On
The Physiological and Therapeutical
Actions
of
Aconite and Aconitea.
In Two Parts.
Part I — Physiological

The following experimental enquiries into the
Physiological actions of Aconite and Aconitea were made
with the British Pharmacopoeia, & Fleming's Mixtures, care
fully prepared by Messrs. Woolley, Sons, & Co., of New
Chester, and the Aconitea of Messrs. Mason & Sons, of —
London, and Mefers T.W. Smith of London and Edinburgh. Their identity of action was fully established.

In reference to the mode of action of the drug, considerable divergence of opinion obtains. The means used, and results obtained by other experimentators present remarkable differences, and are not at all in harmony with those of the author. In the present work it is proposed to attempt to their deduction the action of the drug on the various systems, and to adduce experimental proof in support of the opinions therein prefixed.

A. Action on the Nervous System.

a. On the Cerebro-spinal System. In all his experiments the author has found that, acertified animals remain in a state of perfect consciousness until close upon death. In frogs this is shown by a strong disinclination to remain in positions where they can be watched: this is apparent even when the Acetaminum is very profound. Other animals have also a strong tendency to seclude themselves while under the influence of the drug. These facts, together with an unusual
amount of power of observation, indicate that the functions of the cerebrum are not materially impaired.

The following experiments are demonstrative of the action of the drug on the cerebro-spinal axis.

Experiment I: In a rabbit (weight, 2 lbs, 3 oz) poisoned by the subcutaneous injection of 1/20 gr Aconitum, the brain and spinal cord were carefully exposed immediately on the cessation of respiration, and before the heart's pulsations had ceased. Irritation by a gentle galvanic current of the surface and substance of Brain induced muscular movements of the facial muscles; irritation of the anterior and posterior columns of cord induced muscular contractions as strong as by direct application of the electrodes to the muscles.

Deductions from Experiment: That the brain & spinal cord are not paralyzed by Aconitum.

Experiment II: A healthy, medium-sized male frog 18: Cluny a subcutaneous injection of three minutes B.P.
Picture of Acute... Ten minutes afterwards it was
pushed, and its spinal, exposed by gently lifting
away the arches of several adjoining vertebrae.
Three quarters of an hour after injection, gentle gal:
Ventric irritation of the posterior columns of the cord
induced violent general muscular contractions - the
nerve roots were divided and it was found that
irritation of the peripheral division of the anterior
roots induced sharp muscular contraction of the
limbs. Irritation of the central end of a divided
posterior root produced slight muscular con-
traction. The irritability of the central end of the
divided posterior root soon disappeared, whereas the
irritability of the posterior columns of the Cord
of the peripheral division of the divided anterior
roots continued for 1/2 hours afterwards, - until in fact
the Cord was destroyed.

Deductions from Experiment:
1. That in acutism, the posterior columns of the cord
are not paralyzed.
2. That the posterior roots of the spinal nerves have
firstly impaired, & subsequently abolished, sensibility.

3. That the anterior nerve roots have their sensibility
   undiminished throughout.

4. That the peripheral motor nerves are not paralyzed.

**Experiment 3.** - A medium sized, healthy, male frog
was poisoned by the subcutaneous injection of 2 c.c.
B.P. Tincture of Aconite. Few minutes after injection
pinching of the skin produced no, or very little, response.
Twenty minutes after injection a large square flap
of skin was raised from back, & galvanic stimu-
lation was applied in the usual way, to its extremity.
No result was produced, but on moving the
electrodes half way towards the base of the
flap muscular contraction ensued. The under-
surface of this flap showed no signs of vas-
cularity. One half hour after injection, galvanic
stimulation applied to extremity of flap, &
half way towards base, did not induce muscular
contractions; applied to base of attachment of
flap, violent muscular contractions ensued. One
hour afterwards, the skin continues as at last
report: eye not sensitive: the animal is moving

* See Vasa motor system, pp. 20-28.
away voluntarily. It was now beheaded, and doing so, the facial muscles, especially those of the eye, contracted. Its spinal cord was exposed as before, to the extent of about 1/3 inch, and irritated by a weak galvanic current. Violent general muscular contractions were equally produced by irritation of the anterior and posterior columns of the cord, whilst pinching of the skin produced no muscular movements. One and a half hours after injection, the skin gave no evidence of sensibility on cutting through it to expose the sensory nerves: mechanical and chemical irritation of these nerves induced violent contraction of the muscles of the same limb to the side of the trunk. The muscles also contracted on the direct application of mechanical and chemical stimulation. Irritation of the posterior columns of the cord still induced very violent muscle contractions. A limb was amputated and a flap of skin was raised on it in the same way as on body. Galvanic stimulation...
of the flap induced no response until the electrodes were applied close to its base of attachment, when violent muscular contractions ensued. When the same skin was closely applied to the subjacent muscles, galvanic irritation of it, extremely induced muscular contraction. Three hours afterwards, galvanic irritation of the anterior Column of Cord induced more muscular movement than of posterior columns; on exposure of a fresh portion of Cord, however, the galvanic irritability of both columns was about equal. The irritability was much less with one electrode on the anterior, and the other on the posterior column. Fifteen hours after injection, the irritability of the Cord was completely exhausted, while irritation of the exposed nerves and muscles, both in the attached and amputated limbs, produced contraction. The irritability of the skin of the amputated limbs remained as before; that of the skin of the attached shins had entirely disappeared, even when closely applied to the subjacent muscles, which still retained their irritability.
Deductions from Experiment:

1. That no paralysis of the anterior or posterior columns of the spinal cord ensued.
2. That the extreme peripheral sensory nerves were paralyzed before the main trunks.
3. That the motor nerves and muscles were not paralyzed.
4. That the muscular contractions induced by irritating the base of attachment of the flap of skin were not reflex in character.
5. That there was no paralysis of the Brain.

Experiment 14: A healthy male frog was poisoned by two gr. Aconitia. Two minutes after injection he stretched himself violently. Five minutes after, on pinching abdomen he jumped violently, but did not do so on repeating the pinching. Few minutes after injection violent convulsive extension ensued: skin sensatus. Twenty minutes afterwards, a flap of skin was raised, and its extreme periphery was irritated by galvanism: violent muscular contractions ensued.
With one electrode on each flap, excessive muscular contractions resulted. He exhibited no sensibility on dissecting the flap. Forty minutes after injection, the flap still responded freely to galvanism. An injection of 100 grains Aconitum was now given. Five minutes after second injection, the extreme tip of flap only slightly responded. The animal was crawling and jumping. Twenty minutes from second injection, the irritability of the extreme tip of flap on galvanic stimulation was great. 3 hours after second injection, no mus. Dolor contraction occurred on irritating periphery of flap, but direct galvanic irritation of the muscles induced sharp contraction. The sciatic nerve was now divided: irritation of its peripheral division induced violent contraction of the muscles of the same limits, whilst irritation of its central division produced slight movement only and that of the muscle in its immediate neighborhood. Frequently no movement succeeded irritation of the central end. In ten minutes more, the difference between the two
divisions of the divided nerve is very great, irritation by galvanism at the central end inducing no muscular response, while the same irritation of the peripheral division was followed by sharp muscular contractions — three hours and a half afterwards, irritation of the old, and a newly raised flap induces no contraction, unless the electrode be applied at base of attachment. The electrode near the periphery of each flap was followed by free contraction of muscles.

On autopsy 24 hours afterwards, rectus end of the previously divided sciatic nerve gave evidence of irritability. On the corresponding nerve in the other limb being exposed and divided, galvanic irritation of its central end induced no muscular response, while the same irritation applied to the peripheral end was followed by feeble muscular contractions. The muscular irritability was marked.

**Deductions from Experiment:**

1. That complete paralysis of the extreme peripheral
Sensory nerves do not supernervous unless the dose be large, and poisonous.

2. That the efferent (motor) fibres of the spinal nerves transmit an impulse and exhibit irritability long after the afferent (sensory) fibres have become paralyzed.

3. That the muscular irritability is unimpaired.

**Experiment 5:** A large, healthy male frog was pituted and immediately afterwards received a subcutaneous injection of 2 minims B.P. Tincture of Aconite. He was then placed on a piece of wet gauze and placed under a bell jar, with funnel at top.

Twenty minutes after injection, violent *idiopathic* general tetanic convulsions ensued — the hind legs being fully extended, the webs expanded like a fan, *+* the body propulsed violently forwards. These convulsions were not readily induced by touching the skin, but came on on pricking in vicinity of anus — the body being now rigidly arched. One hour after in.

*This is one of the chief characteristics of the convulsive movements in acridized frogs which have been pituted, + constitutes an essential difference between them + the usual reflex movements, *-
reaction, the violent idiopathic convulsions still occur, appearing occasionally as excessive un-symmetric spontaneous contractions of the posterior limbs. The eye was not sensitive. The convulsions were not induced by noise, or tapping the table on which the animal lay. The body at this time was violently propelled forward, by a most characteristic jerk, the posterior limbs contracting much more markedly and forcibly than the anterior. These spasmodic propulsive efforts came on mainly without any irritation, though they also could be induced artificially. The body is propelled 'en masse', and several of these occur in succession. They were not induced by dripping water on the body, but readily by irritating about the arms, chest, abdomen, or web. One leg was sometimes contracted, while the other was extended. Two hours afterwards, the convulsions still continue, as also at 3½ hours after period of injection - both idiopathic and reflex. Four hours after injection the idiopathic convulsions have disappeared, those reflex continue. The local application of dilute Sulphuric Acid to web was

* The movements on irritation are evidently not reflex, but due to direct transmission to the subjacent muscles. See p.6.
Followed by a violent general convolution, which threw the animal from the table to the floor. Four and a half hours after injection, a general spasm was induced by inserting wire into spinal canal.

**Deductions from Experiment:**

1. That convulsions, not of cerebral origin, occur in aconitized frogs.
2. That they frequently occur idiopathically, but can also be induced by irritation.
3. That they are both general, localized – in so far, at least, as they are sometimes un-symmetrical.
4. That they are more violent than the usual convolution of Aconitine in animals, frogs not deprived of their cerebrum.

*(Note: It may be mentioned that convulsions are an invariable symptom in aconitized frogs.)*
Experiment 6: A healthy, medium-sized frog was fitted and had its aorta ligatured. It was then pursued by the subcutaneous injection of 2 minims of Aconite, and then laid on a wet mat under a glass shade with funnel at top. There was no movement until twelve minutes after injection when idiopathic tetanic convulsions occurred, the legs being as in a previous experiment rigidly "fanned", and the body propelled forwards. Fifteen minutes after injection, the whole muscular system is convulsed, so that the body is rigidly arched and supported on the anterior and posterior limbs, and the webs are violently extended.

One half hour after injection, the above is repeated idiopathically. 2 hours after, no convulsions were induced by irritating the posterior limbs, but on pinching anterior limbs, convulsions occurred, and the left leg was drawn up. The muscles on section, contracted far more in the anterior than posterior limbs.

Deductions from Experiment:
1. That the convulsions occurring in aconitised frogs are not of cerebral origin, but occur idiopathically.
also on irritation when the brain is destroyed.

3. That the muscular and motor nervous irritability of the poisoned limbs was greater than in the protected ones.

4. That the movements induced by irritation the poisoned limbs were in a great measure due to direct conduction to the muscles, (as shown in a previous experiment on an amputated limb).

5. That the poison affects the root of the sensory nerves.

(Note: allowance must be made in this experiment for the diminished sensibility of the protected limbs from the cutting off of its blood supply).

Experiment 1. - A healthy, large, male frog was poisoned by subcutaneous injection of 1 minims 1 mixture of Aconite [B.P.]. On the usual symptoms of Aconitism having become fully developed 1 or hour afterwards, he was now poisoned by injection of two gr Strychnia. Few minutes
After the second injection, the usual strychnine convulsions supervened, and more readily developed on irritating. Death ensued in about 1 hour after wards.

**Deduction from Experiment:** That aconite does not prevent the development of strychnine convulsions.

**Remarks on Experiments:** With regard to the action of aconite on the spinal cord, *Ach. Schramm* concludes that it is unaffected; but the only proof he advances in support of this is the presence of irritability in the nerves of a limb, perforated by ligature, long after it had been lost in the anterior part of the body. *Böhme-Wartmann* contradict these statements, and maintain that the nerves & muscles of poisoned animals retain their normal irritability until death, and they further conclude, that as increased reflex activity does not occur in frogs poisoned by aconite, that the cord is essentially paralyzed.

Receptors: **Mottot** asserts that aconite acts by paralyzing.

* Journal de Physiologie, 1861. p. 533.
* Arbeiten aus dem Physiolog. Laborat der Würzburger Hochschule, 1873.
* Reichert’s Archiv, 1866.
a perceptible centre above the cord, for they found that tying the abdominal aorta close to its bifurcation, and
in another experiment, clamping off the blood supply to the
cord and spinal nerves did not retard the development
of the usual sensory symptoms.
In the present series of experiments, the action
of the drug on the spinal cord has been shown
not to be one of paralysis. In the rabbit
and frog the author has frequently demonstrated
that, after poisoning by acute, both the anterior
and posterior columns of the cord exhibit considerable
irritability on galvanic stimulation. This irritability
has been shown to remain in the frog for various
lengthened periods after death and disappears first
in the posterior columns. It is here manifested
in limits to which the poisoned blood is prevented
having access, and demonstrates its presence in the
pithed frog by violent idiopathic convulsions.

The nature of these convulsions will be more fully
considered in speaking of the respiratory system.
The action of the drug on the peripheral system
of sensory nerves is essentially one of para irritation.
preceded by paralysis. In the dog the presence of the
primary irritation is shown to occur first in the pos-
terior limbs by their being extensively licked or by the
animal.* So the sensory irritation is also due to the familiar
burning produced by the local application of the drug
to the primary affection. The condition of the extreme
peripheral sensory nerves has been experimentally de-
monstrated. It has been shown that, if a large
flap of skin be reflected from the frog's back and
stimulated by galvanism, irritation of the extreme
periphery by flap induces for some time muscular
contraction; but as the Acetonism deepens, the electrode
require to be gradually moved towards the base of
attachment of flap before muscular contraction
occurs. At last a muscular response is only obtained
by irritation of the flap at its extreme base, and
this the same result has he attained in limbs re-
moved from the body, it appears to be due to di-
rect conduction to the subjacent muscles, not
reflex action. The marked difference between the
condition of the sensory and motor nerves is also shown

*So the primary peripheral irritation is due the well-known burning produced
by the local application of Acetic to the tongue, lips &c after the burning has gone

---
In Experiment 1, where section of the sciatic nerve, irritation of the peripheral end induces free muscular contraction, while irritation of its central end induces no movement, and in Experiment 2 where the anterior nerve roots were very irritable while the posterior roots had their excitability at first greatly diminished, and subsequently completely lost. Hence, now, as these experiments both the anterior and posterior columns of the Cord have been shown not to be in a state of paralysis neither are the motor nerves nor muscles, the diminution and subsequent abolition of the power of conduction of the sensory nerves must depend on their intrinsic condition. That this is one of paralysis supervening at varied periods according to the length of the dose, or the size of the animal, is apparent. That this commence, at the extreme periphery of the sensory nerves has also been shown, but that it also implicate the sensory nerve root is also apparent from Experiment 1, and Experiment 6, where, when the blood had only access to the root of the sensory nerves of the posterior limb,
paralysis of elevation still occurred in them.

(ii) On the Vasomotor nervous System.

The exhibition of Aconite in newts at any period followed by vasomotor paralysis. In experiments already detailed, it has been shown that the inferior surface of reflected flaps of the frog's skin show no sign of undue vascularity, and in experiments on the rabbit (to be afterwards narrated) the blood vessels of the ear never exhibit trace of altered blood supply during the whole period of poisoning. The following microscopic observations were made on the state of the circulation in the web of the foot of the Aconitised frog, and are demonstration of the influence of the drug on the vasomotor nervous system.

Experiment 8:—A healthy medium sized male frog was poisoned by the subcutaneous injection of 20 mg. Aconitum Momentary capillary stasis of the web immediately ensued. Five minutes after injection the capillaries were
1. Did the venous blood become brighter?

2. Division of the sympathetic produces dilatation of the vessels
   and consequent increased rapidity of the circulation.
fuller, with occasional stasis. Twenty minutes afterwards the circulation maintained a fair rate, with a marked increase of blood corpuscles & sometimes retrograde movements in the vessels - this crowding of the capillaries with corpuscles was very evident during the whole experiment. Two hours after death, the heart was exposed and found beating faintly at the rate of 28 pulsations per minute. It soon ceased, but recommenced on raising the anterior limbs. During the whole of this observation the calibre of the vessels underwent no change. Before death, the vessels were crowded with blood corpuscles.

Deductions from Experiment:

1. That in the acenitized frog, the vasomotor nerves, as tested by the condition of the blood-vessels of the web, are uninfluenced by the drug.
2. That the blood corpuscles have a great tendency to become aggregated in the systemic vessels.

Experiment 7. - Medicines sized, healthy frog, poisoned by subcutaneous injection of 2 minims B.P. portrait ofaconite. Incontinently stasis ensued immediately in web. Ten minutes...
after injection, the veins are gradually becoming blocked, while the arterioles and capillaries continue at their normal rate. Fifteen minutes after injection, Respiration 2 per minute, Heart 58. The veins are crowded with stagnant circulation, the arterioles are empty. One-half hour from period of injection, the respirations are almost abolished, heart pulsating faintly, 80-90 per minute. The circulation in the veins is almost stagnant, and distinctly gets slower. The vein more crowded. The further it is from the puncture, so that the larger veins are quite blocked with corpuscles. Thirty-five minutes after injection the direction of the current in the veins is reversed; it flows hydropneum, resumed its normal course, but continued semi-stagnant, and more or less crowded during the whole of the experiment. There was no marked alteration in the calibre of the vessels throughout. On exposing the heart 1/2 hours after injection, it was seen pulsating.

Deductions from Experiment:

1. That in theacentriod frog, the calibre of the vessels is unaltered.
2. That the vascular stasis is due to obstruction to the venous circulation.
Experiment 10: Medium sized healthy frog was poisoned by the subcutaneous injection of 2 minims 10 P. Tincture of Aconite. The immediate effect on the circulation of the web was almost complete stasis. Five minutes after injection, the arterial circulation was normal, while the venous was semi-stagnant: 15 minutes after injection, the venous is gradually becoming more crowded and stagnant while the artery contains a fair number of corpuscles and its rate of circulation is normal. One half hour after injection, the current in the veins is distinctly reversed, and the arterial current continues as at last report. Forty minutes after injection the artery contains more blood corpuscles, its rate has diminished, and the circulation in the veins has resumed its normal direction. Forty-three minutes after injection, the amount of corpuscles in the artery was very much diminished: the veins were crowded, and retrofusing. Three quarters of an hour after injection, the artery became completely empty: previous to this, its corpuscles refused to pass and from the heart could not be set a beating on opening chest: there was marked congestion of the venous system. The calibre of the vessels underwent no marked alteration throughout.
Deductions from Experiment:

1. That the blood vessels undergo no alteration of calibre.
2. That arterial stasis first commences in, and is due to obstruction to, the veins.

Experiment II. - A healthy frog, had the sciatic nerve of one limb divided, and was then poisoned by subcutaneous injection of 1/2 his B. P. of C. A. (B. P.). On comparing the two webs there was found to be great difference in the calibre of the arterio-capillaries of the web of the leg with the divided nerve being more dilated and the circulation more rapid than in the other where almost complete stasis obtained. Three quarters of an hour afterwards, the same relative conditions are present. One hour after injection, heart pulsating 100 per minute: the circulation in the larger web vessels of both webs is of the same character, but in the capillaries of the web of the limb with the divided nerve, there was more stasis. The frog was now re-injected with 2 minims of the mixture. The effect of this was to produce almost immediate stasis in both webs; and complete abolition of respiration. Few minutes after
The second injection, heart 56, no respiration. The cir: 25. 

circulation is going at a more rapid rate in the web of 
the limb, with the divided nerve. Twenty-five minutes 
after second injection the circulation is slower, and 40 
minute after, there is complete stasis, in the capillaries 
in the web on the side with the divided nerve, and the 
current in the veins and arteries had almost stopped. 
In the web of the other limb — whose sciatic nerve 
had not been divided. The circulation was at a fair 
rate. Fifty minutes after injection (2nd) the circulation 
was completely stagnant in the vessels of the web 
with the divided nerve. All the circulation, especially the 
arterial is going at a fair rate in the other. Heart 
palpating. One and a half hours afterwards, the difference be 
tween the circulation in the 2 webs just detailed, continues, 
and was unaltered 2½ hours after second injection. On 
autopsy, the venous heart was found distended: the lungs 
were collapsed, and cyanogenic.

Deductions from Experiment:

1. That section of the sciatic nerve — by which the blood vessels 
in the web of the frog’s foot are deprived of the greater
part of the influence of their vaso-motor nerves - induces a greater dilatation of the vessels which is quite absent from the vessels of the corresponding web of the foot.
The sciatic nerve going to which is undivided.

2. The differences between the webs was as follows -

On the web of the leg with the divided nerve -
(a) The vessels were larger (more dilated)
(b) The circulation is at first more rapid
(c) Subsequently, when a more powerful dose of Aconite has been administered, the respiration have been completely abolished and the action of the heart consequently interfered with, the circulation becomes more languid, and eventually completely stagnant, owing to the absence of the assistance of the vaso-motor nerves.

Remarks on Experiments.

From the preceding experiments, it is evident that, Aconite and its alkaloid never produce paralysis of the vaso-motor system of nerves. The stasis of the circulation which is venous in character, is evidently due to the impediments to the circulation in the limbs, and the
consequently diminished "vis-a-vis." That it is not (27) owing to any partial or complete paralysis of the vaso-motor nerves or heart is shown by the heart being found pulsating the vessels not dilated, and the circulation in the arterioles and capillaries normal. The maintenance of the Circulation in the web of the foot of the decapitated frog is thus partly at least, due to the integrity of the vaso-motor nerves, as shown in Experiment 11, where the effect of section of the Sciatic nerve being to produce paralysis of the greater portion of the vaso-motor fibres, those aids to the circulation were lost, and stasis ensued much earlier than in the web of the other foot. These results are con-
firmatory of those obtained by Aichsharumov (op. cit.), & Böhm & Wartman (op. cit.). These latter
found, that, in acertified animals, when the mass of motor centre of Ludvig and Vojanovich was stimu-
lated by an galvamic irritation, the arterial tension was increased. They also found that similar stimu-
lulation applied to a sensory nerve did not pro-
duce this result, but they did not determine whether this was due to paralysis of the nerve itself or of the Cord. In the present work it has been shown that this effect is purely due to paralysis of the sensory nerve, and not to any loss of conducting power of the Cord.

Note: In a subsequent experiment, it was found that the topical application of powerful solution of atonicia to the neck of the frog's foot, caused no alteration in the calibre of reflexes.
B. Action on the Respiratory System: (with illustrative charts).

The action of Aconite upon the Respiration in poison is, par excellence, the action of the drug. The following are detailed descriptions of this action.

1. On the Frog: Its action on the respiration presents the first manifestation of the effect of the poison. In small and deep doses, the respiration are rendered irregular, with pauses equal in duration to 2 or 3 ordinary respirations, occurring at irregular intervals. Their number is diminished, (but they sometimes become quick and shallow) and ultimately abolished. Frequently they are spasmotic. These effects are manifested in periods varying from immediately after the injection, to 5 minutes after. In larger doses, the effect is soon manifested in complete abolition of the respiratory act.

(continued on p 30)
Physiological chart. No. 110. On the frog 29 1/4

Results of Experiment:
1. Rapid interrupted fall in the number of respiration, with a corresponding rise towards recovery.

Note: The dark line indicates the respirations.

Results of Experiment:
1. A rapid fall in the number of the respirations, with an interrupted rise towards the recovery.

Note: The dark line shows the respirations.

Date of admission.
Physiological Chart 15. On the Frog.

Results of Experiment:
1. A rapid fall in the number of respirations, with a corrsponding increase towards recovery.

Note: The dark line shows the Respirations.
the diaphragm continuing to act for some time 30 after the nares has ceased. Previous to this complete abolition, the number of respirations becomes greatly reduced, and gradually fainter. They at least are only 2-3 per minute, recurring in rapid succession and ceasing for 2-3 minutes at a time. The frog may give several gasps after all sign of respiration have disappeared. The heart invariably continues pulsating after the cessation of respiration, frequently for hours. Convulsions are always present (See illustrative chart).

2. On the dog: In the dog (see chart) the first effect in large doses, is to produce a fall in the number of the respirations. This is well seen in the case of the dog (Chart p. 31) where, after subcutaneous injection of three

(continued on p. 32).
Physiological Chart, No. 1. On the Dog.

Results of Experiment:
1. A diminution in the number of Respiration and Cardiac pulsations.
2. Complete alteration in the character of the Respiration—they becoming at first laboured, and subsequently interrupted by frequent spasmodic paroxysms, which respiration cannot be performed for several consecutive seconds.
3. Brief cardiac action, followed by irregular intermittent.

Note: The red line indicates the cardiac pulsations. The black line indicates the respiration, and the interrupted black line indicates a period during which the Respiration could not be counted.
minims of Hemming's Trichine, there was a marked fall in the (39.
number of respirations. This fall always takes place if the dose
be large enough, as seen in charts pp. 33-38., and the degree
of respiratory fall is, as a rule, always proportionate to the
largeness of the dose. It sometimes is slight, and is occasion-
ally preceded by a rise, as n charts. pp. 39-41. In
Chart, p. 42., where the arconia was administered by the
stomach, the primary rise occurred before the absorption of the
drug, which seems to have been delayed, and the recovery
of the animal was no doubt mainly due to the ejection
of the poison by vomiting, 4½ hours after it had been
given.

In addition, however, to this numerical alteration in
the respirations, the whole character of the respiratory act
becomes changed. In the case of the dog already

(continued on p. 43).
Physiological chart, No. 5. On the dog.

Results of Experiment:
1. A diminution in the number of respirations and cardiac pulsations, with irregularity of the latter.
2. Indications of irritation of the thoracic limbs, genitals, and throat.

Note: The dark line indicates the respirations.
Physiological chart, No. 3. On the Dog

Results of Experiment:
1. A marked decrease in the number of respirations, and alteration of their character, becoming laboured and "gashing" as a slight increase, followed by a greater decrease in the number of cardiac pulsations, with the onset of cardiac irregularity.

Note: The dark line indicates the Respin. Red "Card. Incr."

Date of admission.

Entered at Stationers Hall.
Physiological Chart No. 11. On the Dog

Results of Operation:
1. A diminution in the number of respirations (interrupted)
2. A slight increase, followed by a slight decrease, in the number of cardiac pulsations
3. Respiration becoming deeper with prolonged expiration
4. Substitution of cardiac murmur, clarity, disappearing towards recovery

Note: The dark line indicates the Respiration.

The red line indicates the Cardiac Pulsations.
Physiological Chart No. 6. On the Dog.

Results of Experiment:
1. Diminution in the number of respirations and cardiac pulsations.
2. Evidences of irritation of the posterior limbs, genitalia.

Note: The dark line indicates the Respiration, red line = heart rate.
### Periods of Observation

<table>
<thead>
<tr>
<th>Period</th>
<th>Heart Rate</th>
<th>Pulse Rate</th>
<th>Temperature (Fahrenheit)</th>
<th>Respirations</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 minutes</td>
<td>80</td>
<td>140</td>
<td>98</td>
<td>20</td>
</tr>
<tr>
<td>15 minutes</td>
<td>70</td>
<td>120</td>
<td>96</td>
<td>15</td>
</tr>
<tr>
<td>30 minutes</td>
<td>65</td>
<td>110</td>
<td>95</td>
<td>15</td>
</tr>
<tr>
<td>45 minutes</td>
<td>60</td>
<td>100</td>
<td>94</td>
<td>15</td>
</tr>
<tr>
<td>1 hour</td>
<td>55</td>
<td>90</td>
<td>93</td>
<td>15</td>
</tr>
<tr>
<td>1 1/4 hours</td>
<td>50</td>
<td>80</td>
<td>92</td>
<td>15</td>
</tr>
<tr>
<td>2 1/2 hours</td>
<td>45</td>
<td>70</td>
<td>91</td>
<td>15</td>
</tr>
</tbody>
</table>

**Note:** The dark line indicates the patient's oral temperature.

**Physiological Chart No. 1. On the 2nd Day.**

**Results of Examination:**
1.Fairly mottled but no indications of jaundice.
2.Indicated cold feet, cold hands, cold extremities.
3.Indicated cold hands, cold extremities.

**Diagnosis:**
- Acute jaundice.
- Acute pericarditis.
- Acute myocarditis.

**Treatment:**
- Keep warm.
- Keep the patient in bed.
- Avoid light meals.

**Nutrition:**
- Keep the patient in bed.
- Avoid light meals.
- Avoid strong flavors.

**Temperature:**
- Charted in Fahrenheit and Centigrade.
- Temperature ranges from 35° to 42°.
Physiological Chart, No. 9, On the Dog.

Results of Experiment:
1. A diminution in the number of respirations, followed by an increase towards recovery.
2. An increase, followed by an interrupted decrease, in the number of cardiac pulsations.
3. The presence of a very faint slight suffocative sensation.

Date of admission.

Note: The dark line indicates the respirations. "red" line indicates the cardiac pulsations. "interrupted red line" indicates a period when the pulsations could not be counted.
Physiological Chart No. 12. On the Dog

Results of Experiment:
1. An increase, followed by a decrease, and this succeeded by another increase and diminution in the number of Respiration.
2. An uninterrupted decrease in the number of Cardiac pulsations.

Note: The dark line indicates the Respiration. The red line indicates the Cardiac pulsations.

<table>
<thead>
<tr>
<th>Time (Hours)</th>
<th>Temperature (°Fahrenheit)</th>
<th>Respiration</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>30.150</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>28.150</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>27.115</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>24.190</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>29.115</td>
<td></td>
</tr>
</tbody>
</table>

Notes of Case:

Disease.

Days of Illness: 1

No. of Case: 1
Physiological Chart No. 1. On the Dog.

General Results of Experiment:
1. Fall in the frequency of the Respirations, preceded by a rise of short duration.
2. Slight fall in the frequency of the Cardiac Pulsations.
3. The Respiratory Fall is greater than the Cardiac one.

Temperature (Fahrenheit):
- 36.15
- 32.10
- 30.15
- 27.10
- 24.00
- 21.10

Note: The black line indicates the Respirations.
Physiological Chart No. 18. On the Dog.

Results of Experiment:
1. Fall in the frequency of the respirations, followed by a rise of short duration.
2. Fall in the frequency of the cardiac vibrations.
3. Rise in the frequency of the respirations and cardiac pulsations towards recovery.

Note: The black line shows the respirations.
<table>
<thead>
<tr>
<th>Date of Admission</th>
<th>Respiration and Cardiac Pulsaions</th>
<th>Periods of Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Temperature (Fahrenheit)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$37^\circ$</td>
<td>$38^\circ$</td>
</tr>
<tr>
<td></td>
<td>$39^\circ$</td>
<td>$40^\circ$</td>
</tr>
<tr>
<td></td>
<td>$41^\circ$</td>
<td>$42^\circ$</td>
</tr>
</tbody>
</table>

**Respirations and Cardiac Pulsaions**

- Before Infection
- 15 minutes after
- 30 minutes after
- 45 minutes after
- 1 hour
- 1.5 hours
- 2 hours
- 2.5 hours
- 3 hours
- Vomited: Intellgence normal

**Recovery**

- 5 hours

**Physiological Chart**

- Onset:
- 5.25 hours

**Notes of Case**

- Respiration and Cardiac Pulsaions
- Temperature (Centigrade)
- $37^\circ$ to $42^\circ$
referred to (p. 38) profuse *ptyalism ensued, the respirations gradu- 
dually became more deep and laboured, and accompanied by 
spasmodic hiccough. Attacks of complete inability to inspire . 
occurred nearly every minute, during which the thoracic 
walls were contracted and approximated, the abdominal 
muscles were firmly contracted, the larynx quieted and 
were drawn together, and several abrupt attempts to 
breathe, and violent gulps were made. This condition 
of asphyxia continued for from 15-20 seconds, and was 
relieved by the forcible descent of the diaphragm- 
An ejection of frothy mucus from the mouth followed. 
Several of these paroxysms were witnessed by Mr. Hamilton 
Surgeon to the District Infirmary, Ashton-under-Lyne, who 
agrees with the author in the following opinion as to 

* This symptom - profuse ptyalism - is almost general in aconitised animals.
their nature "that they are due to inability to inspire. Not caused by the prolonged action of the diaphragm, that they are relieved by the diaphragm commencing back and that in the intervals the respiratory act is mainly owing to extraordinary effort on the part of the thoracic and abdominal muscles." These spasmodic attacks of apneusis continued for fully 3 hours, becoming at least less frequent.

In smaller doses, the respiration falls in proportion to the largeness of the dose, becoming at the same time deeper, somewhat laboured, and with prolonged expiration. In still smaller doses, the fall may be all that occurs, and even this may be scarcely perceptible.

3. On the Rabbit:— Here, after a poisonous dose (non-fatal) the respiration fall steadily and rapidly, and maintain
a low interrupted curve, until their ascent towards 45.
recovery (see chart, p. 46). In chart p. 47, where a smaller
dose of Adrenalin was given, the fall was preceded by several
irregular rates was slight and transient, and separated from the
most marked and permanent fall by an interval of increased
respiratory movement. The character of the respirations is
similar in chart p. 48.

The character of the respiratory movement undergoes in the
rabbit, as in the dog, marked alterations. At first the
convulsed and laboured, the diaphragm and abdominal
muscles are called upon to redouble their exertions, and the
performance of the act entails considerable labour on
the part of the animal. This gradually increases, the
animal appears to suffer from transient fits of choking,
as shown by the wild manner in which it jerks and

(Continued on p. 49.)
Results of Experiment:
1. A marked diminution in the number of respirations, with alteration of character.
2. A subsequent irregular curve, interfered with suppressed movements
3. An increase in the number of respirations towards recovery.

Periods of Observation

Respiration

Temperature (Fahrenheit)

Before injection
0 minutes after injection of 20 c.c.

Restless
Respiration accelerated
Respiration laboured and abdominal

Infected and prolonged inspiration

Physiological shock

Very marked respiratory difficulty continued

Respiration becoming easier

Respiration ceased, quick and more frequent

Animal lively; respiration normal
Physiological Chart No. On the Rabbit

Results of Experiment:
1. The respirations were affected antecedent to the cardiac indications. Their number being first increased, secondly diminished, then increased and again diminished with an increase towards recovery. In character they became deeper and laboured, interlaced with several slight epheryc phenomena.

2. The heart action was not markedly altered in rate throughout; it subsequently became regular and then suspended as a result of the respiratory embarrassment.

Note: The dark line shows the Respiration.

...dotted red line indicates that the cardiac pulsations could not be counted...
Period of Observation

Respirations

Temperature (Fahrenheit)

Before Injection
1 minute after Injection

Respirations irregular
Resp.: very laboured, abdominal

Very laboured; Resp.: very laboured

Severe paroxysm of asphyxia

Great respiratory embarrassment
Resp. asphyxia thoracic

Physiological Changes:

1. The mucous membranes of the eyes, nose, and throat were congested and edematous.
2. The irritability increased.
3. The pulse was rapid and weak.
4. The temperature was normal.

Results of Treatment:

48 hours after injection.
...is caused in determining the nature of the disease.

A subsequent attack will occur during the day, if it was demonstrated that the disease was caused by the person who was present at the time of the attack.

Animal attacks, breathing deeply, with a flame at the end of its breath, and the animal instantly extinguishes itself. It may not occur, and if it does, a few seconds later. If it does not occur, it generally makes a small attack, or a few seconds later, and human generally.

Note: The attacks gradually subside, and the blockage of the attack may be noticed by the person who was present at the time of the attack.
Physiological Experiment No.

(On the Rabbit, weight 2lbs.)

Results of Experiment:

1. Tracheotomy performed before the administration of Adenalin does not hinder nor retard the development of the usual effects of the poison on the respiratory system.

2. The irregularity of the mucous membrane of the trachea becomes diminished, and ultimately abolished.

3. The symmetrical position of the animal after the Adenalin has been administered, and whether the animal be allowed to die by the natural method, or by the tracheal method.
Physiological chart No. On the Rabbit.
(Weight 7 lbs. 9 oz.
Chloralized).

Results of Experiment:-

1. The immediate effect of section of the vagus on an anaesthetised animal was to produce no alteration in the character or number of the respirations.
2. An increase in the number of the respirations was experienced just before death.
3. Tracheotomy and artificial respiration performed immediately on the elevation of respiration failed to produce any effect.

Note: - The dark line shows the respirations before section of vagus.

Red “after”
Physiological Chart No. On the Rabbit
(Weight 2.4 lbs. Deeply Chloroformed)

Results of Experiment:
1. After section of the vago, there was a considerable fall in the number of respirations before the chloroform had been injected.
2. After the injection of the chloroform, the number of respirations was slightly diminished, and subsequently increased to a greater number than before the injection of the poison.
3. The injection of a larger dose was followed by an uninterrupted fall, which continued till death.
4. The chief characteristic of the respiratory movement throughout was the prolonged pause at the end of expiration.

Note: The dark line shows the respiratory movements after section of the vago, and exhibition of chloroform.
paroxysms are not due to laryngeal spasm, for the performance of tracheotomy antecedent to the administration of the poison failed to prevent their onset. The pause before noted as occurring at the end of expiration still continued, and the attacks recurred at their usual intervals. The careful closing of the tracheal orifice, failed to alter the character of the respirations. Another noteworthy result attained in this experiment was the remarkable respiratory rise after the primary fall. It was also demonstrated that while at the commencement of the experiment, irritation of the tracheal mucous membrane induced muscular contraction of the laryngeal muscles, as the condition deepens, the mucous membrane became gradually less sensitive, until and at last completely anesthetic.
That the anæsthesia is not due to motor paral.
alsys is evidenced by the fact that irritation of the vagus after death in acerulated animals is followed by muscular contraction, as demon.
strated in an experiment performed by the author.
Charts figs. 51 and 52 show the results of section of the vagus during the course of Aconitism. It is shown that the operation does not materially alter the number or character of the respirations.
In the case of another rabbit, weighing 1 lb. 2 oz., poisoned by the subcutaneous injection of 14 oz. of Aconitum, the vagus was cut 8 minutes after injection, and the respirations, which immediately before were 52 per minute fell to 36. The animal had several attacks of asphyxia, and died 14 minutes afterwards in a general convulsion.
As shown in chart p. 51, tracheotomy and artificial respiration performed immediately on the cessation of breathing in an acertizized animal, produce no effect.

Remarks on the Respiration in Acentizism.

The author's researches and observations on the respiration in acertizized animals lead him to the following conclusions:

1. That the affection is primary, and due to the action of the drug on the respiratory centre. These conclusions agree with those of Legëois and Hotlot, and Böhme Wartmann (op. cit.).

2. That it does not act through the medium of the vagus nerves. Böhme Wartmann assert that it produces

* The immediate cause of death is partly from asphyxiation, and partly the variety of collapse spoken of by Brown-Séquard, especially characterized by a great diminution of breathing, ins. due to a peculiar inhibitory influence on the central organs of respiration, the heart continuing to beat with more or less violence.
paralysis of the peripheral branches of the vagus.

But it has been shown in the present paper that this is not the case as far as regards the motor branches for these retain their irritability after death from asphyxia.

Nor are the respiratory symptoms due to irritation of these branches, for the ensuing laryngeal spasm would be relieved by the performance of tracheotomy.

3. The symptoms appear to be partly due at least to diminished, and subsequently abolished, irritability of the mucous membrane of the air-passages. That this is shown by experiment on Chart. p. 50.

The mucous membrane thus comes to be in a condition analogous to its state after section of the vagi nerves. Now, in animals in whom this operation has been performed, the respirations fall, and the sense of
the need of air being no longer experienced. The animal makes no effort to make up, by depth
or otherwise, for the absent respirations. But as the convulsions, apparently partly due to asphyxia, con
continue to occur in animals in whom the trachea have been divided, and the mucous membrane of the
air passages thereby rendered anaesthetized, there occurs during the process of anaesthesia does not im
ply that the membrane is sensitive, and fulfilling its normal function of reflexly invoving the respir
atory act. That the convulsions are not due to the sense of impending asphyxia is shown by the
fact that they are mainly inspiratory, and are relieved whereas the convulsions of asphyxia are expiratory.
and that they are also observed in the pithed frog. 58.
from the fact that section of the vagi does not influence
the action of the drug upon the respiration, Böhm and
Hartmann (op. cit.) believe that the affection is purely
central in character. But the physiological effect
of section of the vagi is to cause a marked diminution in the number of the respirations, and
alterations of their character, and if section of the
vagi be not followed by these effects, the
function of these nerves must previously have been
either partially or completely impaired or destroyed.
This is capable of explanation on the ground that
partial or complete anaesthesia of the mucous mem-
brane of the air passages had already super-
vened. The respiration of asphyxia resembles the
deficits induced by section of the vagus (1) by 59.
its diminution (2) in number: (2) by its not being relieved
by tracheotomy: (3) by the diminished sensibility of
the mucous membrane of the air passages, owing to
paralysis of the different nerves (4) by the presence
of the most characteristic pause or the loss of
inspiration. In comparing the effects of Acurtus,
section of the vagus on the lungs, it must be re-
membered that in the former case the motor nerves
are left intact, whereas in the latter they are
also paralysed; the symptoms in the two cases
Cannot thus be absolutely identical - collapse
4. death always occurs from Asphyxia in
mammals Animals - this is confirmed by the post mortem
appearance for which see Appendix to paper.
Action on the Heart:

Böhm and Wartmann believe that Aconite acts upon the heart by producing paralysis of the peripheral vasi, for they found that the usual symptoms of Aconitism occur after section of that nerve. Achsharumow, from post mortem section of these nerves followed by an increased number of cardiac pulsations concludes that in Aconitism there is abnormal inhibition of the cardiac organ.

*Legois Hottot affirms that Aconite applied locally to the heart, acts directly on that vesice, and Dr. Frothergill states that it paralyses the organ.*

*Journal de Physiologie, 1861, p. 520*
The heart of the frog is not known to receive nerves from any source except the vagus.
in the frog, by arresting the contractions in the diastole. 61.

*Dr. John Harley asserts that aconite has no direct action on the heart, and that it is only secondarily affected, and as a consequence of the respiratory difficulty. +Dr. Fleming in his inaugural thesis at the University, states that it has a direct sedative action on the heart. How far the results obtained by the author agree with the opinions cited, will be evident from the following experiments:

**Experiment 1.** In a frog poisoned by simultaneous injection of 2 mls. snare aconite (B.P.) all signs of respiration disappeared 5 minutes after injection.


* St Thomas's Hospital Reports, Vol 5, p 190.
The heart continued to pulsate for 5 hours after the
Experiment 2. In a frog poisoned by subcutaneous
injection of 2 m\text{g} of Aconitine (BP) the exposed heart
continued to pulsate long after the cessation of
respiration.

Experiment 3. In chart p. 63 are figured the
pulsations of the exposed heart of the frog, the
respiration having completely ceased before the com-
 mencement of the observation.

Experiment 4. A small frog was poisoned by the
subcutaneous injection of 0.004 gr. of Aconitine. Four
and a half hours after injection—when respiration
had long ceased, the thorax was gently opened. The
heart exposed. It was found pulsating. The
application of a weak galvanic current had no effect
(continued on p. 64.)
Physiological Chart. No. 10. On the Frog.

Results of Experiment:
1. The exposed heart continued to beat after abolition of respiration.

Note: The red line indicates the cardiac pulsations.
a stronger current stopped it, but only for a few 634 seconds: the heart was stripped of its pericardial investment and freely bathed in a solution of the mixture of Aconite (1 to 2 Water). No effect whatever was produced; it was next bathed in a solution of Y M. Smith's Aconite (1gr to 3 parts Ag) also without producing any effect. The B. P. mixture of Aconite was next directly applied; 5 minutes after the latter application the diastole was more prolonged, and the systole more firm: this effect, however, disappeared in 15 minutes. Three quarters of an hour afterwards the last application of Aconite, the heart was left pulsating for the night. Next morning it had ceased, but on slight stimulation by a gentle heat, it re-commenced pulsating, and continued so for 10 minutes.
Experiment 4: - Large cat, poisoned by the subcutaneous injection of 40 gr. of ammonia. The heart was felt distinctly beating several minutes after the cessation of respiration, and after all other movements had ceased. It did not respond to pulvinar.

Experiment 5: - Rabbit weighing 2 lbs. 9 oz., with section of the vagi nerves. After death in this animal, the heart was exposed and distinct vibratile contractions were observed for 10 minutes. On depletion 3/4 hour after death, the right side commenced to pullate at the rate of 36 per minute; 1 hour after death, it was still pulsating, and the left ventricle was noticed undergoing slight contraction on being stimulated by a gentle heat. The application of a solution of ammonia stopped all pulsation. (This experiment was witnessed by Dr. Parker, M.P.C.S., one of the assistant medical officers to the Gloucester County Asylum) - (See chart p. 66).
Physiological Chart. No. On the Rabbit (Height 11/2s. 903) Chloralosed.

Results of Experiments:
1. The subcutaneous injection of a previous dose of chloral was followed by a slight increase, and subsequently by a rapid decrease, in the number of Cardiac Pulsations.
2. Section of the Vagi was instantly followed by a very great increase in the frequency of the pulsations, which was not markedly diminished before death.
3. The right auricle dilated for over hour after cessation of respiration and after resuscitation.
4. The left auricle re-commenced dilating slightly one hour after cessation of respiration on being stimulated by heat.

Note: The darkening shows the Cardiac Pulsations before section of Vagi.
Experiment 6: - Rabbit poisoned by 1/20 gr. Aconitum by subcutaneous injection. Death ensued after the usual respiratory symptoms in about 24 minutes. On opening the thorax 5 minutes after death the left ventricle was noted contracting at the rate of 48 per minute. It continued to pulse for 5 minutes longer. The right side continued to contract for 3/4 hour. On section, it re-commenced on the gentle application of heat, but stopped on topical application of cold water. This experiment was also witnessed by Dr. Parker.

Experiment 7: - Rabbit poisoned by subcutaneous injection of 1/20 gr. Aconitum. On the heart being exposed some time after death and irritated by salvarsan, several distinct quivering ensued, similarly circumstances and in the case of another rabbit, the ventricle was distinctly observed pulsating after death from aconitum, and the muscular fibres distinctly retracted on section.

Experiment 8: - Rabbit weighing 2 lbs. poisoned by the subcutaneous
injection of \( \frac{1}{40} \) or \( \frac{1}{60} \) gr Aconitae. Five minutes after cessation of respiration, the heart was exposed, and noted contracting at the rate of 40 per minute. 10 minutes afterwards, at 16 per minute, the contractions being principally on right side: it continued to pulseate, for 20 minutes, chiefly on right side: on cessation it would not respond to galvanism.

**Deductions from Experiments:**

1. That in aconitized animals, the heart may be observed pulsating long after the abolition of respiration, and death of the animal.

2. That the pulsations in the frog's heart are not stopped by the topical application of Sol. Aconitae, or Tincture of Aconite.

3. That the heart of a rabbit may be stopped by the local application of Aconite, but as the same result follows
The local application of cold water, it is probably due to the depressant action of a fluid at a temperature greatly below that of the vessels.

4. That acridity has no direct action on the heart, and only acts through the medium of the lungs.

Remarks on Experiments: The preceding experiments, which have been amply confirmed by others (experiments) have been followed by negative results only, in so far as they have shown that the action of the drug is not upon the heart. Attention has already directed the author's attention to the fact that the peripheral motor branches of the vagus are unaffected in second,

and consequently do not abnormally inhibit the heart. In singular (confirmed on the present occasion) an experiment Aksharumow found the Cardiac pul:enior greatly increased after section of the vagi (see
Chart p. 66) and concludes that the heart was being 68\(\frac{1}{2}\) abnormaly inhibited by these nerves. But this is only the physiological effect upon the heart of section of these nerves, and shows that, previous to section, the nerves had been discharging their normal functions. It has already been shown that acute nerve paralyses paralyzes of the sympathetic (nerve motor) nerves, and as it neither affects the motor branches of the vasi, nor acts upon the intrinsic nerves paralyses of the heart, it can only affect that viscera by acting directly upon the muscular substance. That it does not do so, the succeeding experiments show.

It is a matter of some regret to the author to find himself, almost alone in regard to the conclusions he has arrived at - that aconite does not act directly on the heart, and only affect it secondarily through the lungs. The table
of post mortem appearances appended to the paper, all of which tend to show that death is the result of asphyxia. Dr. John Harley (op. cit.) whose researches on aconite were not published by the author until he had come to the above conclusions, is also of the same opinion. It may not be out of place to refer to the erroneous opinions which were long entertained as to the action of digitalis on the heart to show that first investigators have many disciples who believe their results as he weighed his. Opinions once come to are difficult to gain and such seem to have been the case with aconite. Each worker started with the idea that the drug acted directly upon the heart, from the fact that others who preceded him arrived at the conclusion. If so with aconite, as it likely was with digitalis, and a corresponding revision of opinion must take place.
The action of the aconite, therefore, is only consecutive to its action on the lungs, and is a simple consequence of the respiratory embarrassment, as follows:

1. On the Frog. (See chart p. 41-43). Here the action of the heart is lessened in a space of time proportionate to the lappiness of the dose. The subcutaneous injection of 1-2 min. from Aconite diminishes the pulsation by one-half, in a period of time varying from 20-30 minutes. This action on the heart is always preceded by a more marked respiratory affection. The heart then becomes faint, subsequently irregular, tumultuous, intermittent. It may go on beating for hours after all other signs of life have disappeared; during this time the auricles contract fairly regularly, the ventricles very irregularly. On contraction of the cardiac action, the organ may be excited to renewed contraction by touching, or performing artificial respiration.
Physiological Chart. No. 1. On the Frog.

Results of Experiment:
1. A sudden and great increase in the number of Respiration, ending in their complete abolition.
2. The heart continued to pulsate for several hours after the cessation of respiration.

Note: The dark line indicates the Respiration. Interrupted red line indicates a period when the cardiac pulse could not be counted.
Results of Experiment:

1. Diminution in the number of respirations and cardiac pulsations.

2. A subsequent rise and fall in the number of cardiac pulsations.

3. Expected heart observed beating long after the cessation of respiration.

Note: The dark line indicates the respirations.

Red " " = Cardiac Pulsations.

Double lines indicate before the administration of the drug.

Interrupted black line indicates a period when the respirations could not be counted.
Physiological chart, No. 13. On the frog.

Results of Experiment:
1. The exposed heart continued to pulsate for several hours after the abolition of respiration.
2. On its temporary cessation it was readily stimulated to renewed action by gently raising the animal, or its fore limbs.

Note: The red line indicates the pulsations of the exposed heart. The dotted line indicates a cessation of pulsation.

Entered at Stationers' Hall.
2. In the Dog:—In large doses, aconite diminishes the 1/4 amount of cardiac pulsations (Consecutively) & subsequently renders its faint, irregular & intermittent. In very large doses, such as in the case of the dog p. 31 while a fall corresponding to the respiratory fall took place in the first half hour from 140 to 94 pulsations, as soon as the respiration became laboured and dyspnoeic, a rise to 120 took place in 3/4 hour, but which soon again fell. The action was meanwhile faint, irregular, & intermittent, dropping one beat in 3.

The irregularity of action takes place previous to intermission, and the heart, while it becomes irregular, does not intermit unless the dose be large.

The amount of interference with the heart action is slight, when compared with the respiratory embarrassment. (See Chart p. 31–42.)

Muscular paralysis is never induced by aconite. During the sweep of poisoning, & after death, the muscular irritability is great, & contraction readily occurs under mechanical or galvanic stimulation. It frequently appears to be increased, for it remains longer, and is more intense, in the frogs poisoned by aconite, than in those not so treated.

Experiment: - Two frogs, of equal size, were taken: one was poisoned with aconite, the other was not. Both were put in a normal irritability, as determined by galvanic irritation, disappeared from the non-aconitised frog in 40\% hours, from the aconitised animal in 43 hours. The muscular irritability disappeared from the non-aconitised in 47\% hours; it was present in the aconitised for 42 hours.†

† (See also experiment 6, p.44.)
The irregular, struggling gait assumed by acconsitizd animals is not due to motor paralysis. This is always manifested first in the posterior limbs, and is evidently due to perverted sensibility. The animal becomes shaky, with a drunken straddle, and all the appearances of muscular re-Coordination. During the most advanced stage, dogs can support themselves readily on their hind legs, but in jumping, they do so awkwardly, and frequently fall to the side. That the sensibility of the posterior limbs is first affected is shown in frogs, where, when no movement can be induced by irritation of the limbs, reflex movements ensue on irritating the skin about arms or trunk.
Action on the Temperature. - The temperature is always markedly affected in acenitized animals. In the early stages it is always more or less increased, and the latter diminshed, with a gradual increase towards recovery. If death ensue, this secondary increase does not occur. The increased temperature seems due to the extraordinary muscular exertions on the part of the animal to respiration. As the paroxysm of dyspnea, the temperature falls, owing to the decreased oxidation, by the inflated respiration.

Charts p. 75-78 illustrate the temperature in acenitism. Should the dose be very fatal, an immediate rise is succeeded by a quick, uninterrupted fall, as in chart p. 75 — in less poisons, the primary rise is of longer duration, and the fall is correspondingly

(Continued on p. 82)
Physiological chart No. 1 on the rabbit (Weight 2 lb. 2 oz.)

Results of Experiment:
1. Rise in temperature.
2. The rise is succeeded by a great and sudden fall, which continues until death.

Note: The dark line shows the temperature.
Physiological Chart No. 6 on the Rabbit

Weights 2 lb. 3 oz.

1. A slight decrease of temperature, followed by a decided and gradual increase.
2. A marked muscular tremor.
3. A second marked decrease, continuing without any rise until.

Temperature (Rectal)
Showing the temperature of the car in the Rabbit, after subcutaneous injection of 1/200 cc. of acridin.

Physiological chart. No. 80.

On the Rabbit's weight 2 lbs. 3 oz.

Results of Experiment:

1. A marked increase of temperature, preceded by a slight fall.
2. A very marked decrease of temperature, interrupted by a slight rise.
3. An increased temperature of the animal commencing to recover.

Note: the dark line indicates the temperature chart.
Physiological chart No. 81 on the Rabbit

Weight 2lb. 3oz.

Results of Experiment:
1. A sudden and marked increase of temperature after the injection of the Acetone.
2. A sudden and marked decrease followed by a secondary increase.
3. An increased temperature towards recovery.

Note: The dark line shows the temperature.
delayed, and continues low during the period of urgent depressed, commencing to rise as soon as the respiration becomes easier, and the animal begins to recover.

Summary of Results of Experimental Inquiries into the Physiological Actions of Aconite

1. Aconite acts primarily on the respiration by its influence on the respiratory centre, and peripheral sensory branches of the vagi.

2. It has no direct action on the heart, and only affects that organ secondarily, through the medium of the lungs.

3. Its action on the nervous system consisting in first irritating then paralysing the peripheral sensory nerves, & posterior root of the spinal nerves. It has no direct action on the brain.
the motor nerves or spinal cord (other than on the respiratory centre).

4. It never induces muscular paralysis, but on the contrary, appears to increase the irritability of voluntary muscle.

5. Its action on the temperature is firstly to increase, and subsequently to diminish it.

6. Death ensues from Asphyxia, or "Respiratory Collapse".

(See over for Appendix.)
Appendix.

Containing Table showing a summary of principal symptoms, post-mortem appearances in Acroitize Animals.
### Appendix - Table Showing principal Symptoms & Post Mortem appearance in Acrozyg Animals

<table>
<thead>
<tr>
<th>Journal</th>
<th>Weight</th>
<th>Per.</th>
<th>Principal Symptom</th>
<th>Post Mortem Appearance</th>
<th>Other Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Rabbit</td>
<td>4 lb. 10 oz.</td>
<td>26</td>
<td>Loss of sense of sight;</td>
<td>collapsed; empty</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Rabbit</td>
<td>2 lb. 12 oz.</td>
<td>10</td>
<td>Loss of sense of sight;</td>
<td>collapsed; empty</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Rabbit</td>
<td>2 lb. 5 oz.</td>
<td>30</td>
<td>Loss of sense of sight;</td>
<td>collapsed; empty</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Rabbit</td>
<td>2 lb. 6 oz.</td>
<td>40</td>
<td>Loss of sense of sight;</td>
<td>collapsed; empty</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Rabbit</td>
<td>1 lb. 9 oz.</td>
<td>45</td>
<td>Loss of sense of sight;</td>
<td>collapsed; empty</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Frog</td>
<td>2 lb. 10 oz.</td>
<td>60</td>
<td>Loss of sense of sight;</td>
<td>collapsed; empty</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Rabbit</td>
<td>3 lb. 6 oz.</td>
<td>70</td>
<td>Loss of sense of sight;</td>
<td>collapsed; empty</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Rabbit</td>
<td>2 lb. 1 oz.</td>
<td>80</td>
<td>Loss of sense of sight;</td>
<td>collapsed; empty</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Rabbit</td>
<td>1 lb. 9 oz.</td>
<td>90</td>
<td>Loss of sense of sight;</td>
<td>collapsed; empty</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Snake</td>
<td>2 lb. 4 oz.</td>
<td>100</td>
<td>Loss of sense of sight;</td>
<td>collapsed; empty</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Journal</th>
<th>Weight</th>
<th>Per.</th>
<th>Principal Symptom</th>
<th>Post Mortem Appearance</th>
<th>Other Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>11. Opossum</td>
<td>1 lb. 10 oz.</td>
<td>110</td>
<td>Loss of sense of sight;</td>
<td>collapsed; empty</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>110</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Opossum</td>
<td>1 lb. 5 oz.</td>
<td>120</td>
<td>Loss of sense of sight;</td>
<td>collapsed; empty</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Opossum</td>
<td>1 lb. 1 oz.</td>
<td>130</td>
<td>Loss of sense of sight;</td>
<td>collapsed; empty</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>130</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Opossum</td>
<td>1 lb. 9 oz.</td>
<td>140</td>
<td>Loss of sense of sight;</td>
<td>collapsed; empty</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>140</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Opossum</td>
<td>1 lb. 4 oz.</td>
<td>150</td>
<td>Loss of sense of sight;</td>
<td>collapsed; empty</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>150</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Summary of Results of Post Mortem Examinations in Acrozyg Animals:—**

1. The Head: The most common approach is a complete or partial necrosis of the dorsal or ventral surface of the head. Both eyes are usually cloudy and in some cases, one or both eye sockets are filled with a yellow or green liquid.
2. The Eyes: These are almost always found closed. The pupils are often dilated, and the cornea is usually clear and transparent. The optic nerve is often swollen and the optic chiasm is often visible.
3. The Brain: The brain and spinal cord are usually well preserved, though the brain is often slightly edematous.