

orders in which a change of the personality is a prominent symptom.

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*The Pupil and its Reflexes in Insanity.* By A. H. FIRTH, M.A., M.D.Edin., Assistant Medical Officer, Wadsley Asylum, Sheffield(<sup>1</sup>).

PART II.—PUPILLARY SYMPTOMS IN CERTAIN TYPES OF MENTAL DISEASE.

(1) *General Paralysis.*

Progressive general paralysis is remarkable for the frequency, multiplicity, and variety of its pupillary symptoms, which may often be evident even in the incipient stage of the disease.

From the diagnostic point of view the most frequent and the most important of these is the Argyll Robertson phenomenon. The presence of this classic symptom in a patient suffering from mental disorder of a somewhat indefinite nature gives rise to the strongest suspicion that the case in question is one of general paralysis. But reflex-rigidity also occurs in tabes and syphilis; and intercurrent psychoses in the course of these diseases are not uncommon. Berkley (4), however, states that mental disorder, accompanied by signs of tabes, almost always develops into progressive paralysis.

Reflex-rigidity in general paralysis may be unilateral, or, more often, bilateral. The pupils are often medium in size, or even dilated. In cases of paralysis with tabetic symptoms they are usually small. Typical reflex-rigidity is specially frequent in tabetic paralysis. According to Moeli it is found in 84 *per cent.* of the cases (Bumke (8)).

Cases which present, not abolition of the light-reflex but impairment of its activity, while the near-vision reaction is either unaffected or unduly active, are with propriety classed along with those which show the fully developed Argyll Robertson symptom.

The next most important pupillary symptom is absolute rigidity. It may be associated with mydriasis, or, less frequently, with miosis. Absolute rigidity, however, is by no means such a strong indication of general paralysis as the Argyll Robertson symptom, for the former is relatively frequent in conditions such as syphilis, chronic alcohol poisoning, and senile dementia.

The occurrence of ophthalmoplegia interna in general paralysis has been recorded. Bumke thinks that its presence rather indicates syphilitic pseudo-paralysis. Nevertheless, trustworthy observers have described the occurrence of ophthalmoplegia interna in otherwise typical cases of general paralysis, and it must be accepted as a possible symptom (Bevan Lewis (17)).

Bumke (8) has collected statistics on the condition of the light-reflex in general paralysis. From published records of over 3,000 cases he finds that the light-reflex was absent in 45·4 *per cent.*, impaired in 28·3 *per cent.*, and unimpaired in 26·3 *per cent.*

Bach (2) estimates that bilateral loss of the light-reflex is more frequent than unilateral in the proportion of 4 to 1.

Inactivity of the pupil of one side only is seldom persistent, since the other, as a rule, soon becomes affected (Berkley (4)).

The near-vision reaction is active in 77 *per cent.* of general paralytics, impaired in 11 *per cent.*, and absent in 12 *per cent.* (deduced from records of 578 cases given by Bach (2)).

The sensory reflex usually becomes more and more sluggish as light-rigidity develops; when the latter is complete, the sensory reflex is only exceptionally present (Bach). On the other hand, this reaction may be absent while the light-reflex is retained; Hirschl maintains that the sensory reflex usually disappears before the light-reflex (Bumke (8)). Bevan Lewis (16) is of the same opinion.

Pupillary unrest is absent in a large proportion of paralytics in association with reflex or absolute rigidity; it may, however, be absent when the action of the iris is apparently normal in other respects (Bach (2)).

The myotonic reaction is occasionally seen in retrogressing or not completely developed absolute rigidity. In rare cases of incomplete reflex rigidity the neurotonic reaction may be observed.

Exceptionally the light-reflex is found to be present, and the near-vision reaction absent. Bevan Lewis (17) mentions one case of a female paralytic who showed paralysis of accommodation and loss of the near-vision reaction, with only partial impairment of the light-reflex. Wernicke (quot. Laqueur (15)) records a similar case.

The paradoxical reaction is recorded in some cases. Bevan Lewis (17) describes the occurrence in certain cases of general paralysis of an interesting phenomenon to which allusion has already been made. In testing the light-reflex by concentrated light through a bull's-eye condenser, he found that the initial contraction thus induced may be succeeded by a secondary dilatation—the pupil expanding widely in spite of the concentrated illumination. He saw this symptom in 13·6 *per cent.* of his cases, and refers it to commencing paralysis of the centre of the third cranial nerve.

Hirschl (quot. Bumke (8)) remarks that such a phenomenon may be an instance of pupillary dilatation caused by a strong sensory stimulus.

Irregularity of the pupils is present in a very large proportion of general paralytics. Corectopia may also be found.

The occurrence of unsymmetrical movement of the iris in response to stimuli has already been mentioned.

Inequality of the pupils is extremely common. The statistics of various writers on this point show marked differences; the proportion of cases in which anisocoria is present varies from 92 *per cent.* to 26 *per cent.* and even lower. Evidently a large allowance has to be made for the personal equation of the observer.

Inequality may occur whether the light-reflex is present, absent, or merely sluggish. Bevan Lewis (17) found that out of 73 paralytics showing loss of the direct and consensual light-reflex in both eyes, 34 had unequal pupils; out of 71 other paralytics in whom the light-reflex was intact or only sluggish, 33 showed a notable inequality of the pupils.

Changes in the relative size of the pupils, their outline and their position with respect to the centre of the cornea are quite common. Such variations may take place gradually from day to day, or comparatively suddenly, without any apparent relation to the other symptoms of the patient; or they may be observed to accompany epileptiform or apoplectiform seizures.

See-saw pupils are occasionally found in general paralytics, either associated with unilateral hippus or depending on unilateral loss of the light-reflex, or in the form of alternating mydriasis.

Hippus is sometimes observed in general paralysis, especially in association with seizures.

*The incidence of pupillary symptoms in the different stages of general paralysis.*—Different writers lay stress on different isolated symptoms which may be the sole evidence of disturbance of the pupillary mechanism in cases of commencing general paralysis, and which may be regarded for the most part as forerunners of the more definite and typical ocular phenomena. Among these early symptoms are the following:

- (1) Irregularity of the pupil.
- (2) Unsymmetrical movement of the iris (Salgo, quot. Piltz (22)).
- (3) Inequality of the pupils.
- (4) Hippus.
- (5) See-saw pupils (alternating mydriasis).
- (6) Absence of pupillary unrest (Bach (2)).
- (7) Loss of sensory reflex.

(8) Sluggishness of the light-reflex.

(9) Loss of the consensual light-reflex.

The views of Salgo and Piltz (22) on the significance of irregularity of the pupil and irregular movement of the iris have already been mentioned. Bevan Lewis (17) records a case in which both pupils were equal and somewhat dilated and still reacted to light, but in which hippus was present in the right eye.

Bevan Lewis (16) regards loss of the sensory reaction as a symptom of almost constant occurrence in early cases of general paralysis. Berkley (4) has observed in a considerable number of cases that loss of the consensual light-reflex preceded loss of the direct light-reflex. The presence of this symptom, when combined with mental phenomena, has led him to make a tentative diagnosis of general paresis.

The actual diagnosis of a case presenting only one of the various early pupillary symptoms must depend on the other clinical features; the observer, at any rate, has received warning of the possibility of further developments.

In individual patients no particular connection can be established between the nature and degree of impairment of the pupillary reactions and the stage of the disease. Cases occur in which the ocular symptoms are marked from the first time that the patient is brought under observation. Spastic miosis has been observed to antedate the full development of the disease by ten years (Thomsen, quot. Bach (2)). On the other hand, there are comparatively advanced cases to be found in which pupillary symptoms are not well marked.

An interesting series of observations has been made by Marandon de Montyel (18) on the state of the light-reflex in 140 cases of general paralysis, from the commencement of the disease till death. Of these, 50 died in the first stage, 36 in the second, and 54 in the third. Out of the whole number, the light-reflex was always normal in 24 *per cent.*, always abnormal in 17 *per cent.*, and subject to change in 58 *per cent.*

The condition of the light-reflex in the patients during the different stages is shown by the following table:

Light-reflex.	Patients in Stage 1 ( <i>per cent.</i> ).	Patients in Stage 2 ( <i>per cent.</i> ).	Patients in Stage 3 ( <i>per cent.</i> ).
Always normal .	42	29	3
Subject to change .	32	35	11
Always abnormal .	24	34	85

In the first stage 6 *per cent.* showed exaggeration of the light-reflex in both eyes; 10 *per cent.* showed diminution or abolition of the reflex in one eye. Of the 54 patients who survived till the final stage, every one showed some abnormality at one time or another.

We may conclude that impairment of the light-reflex is relatively much more common in the advanced stages of the disease.

In the remissions which sometimes occur in the course of general paralysis, a retrogression of the Argyll Robertson symptom has been observed by various authorities. For instance, Tanzi (24) says that he has been able to prove that the immobility of the pupil may disappear and reappear in the course of general paralysis, as it has been observed to do in tabes dorsalis. Bumke (8) records one case of retrogression of the already almost extinguished light-reaction in a paralytic during a remission. Dana (28) records one or two cases of what he calls "pre paresis," in which complete Argyll Robertson pupils regained their activity after antiluetic and hygienic treatment.

When once the Argyll Robertson pupil is fully developed, return of the light-reflex is considered by Bach and Bumke to be an extremely rare occurrence. It is possible that some of the recorded instances have been due to faulty observation or inaccurate diagnosis. For example, in pseudo-paralysis due to cerebral syphilis or certain chronic intoxications, immobile pupils have sometimes been found to recover their activity, in association with improvement of the other symptoms.

Miosis, when present, is more often found in the earlier stages of general paralysis, and mydriasis in the later stages. An initially small pupil may gradually become dilated as the disease progresses. Occasionally marked mydriasis may be present from the beginning. Miosis is apt to occur during the irritative phase, mydriasis in the terminal stage of exhaustion.

In the seizures—epileptiform and apoplectiform—which are not uncommon, the pupils as a general rule show absolute rigidity; and variations in their size, form, and situation may take place. Frequently there is mydriasis, which may be marked, even where spastic miosis has previously been found. In other cases there is absolute miotic rigidity.

Hippus and see-saw pupils have been observed in association with seizures.

Table VI (pp. 262–7) gives the records of my observations on 66 cases of general paralysis.

One case, No. 67 (p. 267), is probably only a pseudo-paralytic. The patient is of advanced age—æet. 69—suffers from arterio-sclerosis, and has symptoms indicative of tabes dorsalis. He shows a paradoxical light-reaction in each eye, both to daylight and to the electric light from a hand-lamp. Both pupils dilate slightly, usually about  $\frac{1}{4}$  mm.; they resume their original diameter when the light is removed. There is no consensual reaction. The sensory reflex and near-vision reaction are both absent. There is no unrest visible to the naked eye. Both pupils are small and irregular; the right is  $\frac{1}{4}$  mm. larger than the left. There is marked internal strabismus, both eyes being amblyopic. I have not come to a definite conclusion about this case, but have included it here provisionally.

The 66 cases of general paralysis vary in age from fifteen to sixty-six. The average pupil-diameter is 4·4 mm.

In every case the condition of the pupils showed some departure from the normal.

Anisocoria was found in every case but 5; in these only one measurement is recorded.

Both pupils showed irregularity except in 6 cases, in which only one record of the pupil-outline is given; of the 6 exceptions, in 3 one pupil was irregular, in 3 both pupils were regular.

The first 24 cases show the *Argyll Robertson symptom*, 17 in both eyes, 7 in only one eye—that is, 36 *per cent.* of the whole.

The average pupil diameter is 4·1 mm. Only 5 cases had a pupil diameter of less than 3 mm., and 7 cases had a pupil diameter of over 5 mm. at one time or another. Anisocoria is the rule, the difference being usually not more than  $\frac{3}{4}$  mm.; 5 cases showed a difference of 1 mm. or over. Equal pupils are recorded at one time or another in 8 cases. Change in the size-relation is shown by 14 cases, of which 3 show reversal (Nos. 4, 9, 21).

Temporary reappearance of the light-reflex is shown in Nos. 4, 19, and 24.

Loss of consensual reaction precedes loss of the direct light-reflex in Nos. 13 and 18.

The sensory reaction was usually absent when there was no light-reflex ; but exceptions are found in Nos. 2, 4, 8, 12, and 17.

Loss of sensory reaction preceded loss of light reaction in Nos. 12, 13, and 19. In one case slight unrest was present though the sensory reflex was absent—No. 18.

Alteration in the outline of the pupils is recorded in every instance where there are repeated observations—for example, the left pupil in Nos. 14 and 16.

The next 15 cases (Nos. 25 to 39) show *bilateral impairment of the light-reflex, with activity of the near-vision reaction*. These are cases of bilateral incompletely developed reflex rigidity, and amount to nearly 23 *per cent.* of the whole. The average pupil-diameter is 4.7 mm.

Anisocoria is very common. Equality of the pupils is recorded in 5 cases, of which 2 had only a single measurement. Change in size-relation is seen in 8 cases.

In No. 30 the absolute pupil-rigidity present on admission may be ascribed to alcoholic poisoning. In No. 33 pupil-rigidity and corectopia appeared in a seizure followed by coma, which ended fatally.

In Nos. 38 and 39 renewed activity of the light-reflex followed a period of sluggishness. Loss of the sensory reflex at a time when the light-reflex is not yet extinguished is shown by Nos. 27, 29, 30, 33, 34, 35, and 37 ; in the last of these the sensory reflex was lost before the light-reflex began to be affected.

Change in the outline of the pupils is shown by several records.

Altogether, then, 39 cases out of 66 present the Argyll Robertson symptom, either complete or incomplete—that is, 59 *per cent.*

*Absolute rigidity of both pupils* is shown in five cases (Nos. 40 to 44) ; *unilateral absolute rigidity* in one case (No. 45). If No. 44, a case of juvenile general paralysis, be excluded, the average pupil diameter is 4.1 mm. Marked inequality of the pupils was present in Nos. 40, 42, and 45. No. 45 also showed marked variation in the size-relation of the pupils, and in their outline. Irregularity of both pupils is the rule. The corectopia in No. 44 may be of congenital origin. No. 45 gives the picture of the Argyll Robertson symptom on the right side, and absolute rigidity on the left side.



Nine *per cent.* of the cases, then, show absolute rigidity.

Nos. 46 and 47 are cases of *incompletely developed bilateral absolute rigidity*. No. 46 has shown gradually increasing ptosis on the left side. No. 47 is a case with a history of lead-poisoning, in which general paralysis has developed.

Both cases show changing irregularities.

Complete or incomplete absolute rigidity was therefore present in eight cases; that is, in 12 *per cent.*

Four cases, Nos. 48 to 51, showed *impairment of the light-reflex in one eye*, in No. 50 as a transient alternating symptom only. Nos. 50 and 51 show loss of the sensory reflex.

In case No. 52 the patient resisted further examination. Both consensual reflexes were absent, though the direct light-reflexes were active.

Thirteen cases, Nos. 53 to 65, showed *no alteration of the light-reflexes*, beyond sluggishness of the consensual reflex in one eye in No. 58. The average pupil diameter is 5 mm.

Loss of the sensory reflex was found in 5 cases, but in 2 only as a temporary symptom. The sensory reflex was diminished in 5 others. In every case there was inequality of the pupils. Both pupils showed irregularity in all but No. 65, of which only one record is available. Changes in the pupil-outline were noticed in nearly every case.

Altogether 14 cases showed no impairment of the direct light-reflex in either eye—amounting to 21 *per cent.* of the whole.

No. 66 was a case of juvenile paralysis, in which double optic atrophy, and *double amaurotic rigidity* were present. The loss of the sensory reflex, however, rather indicates the superposition of a condition of absolute or perhaps reflex rigidity.

The figures and percentages arrived at from my records are not of much value for statistical purposes. An investigation of a much larger number of cases, conducted on the lines followed by Marandon de Montyel (18), would be required in order to give any noteworthy results. My cases serve to illustrate much of what has been recorded in the literature and already summarised in these pages.

The records of pupillary unrest in the tables are incomplete. They are estimated by the naked eye only. There was no Zeiss binocular microscope available, and I did not find a corneal loupe of much advantage for the examination of pupillary unrest, chiefly owing to its small field.

(2) *Syphilitic Insanity.*

Marked pupillary symptoms are found in many cases of insanity due to cerebral syphilis, though, on the whole, they are not so frequent as in general paralysis. The clinical picture of this type of mental disease may closely resemble that of general paralysis, giving rise to one form of pseudo-paralysis.

Absolute rigidity of the pupils may be found in cerebral syphilis, usually in both eyes. Miosis in this condition is uncommon.

Ophthalmoplegia interna also occurs, more often on one side only, along with mydriasis. Amaurotic rigidity may be developed from primary or secondary affections of the optic nerve or tract, or the chiasma.

The Argyll Robertson symptom is seldom found in uncomplicated cerebral syphilis.

Bumke (8) maintains that when reflex or absolute rigidity persists as an isolated symptom for a considerable time, the case in question is more probably one of general paralysis or tabes. If other symptoms develop, such as transitory or permanent ptosis, ophthalmoplegia externa, or paralysis of the abducens, cerebral syphilis is decidedly indicated.

Inequality and irregularity of the pupils are common in cerebral syphilis. See-saw pupils may occur. The paradoxical light-reflex, and the neurotonic and myotonic reactions have all been observed in this condition.

Reappearance of the light-reflex after it has been lost has been described, usually following antisyphilitic treatment. Temporary reappearance of the light-reflex may be noticed when the patient is kept for some time in a dark room; this phenomenon is regarded as a symptom of progress towards recovery (Bach (2)).

In Table V (p. 262) seven cases of syphilitic insanity are recorded.

No. 1 was a case of congenital syphilis; the patient was *æt.* 17, and he died from acute nephritis. No evidence of general paralysis was found on *post-mortem* examination. The pupils showed no abnormality, except that they differed slightly in size. No. 2 was a case of temporary excitement commencing two months after the primary lesion. Both pupils were slightly

irregular, but otherwise normal. The patient—æ. 19—was discharged recovered.

Nos. 3, 4 and 5 may eventually prove to be general paralytics. No. 3 shows marked inequality of the pupils, and changing irregularities. No. 4 has irregular unequal pupils, and sluggishness of the direct and consensual light-reflex in the right eye. No. 5 had diminished sensory reaction, which has regained its activity. There is a certain degree of corectopia in the left eye, which may be congenital.

No. 6 was a case of temporary confusional insanity in a man æt. 42. Except for diminished sensory reaction the pupils were normal. No. 7 has shown inequality of the pupils, and absence of both consensual reflexes for twenty-two years. During that period the patient—a woman—has suffered from various syphilitic manifestations at different times. She has had a macular skin eruption, peripheral neuritis with temporary left ptosis, and repeated ulceration of the leg. All these conditions cleared up under anti-syphilitic treatment. Clinically she is not a general paralytic. The pupils are circular, the direct light-reflexes are present, but the sensory reflex is absent in both eyes.

### (3) *The Toxic Psychoses.*

(a) *Alcoholic insanity.*—In the “physiological intoxication” of healthy persons there may be no disturbance of the pupil-reflexes. In the stage of exaltation the pupils are often dilated. Sometimes an increased activity of the light-reflex, and the sensory and psychical reflexes has been observed (Hübner, quot. Bach (2)). In persons intolerant of alcohol the reflexes may show diminished activity. The pupils in advanced intoxication may be small or large. Gudden observed sluggishness, and even complete loss of the reactions in severe intoxication with insensibility (Bach (2)). These symptoms disappeared as consciousness returned.

In idiots and degenerates Vogt found that a dose of 40 c.c. of arrack or rum in water produced change in the pupil-reactions in about one-third of his cases; usually the light-reflex became sluggish.

As Stoddart (24) remarks, not every case of mental disease with a history of previous alcoholic excess is a case of alcoholic

insanity. Turner (26) would limit the application of the term "alcoholic insanity" to cases in which there is alcoholic neuritis.

For our present purpose the psychoses which directly or indirectly originate from long-continued alcoholic excesses are grouped together. Most of the patients suffer from a congenital instability of the nervous system, and a deficient power of resistance to toxic influences. We should expect such cases, if any, to present symptoms of disorder or degeneration of the nervous system after prolonged alcoholic poisoning.

In chronic alcoholics the pupils are frequently found to be of relatively small size, rarely dilated; their reactions are proportionately sluggish, and of small amplitude. The degree of impairment of the reactions seems to be proportional to the severity of the toxic process (Bach). The average quickness of response to light is below the normal. In very rare cases the disturbance is unilateral.

The light-reflex alone may be diminished, or the reactions to near-vision and sensory stimuli may be implicated as well. The myotonic reaction is sometimes observed.

In exceptional cases the Argyll Robertson symptom has been recorded. Moeli (quot. Bumke (8)) says that in very rare cases this symptom is found fully developed and lasting for some time. Whether it really depends on alcoholic excess or not is not quite certain. He allows that a transitory sluggishness may be caused in this way. He has also seen frequent temporary relaxations of the iris, disturbances of the convergence-reaction, and the retention of activity only in isolated portions of the iris. Raimann (quot. Bumke) describes ten cases of alcoholics presenting complete loss of light-reaction; in some of the cases absolute rigidity supervened, but in every instance the light-reflex finally returned.

Bertozzi (5) believes that permanent alterations of the pupil are frequently found in insane patients suffering from the effects of chronic alcoholism, especially permanent spastic miosis. Bumke (8) concludes that the most frequent pupillary symptom of alcoholism is a general sluggishness of the reactions, and that absolute rigidity is comparatively rare; further, that in certain stages of development or retrogression of the latter symptom the light-reflex may be so much more affected than the convergence reaction as to simulate the Argyll Robertson pheno-

menon. He also would refer some of the cases of apparent reflex rigidity to amaurosis following optic neuritis. Diminution of the light-reaction is recorded in 2·5 *per cent.* of the cases, and inequality of the pupils in about the same proportion. On the whole, changes in the innervation of the iris are found in 6 *per cent.* of the cases, and they are usually of a temporary nature.

In *delirium tremens* the pupils are at first contracted, but they usually become dilated as the disease progresses (Stoddart (24)). A sluggish reaction of the pupil to light, and even complete Argyll Robertson pupil may be found. This sign, however, disappears on recovery (White (27)). In *mania à potu* miosis and anisocoria may be observed.

In Table I (p. 260) are collected ten cases of *temporary mental disorder of alcoholic origin*. The patients had all taken alcohol in excess for long periods, and they presented mental symptoms characterised by marked confusion along with varying degrees of excitement. They were all males; the age varied from thirty-four to sixty. The average pupil diameter was 5·1 mm. Two cases showed equality of the pupils, 2 had slight inequality, and in 6 the pupils differed by  $\frac{1}{2}$  mm. or more. In only one case were both pupils circular; 4 showed irregularity of one pupil, and the remaining 5 had bilateral irregularity, mostly of slight degree.

Three cases showed diminished direct and consensual reaction to light; 2 had impaired sensory reflexes.

On the whole, there was deviation from the normal condition of the pupil in all but one case, though the abnormalities were mostly of slight degree. In the majority of the patients there was some irregularity and inequality of the pupils.

In *polyneuritic alcoholic insanity*, which is the most common variety of Korsakow's psychosis, pupillary disturbances are not infrequent, and they usually vary in intensity from day to day.

Inequality of the pupils, sluggishness of the reactions to light and convergence, and even transitory Argyll Robertson pupil, may be observed. Turner (26) records the condition of the pupils in 68 cases of this disorder. Anisocoria was present in 26·4 *per cent.*; sometimes the inequality on different days was subject to alternation, first one pupil and then the other being the larger. In 34·2 *per cent.* the pupils either reacted very slightly and sluggishly to light, or were rigid; but this condition in most cases was only temporary. In eight

cases the pupils appeared at one time quite rigid to light ; in at least six of these the condition was undoubtedly temporary.

Lauder Brunton (7) has recorded that in a number of cases of alcoholic neuritis the reaction of the pupil to light was rapid and extensive, while the contraction on accommodation was slight and sluggish or entirely wanting ; in one or two cases he observed dilatation instead of contraction with accommodation.

In Table II (p. 260) I have recorded two cases of polyneuritic alcoholic insanity. The patients were *æt.* 28 and 29 respectively. The average pupil-diameter was 5 mm. Both cases exhibit change in the size and size-relation of the pupils, as well as in their outline. In both cases the sensory reflex was absent on admission ; afterwards the reflex appeared again, but it was diminished in activity. The light-reflex in the second case was sluggish, but later it returned to the normal.

In *alcoholic pseudo-paresis* pupillary inequality is not uncommon ; sometimes the light-reflex is absent, with slowness of reaction to near vision. The symptoms usually undergo improvement on removal of the poison, and they may more or less completely disappear (White (27), Berkley (4)).

Table III (p. 261) deals with the pupillary records of 26 cases of *chronic alcoholic insanity*. The patients have taken alcohol to excess for many years, and have sustained irreparable damage to the cerebral cortex, which is expressed symptomatically by the dementia from which they all suffer in greater or less degree. Cases Nos. 2, 4, 7 and 8 presented the picture of alcoholic pseudo-paresis.

The age varies from thirty-six to sixty years. The average pupil diameter of all the cases is 4.4 mm. In 8 cases the pupils were equal, in 9 there was slight inequality, and in 9 the difference in size was more marked. Nos. 6, 11 and 14 show change in size-relation of the pupils.

Both pupils were circular in 8 cases ; slight irregularity of one pupil is present in 3 cases, and of both pupils in 15. In 4 cases change in the form of the pupils is recorded. Eight cases show diminished reaction to light in both eyes ; in No. 11 the formerly sluggish light-reflexes regained their activity. In 3 cases the direct and consensual reflexes are sluggish in one eye. In No. 19 there is loss of the consensual reflex in one eye.

In 15 cases the light-reflexes were normal. In 5 cases the near-vision reaction was diminished, and partial recovery is shown in No. 14.

Absence of the sensory reflex was observed in 6 cases; the reflex was present, but diminished in 11; present and active in 6 cases (out of 23). In one case the sensory reflex was absent, but returned (No. 14); in another it was diminished and then disappeared (No. 6). In 2 cases the condition of the pupils was practically normal. In 7 cases diminution or loss of the sensory reaction was the only reflex symptom. In 5 cases no abnormality of the reflexes is recorded; and in 5 cases all the reflexes were affected.

On the whole, we find rather small pupils, as a rule presenting no marked inequality, but showing in most cases some irregularity of outline. Both the anisocoria and the irregularity may be subject to variation from time to time. The light-reflex (direct and consensual) is usually present, but often sluggish. Occasionally the near-vision reaction may be diminished as well. Diminution or loss of the sensory reaction may be the only disturbance affecting the pupil-reflexes.

(b) *Insanity from lead-poisoning.*—In this condition there may be slowly reacting and unequal pupils, associated with optic neuritis. In some cases optic atrophy supervenes, with amaurotic rigidity. The poison may also directly attack the nerves of the interior muscles of the eye, especially the sphincter pupillæ (Bach (2)).

Clinically some of the cases resemble general paralysis (plumbic pseudo-paralysis), and true general paralysis may be developed in patients who have suffered from plumbism.

Table IV (p. 262) contains one case of insanity from plumbism. The patient's age on admission was 65. The pupils are unequal, and show irregularity which has changed in character. The light-reflex (direct and consensual) and the sensory reaction have become diminished. Unrest is not now visible to the naked eye. The near vision remains active. The advanced age of the patient is a complicating factor.

(c) *Less frequent toxic conditions.*—In chloral-hydrate poisoning, which sometimes produces insanity, there may be miosis, with loss or impairment of the reaction to sensory and psychical stimuli. These phenomena disappear as the drug is eliminated.

Insanity from morphine: Miosis is present in the early

stages, mydriasis later, with sluggish reaction of the pupils (Berkley (4)). According to Bumke (8), the light-reaction may be present, or the pupils may react sluggishly or not at all to light. The reaction to sensory stimuli is diminished or abolished, but the reaction to convergence is present. Cases showing contracted fixed pupils have, however, been described, Uthoff (quot. Bumke) states that the light-reflex is never quite abolished, unless morphinism is associated with some other factor (for instance, in physiological old age).

If the administration of opium or morphia be stopped, or even if the dose be markedly diminished, mydriasis may occur, along with increased activity of the pupil (Bumke).

Insanity from carbon-bisulphide poisoning: In this condition unequal and slowly reacting pupils have been described, and in some cases, wide dilatation and absence of the reaction to light (Berkley (4)).

A pseudo-paresis uræmica has been described, in which the pupils may either be miotic and non-reactive, or widely dilated, regular, and slowly reactive to light and accommodation (Berkley).

In pseudo-paresis diabetica—a rare condition—the pupils are usually unequal, reacting to light and accommodation, though unequally (Berkley).

Bromide of potassium given repeatedly or in large doses gradually produces dilatation of the pupils, and sluggishness of their reactions, including the galvanic reflex (Bach (2), Bumke (8)).

This should not be forgotten in the examination of epileptics for pupillary symptoms.

Insanity from bromide poisoning is recorded. A delirious form has been described by Casamajor (9), in which irregular, unequal, sluggishly reacting pupils may be found.

#### (4) *Insanity with Epilepsy.*

The pupillary symptoms are separable into two groups—those which are associated with fits, and those which are found in the intermediate periods.

In general, during an epileptic fit the pupils are large and irresponsive to light or sensory stimuli. It is quite exceptional for the pupil to preserve its reaction to light and sensory stimuli throughout the whole course of a fit.



A marked transitory contraction of the pupils is often observed at the commencement of a fit ; this is also the case in animals thrown into convulsions by the administration of creatinin.

In the tonic stage the pupils are dilated and fixed.

In the clonic stage as a general rule they still remain dilated and fixed. Occasionally, however, hippus is observed, consisting in convulsive movements of the iris which take place at irregular intervals—it may be only once in a period of 1 or 2 seconds, or in close succession ; the pupil contracts to a medium size, rarely to a marked degree of miosis, and almost at once dilates again to its original size. These variations in diameter are independent of the movements of the eyeball, and the pupil remains irresponsive to light. Anisocoria, elliptic pupils, and corectopia are occasionally found. Distorted, markedly irregular pupils are never seen in genuine epileptic fits (Bumke (8)). In the period of stertor which usually follows a fit, in some cases the pupils are fixed, in other cases they react. In the deep sleep which may follow a fit, fixed contracted pupils may be found (Bach (2)). As a rule, in post-epileptic stupor the pupils show no marked deviation from the normal. Bumke records that in two epileptics in this stage, he found the pupils markedly dilated, reacting with convergence and on strong illumination ; the sensory reflex was absent, and the sensitivity of the galvanic reflex was diminished.

Wassermeyer (quot. Bach (2)), found absence of pupillary unrest as an occasional symptom in post-epileptic stupor, the light-reflex at the same time being preserved.

In *status epilepticus*, and epileptic coma pupil-rigidity is the rule. Exceptionally the light-reflex may be retained in coma (Oppenheim, quot. Bumke (8)).

Bumke investigated the state of the galvanic reflex in epileptics as soon as the light-reflex was definitely restored after a seizure. He found that the sensitivity of the iris to galvanic stimuli was much increased at this stage.

*In the intervals between seizures*, the condition of the pupils may present several interesting features. A certain degree of mydriasis is often found, but the administration of bromides may give rise to fallacy here. Anisocoria is not uncommon ; it is usually transient, or it may alternate with equality of the pupils.

Fuchs (quot. Bumke (8)) concludes from a photographic analysis of the pupillary reactions in seven cases that the light-reflex in epileptics is characterised by an unusual activity, both in quickness of response to stimulation, and in amplitude of the movements of the iris.

Pupillary unrest is usually present, but in demented cases diminished or absent (Wassermeyer, quot. Bach (2)).

The sensitivity of the galvanic reflex was found to be increased in six cases examined by Bumke. The ratio between the intensity of current necessary to cause the sensation of light and that necessary to produce reflex pupil-contraction was 1 : 1·25. In healthy subjects he had already found this ratio to vary between 1 : 1·50 and 1 : 4·0.

Albrand (1) has observed that the state of the pupils in epileptics may show considerable variation from time to time; their reactions may be now sluggish, now unusually brisk; and temporary oval or elliptical distortion may occur. The more marked transient anomalies are rare, and are found only among demented patients.

Epileptics, especially demented epileptics, on waking from physiological sleep, may show a transient anisocoria; on one day the right pupil may be the larger, on another day the left; there may be irregularity of outline and corectopia. The pupils may already be unequally contracted in sleep, and they may not become equal for a considerable time after waking. There may be an unusual slowness in assuming or recovering from the initial dilatation on waking; one pupil may lag behind the other in contracting to the habitual medium size, so that a temporary anisocoria may be caused (Albrand (1)).

Eccentricity of the pupil is occasionally found in epileptics, persisting whether the pupil is contracted or dilated. Negro (20) has also observed it as a transient condition (functional corectopia) in many epileptics under examination in a dim light, when the accommodation is relaxed. The corectopia is seen to alter after a short time, especially in cases of hippus. The eccentricity disappears when the pupil contracts on exposure to light, or in near vision; also on the local application of a miotic, or a weak solution of cocaine. The symptom was present in from 8 to 10 *per cent.* of Negro's epileptic cases, and only very rarely among non-epileptics.

Table VII (p. 267) shows the condition of the pupils in  
LX. 16

35 cases of *acquired insanity with epilepsy*, aged from twenty to sixty-seven.

The average diameter of the pupils of the cases below the age of sixty is 4.9 mm. The average pupil diameter of 9 cases before treatment with potassium bromide was 5.1 mm. The average pupil diameter of 20 others was 4.8 mm. (Cases over the age of 60 are excluded.) It may be concluded that the effect of ordinary bromide treatment upon the pupil diameter of epileptics is negligible. (The average dose given is 30 gr. twice daily.) Sixteen cases have equal pupils, 8 show a trifling difference, and 10 show a difference in size of  $\frac{1}{4}$  mm. or more.

In 17 cases both pupils are circular; in the remaining 18 there is irregularity, usually in both eyes and of slight degree. In one case a change in the form of the pupils from circular to oval is recorded.

One case showed diminution of the direct and consensual reflexes in both eyes.

Another case (No. 3) has no direct or consensual reaction to light in the left eye. The sensory reflex is also absent in both eyes. A satisfactory explanation of these symptoms has not been reached.

In 33 cases the direct light-reflex was active in both eyes.

In all 5 cases show loss of the sensory reflex, and 9 cases show diminution.

On the whole, the most common symptoms are irregularity and inequality of the pupils. Loss or impairment of the sensory reflex occurs in an appreciable proportion of the cases, but otherwise the reflexes are not as a rule impaired.

Table VIII (p. 268) gives the results of the examination of the pupils in 19 cases of *imbecility with epilepsy*. The age varies from 7 to 49. The average pupil-diameter is 5.3 mm. The average diameter in 8 cases before bromide was administered proves to be 5.6 mm., but the average age of these is 24, as against 28 for the whole series. Here again the effect of bromide treatment on the pupil-diameter appears to be negligible.

The pupils are equal in 13 cases, unequal in 6; 15 cases have circular pupils in both eyes; 3 cases have both pupils irregular; 1 case has one pupil irregular.

One case shows diminished consensual reaction. Four

cases show diminished near-vision reaction. This is probably due to lack of the power of full convergence associated with congenital deficiency of intellect.

In 3 cases absence of the sensory reflex is recorded, in 5 it is diminished.

On the whole, inequality and irregularity are not quite so common as in the last group, and the average pupillary diameter is slightly greater.

It should be stated that all the observations in Tables VII and VIII were made in the intervals between fits, with the patients in their usual average mental condition.

#### (5) *Imbecility and Idiocy.*

The light-reflex, and near-vision reaction are usually unimpaired in imbeciles. In a very small percentage of cases the light-reflex is diminished.

Bumke found that the psychic reflex was often absent, but the reaction to painful stimuli was seldom altogether wanting. Out of 19 cases Hübner found both the psychic and the sensory reflex present in 8, absent in 2 cases of low-grade type; one was a cretin girl. Wassermeyer observed loss of the psychic reflex and of pupillary unrest in 1 out of 6 cases, where the patient was a low-grade idiot (Bach (2), Bumke (8)). Koenig (14) observed marked pupillary anomalies only thirteen times in ten years, during which period he had examined several hundred imbecile children. One case showed "springende Mydriasis" at irregular intervals, in association with slight post-neuritic optic atrophy; at times the pupils were equal; the reflexes were active. In another case the right pupil reacted sluggishly to light (directly and consensually), and was rather longer than the left. The left eye was healthy. Congenital syphilis was excluded in both these cases.

The other 11 cases showed either absolute or reflex rigidity, complete or incomplete, in one or both eyes. Only in one of these could syphilitic heredity with all likelihood be excluded. Five of them died from general paralysis, one from cerebral syphilis. Koenig distinguishes three clinical groups of cases among those with a history of parental syphilis: (1) Non-paralysed idiots; (2) children suffering from infantile cerebral

palsy proper ; (3) juvenile general paralytics. Pupillary abnormalities may be present in any group ; they are the rule in general paralysis, and occur in many cases of cerebral syphilis ; they are the exception in infantile cerebral palsy, and still more so among the non-paralysed idiots.

Malformations of the iris, which give an irregular form to the pupil, are not uncommon with idiots (Ireland, *Mental Affections of Children*). Coloboma iridis and corectopia may be found.

In Table IX (p. 269) I have recorded the condition of the pupil in four cases of "*higher-grade*" *imbecility*, aged from nineteen to forty-seven. Average diameter 4·8 mm. The pupils were unequal in one case ; one other case had both pupils irregular, and one showed irregularity of the left pupil. The sensory reaction was sluggish in 2 cases.

In Table X (p. 269) 10 cases of *imbecility of ordinary grade* are recorded. Their ages vary from nineteen to forty-one. The average pupil-diameter is 5·5 mm. The pupils were equal in 6, slightly unequal in 1, and they differed by  $\frac{1}{2}$  mm. or more in 3 cases.

In 4 cases both pupils were circular, in 5 both were irregular, and 1 case had irregularity of one pupil. In No. 9 there is double congenital irregularity of the pupils, with diminution of the direct and consensual light-reflexes, and absence of sensory reaction in one eye ; the pupils are also unequal.

In 6 cases the sensory reaction is diminished ; in 1 it is absent in both eyes. One case shows diminished near-vision reaction in both eyes ; in another the reaction was sluggish in the left eye.

In Table XI (p. 269) there are 8 cases of *idiocy*, aged from eighteen to forty-five. The average diameter of the pupils is 5·7 mm. The pupils are equal in 4 cases, slightly unequal in 1, differing by  $\frac{1}{2}$  mm. or more in 2. Both pupils are circular in 6 cases, one pupil slightly oval in 1 case. Four show diminished sensory reaction. The light-reflex is active in all the cases.

In Tables IX, X, and XI there was no case which presented any marked degree of corectopia.

In the majority of the 22 cases in these three tables the pupils were equal. In 9 cases there was irregularity of one or of both pupils, and in a few the irregularity was marked. On the whole, a tendency to sluggishness of the sensory reaction is apparent.

The pupil-diameter tends to be larger in the lower grades than in the higher grades of mental deficiency.

(6) *Hebephrenia, Katatonia, and Paranoia.*

Dementia præcox is the name given by many alienists to a group of psychoses which have their onset as a rule between the ages of fifteen and thirty years. They are characterised by a marked tendency towards early dementia, though the progress of the disease may be interrupted by remissions. Originally Kraepelin grouped under this head three forms of mental disorder, namely, hebephrenia, katatonia, and paranoid dementia. Other alienists have added further subdivisions, such as "simple primary dementia," and "mixed forms."

The opinion of L. C. Bruce (6) is that hebephrenia, katatonia, and paranoia are entirely separate diseases, and should be sharply distinguished from one another. With regard to paranoia, he remarks that as a rule there is little mental enfeeblement, except in a few of the adolescent cases who deteriorate rapidly in mind and become demented and incoherent. We may regard the latter group as corresponding to Kraepelin's dementia paranoides.

Unfortunately writers on the pupillary symptoms of dementia præcox do not always define which disease they are dealing with. Hence many of their records are unsatisfactory from the present point of view (as, for instance, in a paper by Tyson and Clark (29)).

Piltz (22) occasionally found in katatonic patients irregularity of the pupils, changing in form from day to day; transient sluggishness of movement of various portions of the iris; eccentricity of the pupil, subject to daily variation; varying degrees of anisocoria; mydriasis alternans; and increase in the activity of the light-reflex and orbicularis reaction.

Albrand (1) saw mydriasis with absolute rigidity in one case of dementia præcox in a state of katatonic excitement, as a temporary phenomenon. He quotes Meyer, who found "katatonic rigidity" of the pupil only once in 400 cases of dementia præcox. He concludes that absence of the light-reflex is quite an exceptional occurrence in that disease. Much more frequent symptoms he finds to be the following: Marked anisocoria, with a difference of from 1 to 3 mm.; occasional irregularities

of outline, usually in one eye only, with variations in the briskness and amplitude of the movements of the iris; increase in the degree of anisocoria, and sometimes change in the form of the pupils as temporary phenomena in association with outbursts of excitement. The patients whom he examined were mostly in the stage of terminal dementia. He very rarely found see-saw pupils. Occasionally slight corectopia was observed in katatonic cases.

Albrand also points out that anisocoria is rendered more evident when the pupils are examined under diminished illumination. In some cases in which the pupils are equal in ordinary daylight inequality can be observed on examination in a subdued light.

Bumke (8) investigated 33 cases of dementia præcox, of whom 9 suffered from hebephrenia, 22 from katatonia and 2 from paranoid dementia. He used a Westien corneal loupe, and an illumination of seven metre-candles. There was no distinction between the three classes in respect of the size of the pupils; the average diameter was 6.5 mm. An unusual variation in the size of the pupils was observed six times; for instance, diameters of 8, 5.5, and 7 mm. respectively were found on three successive days in one case under similar conditions. Anisocoria was present in three cases. The near-vision reaction was normal, and the sensitivity of the galvanic pupil-reaction was high.

In the 9 cases of hebephrenia the psychical reflex and pupil-unrest were lost when the disease had lasted for some time and had led to a certain degree of dementia. In 2 cases these reactions were present, but only in the initial stage of the disease. In no case did they reappear when once lost. The sensory reflex was present only in 2 cases, which were examined at an early stage. In one case reappearance of the sensory reflex occurred along with marked mental improvement.

In the 22 cases of katatonia the psychical reflex and pupil-unrest were never present. In 6 cases a slight dilatation was obtained from painful stimuli, but only in the early stage of the disease or during a remission. An unusual activity of the lid-closure reaction was observed in 18 cases, the amplitude sometimes amounting to 2 or 3 mm.

Of the two paranoid cases, the sensory reflex was present in one only, and the psychical reflex and pupil-unrest in neither.

Bumke concluded that absence of the psycho-reflex, pupillary unrest, and the sensory reflex are typical of dementia præcox.

In a later communication, quoted by Bach (2), dealing with 200 cases of dementia præcox, Bumke states that he found these symptoms in 60 *per cent.* of the whole, but that his hope of finding in them a reliable early indication of the disease had not been fulfilled.

Wassermeyer (quot. Bach (2)) examined 39 cases of dementia præcox with the Zeiss binocular microscope by daylight. Of these, 5 were hebephrenics, 25 katatonics, and 9 paranoiacs.

Of the 5 hebephrenic patients, in 2 cases pupil-unrest and the psycho-reflex were evident; in the other three they were present, but comparatively inactive. Among the katatonic patients, 2 out of 9 stuporose cases showed almost complete absence of pupil-unrest. In 1 out of 5 excited cases both pupil-unrest and the psycho-reflex were absent. Of 9 other katatonics, including 2 in a state of remission, 7 showed both reactions distinctly.

Out of 9 paranoiacs, pupillary unrest and the psychical reflex were absent in 2. On the whole, 6 out of the 39 cases (15·4 *per cent.*) showed loss of the psychic reflex and unrest.

For the purpose of comparison, Wassermeyer examined 174 soldiers, and found a great variety in the activity and range of movement of the pupils. In about 13 *per cent.* pupil unrest was almost completely absent; in one case he found no trace of pupil-unrest or the psychical reflex.

He explains the difference between his results and those of Bumke by the higher power of magnification which he used. He concludes that the loss of pupil-unrest and the psychic reaction are to be referred principally to mental deterioration, although this loss may occur in dementia præcox before the dementia has become marked. Wassermeyer found no clinical difference between cases which show the symptoms in question and those which do not.

In Table XII (p. 269) I have given records of 10 cases of *hebephrenia*, of between seventeen and forty-one years of age at the time of examination. The average pupil-diameter is 5·2 mm. The pupils were equal in 7 cases; slight inequality was shown by 1, more evident inequality by 2. Both pupils were circular in 6 cases, both irregular in 3; in 1 instance the left pupil



was slightly elliptical, the right circular. There was loss of the sensory reflex in 1 case, and diminution in 3.

Case No. 2 shows the development of corectopia and irregularity of the pupils, along with diminution of the sensory reaction and pupil-unrest. The patient's mental condition, however, was apparently undergoing improvement in the interval between the two observations.

Table XIII (p. 270) contains the records of 17 cases of *katatonia*, varying in age from fifteen to thirty-eight years. The average pupil diameter is 5.4 mm.

The pupils were equal in 10 cases, slightly unequal in 3; a difference amounting to  $\frac{1}{8}$  mm. or more in size is shown by 3 cases. Both pupils were circular in 6 cases; both irregular in 9; one pupil irregular in 2. Five cases showed loss of the sensory reaction in both eyes; in one instance as a temporary condition; 6 cases showed sluggishness of the reaction in both eyes; in 3 only was the sensory reflex active. No. 1 shows improvement in the activity of the sensory reflex.

Pupil-unrest was visible to the naked eye in at least 7 cases, though in 2 of these its activity was diminished. In No. 17 it was absent, but reappeared.

Change in the outline of the pupils is seen in Nos. 1, 2, 12, and 17. Change in the size-relation of the pupils is seen in Nos. 2 and 17. The light-reaction is impaired in Nos. 2, 13, and 17.

Case No. 2 showed in October, 1912, more rapidly alternating inequality, each pupil in turn becoming about  $\frac{1}{2}$  mm. larger than the other, at intervals of a minute or two. The patient was then in a dull stuporose condition. On March 13th, 1913, the patient was in a state of marked katatonic stupor, the pupils were unequal and reacted sluggishly to light, and no sensory reaction or pupil-unrest was visible to the naked eye.

Case No. 17 shows improvement in the state of the sensory reflexes and pupil-unrest, but diminution in the activity of the near-vision reaction.

On the whole, if it is permissible to draw deductions from such a small number of records, there is a rather greater tendency towards irregularity and inequality of the pupils, and disturbance of the sensory reflex in *katatonia* than in *hebephrenia*.

Table XIV (p. 271) deals with 3 cases of *paranoia with dementia*. Inequality of the pupils is twice recorded, and sluggishness of the sensory reflex twice.

Table XV (p. 271) contains 5 cases of *paranoia* without marked tendency to dementia. The age varies from forty-eight to seventy-four. There is inequality of the pupils in 3 cases, not exceeding  $\frac{1}{2}$  mm. in amount. Two cases in the senile period show irregularity of both pupils and sluggishness of the sensory reaction. Diminished sensory reaction is also found in case No. 2.

#### (7) *Melancholia of Involution.*

Involution melancholia is a psychosis of the involutorial period of life, characterised by great emotional depression, apprehension, and anxiety.

There are certain borderland cases of senile dementia with emotional depression that are difficult to distinguish from involution melancholia. Naturally melancholiacs after a prolonged duration may develop senile deterioration (White (27)).

Sluggishness of the light-reflex may be found in presenile psychoses; then there may be difficulty in diagnosing the condition, because general paralysis may be developed even after the age of sixty.

Table XVI (p. 271) contains the records of 27 cases of *melancholia originating in the involutorial or presenile stage of life*. There are 16 females, aged from forty-two to sixty-four at the time of examination, and 11 males, aged from forty-three to sixty-five.

The average pupil-diameter of the whole series is 4·8 mm.; of those aged sixty and below, 4·9 mm.

The pupils are equal in 7 cases; there is slight inequality in 11; and a difference in size of  $\frac{1}{2}$  mm. or over in 9 cases; 16 cases show bilateral irregularity; 5 cases have one irregular pupil; in 6 cases both pupils are circular.

The light-reflex is sluggish in both eyes in 5 cases; one case shows diminution in one eye only. One case (No. 25) has Argyll Robertson pupils; the patient is æt. 61. Probably he has had syphilis; and he may in the end prove to be a general paralytic. Two other cases show loss of the sensory reaction, 10 cases show diminution,

Absence of pupillary unrest is recorded twice, diminution 4 times, and normal activity 15 times.

Change in the size-relation of the pupils is shown in Nos. 4, 7, 8, 9, 17 and 18; in Nos. 8 and 18 there is reversal.

Change in the outline or position of the pupil took place in 7 cases—Nos. 4, 8, 18; Nos. 3 and 17 (transient corectopia; No. 7 and 25 (transient elliptical outline).

In a majority of the cases, therefore, we find a slight degree of inequality (which may be inconstant), also slight unevenness of outline. Changes in the form and position of the pupils may occur. In a few cases there is sluggishness of the light-reflex, and the sensory reflex may be inactive or even absent.

#### (8) *Senile Dementia.*

In physiological old age, the diameter of the pupils is usually smaller than in middle age or youth. In about one-fourth of the cases marked miosis is to be found—the pupils being 2 mm. or less in diameter (Bumke (8)). The reaction to sensory and psychical stimuli is present, but frequently sluggish, especially when there is miosis. The light-reflex as a rule is not appreciably impaired, although in senile miosis the amplitude of the reaction is naturally small. The near-vision reaction is usually unaffected. Moebius (quoted by Bumke), on examining the eyes of 33 old people found marked miosis and absolute rigidity in 3 cases, and sluggishness of some of the reactions in 19 of the remainder.

Other observers affirm that rigidity of the pupil due solely to old age never occurs (Bach (2)).

Bumke found that the galvanic pupil-reflex required a relatively much stronger current for its production in old age than in the earlier periods of life.

In senile dementia the state of the pupils is on the whole similar to that in physiological old age, except that disturbances of the reactions are more common. Bach (2) summarises the extant records as follows: loss of the light-reflex is found in about 2 *per cent.* of cases, absolute rigidity in 0.5 *per cent.*; the reaction to light is reduced in about 4 *per cent.*

According to Bumke (8), the pupils in senile dementia have the following characteristics: they are contracted, often

markedly so ; they react, but slightly and sluggishly to light, and only slightly in near vision, There is no distortion of their outline, and anisocoria is rare ; mydriasis and the typical Argyll Robertson symptom are never present apart from complications.

As the near-vision reaction is never quite intact, typical reflex-rigidity never occurs ; but complete or incomplete absolute rigidity may be found, the former only in advanced old age (Bumke). The gradual development of the symptoms of senile dementia may be subject to interruption and modification from the effect of more acute changes in the brain due to arterio-sclerosis. Hæmorrhages or patches of softening may produce marked pupillary symptoms. There may be mydriasis or miosis in one eye or in both, and the mobility of the iris may be impaired or altogether lost.

The condition of the pupils in 16 cases of *senile dementia* is recorded in Table XVII (p. 273). The age varies from sixty-five to seventy-seven. The average pupil diameter is 4.2 mm.

In 2 cases there are complications. In No. 3 there is amaurotic rigidity associated with loss of vision in the left eye. In No. 4 there is loss of the direct and consensual light-reflex in the left eye, impairment in the right eye, and bilateral loss of the sensory reflex. In none of the others is there any evidence of gross lesion. All suffered from more or less marked arterio-sclerosis.

Five cases had equal pupils, 4 show slight inequality, 7 show more marked inequality. Both pupils are irregular in 12 cases ; 2 have irregularity of one pupil, and 2 have both pupils circular.

Relatively marked miosis is seen in No. 7 and 16. Apart from Nos. 3 and 4, 8 cases exhibit bilateral diminution in the direct and consensual light reactions, and in 5 of these the near-vision reaction is also sluggish. In nine observations loss of the sensory reflex occurs twice, and diminution four times.

From this table it appears that in most cases the pupils are rather small, usually slightly irregular, and differing slightly in size. Usually the light-reflex is sluggish, and in a certain number the near-vision reaction is sluggish as well. The sensory reflex may be impaired even when the reaction to light and near-vision is active.

These conclusions agree fairly well with the observations of Bumke, except with regard to the frequency of slight anisocoria and irregularity of the pupil.

(9) *Manic-depressive Insanity.*

Seventy cases of manic-depressive insanity have been examined. The records appear in Tables XVIII to XXII (pp. 273-6). There are 14 first-attack cases of melancholia and 4 recurrent cases suffering from melancholia on admission. There are 13 recurrent cases suffering from mania on admission and 17 first-attack cases of mania. These were all of short duration at the time of examination. There are also 22 cases of "chronic mania"—in most of which there is variation in the mental symptoms at longer or shorter intervals, occasional periods of apathy and depression, or of acute excitement; dementia is not a marked feature of the clinical picture in these 22 cases.

The 18 cases of *melancholia* will be taken together (Tables XVIII and XIX, pp. 273-4).

The age varies from twenty-three to fifty-five. Average pupil-diameter, 5.4 mm. The pupils are equal in 11 cases, they show slight inequality in 5, more marked inequality in 2. Both pupils are circular in 4 cases; in 1 case one pupil was slightly irregular; in 13 cases both pupils showed irregularity, mostly of slight degree.

The light-reflexes (direct and consensual) were present and active in practically every case. In 5 cases the sensory reflex was diminished. Pupillary unrest is present as a rule. Case No. 7 (XVIII) showed loss of the sensory reflex.

On the whole, the pupils tend to be equal, and are often slightly irregular. Change in the size-relation and outline of the pupils is slight in amount. There may be diminution of the sensory reflex.

There are altogether 30 cases of *mania* in which the attack is of short duration. They are recorded in Tables XX and XXI (pp. 274-5). The age varies from twenty to sixty-three. The average pupil-diameter is 5.4 mm.

The pupils are equal in 9 cases; there is slight inequality in 10 cases, more evident inequality in 10 cases.

Both pupils are circular in 11 cases; 2 cases show irregularity

of one pupil, 16 cases of both pupils. Change in the pupil form (mostly slight) is seen in 5 cases. Transient corectopia is once recorded. The sensory reflex is usually present; its absence is recorded only twice. It is diminished in about half the cases.

In Case No. 4 (XXI) the patient was depressed and emotional on admission, but she later developed a restless excited phase, in which the previously circular pupils became oval and then returned to the circular form, but with slight irregularities.

In No. 8 (XXI) improvement in the condition of the pupils was associated with improvement in the mental state; irregularity and inequality disappeared, and the sluggish sensory reflex regained its activity.

On the whole, slight irregularity and slight anisocoria are commonly found, and in a certain number the sensory reflex is sluggish. Change in these symptoms may accompany change in the mental state of the patient. The light reaction (direct and consensual) is practically never impaired (in Case No. 10, XX, arterio-sclerosis and alcoholic excess are disturbing factors, which probably explain the sluggish reactions).

The average pupil-diameter is the same in the maniacal cases as in the melancholic cases: but anisocoria is perhaps more common in the former than in the latter.

Table XXII (p. 276) contains 22 cases of *chronic mania*. The age varies from thirty to sixty. The average pupil-diameter is 4.8 mm. In 18 cases the pupils are equal; in 4 there is slight inequality.

In 18 cases both pupils are circular. Three cases show bilateral irregularity, 1 case shows unilateral irregularity. The light-reflex is active, except in 1 case. The sensory reaction is active in 11 cases, diminished in 6, and once recorded as absent. The average pupil-diameter is considerably smaller than in the cases where the attack is of short duration.

On the whole, pupillary disturbances are but slight.

#### (10) *Terminal Dementia.*

Table XXIII (p. 277) shows the pupillary condition in 14 cases of *advanced dementia*. The age varies from forty to seventy-four.

The average pupil-diameter is 4.5 mm. Out of 12 observations equal pupils are recorded 7 times, slightly unequal pupils 5 times.

In 9 cases both pupils are circular ; both are irregular in 3 cases, and one pupil is irregular in 2 cases.

The light-reflex is not impaired. The sensory reflex is active in 6 observations, sluggish in 3.

Beyond a gradual shrinkage in pupil-diameter as age advances, no marked anomaly is recorded. Irregularity is not very frequent, slight anisocoria is rather more frequent.

#### CONCLUSIONS.

After consideration of the published records and opinions, as well as the results of my own examination of insane patients, I have formed the following conclusions with regard to pupillary symptoms in mental diseases :

(1) General paralysis presents a very large variety of pupillary phenomena, of which the most significant is the Argyll Robertson symptom. Absolute rigidity of the pupil is not so frequent or so significant as reflex-rigidity. Most of the other symptoms may be regarded as leading up to, or dependent on, the development of one of those two conditions.

Many cases terminate before the light-reflex becomes extinct. Reappearance of the light-reflex when once it is lost is a possible but rare occurrence. On the whole, the more serious derangements of the iris are more frequent in the advanced stages of the disease.

(2) Syphilitic insanity, if accompanied by vascular or syphilitomatous disease implicating the nervous system, may present marked pupillary symptoms, which are not necessarily permanent. In the functional varieties of syphilitic insanity pupillary symptoms are relatively slight and inconstant.

(3) Alcoholic insanity, the most common of the toxic psychoses, is often accompanied by disturbance of the pupils. In rare cases the pupil may not react to light ; sometimes the sensory reflex is absent. Sluggishness of the light-reflex, or of all the reactions, is not uncommon ; irregularity and anisocoria are fairly frequent. All these symptoms may be subject to change.

(4) Insanity with epilepsy presents well-marked pupillary symptoms in association with seizures; but the pupils of epileptics in their "habitual" state often show variations from the normal. These latter variations are in most cases inconstant, and some of them are functional in their nature.

(5) Apart from the rare occurrence of marked congenital abnormalities, pupillary symptoms in imbecility and idiocy are usually unimportant. A slight degree of irregularity is occasionally present. The light-reflex is rarely impaired; the sensory and psychical reflexes may be diminished, occasionally absent.

(6) In hebephrenia diminution or loss of "unrest," and of psychical and sensory reactions may be observed; there may be changes in the form and position of the pupils.

(7) In katatonia there is frequently diminution or loss of the sensory and psychical reactions and of unrest; temporary or changing irregularity, eccentricity, and inequality of the pupils are often present. Variation in the activity of the light-reaction may occur, usually a diminution.

(8) The sensory reaction may be diminished in paranoia, especially where there is a certain degree of dementia.

(9) In melancholia of involution a slight degree of inequality and irregularity of the pupils is often perceptible. Changes in the form, position, and size-relation of the pupils may occur. In a few cases the light-reflex is sluggish, and the sensory reaction may be inactive, rarely absent.

(10) The pupils in senile dementia tend to be small, usually reacting somewhat sluggishly to light: the near vision reaction may also be impaired. The sensory reflex is occasionally absent; it may be impaired when the light and near vision reflexes are comparatively active.

(11) The melancholic phase of manic-depressive insanity presents but few pupillary symptoms. Slight irregularity is not uncommon; anisocoria is relatively infrequent. If there is change in the form or size-relation of the pupils it is slight in amount. The sensory reflex is sluggish in a few cases only.

In the maniacal phase slight irregularity and inequality of the pupils are frequently observed. In a certain number of cases the sensory reflex is sluggish. Change in these symptoms may accompany change in the mental state.



The average pupil-diameter is the same in the melancholic as in the maniacal phase.

The pupil-diameter is smaller on the whole in patients who are habitually in a state of excitement. Here there are no marked pupillary disturbances. In a small proportion of cases the sensory reflex is sluggish.

(12) In terminal dementia irregularity of the pupil is not very common. Slight anisocoria is rather more frequent. As age advances the influence of senility on the condition of the pupils gradually makes itself felt.

(13) Apart from general paralysis, epilepsy, and gross brain-lesions, more evident pupillary symptoms are found in the toxic psychoses and in senile dementia. In katatonia and the habitual condition of insane epileptics transient sluggishness of the light-reaction may be observed.

In many kinds of insanity there is a tendency towards variation in the form, position, and size-relation of the pupils.

(14) It has been claimed that diminution and loss of the sensory and psychical reactions, and of pupil-unrest are typically frequent in the triad of diseases included in the term "dementia præcox." These symptoms, however, are not uncommon in other types of insanity; and no special diagnostic importance can be attached to their occurrence.

(15) Further investigation of the condition of the pupils in insane patients is required. Each case should be re-examined at regular intervals, and control-observations of a sufficiently large number of healthy persons should be carried out under similar conditions.

#### METHOD OF EXAMINING THE PUPILS.

Insane patients sometimes do not submit kindly to methodical examination. Either timidity, suspicion, resistiveness, inattention, or lack of intelligence on the patient's part may demand the exercise of much tact and patience on the part of the observer. He may find it impossible to make any but disjointed observations, which may be vitiated by reactions associated with restless movements of the patient's eyes or eyelids.

I have found it most satisfactory to use only comparatively simple appliances, and as few of these as possible.

The patients were examined in dull diffused daylight, both

eyes being equally illuminated. Each patient was asked to look steadily at some definite object in the distance. The lighting was such that the outline of the pupils could be clearly seen, but bright daylight or sunshine was avoided. One result of this is that, except where the pupils are rigid to light, the sizes recorded in the tables cannot be compared with the "physiological diameter" as estimated by Schirmer. The measurements in the tables, however, were made as far as possible under the same conditions, and may be regarded as comparable among themselves.

Another drawback is that the sensory reflex is not so clearly evident as it is with brighter illumination, but in doubtful cases re-examination before a window can be carried out. On the other hand, examination in a comparatively dull light enables one to appreciate differences in size and irregularities of form which are not always so clearly seen with brighter illumination.

For measuring the diameter, I found it best to compare the pupil with a series of black circular discs marked on a strip of white cardboard. This simple pupillometer, held close to the patient's temple on the same level as the eye, does not distract his attention so much as would an instrument held in front of the eye. The series of discs differ in size by  $\frac{1}{3}$  mm., and it is possible by comparison to judge intermediate sizes, so that one can practically estimate the diameter of the pupil to the fourth part of a millimetre. A black disc on a white ground appears smaller than a black disc on a somewhat dark background; this effect of irradiation may lead to over-estimation of the size of the pupil in patients with dark irides, but the error would not amount to more than  $\frac{1}{4}$  mm. In order to minimise the tendency to error, a series of discs marked on grey cardboard might be used.

For testing the light-reflex, I used a pocket electric flash-lamp or a small surgical hand-lamp connected to a dry battery. In either case a bright light is produced by pressure on a button, and the strength of illumination can be graduated as required by varying the distance between the lamp and the patient's eye.

In testing the sensory reaction, painful sensation was produced by the pressure of a blunt needle on the patient's skin. In cases where the psychical reflex is active, the mere approach

of the needle if observed by the patient is sufficient to produce a marked dilatation of the pupils.

The pupillary unrest was estimated by the naked eye. The ordinary corneal loupe does not give a sufficiently large field of view, and a Zeiss binocular microscope was not available. In any case only a certain number of patients could be satisfactorily examined with this instrument.

Finally, I wish to express my thanks to Dr. Kay, the former Medical Superintendent of Wadsley Asylum, and Dr. Vincent, his successor, for kindly granting special facilities for the examination of patients for the purposes of this investigation.

#### NOTE ON THE SYMBOLS USED IN THE TABLES.

In the records given in the following series of tables, the sign + indicates that the reaction in question is present and active, the sign — indicates that it is present, but with diminished activity, and O means that the reaction is absent, or at any rate not appreciable to the naked eye.

(The term "corectopia" is used in the general sense as explained on p. 87.)

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(<sup>1</sup>) Thesis—M.D., University of Edinburgh.

I.—Temporary Alcoholic Insanity (p. 236).

No.	Sex.	Age.	Size of pupils in mm.		Reaction to light.				Reaction to near vision.		Reaction to sensory stimuli.		Pupillary unrest.		Outline of right pupil.	Outline of left pupil.	Date of record.
			R.	L.	Direct.		Consens.		R.	L.	R.	L.	R.	L.			
					R.	L.	R.	L.									
1	M.	34	5	5	+	+	+	+	+	+	+	+	+				
2	M.	34	5½	5½	+	+	+	+	+	+	+	+	+				
3	M.	40	5½	5½	+	+	+	+	+	+	+	+	+				
4	M.	40	6½	6	+	+	+	+	+	+	+	+	+				
5	M.	42	5½	6	+	+	+	+	+	+	+	+	+				
6	M.	42	5	4½	+	+	+	+	+	+	+	+	+				
7	M.	48	4	3½	+	+	+	+	+	+	+	+	+				
8	M.	53	4½	5½	+	+	+	+	+	+	+	+	+				
9	M.	55	4½	4½	+	+	+	+	+	+	+	+	+				
10	M.	60	5½	4½	+	+	+	+	+	+	+	+	+				

II.—Polyneuritic Alcoholic Insanity (p. 237).

1	M	28	5½	5	+	+	+	+	+	+	+	+	+					26/12/12
			5½	6½	+	+	+	+	+	+	+	+	+					5/2/13
2	M	39	3½	3½	+	+	+	+	+	+	+	+	+					28/12/12
			5½	5½	+	+	+	+	+	+	+	+	+					28/1/13
			4	4½	+	+	+	+	+	+	+	+	+					5/2/13

III.—Chronic Alcoholic Insanity (p. 237).

1	M.	36	5½	+	+	+	+	+	+	+	+	+	O	O	+			Slight flattening on outer lower segment	2/11/12
2	M.	40	5½	+	-	+	+	+	+	+	+	-	+	-	+	+		Circular	13/2/13
3	M.	40	4½	+	-	+	+	+	+	+	+	+	+	+	-	+		"	
4	M.	41	3½	+	+	+	+	+	+	+	+	+	+	+	-	+		Slightly irregular	
5	M.	41	5½	+	+	+	+	+	+	+	+	+	+	+	+	+		Circular	
6	M.	43	5½	+	+	+	+	+	+	+	+	+	+	+	+	+		Slightly irregular	
7	M.	46	4½	+	+	+	+	+	+	+	+	+	+	+	+	+		Irregular	
8	M.	47	5½	+	+	+	+	+	+	+	+	+	+	+	+	+		Slightly irregular	
9	M.	49	5½	+	+	+	+	+	+	+	+	+	+	+	+	+		Circular	
10	M.	53	2½	+	-	+	+	+	+	+	+	+	+	+	-	+		Irregular, three-corned	
11	M.	54	5	+	+	+	+	+	+	+	+	+	+	+	+	+		Circular	25/4/12
12	M.	55	4½	+	+	+	+	+	+	+	+	+	+	+	+	+		Slightly irregular	14/2/13
13	M.	56	5	+	+	+	+	+	+	+	+	+	+	+	+	+		Slightly irregular	11/11/12
14	M.	56	4½	+	+	+	+	+	+	+	+	+	+	+	+	+		Elliptical	11/3/13
15	M.	57	4	+	-	+	+	+	+	+	+	+	+	+	+	+		Irregular	16/8/12
16	M.	58	3½	+	+	+	+	+	+	+	+	+	+	+	+	+		Circular	5/11/12
17	M.	59	4	+	+	+	+	+	+	+	+	+	+	+	+	+		Slightly irregular	
18	M.	61	6 x 5½	-	+	+	+	+	+	+	+	+	+	+	+	+		Irregular	
19	M.	62	3½	+	+	+	+	+	+	+	+	+	+	+	+	+		"	
20	M.	62	4	+	+	+	+	+	+	+	+	+	+	+	+	+		Irregular oval	
21	M.	64	3½	+	+	+	+	+	+	+	+	+	+	+	+	+		"	
22	F.	41	3½	+	+	+	+	+	+	+	+	+	+	+	+	+		Irregular	
23	F.	50	4	+	+	+	+	+	+	+	+	+	+	+	+	+		Circular	
24	F.	56	4	+	+	+	+	+	+	+	+	+	+	+	+	+		Slightly irregular	
25	F.	58	4	+	+	+	+	+	+	+	+	+	+	+	+	+		Irregular	
26	F.	60	3½	+	+	+	+	+	+	+	+	+	+	+	+	+		Circular	

IV.—Insanity from Lead Poisoning (p. 238).

No.	Sex.	Age.	Size of pupils in mm.		Reaction to light.				Reaction to near vision.				Reaction to sensory stimuli.				Pupillary unrest.				Outline of right pupil.	Outline of left pupil.	Date of record.	
			R.	L.	Direct.	Consens.	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.				
1	M.	65	5	4½	+	-	+	-	+	+	+	+	-	-	-	-	-	-	-	+	+	Irregular	Irregular oval	13/3/12 7/3/13
		66	4½	4 × 3½	+	-	+	-	+	+	+	+	-	-	-	-	-	-	-	+	+	Irregular	Irregular oval	

V.—Syphilitic Insanity (p. 233).

1	M.	17	5½	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Circular	Circular	19/1/13	
2	M.	19	5½	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Slightly irregular	Slightly irregular	7/2/13
3	M.	25	7	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Irregular	Irregular	
4	M.	32	6 × 5½	5½	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Circular	Circular	2/3/12
5	M.	40	6½	6½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Slightly irregular	Slightly irregular	13/2/13
6	M.	41	5½	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Circular; coeetopia	Circular; coeetopia	
7	F.	42	5	5	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	" Circular	"	5/1/90
		37	R. < L.		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	"	"	31/5/10
		57	4	4½	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	"	"	

VI.—General Paralysis (p. 230).

1	F.	39	3½	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Irregular	Irregular	3/12/09
2	F.	49	4	3½	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Circular	Circular	9/11/10
3	F.	58	equal	equal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Oval	Oval	23/11/10
		59	3½	3½	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Irregular	Irregular	21/10/12
4	M.	59	3½	4½	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	"	"	13/12/12
		46	4½	4½	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Circular	Circular	28/1/13
			4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Irregular	Irregular	27/2/13
			3½	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	"	"	





VI.—General Paralysis (continued).

No.	Sex.	Age.	Size of pupils in mm.		Reaction to light				Reaction to near vision.		Reaction to sensory stimuli.		Pupillary unrest.		Outline of right pupil.	Outline of left pupil.	Date of record.
			R.	L.	Direct.	Consens.		R.	L.	R.	L.	R.	L.	R.			
20	M.	54	7½	6½	—	—	—	—	—	—	—	—	—	—	Irregular	Irregular	22/11/12
21	M.	55	3½	4½	—	—	—	—	—	—	—	—	—	—	"	"	28/1/13
22	F.	53	4½	4	—	—	—	—	—	—	—	—	—	—	"	"	27/2/13
23	M.	43	4½	2	—	—	—	—	—	—	—	—	—	—	Slightly irregular	Slightly irregular	27/8/12
24	M.	41	4½	3½	—	—	—	—	—	—	—	—	—	—	Irregular	Irregular	22/10/12
25	M.	37	5½	4½	—	—	—	—	—	—	—	—	—	—	Slightly irregular	Slightly irregular	27/8/12
26	M.	66	5½	5½	—	—	—	—	—	—	—	—	—	—	Roughly elliptical	Roughly elliptical	29/10/12
27	M.	38	5½	5½	—	—	—	—	—	—	—	—	—	—	Circular	Circular	2/1/12
28	M.	47	5½	3½	—	—	—	—	—	—	—	—	—	—	Slightly irregular	Slightly irregular	7/11/12
29	M.	53	4	6	—	—	—	—	—	—	—	—	—	—	"	"	13/2/13
30	M.	42	4	4	—	—	—	—	—	—	—	—	—	—	Slightly irregular	Slightly irregular	6/12/10
31	M.	45	4	4	—	—	—	—	—	—	—	—	—	—	Slightly irregular, oval	Slightly irregular, oval	11/11/12
32	M.	61	5	4	—	—	—	—	—	—	—	—	—	—	Oval	Oval	17/2/11
33	M.	38	4	4	—	—	—	—	—	—	—	—	—	—	Very irregular	Very irregular	7/3/13
			3	3	—	—	—	—	—	—	—	—	—	—	Slightly irregular	Slightly irregular	6/8/09
			Very small	Very small	—	—	—	—	—	—	—	—	—	—	"	"	7/11/12
			4	4	—	—	—	—	—	—	—	—	—	—	Irregular	Irregular	2/2/06
			4	4	—	—	—	—	—	—	—	—	—	—	"	"	19/12/12
			4	4	—	—	—	—	—	—	—	—	—	—	Irregular	Irregular	8/10/12
			4	4	—	—	—	—	—	—	—	—	—	—	"	"	24/10/12
			5½	6½	—	—	—	—	—	—	—	—	—	—	Slightly irregular, oval	Slightly irregular, oval	4/12/12
			4½	4½	—	—	—	—	—	—	—	—	—	—	Irregular	Irregular	5/2/13
			3½	3½	—	—	—	—	—	—	—	—	—	—	Corectopia	Corectopia	13/3/13 (Seizure)



VI.—General Paralysis (continued).

No.	Sex.	Age.	Size of pupils in mm.		Reaction to light.				Reaction to near vision.		Reaction to sensory stimuli.		Pupillary unrest.		Outline of right pupil.	Outline of left pupil.	Date of record.
			R.	L.	Direct.	Consens.	R.	L.	R.	L.	R.	L.	R.	L.			
52	M.	36	5	3½	+	+	+	+	+	+	+	+	+	+	Irregular; flattened	10/12/12	
53	M.	32	7½	7	+	+	+	+	+	+	+	+	+	+	Irregular	13/2/13	
54	M.	47	4½	5½	+	+	+	+	+	+	+	+	+	+	Corectopia; circular	9/2/13	
55	M.	32	4½	5½	+	+	+	+	+	+	+	+	+	+	Irregular	12/2/13	
56	M.	42	5½	6 x 5½	+	+	+	+	+	+	+	+	+	+	Irregular; elliptical	26/12/12	
57	M.	44	3½	5½	+	+	+	+	+	+	+	+	+	+	Irregular	14/2/13	
58	M.	31	5½	5½	+	+	+	+	+	+	+	+	+	+	Slightly irregular	24/10/12	
59	M.	44	5½	3	+	+	+	+	+	+	+	+	+	+	"	28/1/13	
60	M.	35	4½	5½	+	+	+	+	+	+	+	+	+	+	Slightly irregular	24/10/12	
61	M.	42	4½	5½	+	+	+	+	+	+	+	+	+	+	Pear-shaped	19/12/12	
62	M.	43	4½	4½	+	+	+	+	+	+	+	+	+	+	Slightly irregular	14/2/13	
63	M.	38	5	4½	+	+	+	+	+	+	+	+	+	+	Slightly irregular	29/10/12	
64	M.	47	4	5	+	+	+	+	+	+	+	+	+	+	Circular	21/11/12	
65	F.	44	5	4	+	+	+	+	+	+	+	+	+	+	"	12/2/13	
66	M.	18	4½	4½	+	+	+	+	+	+	+	+	+	+	Circular	23/1/12	
			4½	4½	+	+	+	+	+	+	+	+	+	+	"	19/12/12	
			4½	4½	+	+	+	+	+	+	+	+	+	+	Slightly irregular	7/3/13	
			4½	4½	+	+	+	+	+	+	+	+	+	+	Corectopia; irregular	25/1/12	
			4½	4½	+	+	+	+	+	+	+	+	+	+	Irregular	7/3/13	
			4½	4½	+	+	+	+	+	+	+	+	+	+	Oval	8/10/12	
			4½	4½	+	+	+	+	+	+	+	+	+	+	Slightly-elliptical	7/11/12	
			4½	4½	+	+	+	+	+	+	+	+	+	+	Flattened below		
			4½	4½	+	+	+	+	+	+	+	+	+	+	Circular		
			4½	4½	+	+	+	+	+	+	+	+	+	+	Irregular	22/3/12	
			4½	4½	+	+	+	+	+	+	+	+	+	+	Slightly irregular	1/8/12	



VII.—*Insanity with Epilepsy* (continued).

No.	Sex.	Age.	Size of pupils in mm.		Reaction to light.				Reaction to near vision.		Reaction to sensory stimuli.		Pupillary unrest.		Outline of right pupil.	Outline of left pupil.	Date of record.
			R.	L.	Direct.	Consens.		R.	L.	R.	L.	R.	L.	R.			
29	F.	57	5½	5½	+	+	+	+	+	+	+	+	+		Circular	Circular	
30	M.	57	3½	4	+	+	+	+	+	+	+	+	+		Slightly irregular	Slightly irregular	
31	F.	63	4	4½	+	+	+	+	+	+	+	+	+		"	"	
32	F.	64	4	4½	+	+	+	+	+	+	+	+	+		Circular	Circular	
33	F.	64	4	3½	+	+	+	+	+	+	+	+	+		Slightly irregular	Slightly irregular	
34	F.	66	3½	4	+	+	+	+	+	+	+	+	+		Circular	Circular	
35	F.	67	4	4	+	+	+	+	+	+	+	+	+		Corectopia—in	Corectopia—in	

VIII.—*Imbecility with Epilepsy* (p. 242).

1	M.	7	6½	6½	+	+	+	+	+	+	+	+	+	+	+	+	+	Circular
2	M.	13	6½	6½	+	+	+	+	+	+	+	+	+	+	+	+	+	"
3	M.	16	5½	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	"
4	M.	18	5	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	Slightly irregular
5	F.	19	4½	4½	+	+	+	+	+	+	+	+	+	+	+	+	+	Circular
6	F.	22	4½	5	+	+	+	+	+	+	+	+	+	+	+	+	+	"
7	F.	23	5½	5	+	+	+	+	+	+	+	+	+	+	+	+	+	"
8	F.	24	5	5	+	+	+	+	+	+	+	+	+	+	+	+	+	"
9	F.	26	5	5	+	+	+	+	+	+	+	+	+	+	+	+	+	"
10	F.	28	5½	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	"
11	F.	28	5	6	+	+	+	+	+	+	+	+	+	+	+	+	+	Slightly irregular
12	F.	30	5	6	+	+	+	+	+	+	+	+	+	+	+	+	+	Circular
13	F.	31	5	5	+	+	+	+	+	+	+	+	+	+	+	+	+	"
14	F.	31	5½	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	"
15	F.	37	6	6	+	+	+	+	+	+	+	+	+	+	+	+	+	Slightly irregular
16	M.	38	5½	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	"
17	M.	39	5½	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	Very irregular
18	F.	43	5	5	+	+	+	+	+	+	+	+	+	+	+	+	+	Circular
19	F.	49	5	4	+	+	+	+	+	+	+	+	+	+	+	+	+	"

IX.—Higher-Grade Imbecility (p. 244).

1	M.	19	5	5	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Circular	Circular
2	M.	20	4½	5	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	"	"
3	M.	37	4½	4½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Irregular	Irregular
4	M.	47	5	5	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Circular	Slightly irregular

X.—Imbecility (p. 244).

1	M.	19	5½	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Circular	Circular
2	F.	24	4½	4½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	"	"
3	M.	25	5	6	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Irregular, oval	Irregular, oval
4	M.	26	7	6½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Circular	Circular
5	F.	27	6½	6½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Slightly irregular	Slightly irregular
6	M.	33	6½	6½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Circular	Circular
7	F.	34	4	4	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Slightly irregular	Slightly irregular
8	F.	40	6	6	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Irregular, pear-shaped	Irregular, pear-shaped
9	M.	40	5½	4½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Irregular, D-shaped.	Irregular, D-shaped.
10	M.	41	5	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Irregular, D-shaped.	Irregular, D-shaped.

XI.—Idiocy (p. 244).

1	F.	18	6	6	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Circular	Circular
2	F.	28	5	5	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	"	"
3	F.	28	7½	7½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	"	"
4	F.	30	6½	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	"	"
5	F.	37	6½	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Slightly oval	Slightly oval
6	F.	40	5	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Circular	Circular
7	F.	41	6	6	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	"	"
8	F.	45	4	4½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	"	"

XII.—Hebephrenia (p. 247).

1	F.	17	5½	5	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Slightly irregular	Slightly irregular
2	M.	22	7	7	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Circular	Circular
			5½	6	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Corectopia; slightly irregular	Corectopia; slightly irregular
3	F.	24	6	6	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Circular	Circular
4	F.	27	5	5	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	"	"

14/2/13  
7/3/13

XII.—*Hebephrenia* (continued).

No.	Sex.	Age.	Size of pupils in mm.		Reaction to light.				Reaction to near vision.		Reaction to sensory stimuli.		Pupillary unrest.		Outline of right pupil.	Outline of left pupil.	Date of record.
			R.	L.	Direct.	Consens.		R.	L.	R.	L.	R.	L.	R.			
5	F.	29	4½	4½	+	+	+	+	+	+	+	+	+		Circular		
6	F.	32	5	5	+	+	+	+	+	+	+	+	+		"		
7	F.	37	5	5	+	+	+	+	+	+	+	+	+		"		
8	F.	37	4	4	+	+	+	+	+	+	+	+	+		"		
9	M.	40	5½	5½	+	+	+	+	+	+	+	+	+	+	Slightly irregular		
10	M.	41	5	5	+	+	+	+	+	+	+	+	+	+	Slightly elliptical		

XIII.—*Katatonia* (p. 248).

No.	Sex.	Age.	Size of pupils in mm.		Reaction to light.				Reaction to near vision.		Reaction to sensory stimuli.		Pupillary unrest.		Outline of right pupil.	Outline of left pupil.	Date of record.
			R.	L.	Direct.	Consens.		R.	L.	R.	L.	R.	L.	R.			
1	M.	15	7½	7½	+	+	+	+	+	+	+	+	+	+	Circular		26/10/12
2	M.	19	5½	7½	+	+	+	+	+	+	+	+	+	+	Slightly irregular		7/3/13
			7½	6½	+	+	+	+	+	+	+	+	+	+	Somewhat oval		4/10/12
			6½	7	+	+	+	+	+	+	+	+	+	+	Circular		28/1/13
			6½	6	+	+	+	+	+	+	+	+	+	+	Corectopia; slightly irregular		14/2/13
			5	6	+	+	+	+	+	+	+	+	+	+	Slightly irregular		11/3/13
			4½	4	+	+	+	+	+	+	+	+	+	+	Slightly irregular		13/3/13
			R.	L.	+	+	+	+	+	+	+	+	+	+	Circular		15/3/13
			4½	4½	+	+	+	+	+	+	+	+	+	+	Slightly irregular		16/3/13
3	M.	21	4½	5	+	+	+	+	+	+	+	+	+	+	Circular		
4	F.	22	4½	5	+	+	+	+	+	+	+	+	+	+	Slightly irregular		
5	M.	23	6	4½	+	+	+	+	+	+	+	+	+	+	Circular		
6	M.	23	4½	5	+	+	+	+	+	+	+	+	+	+	Slightly irregular		
7	F.	23	5½	5	+	+	+	+	+	+	+	+	+	+	"		
8	M.	23	5	5	+	+	+	+	+	+	+	+	+	+	Circular		
9	F.	24	5	6	+	+	+	+	+	+	+	+	+	+	Slightly irregular		
10	F.	26	6	5½	+	+	+	+	+	+	+	+	+	+	Circular		
11	F.	26	5½	5½	+	+	+	+	+	+	+	+	+	+	"		





XVI.—*Melancholia of Involution* (continued).

No.	Sex.	Age.	Size of pupils in mm.		Reaction to light.				Reaction to near vision.		Reaction to sensory stimuli.		Pupillary unrest.		Outline of right pupil.	Outline of left pupil.	Date of record.
			R.	L.	Direct.	Censens.		R.	L.	R.	L.	R.	L.	R.			
7	F.	49	5½ 5	5½ 5½	+	+	+	+	+	+	+	+	+	+	+	Irregular Slightly oval	9/11/10 23/11/10
8	F.	50 51	5½ 5½ 5½	5½ 5½ 5½	+	+	+	+	+	+	+	+	+	+	+	Slightly irregular "	24/10/11 22/11/11 28/11/11
9	F.	53	4½ 4½ 4½	4½ 4½ 4½	+	+	+	+	+	+	+	+	+	+	+	" "	3/10/11 31/10/11
10	F.	54	5½	5½	+	+	+	+	+	+	+	+	+	+	+	Slightly elliptical Slightly irregular	
11	F.	55	4	3½	+	+	+	+	+	+	+	+	+	+	+	"	
12	F.	57	4	4	+	+	+	+	+	+	+	+	+	+	+	"	
13	F.	58	4½	4½	+	+	+	+	+	+	+	+	+	+	+	"	
14	F.	60	4½	4½	+	+	+	+	+	+	+	+	+	+	+	"	
15	F.	61	4½	4½	+	+	+	+	+	+	+	+	+	+	+	"	
16	F.	64	3½	3½	+	+	+	+	+	+	+	+	+	+	+	"	
17	M.	43	4½	4½	+	+	+	+	+	+	+	+	+	+	+	"	
18	M.	47	6	5½	+	+	+	+	+	+	+	+	+	+	+	Corectopia; slightly irregular	28/8/12 13/2/13
19	M.	48	4½	4½	+	+	+	+	+	+	+	+	+	+	+	Somewhat oval Oval; irregular	22/11/12 13/2/13
20	M.	49	5	4½	+	+	+	+	+	+	+	+	+	+	+	Corectopia; slightly irregular	
21	M.	53	3½	3½	+	+	+	+	+	+	+	+	+	+	+	Slightly oval Irregular	14/10/12 5/2/13
22	M.	56	5½	5½	+	+	+	+	+	+	+	+	+	+	+	"	
23	M.	56	5½	5½	+	+	+	+	+	+	+	+	+	+	+	"	
24	M.	59	4½	4½	+	+	+	+	+	+	+	+	+	+	+	"	

		18/1/13	7/2/13																		
LX.	25	M.	61	4½	4½	5½ x 5	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	26	M.	64	4½	4½	4½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	27	M.	65	4½	4½	4½	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
XVII.— <i>Senile Dementia</i> (p. 251).																					
1	M.	65	4½	4½	4½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
2	M.	65	3½	3½	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	M.	65	4½	4½	4½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
4	M.	67	4	4	4½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
5	M.	67	3½	3½	3½	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	M.	67	4½	4½	2½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
7	F.	68	4½	4½	2½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
8	M.	69	4½	4½	4	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
9	M.	69	4	4	4	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
10	M.	70	4½	4½	4	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
11	F.	71	5	5	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	M.	72	3½	3½	3½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
13	M.	73	3½	3½	4	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
14	M.	74	6½	6½	6½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
15	F.	75	4	4	3½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
16	M.	77	4	2½	3	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

XVIII.—*Melancholia (First Attack)* (p. 252).

		31/10/11	8/11/11	22/11/11																		
LX.	1	F.	23	5½	6	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
	2	F.	26	5½	6	6	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
	3	F.	26	5½	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	4	F.	27	5	4½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	5	F.	27	5	5	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	6	F.	32	6	6	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	7	M.	33	5½	5½	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

XVIII.—*Melancholia (First Attack)* (continued).

No.	Sex.	Age.	Size of pupils in mm.		Reaction to light.				Reaction to near vision.		Reaction to sensory stimuli.		Pupillary unrest.		Outline of right pupil.	Outline of left pupil.	Date of record.	
			R.	L.	Direct.	Consens.		R.	L.	R.	L.	R.	L.	R.				L.
8	F.	33	5½	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	8/11/12
9	F.	34	5½	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	22/11/12
10	F.	34	5½	6	+	+	+	+	+	+	+	+	+	+	+	+	+	7/11/11
11	F.	34	5½	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	22/11/11
12	F.	34	4½	4½	+	+	+	+	+	+	+	+	+	+	+	+	+	
13	M.	37	4½	4½	+	+	+	+	+	+	+	+	+	+	+	+	+	
14	M.	39	5	5	+	+	+	+	+	+	+	+	+	+	+	+	+	
		43	6½	6½	+	+	+	+	+	+	+	+	+	+	+	+	+	

XIX.—*Melancholia (Recurrent)* (p. 252).

1	F.	32	5½	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	
2	F.	42	5½	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	
3	F.	39	5½	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	17/10/11
4	M.	55	5½	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	24/10/11

XX.—*Mania (Recurrent)* (p. 252).

1	M.	23	5	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	
2	M.	26	4½	6½	+	+	+	+	+	+	+	+	+	+	+	+	+	
3	M.	27	5	6½	+	+	+	+	+	+	+	+	+	+	+	+	+	
4	M.	28	5½	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	
5	F.	35	5½	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	
6	F.	36	5	5½	+	+	+	+	+	+	+	+	+	+	+	+	+	
7	M.	40	7	6½	+	+	+	+	+	+	+	+	+	+	+	+	+	

8	F.	47	4 1/2	4 1/2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		Slightly irregular; corectopia	7/11/12	
9	M.	50	5 1/2	5 1/2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		"	7/11/12
10	M.	52	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		"	7/11/12
11	F.	53	4 1/2	4 1/2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		Irregular	
12	F.	59	5 1/2	5 1/2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		Slightly irregular	
13	F.	63	5 1/2	5 1/2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		Circular	
					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		Slightly irregular	

XXI.—Mania (*First Attack*) (p. 252).

1	F.	20	6 1/2	6 1/2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		Slightly irregular	9/11/10
2	M.	20	7	7	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		"	23/11/10
3	F.	22	6 1/2	6 1/2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		Circular	17/11/11
4	F.	26	5 1/2	5 1/2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		Corectopia	28/11/11
5	M.	27	5 1/2	5 1/2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		Slightly irregular	3/10/11
6	M.	27	6 1/2	6 1/2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		"	24/10/11
7	M.	27	6 1/2	6 1/2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		"	31/10/11
8	F.	28	5 1/2	5 1/2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		Slightly oval	31/10/11
9	M.	28	5 1/2	5 1/2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		Slightly irregular	25/6/12
10	M.	29	5 1/2	5 1/2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		"	18/2/13
11	M.	31	4 1/2	4 1/2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		Slightly irregular	17/10/11
12	F.	31	4 1/2	4 1/2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		"	28/11/11
13	F.	31	5 1/2	5 1/2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		Circular	
14	M.	32	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		Irregular	
15	F.	35	6	6	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		"	
16	F.	35	5 1/2	5 1/2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		"	
17	M.	36	5 1/2	4 1/2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		"	
					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		"	
					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		Circular	
					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		"	
					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		Irregular, elliptical	
					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		Circular	
					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		Irregular, elliptical	
					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		Circular	

XXII.—*Chronic Mania* (p. 253).

No.	Sex.	Age.	Size of pupils in mm.		Reaction to light.				Reaction to near vision.		Reaction to sensory stimuli.		Pupillary unrest.		Outline of right pupil.	Outline of left pupil.	Date of record.
			R.	L.	Direct.	Consen.		R.	L.	R.	L.	R.	L.	R.			
1	F.	30	6	6	+	+	+	+	+	+	+	+	+	+	Circular	Circular	
2	F.	31	5	5	+	+	+	+	+	+	+	+	+	+	"	"	
3	F.	33	R. = 4	L. = 4	+	+	+	+	+	+	+	+	+	+	"	"	
4	F.	34	5½	5½	+	+	+	+	+	+	+	+	+	+	"	"	
5	F.	35	5	5	+	+	+	+	+	+	+	+	+	+	"	"	
6	F.	36	5½	5½	+	+	+	+	+	+	+	+	+	+	"	"	
7	M.	37	4½	4½	+	+	+	+	+	+	+	+	+	+	"	"	
8	F.	39	4	4	+	+	+	+	+	+	+	+	+	+	"	"	
9	F.	40	R. = 5½	L. = 5½	+	+	+	+	+	+	+	+	+	+	"	"	
10	F.	41	5½	5½	+	+	+	+	+	+	+	+	+	+	"	"	
11	F.	42	3	3	+	+	+	+	+	+	+	+	+	+	"	"	
12	F.	44	4½	4½	+	+	+	+	+	+	+	+	+	+	"	"	
13	F.	44	5½	5½	+	+	+	+	+	+	+	+	+	+	"	"	
14	F.	44	5½	5½	+	+	+	+	+	+	+	+	+	+	"	"	
15	F.	44	5	5	+	+	+	+	+	+	+	+	+	+	"	"	
16	F.	46	5	5	+	+	+	+	+	+	+	+	+	+	"	"	
17	F.	49	R. = 5½	L. = 5½	+	+	+	+	+	+	+	+	+	+	"	"	
18	F.	50	5½	5½	+	+	+	+	+	+	+	+	+	+	"	"	
19	F.	50	5½	5½	+	+	+	+	+	+	+	+	+	+	"	"	
20	F.	54	4	4	+	+	+	+	+	+	+	+	+	+	"	"	
21	F.	55	4	4	+	+	+	+	+	+	+	+	+	+	"	"	
22	F.	60	4½	4½	+	+	+	+	+	+	+	+	+	+	"	"	Oval

