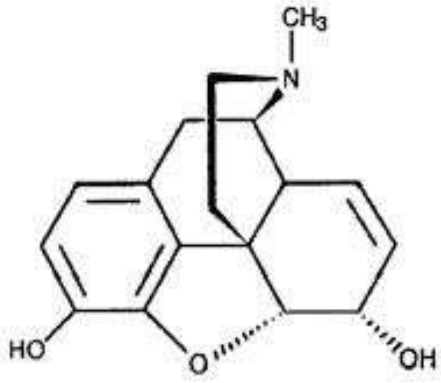
Laugher has its own biochemistry, discovered thanks to the therapeutic effect on pain. The biochemical constellation that can suppress suffering and physical pain through the

induction of laughter is an object of study in modern medicine. Experience teaches us that whatever stops suffering and pain favors laughter. Reynolds was the first to obtain analgesia through electric stimulation of the ventrolateral periaqueductal area in rats, without modifying their behavior or motor activities. The researcher obtained similar results by stimulating the caudal area of the diencephalon, the anterior side of the paragiganto-cellular nuclei, and the raphe magnus nuclei (Reynolds D. V., 1969). The analgesic effect materializes with the inhibition of the neurons in the dorsal horn of the spinal cord at the lamina I, II and IV levels. In humans, the stimulation of implanted electrodes produces a state of analgesia.

After six years of research, opioids were discovered: neuropeptides produced by antalgic receptors. Two independent teams of researchers, headed by John Hughes and Hans Kosterlitz of Scotland, isolated in the pig brain a chemical they named enkephalin (from the Greek εγκέφαλος, cerebrum or brain). At the same time, Rabi Simantov and Solomon H. Snyder of the USA separated from the calf brain opioid receptors that they named "endorphin receptors". Endorphin, a "body morphine" with a chemical formula very similar to morphine, derives its name from "endogenous" (produced by the body) and "morphine". Recent studies attest to the capacity of animals to produce their own morphine.



Morphine



Endorphine

The discovery of opioid neurotransmitters opened the way to the biochemical age of emotions that cause fear, panic, stress and pain. The science that deals with them is psychoneuroendocrinology. Beta-endorphin and metencephalin were discovered in the human

body. As the pain grows, the level of beta-endorphin rises gradually, which shows that this is a stress hormone. The discovery of endorphin and naloxone with an antagonistic effect, along with another two neuropeptides, encephalin and dynorphin, produced by the pituitary gland and the hypothalamus during physical exercise, states of excitement, and orgasm, enabled the study of the effects of negative and positive stress on the nervous system.

What is the chemical substrate of release from suffering? Is it perhaps a biochemical effect? There was evidence about the therapeutic effect of laughter obtained by inhaling laughing gas or nitrous oxide, and by ingestion of cannabis (hashish). But the discovery of beta-endorphin clarified the effect of laughter. Endorphin levels rise in the blood as a reaction to any reward activity. Beneficial laughter allows the discharge of beta-endorphin into the nervous system and the blood. There are still many unknowns regarding the way beta-endorphin works. It is derived from pro-opiomelanocortin (POMC), a precursor of the adrenocorticotrophic hormone (ACTH) secreted by the hypophysis. The behavioral effects of beta-endorphin are a result of the action of hypothalamic neurons on the brain and the spinal cord. When the ACTH level rises, the secretion of endorphin also rises. The cellular receptors of endorphin have been studied in detail, and numerous types described, from which I shall cite four, activated by the contact with beta-endorphin. The highest endorphin affinity is displayed by the μ1 opioid receptor, and a lower affinity by the μ2 opioid receptor and the δ and κ1 opioid receptors. The morphine injected into the body acts on these receptors as well. The μ receptors mentioned above modify the release of GABA neurotransmitters and dopamine, ensuring the pain relieving (analgesic) effect.

Endorphin receptors play important roles in the organism, at the pre- and post-synaptic levels, modulating pain, the cardiac, gastric and vascular functions, as well as panic, satiety, and suffering. Endorphins also act as febrifuges. Among the neuropeptides with direct effects on endorphins: pro-opiomelanocortin, adenocorticotropin, beta-lipotropin, alpha-melanocyte stimulating hormone, beta-melanocyte stimulating hormone, and beta-endorphin. Capsaicin is an active chemical substance derived from chili peppers that provokes the release of endorphin, and therefore is used in the treatment of chronic pain.

The presence of P substance and histamine receptors in the limbic system involved in laughter has been evidenced.

In a marathon or any long-distance running, a state of euphoria appears known as "runner's high". During exhausting activities that exceed the average intensity of physical exercise, the secretion of endorphins increases. This goes in parallel with the use of glycogen reserves in the muscles. The activities that usually produce an endorphin excess are running, swimming, cycling, weightlifting, aerobics, basketball, cross-country skiing, and rugby. Some researchers claim that the challenge to compete has a greater importance than the intensity of the effort. Research undertaken in the early 1980s disputed the connection between endorphins and the runner's high for the following reasons: first, the infusion of naloxone (an endorphin antagonist) or the ingestion of naltrexon (another antagonist) do not prevent euphoria; secondly, the runner's high cannot be obtained in a lab, but only in the natural environment of the competition.

In 2004, research at Georgia Tech detected the increase of another chemical, endocannabinoid anandamide, in cases of runner's high. Anandamide acts chemically like marijuana. It was believed that these substances were the result of sustained stress or pain caused by muscular effort. Subsequent research did not confirm the euphoric effect of anandamide. In 2008, German researchers proved that the runner's high "legend" is true. Utilizing positron-emission tomography in combination with recent chemical substance detection techniques, the scientists detected the presence of endorphins in the runners' brains before and after the race. The runners were told that the opioid receptors in their brains would be examined in connection to runner's high. The participants were examined and took a psychological test before the race and two hours after it. Endorphins appeared during the exercise in areas of the brain associated with emotions, limbic areas, and prefrontal areas (H. Boecker et al. 2008).

Laughter and sex. The sexual act seems to be a variable that plays a role in hysterical laughter which is much more evident in women than in men (Black, 1982). Men and women react in different ways to jokes. A MRI study published in *Proceedings of the National Academy of Sciences* describes the reactions to cartoons of ten men and ten women, on a scale of 1 to

10, from humorous to humorless. Men and women evaluated the cartoons almost identically, but their brains reacted in different ways. When the women looked at the funny cartoons, their brain had a more intense activity in the nucleus accumbens. When they looked at cartoons they did not find funny, the nucleus accumbens was not activated. The men's nucleus accumbens did not react to the funny cartoons.

The men reacted only with a decrease of cerebral activity to unfunny cartoons. Scientists suspect that the difference consists in the surprise element. The women who looked at the cartoons did not expect them to be funny, therefore the surprise element acted in the women, but not in the men, thus explaining the difference in the reaction of the nucleus accumbens. Nevertheless, the possibility cannot be ruled out that, when the women were pleasantly surprised upon seeing the funny cartoons, the nucleus accumbens intensified its activity – a trait that makes the difference between the two sexes. Scientists interpret the men's decrease in the overall activity of the brain upon seeing the unfunny cartoons as a disappointment caused by the lack of humor. Some see in this study a justification of the gender differences seen in the symptoms of affective diseases. Whatever the case, it looks like the two sexes have a different approach to humor, concludes Allan Reiss (2005).

The social substratum of laughter was studied by Bergson, who highlighted its role in the establishment of good communication among people. Laughter is a primitive form of human communication, especially in situations in which language difference prevents understanding through words. Laughter and smile underpin gestural communication.

A statistical study of preschool children shows that laughter occurs the most frequently (94%) in a group, and only in 6% of the cases when the child is alone (Kennerdine, 1931). The frequency of laughter increases in direct proportion to the social agglomeration, and the contrast is generally accepted between the frequency of laughter in an isolated individual, and its presence in a social group (Freedman, 1979).

Contagious laughter is the product of a social group (Izard, 1979). Collective laughter as a form of behavior and communication has gained universal recognition. However, the communicative value of laughter must not stop us from seeing the negative effect of a fit of laughter in a certain context or an unsuitable circumstance. Laughter may appear as mockery

and breed adversity, enmity, and wish for revenge. In social relations, people strive to arouse the laughter of their partners in dialogue, and thus prove their success in communication and in achieving a mutual transfer of empathy. The reaction of amusement from the partner in dialogue increases the self-confidence of the person who provoked the laugh. Many hone their joke-telling technique in order to draw social empathy to themselves. The first social forms of laughter appeared in tribal life, playing a major role in consolidating the group.

Laughter as social interaction

As an integrative part of the universal human vocabulary, laughter facilitates social contact. Laughter indicates the mutual acceptance between the individual and the group. Being contagious, it may falsify the intrinsic humoristic value of the situation. According to Raju Mandhyan, in human physiology, the benefits of laughter come immediately after the physical and psychological benefits of sex, a fact proven in recent decades, hence its use in the treatment of pain.

Like humor, laughter has been regarded as an expression of superiority (Aristotle), one's own ridiculousness (Socrates), blatant incongruity (Francis Hutcheson), the denial of appearances (Schopenhauer and Hegel), a way of releasing energy (Freud), escape from an unexpected danger (John Morreall), detecting incongruity (Victor Raskin and S. Attardo). Recently, Peter Martienson elaborated the theory according to which laughter is our response to the understanding of the fact that the perceived truth differs from the actual truth, and the distinctions between cultural and natural truth types are blurred. This is called OETC – the ontic-epistemic theory of the comic, which deals with the relation between the comic and the limits of knowledge. In his story *Stranger in A Strange Land*, Robert A. Heinlein explains that laughter is empathy plus release of energy, which sometimes may hurt. But laughter can also be a mechanism that enables people to cope with misery, anger, sadness, and it is not always linked to humor or comedy.

Laughter consumes energy. It was estimated that laughing 100 times is tantamount to a 10-minute treadmill walk, or a 15-minute bicycle ride. Laughter activates the diaphragm, abdominal, respiratory, facial, leg and spinal muscles. William Fry, a pioneer of laughter

research, says that one needs to walk a treadmill for 10 minutes to increase heart rate, while laughter does this in just one minute.

The development of laughter in man. Laughter appears between the sixth and the eighth week after birth. But if we consider smiling a moderate form of laughter, it first appears as an inborn reaction manifested as early as intrauterine life (Black, 1984). Any mother can undoubtedly confirm that laughter appears in the third week as vocal, spontaneous sounds of laughter (*Early Human Development*, 2006). Others claim that bursting laughter does not occur before the age of four months (J. Y. T. Greig), while Izard (1977) says that it appears only after five weeks, and can be provoked as a response to a pat-a-cake game. Still other authors maintain that laughter does not appear before the age of 40 days, but smiling occurs before that (Srofe, L. A.& Waters, E, 1976) demonstrates the existence of a common pattern of smiling and laughter in various human societies with different economic and cultural structures.

The school of Lyons regards smiling as a motor reaction that appears on the very first day of the newborn. They interpret the newborn's smile as the expression of a positive affect of empathy, similar to the REM (rapid eye movement) phase of sleep (Jouvet, 1992). We may suggest that REM sleep and laughter display similar curves over the human life span: in the first year it is intense, but maturation plays an inhibiting role in both.

The age curve of laughter shows that, in preschool children, laughter may occur up to 400 times a day. Its frequency in an adult is 17 times a day at most. In the presence of friends, the laughter in the aforementioned situations is much more frequent, owing to its contagious effect, to the sensation of mutual empathy given by the intimacy of the situation, and to the tendency to reenact hilarious situations. The audible expression of laughter was studied in depth by J. Y. T. Greig.

The "common sense" delimitates the physiological from pathological laughter.

The more enjoyable it is to laugh and to see people laughing, to be able to rouse the laughter of the beloved ones or to be willing to laugh, the more unpleasant and embarrassing it is to be faced with inadequate laughter, one that cannot be understood. We can tell adequate and

inadequate types of laughter apart if we know them. To recognize laughter resulting from a diseased brain or body, we must know the forms of laughter that do not jibe with "common sense". The "common sense" designates what people consider to be an acceptable reaction. Aristotle and Ibn Sina (Avicenna) regarded as common sense anything accepted by the conscience. Thus, they left room for the possibility that some people may take common sense for what others would not. John Locke, an empiricist, wrote about "a people so strangely bereft of common sense, that they can hardly be reckoned among mankind." It is suitable for us to consider common sense as representing a truth about a lived situation. Descartes advises us to be careful with the notion of common sense and to eliminate anything that raises doubt. But can we tell precisely what should be considered common sense? Of course not. When we enter the realm of logic and philosophy, axioms come into force, intuition appears, and the ground becomes so unstable and slippery that it makes Einstein declare: "Common sense is the collection of prejudices acquired by age eighteen." Failing all else, we look to nature and biology to cull a little wisdom. Walter Bradford Cannon is the founder of the notion of homeostasis (from the Greek *homos*, i.e. similar, and *histemi*, i.e. resistant). He claims that the life of the human organism is possible as long as a state of balance is maintained that determines health, and that drifting out of the standards of common sense is tantamount to sickness and death. Claude Bernard defines homeostasis as a dynamic equilibrium, and life as an assemblage of mechanisms that regulate this dynamic equilibrium, the common sense of a healthy life. Maintaining a certain temperature, level of sugar, oxygen, water, electrolytes, muscular tension, attention, sleep and wakefulness is the secret of healthy life, the biological common sense. Regulatory mechanisms wage a titanic fight to maintain this dynamic equilibrium. The study of these mechanisms is fascinating. The dynamic equilibrium, homeostasis, makes all the constants vary within the bounds of common sense, like a ping-pong ball that flies from one side of the table to the other without falling. The moment it falls spells illness or the end of the game – death. It is the same with laughter, crying, smiling and humor: as long as they occur within the limits of homeostasis and traditional common sense, they are adequate and beneficial. The moment they are inadequate, incomprehensible, and unsuitable for the circumstances, they have turned into pathological laughter, smiling, humor

and crying. Inadequate laughter and crying indicate an unbalanced ego, one that drifted out of the homeostasis of common sense. These aspects must be well-known in order to enable a correct diagnosis between normal and abnormal.

Many forms of psychiatric pathology have been described, but the most frequent are: hysterical laughter, the maniac's and the schizophrenic's laughter, and the Angelman syndrome laughter. In neurology, among the forms of frequent pathological laughter we may count: gelastic epilepsy, laughter in the vascular diseases of the brain, prodromal laughter, laughter in degenerative diseases such as amyotrophic lateral sclerosis and multiple sclerosis. Laughter can cause pathological manifestations of latent diseases, among which cataplexy and enuresis risoria or "giggle incontinence".

Hysterical laughter occurs in fits that are not justified by the situation or circumstances. It has been described since ancient times. Sometimes it occurs as a result of trauma, shock, or a state of deep anxiety. Its inadequacy makes it easy to diagnose (Hempelmann C., H. 1962). Hysterical laughter is much noisier than natural laughter, and even than psychiatric laughter.

Epidemic of hysterical laughter appears in a religious milieu. Among 1000-strong community of schoolgirls whose fit of laughter contaminated their neighbors and the people with whom they came into contact, involving almost the entire community. Some schoolgirls had to be sent to hospital, as their strength had been sapped. This phenomenon are associated with the religious way of life of these girls, who engaged in the liberating laughter as in a kind of religious rapture. Contagious and conversive laughter are characteristic of the low socio-economic status of the girls living in a religious milieu, who were thus confronting the crisis in their identity transformation.

The schizophrenic's laughter is dramatic. Schizophrenia, the most severe mental illness, consists of manifestations such as delirium, hallucinations, disorderly speech, severe unruly behavior, catatonia, social maladjustment, and impossibility to practice one's profession. The schizophrenic's laughter is unfathomable: one has to penetrate into the diseased person's delirious, hallucinatory world to try and find its justification, a nearly impossible feat even for

an eminent specialist in psychiatry. Kraepelin describes the unrestrained pathological laughter in schizophrenia, which lacks any stimulus or reason, as "silly laughter". Defendorf regards it as devoid of emotional significance. In 1950, M. Bleuler puts it in the category of parathymia, i.e. the distorted expression of emotion, a heading under which he lists a group of unmotivated reactions, including the specific laughter of schizophrenics. In time, however, parathymia has lost its pathological denotation only to take on a broader signification, since a healthy person can also cry in moments of great satisfaction and joy, and smile in moments of deep sorrow. The schizophrenic does not know why he is laughing; he often considers that he is guided or given instructions to laugh, or that an external force orders or compels him to do so. In 1977, Izard described the contagious effect of laughter on schizophrenics and hysterics. In 1982, Black characterized the quick succession of laughter and crying as typical of schizophrenics.

Laughter in mania/hypomania and depression is inadequate, brutal, and noisy. It was named "wild laughter". The complete absence of laughter was interpreted as a sign of depression by Shakespeare. It was asserted that, along with decreased motor activity, the absence of laughter is defining of depression.

Lacunar laughter or pseudobulbar crying/laughter is a fact of everyday neurology. Every neurologist must know this crying/laughter which has made its way into medical textbooks. A host of scientific articles flooded specialized medical periodicals and eventually imposed the study of this manifestation in neurology curricula, under the name of "spasmodic laughter" or mixed laughter-crying. Bilateral lesions of the motor tract that enables voluntary movement trigger pseudobulbar or spasmodic laughter in amyotrophic sclerosis (ALS), progressive supranuclear palsy (PSP), and Parkinson's disease (PD); spasmodic laughter and crying appear as a consequence of severe injury of the brain. The brain lesions and various diseases in which this laughter manifests itself are detailed in the table below:

Spasmodic laughter is provoked by bilateral pyramidal lesions caused by trauma, vasculopathy, inflammation, degenerative processes, and tumors.

Bursts of involuntary crying or laughter, unmotivated and without explanation, are a characteristic sign of these diseases. Very specific is the capacity to switch from laughter to crying and back in fractions of a second, without any explanation. These shifts indicate the emotional instability that underlies this laughter. Called by Germans "Zwangslachen und Zwangsweinen", and by the French "rire et pleurer spasmodique", it may be found in the works of Oppenheim, von Monakow, and Wilson. In some cases, catastrophic news can – paradoxically – bring about a fit of laughter.

Cumhur Ertekin and his collaborators describe laughter as a signal before a disease is about to set in (prodroma) in three cases. A sick person had a paralysis of the right half of the body one hour after an inexplicable, inadequate fit of laughter. In this case, infarction of the cerebral trunk evidenced both the fit of laughter that occurred at the beginning of the blood flow blockage and the paralysis that came after the slow, progressive infarction of the right pontine region, which lasted one hour. Over the years, as infarctions became bilateral, the same patient experienced laughter/crying on a daily basis. The second case was that of a patient suffering from hypertension who, one hour after the prodromal laughter, had a right hemiplegia. The third case was an elderly patient who, after laughing for 15 minutes, came down with a paralysis of the right half of the body and language loss (aphasia). Some authors describe prodromal laughter as a very serious symptom in vascular accidents. Other authors attempt to explain the pathophysiology of the phenomenon as an excess of emotionality resulted from a loss of rational control caused by lesions of the coordination centers.

Epileptic laughter or gelastic epilepsy was described by the famous Russian writer Fyodor Dostoevsky in 1868, according to the neurologist W. Lennox. In *The Idiot*, he depicted fits of laughter and giggles and grins, accompanied by pleasure and sometimes even tears of joy. There are hints attributed to the famous French physician Armand Trousseau (1873). The terminology of gelastic epilepsy was established by Daly and Mulder in 1957.

In 1971, Gascon and Lombroso established the diagnostic criteria of gelastic epilepsy based on five cases. Repeated fits of uncontrolled laughter without precipitating causes, in the absence of other epileptic manifestations, ictal or interictal presence of

electroencephalographic signs, and absence of other causes of pathological laughter are diagnostic criteria. The number of fits of convulsive, inadequate laughter can reach 12-14 daily. The laughter is in most cases accompanied by blurred consciousness. It usually occurs without any precipitant factors, but it may be triggered by tickling sensitive areas. In some cases, it brought about the loss of control of sphincters, hence urination and defecation. In the anamnesis of patients with gelastic epilepsy may be found febrile convulsions in early childhood. All laboratory tests – clinical, neurological, general – as well as computerized tomography, are usually normal. Even the interictal (i.e. between crises) electroencephalogram can be normal.

Epidemiologically, it is a rare epilepsy. In 1973, Chen and Foster delivered a statistical paper showing that, out of 5000 children who suffered from convulsive disorders, only seven had gelastic epilepsy, i.e. 1.4%. Less than 150 cases were reported in medical literature before 1981 (Matustik, Eisenberg & Meyer). Gascon and Lombroso raised the percentage to 1-3%. Matustik et al. consider it to be more frequent in children than in adults.

The neurologists' attempts at classifying gelastic epilepsy resulted in the description of two types: bursts of laughter that occur either as an isolated event or in association with other automatisms (Daly & Mulder; Holmes, Dardick & Russman, 1980). Most laughter seizures are of the latter (associated) type. The pure type involves a blurring of consciousness that lasts about 30 seconds, and a loss of memory to a certain degree (amnesia crisis) (Daly & Mulder, 1957; Holmes et al., 1980; Loiseau et al., 1971).

In forms associated with other diseases and automatisms, associations were described with: a) temporal epilepsy; b) mental retardation and precocious puberty; various cerebral diseases. Among forms associated with temporal epilepsy, the most frequent is "running epilepsy" or cursive epilepsy.

In 1980, Jacome described a patient who, through the hyperextension of the trunk and neck, could trigger a laughter seizure accompanied by an intense orgasm with ejaculation. Known as postural reflex gelastic seizure, it has a temporal origin. In 1976, Offen, Davidoff, Troost and Richey described a patient suffering from gelastic epilepsy associated with dacrystic epilepsy (crying epilepsy) and torticollis epilepsy (i.e. with voluntary torsion of the neck) as a

consequence of the atrophy of the temporal lobe. The associated forms of gelastic epilepsy show signs of epilepsy in electroencephalograms between seizures (Druckman & Chao, 1957; Gascon & Lombroso, 1971; Lehtinen & Kivalo, 1965; Loiseau, Cohadon & Cohadon, 1971).

Dostoevsky's photographs and free access to Russian archives after perestroika generated heated arguments, not unlike the dispute that took place in the early 20th century between Stefan Zweig and Sigmund Freud, with the former admiring the way in which Dostoevsky put his epilepsy to clever use in his literary art, and the latter claiming the existence of a genuine "hystero-epilepsy" of the writer. The relation between Dostoevsky epilepsy and laughter is exoressed by the ecstatic aura", which is a warning of an impending seizure.

In 1971, Temkin wrote that "the genesis and nature of Dostoevsky's own epilepsy is still a matter for debate." In 1984, the renowned epileptologist Henri Gastaut presented his conclusions about Dostoevsky's epilepsy, claiming that the writer suffered from a very discreet temporal lesion. This causes either focal crises, which include gelastic seizures, or generalized epileptic seizures, secondary to the generalization of the focus. The theory, backed by an impeccable article signed by A. G. Voskuil, was presented at a seminar organized by the "Institut national d'études slaves" in Paris to mark the one hundredth anniversary of the author's birth.

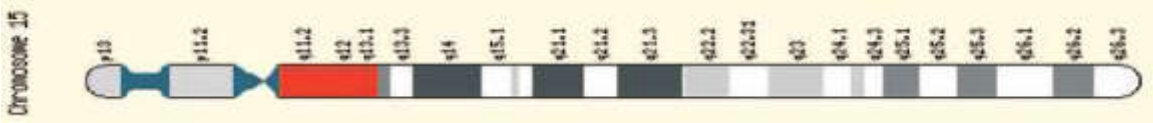
Even after Gastaut's and Baumann debate the "Did Dostoevsky suffer from temporal epilepsy?" In 1963, the renowned French neurologist Th. Alajouanine wrote that Dostoevsky's description of the seizures, allowed the conclusion that the temporal lobe epilepsy diagnosis was accurate. In the 19th century, John Hughlings Jackson's description of epilepsy matches Dostoevsky's accounts, including warnings of a seizure, a subjective awareness of its coming, and sometimes even pleasant sensations, which pleads for its temporal origin. The observation and good knowledge of his own suffering enabled Dostoevsky to describe the precipitating factors of epileptic seizures in *The Idiot*, *The Young Wife*, *The Brothers Karamazov*, *The Demons*, and *Crime and Punishment*, based on his own experience and its connections to erotic excitement and the sexual act, characteristic of gelastic epilepsy.

The gelastic epilepsy with a temporal origin that Dostoevsky suffered from casts on his descriptions a mystic halo that is also employed by Salman Rushdie in *Midnight's Children*. He describes the prophecies of the central character as being caused by temporal epilepsy. Ayesha's false prophecies in *The Satanic Verses* are also the fruit of possession by the demon of epilepsy. In *Gospel*, Wilton Barnhardt refers to St. Paul's experience on the road to Damascus, described in the New Testament, as a temporal epilepsy seizure: the sudden sight of a light coming from the sky envelops him and throws him to the ground, while a voice says, "Saul, Saul, why do you persecute me.

Laughter in multiple sclerosis. This disease generates patches of demyelination in the white matter of the nervous system, which permit the deviation of excitation towards the emotional centers in the limbic area, causing the patients' inappropriate, unjustified bursts of laughter and tears.

The Angelman syndrome (AS) is a neurogenetic disease characterized by arrested development, sleep disorders, convulsions, ample hand myocloni, and a cheerful behavior, with laughter and smiles. Described in 1965 by the British pediatrician Dr. Harry Angelman, it is also known as the Happy Puppet Syndrome, or Angels' Syndrome.

Engelman Sindrom



Chromozom 15

The red colored (see figure) segment of chromosome 15 is missing or inactive. If the missing part is from the mother's side, the disease caused by this heredopathy generates Angelman's or the Happy Puppet Syndrome. A healthy person receives two copies of chromosome 15, one from the mother and the other from the father. In the area colored in red, chromosome 15 receives very different characters from the two parents as a result of DNA-dependent sexual characteristics. In normal persons, the maternal allele is manifested, while the paternal one is silent. If the maternal allele is lost, the "angel's" syndrome results. If the paternal allele is absent, the Prader-Willi syndrome results. A positive diagnosis of the syndrome is obtained by methylation testing, which detects the UBE3A gene, an integral part of the ubiquitin apparatus that demarcates the DNA replication areas. The paternal allele of this gene participates in the development of the hippocampus, which is involved in the mental retardation and grave memory disorders (unjustified laughter included) of children with the Angelman's syndrome. The deficiency in the development of the cerebellum explains the balance troubles, the arms' wing-like movements, and the motor disinhibition that accompany the disease.

Patient care is demanding, because of difficult communication and lack of comprehension (sometimes the verbal repertoire is made up of fifteen words), but the disabled persons' permanent happiness usually generates sympathy around them. Hydrotherapy and music therapy are helpful.

This genetic condition may improve with age. Sexual development is not hampered. Only one case was reported of a woman who gave birth to a baby girl who also suffered from Angelman's syndrome.

The pair syndrome resulted from the absence of the paternal gene of chromosome 15 causes the Prader-Willi syndrome (PWS). The missing paternal gene induces severe modifications of the hypothalamus resulting in loss of control over hunger, temperature, pain,

hydro-electrolytic balance, fertility, and emotions. The sufferer has a permanent feeling of unsatisfied hunger that will result in progressive obesity unless kept under control. The genetic flaw can be inherited or appear as a mutation at the moment of conception. Oddly enough, due to low muscular tonus at birth, the PWS newborn creates the impression that it is thin and does not eat enough because of difficulty in suckling. As the child grows, the sensation of unsatiated hunger appears, along with behavioral disorders, retarded cognitive development, and sexual insufficiency. Longevity is not affected. For every 15,000 births, one baby with this syndrome is born. It was described by the Swiss physicians Andrea Prader, Alexis Labhart and Heinrich Willi in 1956. Today, a phenotype is ascribed to it consisting of small hands and height, progressive obesity, low muscular tonus, and retarded psychomotor development. There is no curative treatment for PWS.

Cataplexy caused by laughter in narcoleptic patients. Narcolepsy is a disease characterized by sudden spells of falling asleep, or fits of sleep, with or without cataplectic seizures. A cataplectic seizure involves the sudden loss of muscular tonus in all voluntary muscles and a sudden, brutal fall to the ground. The dramatic, sudden falls caused by the loss of muscular tonus were impressive even from the first description of narcolepsy by the French physician Gelineau in 1880. As they did not occur with loss of consciousness (the sick person witnessed the sudden fall), physicians distinguished them from epilepsy. The neurologist Zarcone described it in detail and invested it with individuality, distinguishing it from the sudden, uncontrolled falling asleep in the absence of consciousness. Cataplexy is most often caused by laughter. The Germans even call this disease “Lachlag Syndrom”. Laughter is not the only precipitating factor of cataplexy: great fear, panic, stress or surprise may also provoke it. The laughter-cataplexy association in the narcoleptic disease proves that the reticulate substance of the cerebral trunk is activated by laughter, because the centers of muscular tonus, like those of attention and awakening, are in its neighborhood, which explains the sudden fits of sleep.

This hypothesis is backed by the fact that patients with gelastic epilepsy can present with general muscular hypotonia during fits of laughter (Lehtinen & Kivalo, 1965). Why only some of the narcoleptics trigger cataplexy by a burst of laughter remains an enigma.

Giggle incontinence, "enuresis risoria", or, popularly said, "I wet my pants laughing", has been known since ancient times. Its specifics, which distinguish it from other incontinences, such as stress or fear incontinence, were defined by Galin, who in 1979 coined for it the term "enuresis risoria", showed that the best treatment method is to educate the inhibition of laughter. In "enuresis risoria", the urodynamic test does not evidence any defect (De Jonge, 1975).

Laughing gas-induced laughter was described in 1772 by Priestley, who discovered nitrous oxide (NO2), the surprising effect of which consists in provoking laughter and an uncontrolled good mood verging on euphoria. Initially used for social amusement, it soon became an adjuvant in dental treatment, thanks to its anesthetic effect. The discovery in recent decades of the analgesic effect of laughter made the question "is the analgesic effect due to the gas or to the laughter?" more difficult to answer. It has been considered a direct effect of the gas, hence its "laughing gas" name.

The fear of being laughed at, or gelotophobia, was described by M. Titze. A multidisciplinary research study confirmed that this phenomenon is widespread. In *Laughter*, Henri Bergson describes the Pinocchio complex, reckoning that the wooden puppet, deprived of any chance to communicate, adjust, defend itself, fight, or run away, is afraid that everybody makes fun of it.

The Therapeutic Effect of Laughter

The art of medicine consists of amusing the patient while nature cures him. (Voltaire)

The year 1979 brought a scientific revolution in the field of laughter research, with the discovery of its therapeutic effect in medicine. Norman Cousins publicized how he had managed to assuage the terrible pains caused by Bechterew's disease (ankylosing spondylitis) that he suffered from.

His spinal column had become a single bone, crushing the nerves in the vertebrae. The pain was permanent. The curved bamboo-shaped spinal column forced him to look down all the time. The disease bears the name of the physician who first described it.

Every time he watched a Marx Brothers movie that made him guffaw, Cousins noticed the remarkable effect of this explosion of joy on the pains caused by his disease: the pain went away and he was able to have his best two hours' sleep. In his memoirs, he writes how, by an accident, his pain disappeared while he was watching a Marx Brothers movie, which determined him to take a Marx Brothers and Candid Camera cure that made him feel much better. He came to the conclusion that a 10 minutes' laugh ensured him a two hours' sound sleep. This conclusion

on historical point of view, was achieved a few years after the presence of endorphins in the human body was detected, along with their role in suffering and pain. The journalist Norman Cousins was not a physician, but decided to publishe his observations on the role of laughter in appeasing pain (*Anatomy of an Illness as Perceived by the Patient*). Cousins wrote about the beneficial role of laughter in Bechterew's disease, based on his own experience. The prestigious *New England Journal of Medicine* published his observations in 1989. At the beginning the article drew the attention on the possibility of therapy by humor, but was lacking necessary authority to be heeded by physicians. Ten years later, the physician Lars Ljungdahl published in *JAMA* an article that confirmed the antalgic (pain relieving) effect of laughter in chronic diseases. Thus, in the last decades of the second millennium, laughter turned from an object of study into a method of treatment of pain, the "laughter cure".

In subsequent years, the laughter cure began to be utilized sporadically, in isolated cases, to break the sad moods caused by cancer. Towards the end of the millennium, clowns

made their way first into children's, then into adults' oncology clinics. In 1996, a new branch of the medical science was born and began to develop named "psycho-neuro-endocrino-immunology" (PNEI), that scientifically studies the biochemical and immunological changes induced by laughter in the nervous system and the internal secretion glands. Laughter became a subject of medical therapeutics.

In children, stress depresses the immune system, raising the risk of complications after surgery by 60%. Laughter, on the other hand, boosts the defense capacity through increased antibody production. Laughter also stimulates the activity of "killer cells" engaged in the fight against cancer and viruses. It also increases gamma-interferon secretion (a protein that fights disease), as well as the number of T and B cells, which produce very important antibodies. An article published in 2005 presents the conclusions of research carried out among 40 children demonstrating that the presence of a clown, along with the parents and the team of doctors, substantially reduces the child's anxiety before minor surgery interventions.

Thomas Kuhn, a prominent specialist in the philosophy of science, believes that a breakthrough can start a revolution in knowledge only if it creates a "scientific paradigm". Before regarding humor and laughter in the treatment of pain as a new scientific discovery, we must shift our attention from epistemological, linguistic, sociological, anthropological, and philosophical questions, to the question: Is the analgesic effect of laughter a paradigm? The answer to this question is the object of a new science named (with a word derived from Greek) gelotology. Gelotology deals with the beneficial, therapeutic aspects of laughter as a support of good mood, with the purpose of improving the quality of life. Laughter therapy yields results in the children, elderlies, invalids and psychotics' suffering. The medical staff is about to start its initiation into the art of provoking laughter. The use of humor and laughter as therapy in medical practice helps patients fight any kind of illness.

There are no specific therapies that depend on medical specialty. Laughter treatment can be administered to any sick person, individually or in a group, with the doctor's approval. Laughter is the easiest drug to procure. The humor in books, shows, and films, or the stories and jokes transmitted orally in conversations with patients exist at the disposal of any suffering

person. The clinician's role upon coming into contact with the patient is to determine whether the latter has a sense of humor and whether laughter could be harmful.

In 1999, researchers reported effects similar to those of laughter that were obtained through acupuncture. In the absence of laughter, the insertion of needles in specific points increases endorphin secretion in the nervous system. A higher concentration of endorphin was detected in the cerebrospinal fluid following acupuncture. Naloxone was proven to cancel the pain release effect obtained through acupuncture.

Reynolds induced an analgesic effect by electrical stimulation of the periaqueductal area for more than 30 minutes.

The activation of the endorphin release process in antalgic therapeutics through acupuncture, and the use of capsaicin and prolonged physical exercise remain objects of research, but laughter is handy to any sufferer, and its efficiency is a proven fact.

Outstanding in laughter therapy are its effects on the heart, blood circulation, blood glucose, and respiration. The minimal duration for laughter to be efficient is 30 seconds, until one gets a light feeling of heat.

Laughter protects the heart by curtailing the action of its greatest enemy, stress. The psychologist Steve Sultanoff, President of the Association for Applied and Therapeutic Humor, says that laughter decreases stress-produced cortisol concentration, and increases tolerance to pain and the production of infection-fighting antibodies. Hostile persons, who are always edgy and laugh very rarely, are much more prone to heart attacks, angina pectoris, strokes, and depression than people predisposed to humor.

Laughter improves blood circulation, say researchers from Maryland University: after watching a comedy, blood circulation is more smooth, lively and dynamic than after watching a drama.

Laughter influences blood sugar, demonstrates Keiko Hayashi from the University of Tsukuba (Ibaraki), using as example 19 type-2 (not insulin-dependent) diabetes sufferers whose glucose levels dwindled after a few healthy bursts of laughter. The patients listened to a boring lecture on the first evening, and attended a humorous show, then had dinner, on the second. Blood

was collected before and two hours after mealtime. Research on healthy individuals provided the same results. As a conclusion, the chemical messengers produced by laughter offset diabetes and reduce blood sugar (Keiko H. 2003).

Laughter ameliorates asthma. About two thirds of asthma sufferers reported the effect of provoked laughter in improving asthma (a study presented in 2005 at the annual congress of the American Thoracic Society). It did not specify if it was giggling, chuckling, or belly laughing, says Dr. Stuart Garay of the New York University Medical Center. The patients, participants in a program the object of which was to evaluate various asthma crises, were not separated by age groups or duration of the illness, and did not have a family history of asthma. However, it must be emphasized that some asthma patients may suffer crises induced by laughter and physical exercise. In cases of laughter-induced asthma crises, both the movements of the respiratory system and emotion are provocative agents. **Laughter has an effect of strengthening abdominal muscles.**

Models of Laughter Therapy

Clown therapy. In some hospitals "clown rounds" are conducted. With the help of music, jokes, pantomime and playfulness, clowns create an atmosphere that prevents suffering from setting in, and moments of release from fear and decrease of panic. The doses of sedative drugs administered to patients can be reduced. The use of clown therapy is not restricted to hospitals: it may be also applied in retirement homes, orphanages, refugee camps, prisons, or on warfronts.

Impulse therapy is patient customized. Laughter is obtained from the knowledge of situations specific to the patient. All the situations, objects, scenes, themes, jokes and funny things in general are individualized, and sometimes yield spectacular results. Based on information from the patient and his family, the therapist creates a treatment profile that fits what the sick person believes to be funny. This humoristic set contributes to the success of the therapy to the highest extent. The patient can later use the technique of getting good humor himself.

Laughter meditation. Similar to traditional meditation: the person focuses on the laughter and its cause, in a three-stage process: concentration, laughter, and silent meditation. In the first stage, all the energy is concentrated on relaxing the musculature without laughing. The second stage starts with a smile which gradually turns into peals of laughter. In the final stage, the person abruptly stops laughing and, eyes closed, breathes calmly and concentrates in meditation. Each exercise lasts 15 minutes. The technique works well for persons who do not usually laugh spontaneously. It is practiced individually.

Yoga laughter. Similar to traditional yoga, as presented by Dr. Madan Kataria in 1995 at Bombay, the technique combines breathing exercises and bursts of laughter. The intervals of laughter, whose duration is variable, are made easier by exercising. This method is used as preventive therapy. It can be practiced in groups or in specialized clubs. No amusing materials are needed. Laughter yoga is similar to asana yoga and Buddhist forced laughter. Some participants find it embarrassing and are uncomfortable practicing it, but despite these shortcomings, laughter yoga practiced in clubs and the International Laughter Day have shown in recent years that laughter methods, a good health therapy, are increasingly widespread. In China, new names have been coined for laughter styles: “the lion’s roar” and “nervous laughter”.

The laughter cure. Self-imposed laughter, without any guidance from outside, allays hunger and quenches thirst, raises the threshold of pain, and reduces stress as a result of the specific topography of muscular contraction. The association of psychological relaxation and laughter steers the effect towards optimism.

Notes:

1. Kataria's first Laughter Yoga Club began on 13 March 1995 in Mumbai.

2. Dostoiewski knowledge in epilepsy: Dominique Arban, who studied the pre-Siberian years of Dostoevsky’s life. Temkin wrote that “the genesis and nature of Dostoevsky’s. Henri Gastaut about

Dostoevsky's epilepsy. Hughes supports Gastaut's theory. A. G. Voskuil, was presented at a seminar organized by the Institut national détudes slaves in Paris to mark the one hundredth anniversary of the Dostoevsky birth & his epilepsy.

Th. Alajouanine wrote that Dostoevsky's was suffering of epilepsy, other ways he couldn't described so correctly.

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