LAUGHTER IN EPILEPSY, WITH SOME GENERAL INTRODUCTORY NOTES.

By JIŘÍ ROUBÍČEK, M.D.,

Assistant Physician at the Neurologico-Psychiatric Department of the Bulovka-Hospital in Prague. Director: Prof. O. Janota.

[Received July 28, 1946.]

LAUGHTER, known to mankind as a physiological response to happy and comical events in general, is one of the most inviting guides through human life, but sometimes it may point to various morbid states of mind.

Physiological laughter has been studied by numerous psychologists and philosophers, the pathological part of the subject and compulsive laughter by many physicians, both clinicians and anatomists. Reading through the accessible part of the extensive literature on laughter one realizes that much has not yet been quite elucidated. In recent years we have had an opportunity of following a few most interesting cases of pathological laughter. This essay has been devoted to a review of the psychological, clinical and anatomical studies, and to an analysis of our five cases and their relation to epilepsy.

I. PHYSIOLOGICAL LAUGHTER.

The anatomico-physiological act of laughter consists of a deep intake of air, followed by short, violent expirations by means of which the air current is expressed through the stretched-out vocal cords. Variation, intensity and timbre of the sound are produced by the vibration of the vocal cords in the larynx and of the soft palate. To this succeeds the familiar expressive movements of the facial muscles, consisting in a synergic contraction with the characteristic facial expression of extended cheeks, contraction of the mouth-corners backwards and upwards, narrowing of the eye-slits and deepening of the naso-labial wrinkle. The extent of laughter ranges from a scarcely perceptible and inaudible smile to roaring laughter, when—apart from the muscles of expression —those of the trunk and limbs will also participate. Sometimes, when laughter is being prolonged or is too violent, even tears may appear. The quality and form of laughter are rather individual. Somebody will laugh more with his eyes. His sight will appear to brighten, the skin around his eyes being creased to minute wrinkles and the mouth corners raised up; another person will laugh chiefly with his mouth, cheeks and head; and finally there will be people whose laughter is conspicuous by a rapid rhythmic movement of shoulders—they virtually laugh with their shoulders, trunk and abdomen.

Laughter is an expressive manifestation, specially human. Rabelais says: "Le rire est le propre de l'homme." To Balzac also laughter is only man-

kind's privilege. Darwin describes laughter in monkeys produced by tickling, by their mutual tender affections and sudden joy. R. Francé heard that playing monkeys laughed aloud like children. According to Selenka, younger and female monkeys utter a loud, high-pitched laughter, which terminates in a quieter tone. We could not, however, confirm these observations, watching them in captivity in zoological gardens and in the specimens kept at our hospital. Nor did we observe in other animals an expression equivalent to laughter. Animal expressions of joy and mirth are undoubtedly frequent, the most familiar of them being a dog's wagging of its tail, but if these be equivalent manifestations, they are still too remote from our conception of laughter.

In laughter we can, therefore, differentiate a mechanism of facial muscles, a respiratory and phonetic mechanism, and finally a generalized muscular mechanism occurring in violent laughter. Regarding the respiratory mechanism the opinion now prevails (Raulin's) that the staccato expiration is dependent on the relation to the internal intercostal muscles, which check the enlargement of the thorax, and that the part played by the diaphragm, which was previously attributed the principal part (Darwin, Brissaud), is but secondary.

Most frequently laughter is brought about in a psychic way by various pleasant sensations or imaginations, i.e. wit, ludicrous situations; mechanically, by tickling; or chemically, for instance, by laughing gas. It means that laughter originates from central and peripheral impulses. Laughter is easier set free after small quantities of alcohol, opium, kawa, maté, or hashish have been taken. With regard to the participation of facial and respiratory muscles and occasional compulsiveness to laughter, Zutt compares it—apart from crying—to such other phenomena as yawning, sneezing, coughing and hiccup. Among these yawning especially is important as an expressive function, and like laughter and crying, is sometimes accompanied by lachrymation. Zutt put up the following parallel: Laughter—joy—tickling; crying—sorrow—pain; yawning—boredom—fatigue.

Laughter is an intensified sensation and manifestation of vitality, an expression of psychical youthfulness and freshness. *Vice versa*, the lack of laughter points out to a sort of psychic rigor. Absence of laughter in melancholy and the peculiar laughter of the debilitated and the demented are well known. Laughter brings in a mental refreshment. Should the listeners in the course of a serious lecture be given an opportunity to have a good laugh their attention will again be raised. Laughter can be set free in connection with various affections. In itself it is a manifestation of a preponderatingly affective nature, which does not originate in a mere sensation of contrast, but only on the basis of emotion, which is called out by this sensation. Laughter—be it expressing a good humour or resulting from a descendant contrast (which will be explained subsequently)—is felt as a pleasant agitation. Quite exceptionally the contents of laughter may consist in bitterness and pain. According to the way of expression and causes we differentiate laughter emanating from joy, happiness, naïveté; a good-natured, cordial, coquettish, sarcastic laughter; then laughter produced by embarrassment, knowledge of preponderance or derisive and desperate laughter. We know and can discern a forced, insincere

laughter. Laughter reflects not only the actual state of mind and the momentary posture towards the environment, but the whole character of the person concerned permeates it. People taking a positive attitude towards life not only laugh oftener, but their laughter sounds quite different from a bitter derision, a mocking outburst or the cold laughter of a pessimist. A certain relation seems to exist between laughter and the somatic constitution. The average pyknic will produce a different kind of laughter from (or to) a person of a leptosome type. Again, the difference consists not only in the quantity, but in the quality of the laughter as well. Laughter necessarily serves to balance the earnestness of everyday life and to mitigate various checks. Delight in art or wit is a delight in freedom of the spirit.*

History and literature teach us that even in times of oppression bantering from clever heads went on followed by laughter of those who understood. Laughter is one of the most beautiful capacities, by which man differs from the animal and through which he approaches the Divine. It is one evidence of the freedom of the spirit over the body.

Psychological explanation of laughter.—The problem of laughter is often confused with the problem of the comical. But it is obvious that psychological motives in laughter are frequent and not exhausted only by the comical. One can laugh without any sensation of ludicrousness, out of joy, euphoria, after agreeable tidings, or after good eating and drinking (laughter of the Homeric gods). Physiologically it is the same process, but psychologically there is a confluence of two very distinct sources. One laughs in reaction to a change from unpleasant surroundings into agreeable ones (in contrast after hours of tiresome uninteresting work or a sad experience), when looking at something lovely; unexpected meetings of dear friends are expressed with a smile. Children and savages laugh when presented with a new toy or a knick-knack. Acquired experience, however, makes people lose more and more of that reactive link for the perception of hilarity; they immediately and too critically take into consideration the opposite side of all actions. The more the cortex is developed and differentiated, the more extensive are these checking arrangements; the more numerous is their experience and knowledge, the rarer and more restricted is the laughter. Refreshing laughter is getting scarcer and scarcer. No wonder that children and primitives can laugh easiest.

Laughter out of the sensation of something comical, and the problem of what the comical really is, has attracted the attention of numerous philosophers and psychologists from Plato to Bergson. To Plato the comical is a painless ugliness. Hobbes developed Aristotle's notion of degradation. Laughter was attributed to a sudden feeling of triumph emanating from a state of superiority as compared with the inferiority of others or our own in time gone by. Bain

* Laughter is a form-casting and creative activity, which selects its subject according to plan from actions and men precisely as an artist in an elevated sphere of action would do. Laughter not only does not take notice of imitations, but it puts up parallels, is constructive, is a manifestation of imaginative powers. It is not beautiful just because it discovers vital automatisms, but because it creatively builds up artificial comparisons. The great art of laughing has a curative, regenerative, liberating power. Thanks to its bellicose arch-origin (see below) it is always a sort of weapon against convention in the name of imagination, which dramatizes the working-day and which in the name of social health sends it on its mission. Tartuffe and Goethe's priggish Wagner are examples of both curative and stormy hilarity (Frejka).

adds to this that the cause of ludricrousness lies not only in the degradation of the persons in question, but also of objects. This explanation, certainly fitting in many cases, because we do sometimes want to express by laughter, "We should not be capable of such a mistake or clumsiness," lags at other times behind. We do often laugh without a feeling of superiority and degradation of our surroundings, in a good humour, at a joke and so on. To Kant the comical is a suspension of expectation, and laughter is explained by him as a sudden relaxation of a strained expectation into thought. According to Sully it is just the expectation which dispels the waiting, the unforeseen in the behaviour, speech, deeds, which is the source of laughter. On the other hand, of course, we know that not everything unforeseen can call forth laughter. According to Schopenhauer the origin of laughter is to be looked for in a sudden discovery of a discrepancy between the conception and the actual fact. The greater the divergency, the more violent the laughter. As a matter of fact by laughter we oppose reality. Dumont believes that contrast and divergency are not sufficient to explain this, and that a logical contradiction between two contemporary notions is essential. Mélinand sees the origin of laughter in the oddness and absurdity of facts that suddenly turn commonplace or even vulgar. Decisive, however, is the sudden transition from the valuation of something being absurd to the fact that the matter is quite natural. Spencer supports the theory of contrast as well. He discerns, however, two kinds of contrast: from less to more, and *vice versa* from more to less. The contrast that brings about the laughter is only that from more to less. To make this theory generally valid it would in any case be necessary to ascertain the amount of the accumulated energy which then is discharged in the descending contrast. Lipps in accordance with the previous author holds that a comical effect arrives when one expects something great and by way of contrast there happens something insignificant. Then the redundantly accumulated psychic energy under accentuation of a tendency for the discharge of laughter is set free. Herbart says that laughter is "anaesthetic value" consisting in a disharmonious relation the degree of perplexity in which is subjectively relative in effect, once acting comically, at another time even tragically, there being a possibility of transition from the comical to the majestic. To Croce the comical is a psychological process of a purely organic or of a mental and organic origin, which puts the observer into such a position that when forecasting and expecting a certain phenomenon he suddenly discovers that his supposition has turned upside down, but the sense of unpleasantness and disappointment is immediately substituted by liberation, pleasure and their psychological equivalent laughter. Friend believes that in a joke there is a kind of permanent reserve, pleasantly accentuated, which is drawn upon in the laughter. Wit helps to overcome suppressed tendencies (for instance, by an obscene joke one takes the liberty of being rude). At the same time the internal discrepancies are being removed, whereby their internal psychical energy is saved. According to Bergson, laughter is forced upon man whenever there appears something stiff, mechanical, machine-like in the middle of a mindful, strained and expectant vital current. If man does not adapt himself to the situation but reacts like a machine, rigidly and mechanically, like an

automaton, a contrast will arise between him and the reality which will be perceived as comical. Bergson considers laughter to be a social process which acts in the social life like a corrective of automatism. Laughter is a penalty paid by those who betrayed life by their rigidity, laziness and machine-like ways. It is to bring them back to real life again. It is a remedy for paralysing man's tendency to automatism—a remedy which puts up conventionality on the pillory. Weltsch considers Lipp's and Freud's considerations as being too commercialized, holding that one cannot always talk about reserve " savings " which could be disbursed in laughter. He also objects to Bergson's view of explaining laughter, because a punitive social remedy does not seem to be satisfactory for the simple reason that laughter is not always a mockery, and a laughing person is not always equivalent to a mocking person, and cannot always be insensibly and objectively above the situation. He thinks that there are at least two lines of thought of a different category in respect of their contents and a link of surprise which happens to join them against all expectation, as an essential of the wit. Laughter brings forth an explosive disruption of this link. There is a disconnection of the chaotic linking up of the various currents of thought by an unexpected elucidation and comprehension of the connection and meaning—an acrobatic feat of the spirit. But even this elucidation, reminding us after all of Ebbinghaus' view, is obviously valid in some situations only. Dumas considers as most appropriate Spencer's conception. He holds that the latter's view of " the descendant contrast " approaches in substance the older theory of degradation, and stands in no essential conflict with Bergson's general theory when automatic reaction in place of an adequate and expected rational reaction is made equivalent to the effective contrast of " from more to less." In this way conceptions of laughter coming out of a sensation of something comical which can be taken for a phenomenon of a sudden alleviation could be brought nearer together, in the same way as the conception of laughter out of joy and exuberancy when it is understood to be a result of the decline from the previous exultation above the everyday's average, or from a suppression of anxiety. This results in loosening the tension and liberating the discharge after an intensified pleasant agitation. In such a laughter there is a certain gradation of human feeling of vitality. Although much ingenious theory has been written about laughter, still a uniform psychological explanation that would give an all-round satisfaction does not yet exist, even if it be admitted that Dumas's synopsis is remarkable.

The sociological side of laughter.—Generally speaking it is a well known fact that for an individual, collective emotions are always much more intensive than those which are quite private and personal. Let us recall the reactions stirred up in crowds by suggestive orators, in spectators at sporting matches and the like. So laughter in society is also a connecting linking element which in virtue of its contagious operation brings the individuals close together. Laughter amongst a theatrical audience belongs to the same category. It does not consist only in the concerted action of the comedian and the public, but also in that of the spectators in the auditorium among themselves. Bergson felt that laughter stood in need of an echo. Through his laughter the individual hastens to express his assent to the merriment of his environment, shows that

he is just a jolly good fellow like the others and of the same, fine, sensitive spirit. In a way laughter is evidence that the individual is capable of social life. Those who spread an atmosphere of mirth and laughter around are welcome to us and sought after by society. When alone we laugh, as a rule, neither so often nor so intensively as when we are in company. A person laughing during a conversation is not likely to incur displeasure and adverse interest, but if an isolated person begins to laugh louder, say over a book in a park, during a ride in tram or train, then he attracts the attention of the whole neighbourhood; and there will be people watching him with a questioning eye and even shocked. Those who burst out laughing at a recollection become the target of incredulous looks and may even be suspected of insanity. Crying pertains to solitude; laughter, however, is an emotion tending to society. Almost every branch of human activity exhibits its own, separate, singular kind of ludicrousness and jokes of a special character. Let us only think of the jokes of the medical men on the medical profession, of political jokes and anecdotes or jokes current in the theatrical world, etc. The diversity in laughter and jokes, however, is characteristic not only in individual professional groups, but often also in national units, showing a characteristic posture in this respect. We can easily discover the difference in French wit. Special features are betrayed, for instance, by Scotch or Irish jokes, by the humour of the Oriental people or in Jewish jest. There are, however, nations incapable of hearty laughter.

Laughter and human age.—Laughter accompanies man throughout his life, but there are periods when it appears more frequently and can be released more easily. In childhood and in youth good humour is chronic and laughter frequent. That is one reason why people revive in the presence of young folks. During puberty, especially where girls are concerned, laughter is always near at hand. That is one of the traits peculiar to this age. Such laughter bursts out from quite insignificant causes, sometimes without any apparent cause whatsoever and may even occur paradoxically. A connection with the incretorial changes in the organism seems to be unquestionable, so much so that the second period when laughter is more frequently occasioned is incipient old age. A strict differentiation, however, is essential as to what is due to psychological action—an old man's benevolent smile, emanating mostly from an experienced, ripe outlook on the surrounding strife, which in old age often appears to be trifling—and what, on the other hand, must be attributed to the sphere of pathological action, such as the compulsive laughter due to atherosclerosis of the brain vessels. During the discussion following my lecture on laughter at the Society of Czech Physicians in Prague in 1942 a controversy arose as to whether laughter is a mental manifestation phylogenetically recent or ancient. The point is difficult to decide. Autogenesis is an abbreviated phylogenesis. We can see that on the faces of few weeks' old babies a radiant smile can be called forth. Of course, in such a case a child's great imitative power must also be taken into consideration. The infant, as a rule, sees more smiling than frowning faces around. Laughter, in my opinion, is phylogenetically rather ancient; it is one of the earliest human emotions and it appears soon after fear and awe. Man on the earth feared earlier than he

laughed. There were so many things for him, so many natural phenomena which he did not understand and which he worshipped out of fear.

Fear is a matter of loneliness; laughter, on the other hand, issues from society. The fact that somebody belongs to a certain group or caste is capable of initiating laughter; derision of a man coming from another place, behaving in a different manner (Frejka). It might have been necessary for man to belong to a more advanced settlement, to enable him to laugh for the first time at his foe, beaten or killed, the foe from the backward village where such clumsy flint spearheads would still be made. Let us think of the first laughter at fashion and the fashionable man! Just as to-day the newcomer from the great town would be laughed at in a society of the small town, dwellers of the town would laugh at the country man and the country-man again at the town-inhabitant treading clumsily across the country-side. Everyone of us bears in his mind a notion that he belongs to a clan, which fact makes us laugh at others and other things out of this clan self-consciousness, although they are no worse than ourselves, but simply come from somewhere else, are country-like, barbaric as the ancient Greeks would have it, not excluding even such an advanced culture as the Persian. The ludicrous, the barbaric would simply come from outside of one's own country, from outside the familiar—from outside one's own world.

Laughter and sexuality.—In the same easy way as bringing about laughter that originates in joy and euphoria, on receipt of pleasant things, after good eating and drinking in an engaging society, so the state of sexual emotion—which in itself brings in an intensified sensation of vitality—is followed by a pleasant state of mind, and apart from the internal joy there is also a more facile release of laughter. People longing and loving are always, as it were, in exalted spirits, happy and gay, and laugh oftener than usual. The misogynes affirm that love and longing stupefy and impair higher psychical functions. Formulating this point of view in another way, we can say that sexual manifestations are, up to a point, a discharge from evolutionally more ancient centres placed in the mid-brain and interbrain into the functions of the cerebral cortex. In the same way, for instance, as by the consumption of a sufficient amount of alcohol, so by the sexual emotion a partial suspension of the inhibitory cortical functions can be effected in conjunction with the release of the centres which are placed in the extracortical basal grey matter, where also is placed the mimic centre of laughter.

There is no doubt that physiological laughter is often subservient to sexuality. Young people, especially girls when courting, laugh excessively for slight reasons, and for no reasons as well, the laughter coming out in quite unusual and unexpected tones, as if in affectation. In some women's laughter there is a downright gush of sexuality. This is characteristic not only of the "spoiled" inhabitants of towns; in the country, laughter of the adolescent young people courting at night resounds far and wide. There is no wonder, either, that poets keenly perceived this close relationship between sexuality and laughter (as could be adduced from any nation's literature). Special attention has been paid by the psycho-analytical school to the relation of laughter to sexuality. The views expressed there vary. It is believed that

there exists a relationship between laughter and masturbation (Raitzin). Others consider compulsive laughter to be a symptom of defence against vanity, narcissism; according to Ferenczi there are cases of pathological laughter equivalent to erection. Bechterew described, in 1900, two patients who affirmed that their fits of compulsive laughter were due to masturbation. There are not infrequent references in writings and talk to the sensual smile of Gioconda, a smile suggesting and partly betraying the secret of perfect womanhood, longing and wise at the same time. H. Van Loon is of the opinion that this, so many times glorified expression, originated in Leonardo's mere artistic incapacity, as can be observed in numerous ancient statues. It is suggested that there should not have really been a smile, but that this was occasioned by the lack of technical skill of the sculptors in such places where we might expect an expression of profound grief. It is, however, difficult to agree to Van Loon's opinion concerning the sculptors, and especially a painter possessed of such anatomical and physiological knowledge as was Leonardo da Vinci. That smile of Mona Lisa bears a considerable resemblance to Leonardo's St. Anna, but not to that of other women that he had painted. Ebbinghaus holds that this archaic erotic smile represents a grimace displayed in erotics as a releasing laughter in the sexual act.

It is not altogether without interest that in the Bible the first allusion to laughter bears a close relation to sexuality. Sarah laughs at the prophecy of getting pregnant (Genesis, 18, xi).

The intimate connection between sexuality and morbid laughter is supported by an interesting case published by Wilder. The man concerned was a 44-years-old journalist who, since his childhood, was subject to baseless attacks of laughter, during which in later years he experienced a sensation similar to that in coitus; this, after the attack, was sometimes accompanied by orgasm, followed in turn by low spirits. For many years there was in the patient no derangement of the sensorium or amnesia. The journalist cleverly hid his fits by quickly improvised jokes, when in company. The attacks, however, gradually gained in intensity, were more frequent and used to occur in his sleep. At times the normal adequate laughter passed into an inadequate, intensified seizure. This, in later years, was coupled with headaches; there was a twinkle in his eyes and a curious sensation of smell of something burnt, and a tremor during which the patient bit his tongue more than once. In addition to this there were amnesic disturbances. In the end these seizures of laughter were followed by severe attacks of unconsciousness accompanied by fall, injury and complete amnesia. Sometimes this compulsive laughter passed over—without an apparent cause—into compulsive crying. On bromine and luminal being taken the attacks of laughter were markedly reduced and the major epileptic fits disappeared. For years the patient took a passionate interest in aviation. He also wrote numerous popular articles on flying. During the flight in an airplane which he often indulged in, he sometimes felt happiness as during coitus or in his fits of laughter. All that concerned flying rather excited him and at times even caused a fit of laughter. This sometimes was provoked by mere flying of a bee. When he got a fit of laughter whilst in bed then, instead of erection, there came a sensation of flying. That, how-

ever, never occurred while he was sitting or walking. I shall come back to analyse this case once more in the chapter on epileptic laughter; here I only wished to indicate how sexual experience blended with uncontrollable attacks of laughter, which in former years showed nothing suspicious of an epileptic basis. There is an easy comparison with the so-called "flying dreams" and levitations, which for a psychologist are a symbol of coition.

Taking into consideration the points of contact which laughter and sex have in common we can see that there is a certain "discharge" of the accumulated energy. If both these actions were illustrated graphically we should probably get a moderately rising curve which, on reaching the apex, would abruptly decline—just a picture of heaping up and discharge of the accumulated energy. Ferenczi reminds us of the comparison to the psychosomatic mechanism of the erection. Similar accumulations of energy and its discharge can be seen—apart from laughter—also in anger and rage. In all probability crying exhibits a similar curve with acme of growth and precipitous decline as well. Noteworthy is Raulin's suggestion; he draws attention to the psychological point of view and to some sort of warnings—sensory, vasomotor or motor "auras," which sometimes precede laughter. Furthermore, he recalls the exhaustion and fatigue following a severe dyspnoeic laughter, and so comes to compare the seizures of laughter to epileptic fits. Really, on casual comparison there is an initial coincidence, a warning of an impending paroxysmal mechanism, then a violently passing paroxysm itself sets in when in either case vehement contraction of muscles can be observed, and finally its termination—a similar termination in either of these mechanisms, viz. exhaustion.

Intruding character of laughter.—Normal laughter possesses some sort of autonomy, and apart from it a certain intrusiveness and persistency. One often bursts out laughing against one's own will, being conquered by it. Having started to laugh, then, contrary to one's will, one cannot quite stop it. There is, therefore, a mechanism which offers itself, intrudes, and when put in motion by an adequate stimulus it disperses and exhibits its own autonomy, which is not under the full control of our will. We may laugh so much as to be obliged to sit down, to lose our self-control. In such a case the decline of tonus is apparent and the collapse near. Now catalepsy, so frequently preceding narcolepsy, can be expected to set in. Similar states when after an adequately substantiated but persistent physiological laughter there was a breakdown were described by Oppenheim as "*Lachschlag*" (laughing fit). Hyperventilation may be participating here, to the study of which—a study of provocative method for bringing about epileptic fits—numerous pieces of research have been devoted. The participation of hyperventilation must not, however, be overestimated, as we know that even grievous emotion accompanied by crying may result in cataleptic phenomena. Of course, even in such cases we may observe, sometimes at least, prolonged sobbing which, in itself up to a point, is hyperventilation. In folklore also we can observe the relation of laughter to unconsciousness. Tickling that leads to the loss of consciousness and even tickling to death is discussed.

The transition to an expressly pathological region is often not clearly marked,

being gradual and sometimes hardly noticeable. Firstly, the intrusiveness and inducement to laughter may be more marked, but still the impetus appears to be adeqate. The laughter, however, is exaggerated, more frequent and lasting, and less controllable by will. Anyhow it still remains a roughly normal phenomenon, and the transition to the pathological laughter is rather quantitative than qualitative. As a rule, this laughter still makes other people laugh. Secondly, the part played by the stimulus becomes diminished and the laughter is spoken of as inadequate. The compelling force increases to such an extent that the laughter irresistibly occurs in very awkward situations. Such laughter is incomprehensible for the entourage. The laughing person gets suspected and becomes the subject of attention from all his neighbours. At times the laughter may even break out under such circumstances that in a given situation or in respect of the general condition of the person in question it may produce a shocking effect. Laughter in this form completely loses its capacity as a common link; it lacks contagiousness for the neighbourhood. The conception of adequateness is certainly vast, its boundaries are elastic, and the personal point of view as to whether it be adequate or improper is rather relative. Many people would, quite naturally, laugh at what will not induce other people to laughter, but the laughter which the company concurrently considers inadequate may later on provide sufficient explanation of the causes which were previously unknown. At times we are forced to laugh in the most serious circumstances, for instance, at school, church, etc. Finally, there have been known pathological fits of laughter, when consciousness was impaired and partial or complete amnesia occurred. Here occurs an overwhelming burst of laughter without a psychologically comprehensible stimulus. It does not make the others laugh; the facial movements go over into a rigid grimace, which in itself produces horror in the company. There are cases when it is possible to observe all degrees of transition from physiological into pathological laughter in one and the same person. So it was, for instance, in the aforementioned case, published by Wilder.

II. Pathological Laughter.

Apart from the attacks of inadequate, paradoxical, compulsive laughter occurring against one's will which presents one of the pathological symptoms in graver psychoneurotic cases and in patients suffering from obsessional states, we meet also with a non-physiological laughter, associated with various physical and mental maladies. In the majority of cases this laughter lacks the usually attendant perceptive sensation of internal joy and will not, as a rule, be coupled to any of the known impulses to laughter; it will be unfounded. There will be a certain dissociation of the outer (respiratory and vocal) mimic manifestation and the internal experience. This, however, is not always the case. Some patients will begin to laugh *only* after an adequate stimulus, such as a ludicrous situation or a joke. Only then the mechanism of laughter will pass over into the pathological region both in regard to form and duration.

As to frequency, mention firstly ought to be made of the morbid laughter which occurs in the more advanced atherosclerosis of the brain vessels in the

"*status lacunaris*" and in post-apoplectic states. Similarly, in disseminated spinal sclerosis accompanied by psychic euphoria laughing is nothing extraordinary. Its effect is sometimes cruelly paradoxical in severe paraplegias generally associated with a poor state of health. Grigorescu states that he has found compulsive laughter in 33 per cent. among his patients suffering from disseminated sclerosis. In this percentage, however, he includes also the stereotyped grimace in some of the sclerotic patients. Curtius describes a woman suffering from disseminated sclerosis who on the death of her husband burst out into compulsive laughter lasting ten minutes, and also during the investigation of the case burst out repeatedly laughing. In the year 1939 a 45-year-old clerk was receiving treatment in our ward. He was suffering from an advanced disseminated sclerosis and also used to laugh in an unnatural manner. Besides crying, compulsive laughter is one of the familiar symptoms of *amyotrophic lateral sclerosis*. Bodechtel believes that crying and laughing in such a case are not really organic symptoms, but that they are caused by lack of power which the patient comes to realize in the course of the malady. He will couple a consoling word with new hopes, which are immediately manifested by the change of mind—by directly passing over from crying to laughing. However, we should prefer to seek the reason in organic causes. In these patients we can frequently observe—apart from affective disturbances—other psychical derangements as well. The compulsive laughter is often a symptom of pseudobulbar paralysis (in the syndrome of the internal capsule). Violent attacks of laughter are known to exist in post-encephalitic states. They belong to those symptoms of chronic epidemic encephalitis which formerly were considered hysterical. In these conditions, termed by Rothfeld gelo- and orgasmolepsy, one can follow the relation of epidemic encephalitis to narcolepsy. A breakdown and collapse of narcoleptic patients can sometimes be introduced by a fit of convulsive laughing. This consists of a sudden loss of general tonus. A short time ago we witnessed a spasmodic fit of laughter in an 11-year-old boy, suffering from acute disseminated encephalomyelitis; there were occasional attacks of crying and a special kind of rounding lips. Attention was drawn by Salmon to the antagonism existing between the active loss of tonus in narcolepsy and catatonic states that are known in catatonic schizophrenia. The fits of laughter, however, represent also one of the affective schizophrenic disturbances. Through its character of spiritless mimic expression,* in which, as a rule, no trace of sentiment can be detected, it differs from the fits of spasmodic laughter in some of the hysteric states, where the laughter is attributed to affective and respiratory cramps. So fits of laughter are regularly attendant upon mania, this being closely connected with the whole psychic condition of the patient. Disproportional laughter is frequent in some forms of general paralysis, perhaps as one of the manifestations of general mimic ataxy. Silly joking and uncritical laughter—so called *moria*—is known to exist in some of the organic brain lesions, such as in new growths, cranial trauma and so on. This symptom is considered important in localization in

* As quoted above, Raitzin comes to the conclusion on the strength of his profound studies that not even in schizophrenic laughter is there a casual, mechanical, psychologically empty expression of the spirit, holding that there is a close relationship between laughter and masturbation in such cases. This view seems to be acceptable only in some cases.

cases of injury to the frontal lobes. An early and considerable moria is really one of the fairly reliable symptoms of frontal localization. A merely indicated or late moria is, however, of little topical value. Fits of laughter after more serious alcoholic intoxications are a commonplace symptom. In delirium tremens attacks of portentous terrifying laughter may sometimes occur. Horror and anxiety of the patient diffuse and mingle with a euphoric state of mind. Compulsive laughter was also described by Embden as a symptom of manganism. Zutt draws attention to it as to a rare symptom of migraine. Anton observed it in a defect of the cerebellum, Infeld in pachymeningitis haemorrhagica, Oppenheim in tumours of the thalamic region.

It will be noted that the disturbance may come from the psychical region, as for instance in mania, atherosclerosis of the brain-vessels, paralytic dementia, etc. In the so-called " risus sardonicus " there is really no laughter at all, but only a spasmodic facial contraction in the region of the n. facialis as is frequently the case in tetanus.

Centres of laughter.—There exists a vast literature on the centres of laughter based especially on anatomical and pathological investigation of cases of morbid compulsive laughter. At least Bell's, Romberger's, Nothnagel's, Brissand's works ought to be mentioned here. In compulsive laughter most frequently a disorder in the thalamus has been ascertained, where most research workers place the chief mimic centres. Far less frequently an injury to the pons has been discovered. According to Sternberg mimic centres exist, apart from the pons, also in the medulla oblongata. Head believes the nucleus anterior and n. internus thalami to be the chief mimic centres. Monrad-Krohn holds that the thalamus contains the motor centre of laughter in the sensory, lens-like core.

Bechterew is of the opinion that compulsive laughter is derived from the disconnection of a link between the thalamus and the cortex. Constantini has found that in 65 per cent. of the cases of compulsive laughing the nucleus lentiformis was affected, in 20 per cent. the anterior armlet of the nterinal capsule, but without exception there was a lesion of the nucleus lentiformis as well. From the investigations of Mingazzini's school, which devoted much attention to the question of morbid laughter, we gather that most frequently the lenticular nucleus, especially the putamen or internal capsule, or both, have been affected. Rarely an injury to the thalamus, cortex or pons has been ascertained. Mingazzini considers the thalamus to be the most important centre of mimic activity, and believes that important routes run through the nucleus lentiformis. Apart from the peripheral auditory and visual impulses, the thalamus is being regulated through the cortex by way of the cortico-thalamic routes which pass in the anterior part of the internal capsule. The centre is connected by the thalamo-bulbar route with the bulbar core of the nucleus facialis. Whenever the restrictive links between cortex and thalamus have been severed, voluntary laughter and laughing on request are made impossible. On the contrary, there occurs, against the patient's will and without an adequate stimulus, an inadequate compulsive laughter. According to Mingazzini it is a psycho-reflex to a pathologically provoked automatism of the mimic centres as a result of their release from the inhibitive cortical influences.

Senise, who devoted a monograph to laughter written from the anatomical point of view, differentiates a fronto-thalamo-pontine route for the automatic involuntary laughter and a direct cortical-pontine route for the voluntary laughter. According to him the former runs from the frontal cortical area (F_2) through the anterior flexure of the internal capsule via the thalamus to the core of the facialis nucleus and then into the pons.

Laughter and epilepsy.—The relation of morbid attacks of laughter to epilepsy will now be examined more closely. Before Brissand first drew attention to it there were only isolated reports on epileptic laughter. Wilson described two patients in whom laughter sometimes represented aura, preceding a major epileptic attack. The aforementioned Wilder's patient belongs to the same category. His fits of laughter, of an obsessional character at first, changed in course of years so much that the laughter was often a prelude to a major epileptic fit. In this patient's family one brother was treated for severe epilepsy in an asylum. His second brother had been, since childhood, in the habit of laughing without any motive. In addition, this brother's son was suffering from a similar compulsive laughter. Here one may talk about an epileptic disposition of the brain, affecting the whole family, coupled with additional local inferiority of some definite brain section which played a decisive part in originating the attacks and their form. At first there was a sort of compulsive paramimia in the shape of laughter contrary to the patient's will under inadequate psychical stimuli; in the end the laughter became an aura of the familiar epileptic phenomena. In 1937 Rogal described attacks of laughter lasting about half a minute in a 14-year-old boy who had suffered from them since his second year. These attacks were always accompanied by severe impairment of consciousness and were followed by amnesia. In addition one typical epileptic fit had occurred. These attacks gained in intensity on sympatol being given. Wilder and Rogal hold concurrently that their patients were suffering from genuine epilepsy and consider the fits of laughter as epileptic equivalents. Wilder's case is, as remarked, evidence of an intimate connection between morbid laughter and sexuality. In 1942 Veraine described attacks of laughter in a young epileptic, originating from a trauma in the frontal region and considered them to be an epileptic equivalent. The mechanism of the inception is explained by him in the same way as that suggested by Senise, *viz.* the loosening of the subordinated centres after the disengagement of inhibitory influences.

In the years 1940 to 1942 we had an opportunity of observing five cases of pathological fits of laughter. Three of them were connected with epilepsy beyond any doubt; the other two were not quite so certain.

The first case was a chauffeur, aged 29, who was first received at the Neurologico-Psychiatric Department of the Bulovka Hospital on August 21, 1941. His father had been killed in the war; his mother had died in her 65th year of age of emphysema. Three of his brothers and sisters are healthy. There were no degenerative signs in the wider circle of his relatives. When six years old the patient had pneumonia. In 1933, during his work in the garage, he was forcibly hit on his head just above his left eye, but he did not become unconscious. In 1934 he contracted gonorrhoea. He did not indulge in alcohol and smoked only a little. In 1938, for the first time, he had an attack of unconsciousness, which he believed had lasted several minutes. He was unaware of there being any cramps as well. He did not

wet or hurt himself in any way, but bit his tongue. A year after he had the second similar attack, and at the same time there appeared other fits, which the patient described as follows: Suddenly I felt as if everything in my head got dulled, thinking and all mental activity ceased, my breath paused and I experienced a sort of humming. I began to laugh violently against my will. At the beginning I tried to suppress the laughter, setting my teeth together, but all in vain. In my fit of laughter I heard I was laughing. The laughter lasted from a quarter to three-quarters of a minute. It was a loud giggling and at times a sort of rolling laughter. In my laughter I never felt any hilarity and never quite lost consciousness. These fits kept on coming oftener, in the last period even several times a day.

On neurological examination no substantial derangement was discovered. The urine, the ophthalmic background, the blood-serum and the X-rays of the cranium yielded normal results. From the lumbar puncture a clear fluid issued under the pressure of 18/12 according to Claude's method. The fluid—apart from Pandy's positive reaction—was normal. The patient was a pyknic in habitus, weighing 78 kgm. and measuring 168 cm. On psychiatric examination a certain retardation of the cogitative processes was ascertained, the patient answering slowly, trying to formulate his answers with pedantic accuracy and pausing in conversation. Also during his stay in the hospital he behaved in a strange manner, was rather clumsy, slow in grasping other patients' jokes and irritable. He would stop the physicians in the corridor and again and again ask questions regarding his malady, and during the visiting hours he would always have some question to ask. At the hospital he at first had two to six attacks of laughter daily. We saw him laugh sitting or standing. When in a recumbent position he would first sit up and only then burst out laughing. When he had a laughing fit in his sleep he would not change his positions. The fits were initiated by sharply fixing the eyes on a spot, pausing if he happened to be walking. Then he would burst out into loud laughter, or chuckle in a rather sharp manner. His face would turn red. In his face there would not be a trace of warm infectious humour, his grimace appearing to the spectators insincere and strange, and at times there would be something almost terrifying in it. At the end of the attack the red colour of his face would turn light cyanotic. The patient would then utter a slight cough, breathe out several times, look unsteadily about him and begin to talk about his having involuntarily laughed again. When addressed or called after the attack, he would turn his head round, but would not answer. Being questioned after the fit as to what was going on in his neighbourhood during the fit, he would sometimes give a good description of everything; at other times his answers would be evasive, and one could see and prove that he was not quite so well informed. When addressed or disturbed during his fit he brought the half-a-minute's period of laughter to the conclusion without any interruption. We were never able to put a check on, or stop, the mechanism once it was set in motion. The patient did not react to treatment with 0·1 gm. luminal, behaved refractorily to psychoton, and only after injections of dormiral and on taking prominal was without a fit for several days. He had no major epileptic fit in the ward. The patient was discharged on September 21, 1941. He came back again in June, 1942. The immediate cause of his return to the hospital was a heavy fall from a 1 metre high stage in a fit a day before, when he broke his left wrist. He stated that he was being employed as an unskilled worker and that for about a month after his discharge from the hospital he had no fits of laughter, but then they reappeared and were coming several times a day, as a rule when he was moving or walking. He had wetted himself several times. There were no major attacks with fall, the last one excepting. He did not notice any changes and his appetite was good. Lately he was taking prominal, 0·2 gm. three times a day. When experimentally 0·05 gm. of ephedrin was added to the morning and afternoon dose of prominal the fits of laughter were enormously increased, the number having reached 50 one day and 30 the next. Then, having left off ephedrin and taking prominal with bromide and occasional injections of dormiral the fits became rare again. The patient left the hospital on July 30. When he was re-examined in 1942 and his case demonstrated to the meeting of the Association of Czech Physicians in November, 1942, he stated that his fits were not so violent. They would occur during his work two or three times a day; exceptionally there would be a break of a few days. It will be noticed on recapitulation that this 26-year-old pyknic was the subject of isolated epileptic fits, the basis being probably the so-called "genuine epilepsy." In view of the negative neuro-

logical evidence the injury of 1933 could hardly be attributed any substantial importance. A year after there appeared, independently of the epileptic fits, attacks of violent, compulsive and uncontrollable laughter. Even were there no major fits and psychic changes, the character of this patient's fits of laughter alone would suggest a diagnosis of *petits maux*. The fixed absent look, the striking and constant change of colour in the face, the impossibility of the patient's response in his fit and in the later period the micturition, indicate the epileptic character of the attacks. Lastly, the patient reacts positively to the anti-epileptic routine treatment. Thus, in this case we can take the diagnosis of epilepsy with fits of laughter as epileptic equivalents for granted.

The second case.—The epileptic fit was sometimes introduced by brief laughter and concerned an apprentice to a locksmith, aged 15. The patient came for treatment to the Neurologico-Psychiatrical Department at the Bulovka Hospital in the months of November and December, 1942. His parents, brothers and sisters were healthy. His father's sister, however, was in an asylum with paranoid psychosis. Apart from measles the patient had never been ill. About a year before the above-mentioned date he developed fits, coming on two to three times during the day, sometimes also at night. He stated that his eyes would suddenly get blurred and he would not know what was happening to him. Those about him intimated that sometimes he would make a nasty grimace; at other times he would burst out laughing and then start muttering. He would answer no questions or only say something incomprehensible, inadequate. The fit would, as a rule, last not quite a minute. He would never get a convulsion or fall. Sometimes, however, he would wet himself in his fit. The attack would surprise him when he was walking, but he would not knock against anything. Often he would start running. There would be no other difficulties. He slept well, faeces and urine were normal, the appetite good. During the last year he lost weight (several kgm.). He had been attending an upper elementary school for three years and had showed good progress. He liked his trade. Recently, however, he noticed that he was getting vehement, wild and easily irritable, which he never used to be before. Objectively, he was a leptosome, weighing 60 kgm. and measuring 170 cm. Neurologically he was found quite normal and so was his urine; the fundi were normal and the result of X-ray examination and the W.R. in the serum and the fluid were negative. The result of the examination of the cerebrospinal fluid was negative. Encephalographical examination did not show any pathological changes. In the ward two fits a day were observed on the average and described thus: The patient got up from his bed and went to wash himself. He turned on the taps, and as soon as he put his hand into the water he burst out into a short, loud laughter. Then he turned away from the wash-basin, ran twice round the room and from there out into the corridor, hopping alternately on one and the other leg in the direction of the women's ward. When called, he did not respond. On reaching the women's ward he stopped, looked round bewildered, confused and asked how he came to be there, unable to understand how he could have got there. In his fit, which lasted about a minute, he turned red. The other fits followed a similar course, sometimes, however, without the introductory laughter, the patient only uttering a murmur or grumble. On getting 0·1 gm. of luminal three times a day the fits became very rare.

This was undoubtedly a case of the so-called genuine epilepsy with minor fits and already marked by psychical derangements. Some of this patient's *petits maux* were introduced by short loud outbursts of laughter. It was characteristic of the fits that the patient would start to run. The attacks were followed by amnesia.

The third case, a workman, aged 40, was examined at the Neurologico-Psychiatric Department of the Bulovka Hospital from February 22 to 25, 1943. He originated from a hereditarily affected family. His father was a drunkard; out of his seven brothers and sisters one threw himself under the train when 17 years old; the second one was suffering from paralysis of the limbs and constant headaches, since his 25th year; one sister was deaf. The other children and their descendants were healthy. The patient was divorced, his wife having left him on account of his infirmity and he had a 10-year-old daughter.

He recollected that in his childhood he had been hit on the head with a stone. At school he began to laugh strikingly often; not only in adequate, ridiculous situations, but quite improperly when other people would not laugh and would be wondering why he was laughing. This used to happen to him at school, at home, in the fields and woods. It sometimes occurred under queer circumstances; for

instance, he watched felling trees, and when a particularly beautiful piece of timber went down he started to laugh against his own will. At other times it was quite sufficient for someone familiar to him to pass by, walking or driving, and he would laugh irresistibly and ostentatiously, too. Having burst out laughing he would turn his face from the subject of the laughter, the laughter would soon cease and only a sensation of fatigue in his body, especially in the lower limbs, would remain. Later on, however, more and more often he happened to be unable to turn away his head by his own will-power, as if he had lost all control over his body and for a while would feel a strange undefinable levity in his limbs. He would feel like a bird, but when he was about to fly up he collapsed. As a rule be became unconscious for a little while only, had no convulsions, and shortly afterwards he would remain exceedingly pale. Sometimes he urinated and bit his tongue. These attacks of compulsive laughter, or laughter followed by fall and loss of consciousness, accompanied the patient since the school-years up to the time of his military service. The last attack was described by him thus: He moved in a waggon various things belonging to one of his acquaintances. Attached to the back of the waggon was a small cart loaded with casks. While making way for a motor car to pass, the little cart tipped over, the casks rolling in all directions and the car drove over them. Seeing this he got a violent fit of laughter, became unconscious and urinated. Since that time he had no such attack for 15 years. There were, however, periods of unconsciousness without any introductory laughter coming on every second month on the average. Besides, he often suffered from severe headaches, so severe that he would run away from his home because of them. A year before coming to the hospital he went for treatment to an asylum at a country town. It then occasionally happened that without any reason whatsoever he started crying. Tears would begin to run down his cheeks; he would sob, not knowing why. He would very much like to overcome this, but all in vain, crying went on. He admitted that he always used to be exceedingly sensitive, easily burst out crying when he met a funeral procession or when he saw somebody maltreating animals and the like. In the year 1936, during a seizure of unconsciousness he fell down from a height of several metres in a quarry. At another time he received grave injuries in a fit during a bicycle ride. Since the pains were felt most severe at rest, he was working whole days and nights. At the paper-mill, where he was employed at that time, he preferred to take night turns. There he would work for 12 hours and during the day he would work in a sand or stone quarry. He would sleep three to four hours a day. At night he would be subjected to wild dreams—flying above the woods, being chased, frequently seeing himself under horses' hoofs, riding at a break-neck speed in a car or boat. Often, when he woke up, he found blood in his mouth.

He made a good progress at school, never failing at examinations and getting average marks. He was bad at drawing but the best at mathematics in his class. He was possessed of a satisfactory general knowledge, was well informed as to place and time. When questioned he used to reply willingly and appropriately; often, however, he would enlarge upon the subject, his voice would sometimes tremble sorrowfully or he would start crying; at another time he would boastingly emphasize his enormous strength and earnings.

Somatically he was an athlete, weighing 82 kgm. and measuring 185 cm. He looked unusually young for his age—some 30 years. His skull showed an indication of luricephaly; on sounding the patient intimated that he felt a slight diffused pain. On the right edge near the apex of his tongue there were two short tough scars; one above the right supraorbital arch, one on the abdomen and one on the left thigh. Neurologically there was nothing pathological. Blood-pressure 140/80 mm. Hg. The result of the internal examination was normal. The patient had peculiar long upper limbs, superbly developed muscles of the trunk and limbs. His strength was enormous. His callous palms pointed to a hard manual work. His urine was normal, so were the fundi. W.R. in the serum was negative. X-ray examinations of the skull showed no pathological changes. In the ward the patient was rather uncommunicative and reticent but willing towards those round him. On getting 0·05 gm. of luminal in the morning and at noon, and 0·01 gm. at night, the attacks ceased, the patient slept well, the pains in his head became substantially less severe than they were at his home. He left the hospital at his own request, saying he longed for work. He refused to have his cerebrospinal fluid tested.

Thus we see that at first the patient was subject to fits of an adequate though exceptionally intensive and long-lasting laughter; then to seizures of inadequate

laughter lacking a proper stimulus. Further on, the fits became coupled with fall accompanied by loss of consciousness. Sometimes the patient bit his tongue and passed water. In the end these fits of laughter disappeared altogether and the patient was only getting fits of unconsciousness with fall, often at night. On his body there were numerous scars resulting from injuries sustained in the attacks and his tongue was bitten. Psychiatric investigation disclosed a certain striking discursiveness, affective instability and infantile boastfulness.

This is probably the so-called genuine epilepsy in an emphatically athletic habitus. At the beginning there were only attacks of morbid laughter; later on the laughter was followed by fall and loss of consciousness (analogy with Oppenheim's *Lachschlag*). Finally both the independent attacks of laughter and the laughter introducing epileptic fits disappeared and only epileptic paroxysms occurred at day and night. In this case the laughter was either an equivalent to epileptic seizures, or in the later stage an aura of major epileptic paroxysms. It will be noticed that, as in Wilder's case, the laughter, which at first was adequate only longer, and which in its course got out of the control of the will-power, later on was replaced by fits of laughter coarsely inadequate and in the end undoubtedly epileptic.

In the three patients that have just been described diagnosis of epilepsy could safely be made. In the following two cases our patients did not exhibit up to that time any emphatic, familiar, epileptic manifestations.

The fourth patient, a magistrate, aged 36, appeared for the first time at our Neurologico-Psychiatric Department on March 24, 1941. His father died in his 50th year of apoplexy; mother was healthy; one brother died in infancy, the cause of death not being known to him. The family was in no way tainted. The patient had suffered from scarlet fever, and in 1928 from cholecystitis. He was a teetotaller and non-smoker. His wife and a 3-year-old daughter were healthy. The patient intimated that for about a year he had observed that he would, either for no reason at all or in moderately comical situations, burst out laughing quite loudly and could not manage to suppress the laughter by his own will power, the laughter lasting against his will for about one minute. Since Christmas, 1940, this happened to him fairly frequently, in the last weeks almost daily. It would come on at about noon. In vain would he make up his mind beforehand that he would suppress the compulsion to laugh. In his laughter he used to think to himself: "Well, man, why are you laughing so stupidly!" He would be overcome by laughter even during the proceedings at court. His laughter would be provoked, for instance, by an employee of the local workhouse—a ridiculous figure, with deflected ears and a stupid expression in his face, who would often attend at the court. Only once—for a while at least—did he succeed in suppressing the compulsion to laugh. At that time he was in attendance at the Ministry in his official capacity. During the proceedings he suddenly felt that he would burst out laughing. He managed to bring the business to a conclusion and ran to the lavatory, where he had a hearty go at it. When subsequently he was telling his friend in a café about it he had a fit of laughter again. His laughter would then come on more frequently, *sine causa*, more inadequately than if caused by ludicrous situations. In general the patient was attacked by the fits quite unexpectedly; exceptionally, as for instance at the Ministry, he would have a feeling of being hot. It is not possible to ascertain whether this sensation did or did not originate in his endeavour to suppress the fit. Originally his laughter was more of a barking sort; then it appeared to him to be almost such as when he laughed in the normal way, only louder and louder. In his laughter he would sometimes manage to speak out or answer a question. Having passed through the fit of laughter he felt quite all right, was not tired or exhausted. After the attack there would be no amnesia.

Somatically he was a pyknic, weighing 110 kgm. and measuring 175 cm. Neurologically no pathological deviations were discovered. W.R. in the serum was negative, the urine normal; so was the ophthalmic fundus. Glycaemia registered only 180 mgm. per cent. The skull, after being X-rayed, showed a normal configuration, its bones were relatively strong, the structure undisturbed, the gyrification normal, the exostoses in no striking way developed, the cranial sutures were not separated. The sella was of a conspicuously small size. The dorsum sellae and processi clinoidei were prominent. There was a light haziness in

the right frontal sinus (Dr. Polland). Otherwise, psychically, the patient was quite ordinary and intimated that he always used to be jolly and sociable. During the first day in the ward he was seized with a fit of laughter, laughing noisily for about a quarter of a minute, turning red in his face. Having been questioned as to what he was feeling during his laughter he said he thought that at home they had much better sausages—that day sausages with tomato purée were being served for dinner in the ward. At the hospital he had two more attacks, both in the afternoon—one while reading a novel by Dickens, the second when reading reviews in a newspaper. At first he was given 0·05 gm. luminal three times a a day and before noon a tablet of psychoton. Later he received an injection of pervitine with scopolamine in three successive daily doses. Thereupon for several days no fits were observed. According to his communication, dated end of May, this medication proved successful at home; in April there were three attacks only, always in the afternoon, lasting 30 to 40 seconds. The prolonged taking of psychoton, however, brought forth headaches and at times he was not able to fall asleep for a long time. Following the advice of his physician he stopped taking the medicine for a fortnight and immediately he had four seizures of laughter, viz. much more frequently than when he was making use of psychoton, but no longer daily as used to be the case before. The headaches, however, persisted. The examination for glycaemia at that time showed a normal result (105 mgm. per cent.) and the course of the glycaemic curve was also normal. When psychoton was replaced by ephedrine and when in the afternoon amidopyrine with caffeine was added, the headaches diminished in intensity and became rare. In August and September there was only one attack each month. These were reported to have lasted only a few seconds. Later on he tried taking jastyl for a fortnight, but owing to increased headaches he returned to the previous medicine. Then there were no fits for two whole months. In February, 1942, he came for re-examination. There had been no fits, but his headaches increased again and the troubles with sleeping got worse. He was advised to take ephedrine in the morning, luminal with caffeine and amidopyrine at noon and eldoral at night. On further re-examination in March the patient intimated that after a 5-months pause he laughed once again vehemently and without an apparent cause, adding that he was working hard at the time and worried by various family troubles. In September we received a note from him saying that he had one fit in May and two more in August, invariably towards 8 p.m. in the heat of the kitchen. He was advised to take, in addition to the usual medicine, 1–2 tablets of ephedrine at 4 p.m. Since the time when he appeared at the hospital for the last time the patient had fits once or twice a month on average, mostly in the afternoons or evenings, without any apparent cause whatsoever. In February, 1943, following an attack of influenza there were several fits of laughter provoked by persistent coughing (hyperventilation ?). One fit occurred after an excitement. On the whole, however, no immediate cause of these fits could be recognized. Apart from that the patient was still suffering from recurrent severe headaches. His sleep was relatively satisfactory.

Before summing up I wish to mention the fifth case, observed by Prof. Janota in a student of theology, aged 22, who came to consult him on October 4, 1940. He complained of suffering during the past year from an occasional irresistible laughter. The more serious the situation the easier the laughter broke out—as for instance during prayers, lectures and on similar occasions. His laughter would infect the others and there would be trouble. He struggled against it in vain. Sometimes he would laugh shortly, at other times even several minutes. He was being seized by it at varying intervals, several times a week or even a day, at other times after an interval of several weeks. He recollected having made a bet when about 12 years old with other boys of his age as to which of them would desist laughing longest. He won the bet and was proud of being the most serious of them. He was told that in his infancy, when about one or two years old, he used to get unconscious, suffering from convulsive seizures. In later periods of his life he enjoyed good health and had no fits of unconsciousness or cramps. There was nothing unusual in his dreams. Psychically there was, during the examination, nothing remarkable about him, and psychologenetically nothing substantial could be discovered. Somatically he was an asthenic youth, with slightly enlarged thyroid gland without any symptoms of its hyperfunction and with a slightly dropped left eyelid. He was prescribed hysteps three times a day, one tablet. Then he was lost sight of.

Easy as it was to ascertain the diagnosis in the first three patients, the decision as to the origin of the fits of laughter in the fourth and fifth cases was difficult. The fourth patient, the magistrate, never became unconscious, and we were never able to recognize any emphatic psychical changes. The fits of laughter could not be influenced by luminal; they yielded, however, to psychoton, and ephedrine, and they responded well to a combination of pervitine with scopolamine, that is to say, to remedies which bring the best curative results in narcoleptic phenomena.

The patient never had a breakdown, and he himself decidedly denied having ever felt exhausted after the attacks. These are certainly not narcoleptic states of an affective loss of tonus after the laughter.

The results of the neurological examination, like those of the accessory investigation, were without pathological deviation (the diminished sella of the skull shown by the X-rays excepted). Zutt described fits of laughter in migraine. Our patient's headaches, however, were not of the migraine type and, as a matter of fact, appeared only in conjunction with taking a substance of the β-phenyl-isopropylamine and ephedrine groups and were accompanied by sleeplessness. They are a familiar complication of this remedy. On the other hand, cases of epilepsy have been known where treatment by barbiturates failed completely, and it is most frequently in cases where *petits maux* prevail that luminal brings no relief, just as in cases of pycknolepsy. In 1939 Janota drew attention to the old experience that in some cases of epilepsy a combination of luminal with caffeine* was rather beneficial, and he recommended at that time to try ephedrine or psychoton in some persistent forms of *petit mal*. Since that time we have made good use of this idea in several cases. On the strength of the pharmaco-therapeutic experience it is not advisable to exclude the possibility of an epileptic origin of fits of laughter even in this patient. At the same time we are quite aware of the objection that could be raised that it is just the remedy which had increased the number of fits of laughter in the first case that appeared to work curatively in the fourth case. In considering this one could imagine that the outset of the epileptic mechanism might be disturbed once by damping (with barbiturates and bromine) and at another time in exceptional cases by excitation (with ephedrine and substances of the beta-phenyl-isopropylamine group). Important and decisive will, in all probability, be a certain deflection of the threshold of irritability upwards and downwards. The question of pathogenesis of the fits of laughter cannot be decided with any degree of certainty. Apart from epilepsy—let us remember that Wilder's patient did not exhibit any obvious epileptic symptoms for a long time—one could think of some relatively fairly stationary affections in the region of the diencephalon (tumour). Given the patient's improving state of health we did not recommend ventriculography. Nor was there any ground for considering epidemic encephalitis.

Finally, in the last case, that of the student of theology, we saw violent compulsive fits of laughter, originating paradoxically during prayers and

* Caffeine operates either that by enlarging the vessels it facilitates the penetration of a larger part of luminal into the brain, or, according to Vondráček, works as a pharmaco-dynamic catalyser, making more potent the effect of other drugs (which, of course, holds good for small, centigram doses only).

instruction. The attacks were not followed by amnesia and there were no psychical disturbances. Although convulsive seizures do not yet imply epilepsy, we have to recollect that in his infancy the patient was subject to fits coupled with unconsciousness; but epileptic ground can in no way be proved. It is a pity that he did not reappear for examination and was lost sight of, so that it was not possible to make a detailed clinical investigation of the case.

So much is certain that in the fourth and fifth case we should not by any means think of an epileptic ground were it not just for Wilder's case. There at first it would certainly be odd to think of an epileptic ground. The fits were very similar to those of our magistrate, but in the further course epilepsy emerged beyond any doubt.

In the two latter cases one could in the extreme think of a certain analogy with *tics*. These appear as synergic movements of several (seldom one) muscles. The movements are rapid, ungrounded and evenly repeated. These are states partly automatic, only occasionally influenceable by will, and imperfectly at that. The patient can overcome the compulsion for a short time, but never for long, and in the end he invariably succumbs. Tic differs from voluntary movements by its relatively limited scope, but especially by its violent characteristic course making an impression of a jerk, and finally by its quite ungrounded repetition of innervation of the same muscles or of groups of muscles. Besides tics that are mostly psychogenic, the existence of other tics, caused organically, especially in later postencephalic stages, is also admitted. Pilcz, describing fits of laughter in a 15-year-old student, speaks of a "*lach-tic*" (laughter tic). Previous to this, however, his patient went through a severe attack of influenza (encephalitis ?). Pilcz further refers to a similar case in which lues cerebri had been ascertained on clinical examination.

We know that some otherwise healthy people are occasionally inclined to laugh in the most serious situations. The more they try to suppress the laughter the more violent the outburst will be in the end. Many of us have probably experienced something similar. Such compulsive laughter, just as other compulsive states and ideas, will mostly be based on indecent and blasphemous motives. The dynamics of affectation in these spheres, in general, will be more powerful.

There is a certain relation between tics and obsessional states.* In our

* An innkeeper, aged 48, was treated at the Neurologico-Psychiatrical Department of the Bulovka-Hospital in Prague from May 10 to June 9, 1939. He was apprenticed to a bootmaker, but owing to his malady he left the trade. His father was said to have been a drunkard and an ill-tempered man, who cut himself with a saw in his face. The patient fled home at that time, chased by the idea that it was himself who had done it. Since that time he started to bite his lips and the inside of his mouth, and was impelled to scratch his face (always with his right hand). When he started to work at the shoemaker's shop with the cobbler's knife he was in constant temptation to cut his face, the hand holding the tool approaching as if attracted to his face in spite of his will, moving rhythmically before it in movements similar to cutting. His face was really hurt on several occasions (witnessed by scars). He was forced to leave the trade and to start work at an inn. At that time he used to scratch his right cheek with his nails or he bit the inside of his mouth. For that reason he had his teeth extracted. Finally the violent rhythmical movements of his right hand attained such an intensity, the hand approaching the face in movements similar to those of a tic, to which movements the patient was constantly and irresistibly impelled. To protect himself he put a boxing glove on his right hand and so he came to the hospital.

The patient was subject to many other compulsive manifestations. Already at school during the most profound silence in the hours of lessons something made him whistle. During the world-war he used to repeat compulsively in public, "The Emperor is a silly ass." I choose this case to show the close reciprocal permeation of tics and obsessional mechanisms.

patients Nos. 4 and 5 it was impossible to get at any substantial psychogenesis. No intrusive ideas of blasphemous or other such sort were present. Were it possible to discover some obsessional traits in them, even then it would not quite exclude an epileptic ground, because similar phenomena have been known in epileptic patients. Fits of laughter as epileptic phenomena are a rarity in the world medical literature. They are much less frequently mentioned than crying. In the larger monographs, such as those by Delasiauve, Bouché, Voisin, Vogt, Redlich, no mention of them has been made at all.

Binswanger holds that violent laughter can provoke an epileptic fit in predisposed people. One might add that violent, long-lasting laughter can in reality operate as hyperventilation. In 1924 Foerster recommended hyperventilation, deep breathing for several minutes, as a means to provoke epileptic fits for diagnostic purposes. Although this method proved a failure to many authors as a reliable means for provoking fits when applied to an extensive material (Janota, Toulouse, Marchand), it is certain that hyperpnoea can in exceptional cases provoke a fit. That has been confirmed by Binswanger's patients. The essence of hyperventilation probably consists in upsetting the acid-base equilibrium and in a movement towards the alkaline side. Of course the mechanism through which the laughter could provoke an epileptic fit does not, in our opinion, rest merely on hyperventilation; powerful vegetative irritation and an ascending wave can assert themselves when the tension of the accumulated energy will in certain cases be capable of sounding the wave of the epileptic mechanism.

In Czech literature, so far as I know, no mention has been made of the relation of laughter to epilepsy. In the world literature there are—as remarked above—only isolated reports. For these reasons, and also owing to the fact that we had had a few notable cases in our hospital, I decided to devote more attention to this chapter.

Pathological outbursts of laughter are surely an interesting neurological syndrome, just as physiological laughter is so far not quite a solved but always an attractive chapter of psychology. The study of morbid states has contributed much to clarifying the conception of its localization. Now it appears certain that motor co-ordinative centres for so many paratactic mechanisms participating in the act of laughter are in the subcortical grey matter. It is impossible to make an exact decision as to the place, and whether there be a unique or a divided centre in this region so heavily charged with various endeavours for localization.

It is well to bear in mind the difference between physiological, genuine laughter, accompanied by a feeling of joy and mirth, and the motor phenomena, similar in outward facial expression but lacking adequate psychic contents, the laughter that originates inadequately and very often against the will of the person concerned. One speaks of the laughter, the compulsive laughter, the involuntary laughter, the fit-laughter and so on. From the general point of view it is all laughter; it is in principle the same mechanism, originating in the mid-brain and interbrain, including mimic, respiratory, vocal and generalized muscular constituents, though we are aware that a participation by Psyché and consciousness is absent.

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https://doi.org/10.1192/bjp.92.389.734 Published online by Cambridge University Press