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A CONTRIBUTION TO THE PHYSIOLOGICAL
STUDY OF VERATRUM VIRIDE AND
VERATRIA, WITH EXPERIMENTS.

By Drs. AMORY and WEBBER, LaGrange Street Laboratory, 1869.

PREFACE.—The experiments which will be related in this paper were performed with the assistance of Messrs. Wood, Boutelle, Bridge, Spooner, Putnam, Pierce, Brigham and Cutler. Many points of interest still remain uninvestigated; but, as it may be several months before experiments with this drug can be resumed, and as we think the results thus far obtained are in one or two respects an advance on what has been hitherto recorded, at least in the English language, we venture to present them in this, comparatively, incomplete state. We wish to call attention to the fact, that the historical investigations on this subject were not commenced, until after our experiments had been performed.

Veratrum viride was not brought into notice until a little more than two years ago. Several practitioners had used and found this drug to be of great value; but its advantage was not generally known until Drs. Cutter, Rickard and Ingalls, in behalf of the Middlesex District Medical Society, called the attention of physicians to its use, and prepared an account of their experience with it, which was published in the *American Journal of Medical Sciences*.

Dr. Cutter's monograph attracted attention in Europe, and the drug was experimented upon there.

Veratria.—Previously the alkaloid *veratria* had been studied, but this was obtained from the seeds of *veratrum sabadilla*, and seems in some respects only to imperfectly represent the virtues of *veratrum viride*.

Magendie experimented with an impure *veratria* in 1820. In 1829 Bardsley published an article on the Therapeutical Value of *Veratria*. In 1844 Dr. Gebhard com-

pared the action of *veratria* and *strychnia*. These are a few of the authors referred to by Van Praag.* A pricking or tingling, especially of the hands and feet, compared by some to the sensation produced by electricity, is mentioned by many; also, a sense of warmth followed by a feeling of coolness.

Van Praag noticed in several cases that the animals upon which he experimented had a peculiar spasm, which he likens to St. Vitus's dance, a stiffness of the limbs which ended in a dancing movement. He states that the cardiac pulsations were first increased and then diminished, irregular and then weak. The respiration was affected only when large doses were taken, when it was embarrassed or ceased entirely. He noticed, also, the weakness of the muscular power, but in his summary this seems not to have attracted his attention so much as the spasms. In some cases the pupils were dilated; there was evidence, also, of pain in the mouth or throat. Nausea and vomitings occurred constantly. No inflammation was seen in the *primæ viæ*. He performed experiments, also, on birds, frogs and fishes. His conclusions are:—

"The respiration and circulation diminish in intensity. The muscles lose their tension. The irritability of many nerves (especially the peripheric cutaneous nerves) is considerably lowered. After very small doses vomiting follows; often, also, diarrhoea, but this more frequently after large doses. The secretion of urine is not notably excited. Salivation is considerably increased. * * * The stage of stimulation [*erregungsstadium*] is shown by accelerated respiration, increased frequency of the pulse, cramp-like tension of the muscles, increased irritability of the nerves. Death from *veratria* poisoning seems to proceed from paralysis of the spinal cord."

He states, also, that *veratria* acted in a similar manner upon man. In no case did he find any signs of inflammation, and the

* *Veratrin Toxikologisch-pharmakodynamische Studien* von J. Leonides Van Praag, in *Virchow's Archiv*, 7, Band, 1854, s. 252.

[WHOLE No. 2173-74.]

results of *post-mortem* examination were entirely negative.

Veratrum viride.—Much has been written in regard to the use of *veratrum viride* in different diseases; and, so far as the record of cases gives an insight into the physiological action, this agrees with our experiments. The therapeutical and pharmaceutical character and uses of this drug are not, however, the subject of our investigation, and will be entirely disregarded.

Drs. Cutter and others investigated its action.* They remark that the benefit derived from its use is due to its sedative power over the circulation and the nervous system. The reduction of the pulse is mentioned in almost every case (40 to 60 beats per minute in the course of twelve to eighteen hours), as well as the general depression from prolonged sedation. Generally there was no nausea after its use, though this symptom is mentioned by other writers. Most of the facts mentioned in this paper are, however, therapeutical, and are not included in the plan of our investigation.

Another paper† by the same authors gives one or two cases worth referring to. In the first case detailed below, the effect of the drug upon the respiration is noticed. The case was reported by Dr. Minot, of Boston.

CASE.—A young man, 18 years of age, with acute pericarditis, having an irregular pulse (96–116), took of Thayer's fl. ext. of *veratrum viride* gtt. iv. The respirations numbered 30 per min. He became more comfortable during the day. The pulse in the evening was 96. This was October 12th.

Date.	Pulse.	Resp.	Remarks.
Oct. 13	87	36	Had taken seven doses; stopped on account of vomiting.
" 14	112	36	Resumed the medicine.
" 15	112	30	Six doses taken; dose increased to gtt. v.
" 16	114	40	Took three doses.
" 17	112	24	(Pleurisy.) gtt. v. ev. 4 hrs.
" 18	96	22	Five doses; vomit. after last.
" 19	96	24	Four " nausea.
" 20	100	30	Three " "
" 21	96	28	Four " "
" 22	96		Five " "
23–25	100		

The medicine was omitted for a time, and then renewed, but neither pulse nor respiration were noticed particularly.

Another case‡ is reported by Dr. Forsaith, in which the pulse was reduced from 120 to 40, and the respiration was only 15, an over dose having been accidentally taken.

In another case,* reported by Dr. C. S. Bishop, of Philadelphia, a medical student who had been injured by fireworks; the pulse, at first 100, was kept at 60 for thirty-six hours, and "from the time that the sedative influence of the *veratrum viride* became manifest he felt no pain."†

In the *Edinburgh Medical Journal*‡, Dr. J. Watson gives the results of experiments on himself and on several patients, from which we can derive some knowledge of the action of this drug. He took gtt. viij. of a tincture (made according to Dr. Cutter's direction) at 3 o'clock, P.M. Two hours after, his pulse was unaffected. At 5 o'clock he took another dose, and then had tea. At 6 o'clock his pulse was the same as at 3 o'clock. Towards 7 o'clock he was troubled with flatulence. Some minutes before 7 he began to feel nauseated and would have vomited, but restrained himself. The force and frequency of the pulse became diminished. There was griping of the bowels, sickness and weakness, with considerable pain in epigastric region; he had a heavy, dull headache, with, occasionally, painful throbbing in the temples. His pulse, 70 at 3 o'clock, was reduced to 64. The pain in the bowels continued, and he felt himself growing weaker; but as he wished to experience the full effects, at 7 o'clock he took another dose of eight drops. From 7½ he felt about as described above. Soon he became weaker and felt that he must vomit. The pain in his stomach and bowels became much more severe; a clammy cold sweat broke out on his brow, and at 7½ he vomited with much pain. While vomiting he required all his strength to support himself; his back became extremely weak; and, when a fit of retching came on, he felt as if he was going to be asphyxiated; he had one or two cold shivers; his feet and hands became cold and benumbed, though there was a large fire in the grate; the cold, numb feeling crept up the legs and arms, and, at last, his whole body felt as if enveloped in cold, damp cloths, and he became quite prostrate.

At a little after 8 o'clock his pulse was 40 and very weak. The flatulence continued, till a quarter past eight, when he again vomited slightly. The cold, clammy sweat continued, and the whole surface of the body was numb. At 8½ his pulse was 56. After vomiting his face was quite pale, but there was no dilatation of the pupil. He felt prostrated during the evening, but the next day was quite well.

* American Journal of the Med. Sciences, Oct., 1858.
† Idem, Oct., 1861, p. 400. ‡ Idem, p. 403.

* Am. Jour. of the Med. Sciences, Oct., 1861, p. 406.
† Italics in the original. ‡ January, 1864.

This is one of the most valuable experiments recorded, and, so far as it goes, agrees with what has been found in animals.

Dr. Watson administered the tincture in three cases. In one the patient was suffering from phthisis with a pulse of 120. At quarter to 9 o'clock, gtt. viij. of the tincture were given, which dose was repeated in one half an hour, as no effect had been produced upon the pulse. In half an hour more the pulse was still the same, but in a few minutes she was found retching violently and vomiting. Her pain was intense and her prostration excessive. She continued vomiting at short intervals till within a few minutes of 11 o'clock. A cold, clammy sweat broke out over her whole body, but especially upon the face. At 10½ the vomiting was diminishing in severity (brandy had been given), but the prostration became more marked. Just before the vomiting commenced her pulse was at 120, but at 10½ it had sunk below 60, and was very weak. At a quarter before eleven it was 60, and at 11 o'clock it was 80 after taking wine and morphia. She was very much frightened on account of a *dead* feeling she experienced, especially in her limbs, and to a certain extent over her whole body. The following table shows the rapidity of her pulse:

9.45, P.M.,	120	12, midnight,	76
10.30 " "	below 60	12.15, A.M.,	72
10.45 " "	60	12.30 " "	72
11 " "	80	12.45 " "	80
11.15 " "	72	1 " "	80
11.30 " "	72	9 " "	120
11.45 " "	80		

In this case, the symptoms were essentially the same as in the previous experiment.

In the second case the tincture was given to a young man, aged 16 years, who had undergone amputation of the thigh on account of a tumor.

At 7 o'clock, 4 minims were given.
At 7.15, he had nausea.
At 7.30, he vomited.

His pulse was as follows:—

At 7, P.M.,	152.
7.15 " "	152.
7.30 " "	136.
7.45 " "	136.
8 to 9 " "	132.
9 " "	4 minims more were taken.
9.15 " "	132; nausea increased.
9.30 " "	124.
9.45 " "	124; vomiting, with great weakness.
10 " "	124; vomiting.

The next day, 11, A.M., 150.

The following day, 10, A.M., 132. Tincture again taken in the dose of 4 minims.

10.15, A.M.,	132; feels sick.
10.30 " "	124.
11.15 " "	124.

11.30, A.M.,	120.
11.45 " "	126; 4 minims more. [iting.
12 " "	124; great nausea and occasional vom.
12.30, P.M.,	124.
1 " "	128.
3 " "	132.

The next morning, 160.

In the third case, the tincture was given to a man, aged 52, who had a fracture of the thigh-bone. Six weeks after the accident his pulse was high, but the general health of the patient was good.

At 7.15, P.M., pulse 100; gave 4 minims.

7.30 " "	100.
8 " "	100; gave 4 minims.
8.15 " "	96; flatulence and nausea.
8.30 " "	92.
8.45 " "	88.
9 " "	100; patient retching.
9.15 " "	94; vomiting over, though great nausea.
9.30 " "	88.
9.45 " "	36; great nausea.
10 " "	86.
11, A.M.,	92.

On the second day the medicine was again tried.

At 10, A.M., pulse 100; gave 4 minims.

10.30 " "	100.
11 " "	96; flatulence.
11.15 " "	96; sickness and flatulence.
11.30 " "	92; " "
11.45 " "	94; another 4 minims.
12, noon, " "	94; flatulence.
12.30, P.M.,	pulse 94; great nausea.
1 " "	90; other 4 min.; great nausea.
1.30 " "	96.
2.15 " "	severe fit of vomiting, which lasted from 20 to 30 minutes.

He complained of a sinking at the heart, pain in the stomach and bowels, and, after the vomiting, of great depression, and of a *dead* feeling in the limbs. After vomiting, the pulse fell to 80, but at 3 o'clock, after taking stimulants, it was 92, and the next morning it was at 96.

In the *Medical Times and Gazette** is recorded by Dr. Edwards a case of accidental poisoning with veratrum viride.

A chemist took an over dose of the tinct. ver. vir. for the purpose of testing its effects. He took ʒj., equal to about 12 grs. of the powder. He was found sitting in the water-closet, vomiting into the pan. His features were sunken, skin cool and covered with a profuse clammy sweat; his pulse was quite imperceptible. He complained of intense pain in the epigastrium. The vomitus, at first, appeared to consist of food and contents of stomach, afterwards of a glairy mucus. He received immediately ʒjss. of pure brandy, which checked the vomiting. He was removed into a room, and on to a couch in front of the fire. The surface of the body was still very cold, especially of the extremities. The clammy sweat continued, but the pulse could be indistinctly felt, beating feebly and with irregularity.

* Jan. 3d, 1863.

about 44 a minute. Under the use of brandy warmth gradually returned to the surface, and the pulse became better in volume and power. He fell asleep, and awoke better. The next day he was well. There was no diarrhoea. He stated afterwards, that before and during the vomiting he had a sense of constriction in the throat, and excessive pain. His mind was calm, though consciousness was clouded for a time. Immense circles of green color were seen around a candle flame, which turned to red on closing the eyes. There was a tendency to cramps in his legs when they were touched.

M. Oulmont has published* in a memoir, read before the Académie de Médecine de Paris, the results of his experiments with this drug. He sums up the results of his experiments (which are not related) with *veratrum viride*, as follows:—

"1st. It quickly causes nausea, vomiting and diarrhoea, which two former may last fifteen to twenty hours.

"2d. The respiration is greatly modified, becoming irregular; sometimes, very rapid, sometimes so retarded, that there may be but one or two respiratory movements during a minute; sometimes in frogs it is completely suspended.

"3d. The circulation is very rapidly diminished in frequency; the pulse, at the end of a quarter or half of an hour, as much as 20, 40, or 60 pulsations a minute. In man not in a febrile state, *veratria* (in the dose of 1 to 3 centigrammes) causes the pulse to fall thirty to forty beats.

"4th. The temperature follows a descending scale a little less marked; at the end of half an hour to two hours only, it descends 2°, 3° or even 5° (C.), and may remain there twenty-four hours without death resulting.

"5th. The debilitating action of *veratrum viride* is manifested from the beginning. Feebleness and prostration continually increase, and when they have attained the highest point the animal dies.

"6th. There never results contraction, muscular rigidity or tetanic convulsions.

"7th. The poisonous dose of *veratrum viride* for frogs is 20 drops of the tincture, for rabbits 60 to 80, and for dogs 120 to 150."

He concludes from comparative experiments that *veratrum album* is much more unequal in its effects, and more severe in its action. He thinks that the action of *veratrum viride* does not depend on the alkaloid *veratria*†, as the latter causes muscular contractions and spasms.

* Bul. Gén. de Thérap., 1868, tome lxxiv. p. 145.

† According to our experiments, this distinction cannot be maintained.

M. Limon* found that the tincture of *veratrum viride* causes diminished frequency in the pulse and reduction of temperature. The pulse decreased from 112 to 54, and the temperature from 39 to 37 (C.). He noticed, too, that the sphygmograph showed an increased arterial tension,* when the pulse is reduced in frequency. Its effects passed off rapidly, and there was no cumulative action. He, also, mentioned the vomiting.

Two cases, well reported and observed by MM. Tuber et H. Hirtz, *internes aux Hôpitaux de Strasbourg*, were reported by M. Oulmont to the Society of Therapeutics.

The first was a case of pneumonia in a woman, 30 years of age, mother of three children, pregnant with a fourth. She entered the hospital on the evening of the 9th of March, on account of pneumonia of the left lung. The temperature was 39° (C.), pulse 112.

March 10th.—Temp. 38.8° (C.); pulse 108; respiration 80. Antimony and bleeding had been her treatment. In the evening the temperature was 39.2° (C.); the pulse 108; respiration 48.

March 11th.—Asphyxia seemed imminent. Temperature 39.7° (C.); pulse 112; respiration 76.

Veratrum viride was now ordered in granules containing 1 centigramme of extract. This was first given at 9½ o'clock.

Hour.	Dose.	Temp.	P.	R.	Remarks.
9.30	1st gran.	39.7°	116	76	Vomiting.
10.30	2d "	39.4	108	76	
12	3d "	38.7	98	68	
1.30		38.1	68	42	
3		37.8	64	44	Temp. of vag. 38.6°.
4.30		36.8	64	38	

The vomiting which arose after the third granule caused considerable distress, which was of short duration. During the evening the symptoms recurred in severity.

March 12th, A.M.—Temperature was 39.2°; pulse 104; respiration 80. *Veratrum viride* was again given.

Hour.	Dose.	Temp.	Pulse.	Resp.	Remarks.
10	1st gran.	38.8°	108	74	Vomiting.
11	2d "	38.3	100	50	
12	3d "	37.4	82	50	
1.30		38.3	60	30	
2.30		38.6	60	40	
3.30		37.7	64	40	
4.30		37.5	72	40	
5.30		37	68	28	
6.30		37.5	80	40	
7.30		37.5	80	36	
8.30		37.2	80	36	
9.30		37.9	80	36	
10.30		38.1	80	36	
11.30		38.6	96	40	

* De l'action du Ver. Vir., Gaz. Méd. de Strasbourg, in Bull. Gén. de Ther., Jan. 30th, 1869.

March 13th.—Temperature 38.7°; pulse 96; resp. 32. She gradually recovered.

The second case is one of generalized bronchitis in a man 37 years old.

We do not think it worth while to transcribe this case, which agrees in every essential with the one detailed above.

SUMMARY.

The conclusions in regard to the physiological action of veratrum viride, and the alkaloid, veratria, which can be drawn from these experiments and cases recorded by others, confirm those that we have been induced to draw from our own experiments. We need only mention, here, the influence which is exerted upon the nervous system. In some respects resembling the action of woorara, it differs from that poison in less energetic action, in attacking the sensory fibres as well as the motor, and in diminishing the frequency of the cardiac pulsations. We have not performed any experiments to show whether the periphery or centre of the nervous system is affected, or whether the whole nervous tract is influenced.

The influence over the cardiac pulsation is, however, such that we are disposed to suspect that the nerves supplying that viscus are influenced at their central origin. The reduction in temperature indicates that the metamorphosis of tissue by which the temperature is sustained is interfered with; but this is most marked in cases of abnormal excess of temperature. The reduction of temperature would, also, indicate an influence over the vaso-motor system; the paleness of face, the dilated pupils, which have been sometimes noticed, and the increase of the arterial tension, observed by Limon, point to the same conclusion. If this be so, the weakness and paralysis may be due to an excessive contraction of the arterioles. Our experiments do not allow us to decide whether it is the spinal cord which is affected by this contraction, or whether it is the nervous trunks, or the terminal fibres of the nerves, or the nervous plates, which form the connection between the nerve and the muscle; but inasmuch as the respiratory and cardiac movements, the arterial contractility, the motor and sensory powers, and the secretory functions are all more or less affected, it seems more reasonable to refer the disturbance to the spinal axis, as that part of the nervous system through which the influence is exerted, and from which all the above-mentioned results are produced.

The nausea and vomiting, the sensation

of tingling, the prickling in the fingers and toes, and other abnormal sensations in the throat and elsewhere, which seemed to be present even when the drug was administered hypodermically, might be caused by the direct contact of the drug upon these parts as it circulates through them in the blood. A local application produces a numbness and deadens the pain of neuralgia. The deadness and diminished sensibility may, likewise, be due to the local contact of the drug; or, both these effects, viz., the loss of sensitiveness and the abnormal sensation, may be due to its influence over the central nervous system.

In one case only, that of accidental poisoning, does there seem to be a cloud over the intelligence.

These are the conclusions which follow from what has been recorded by others; and it will be well to bear them in mind in considering our experiments, which will now be given.

It is proposed to show, by the following experiments, the symptoms produced in various animals by veratria, and at first from a poisonous dose.

EXP. I.—Green-colored frog. Before the administration of the poison, the thorax is opened, and the number and force of the cardiac pulsations noticed:—Respiration 10; pulsations 32. Veratria placed upon the web of the frog's foot.

Hour.	Respiration.	Pulsation.	Remarks.
0.21	feeble.		
0.31	very feeble.		
0.36			
0.41	nearly ceased.	very feeble. 28	veratria applied to heart itself. heart pale. tetanic spasms; right lung forced out of thoracic opening and ruptured.
0.58	ceased.	the same. very feeble.	tetanic spasms every few minutes.
2.21		still goes on.	
2.31			obliged to leave; muscular fibres contract to stimulation.

Post Mortem, twenty-one hours after. Continued rigor mortis; muscles, heart and liver all very pale. No muscular contractility to stimulation or by electricity. Lung tissue contains air. No transverse striæ visible by the microscope in cardiac muscular fibres, which seem to be replaced with granular spots.

In this experiment it may be noticed that veratria is not very readily absorbed by the skin of a frog; and, also, that after its topi-

cal application to the cardiac muscles, it does not cause paralysis of the heart's action, though it does produce cessation of the respiratory function. It produces various muscular spasms, to which the frog, of all animals, is the most liable, and which may, after all, be voluntary movements.

Exp. II.—Russet-colored frog. As it is stated by some observers, that phenomena produced in the green-frog and in the russet-frog are dissimilar, the effects are reproduced upon the latter that a comparison may be drawn. The *tincture* of veratrum viride was used in this case.

Tinctura veratri viridis gtt. q. s. Subcutaneous injection to leg.

Hour.		Pulse.	Resp.	Remarks
0.07	Thorax opened.	22		
0.07		weaker.		
0.13		22		
0.18			very feeble	spasms.
0.35		do.		
0.40		18		
0.53		10, irreg.		
1.00		12		
1.12		10		
1.22		12	ceased.	

Post-mortem examination showed diminished response to electrical stimulation in the leg to which the injection was administered; striated muscular fibres of this leg somewhat disintegrated, though the striæ can be distinguished. This is specially true of the cardiac muscles. Rigor mortis very marked.

This last experiment agrees in general with the previous one, but the symptoms and other effects are more intense, probably, because the dose of *veratria* was larger.

Exp. III.—Frog (green). Tinctura veratri viridis gtt. xii. placed under skin of a frog's leg. When it touched the flesh the frog jumped and kicked.

- 1'. Respiration spasmodic.
- 5'. " irregular and jerking; violent struggling.
- 11'. Respiration slower and jerking; violent struggling.
- 16'. Respiration feeble.
- 17'. Convulsive movements; bulging of sides, reminding us of the efforts at vomiting by a cat under similar circumstances.
- 24'30". Same effects; resp. ceased for a short time, and was then resumed.
- 1.8'. Muscular quiverings in posterior extremities.
- 1.45'. All phenomena of life had ceased, including those of reflex action.

Post mortem.—The muscles near to the place where the *veratria* had been applied were, in some places, covered with granu-

lar degenerations (as it appeared under the microscope), and, in others, extremely fine transverse striæ were arranged very near each other; the corresponding muscles of the opposite leg had nothing of this peculiarity. The cardiac muscles were easily separated into fibrillæ, some showing a coarse striation, others the same granular appearance above referred to. The hearts of each of the two frogs (Exp. II. and III.) were pale and muscles somewhat contracted, each animal having an abundance of fluid blood in its body.

These peculiarities were afterwards explained by a more careful examination, made with the use of alcohol and ether, which cleared up the field of observation, leaving the striæ more distinctly marked, though the fibrillæ were a good deal disintegrated and broken up. We were led to suppose that these dubious effects were due to mechanical deposition of the drug, as both the solution of *veratria* and the tincture of *veratrum viride* under the microscope had these same spots, and muscles soaked in either of the above were covered with these same globules.

This last experiment shows, in a general way, how the respiratory movements in a frog are modified, and that death can be induced by a dose of 12 drops; also that the *post-mortem* changes reveal little to show by what cause the vital functions are interrupted. It will be interesting to compare these first three experiments, taken from a number made upon frogs, with

Exp. IV.—Upon a cat.

A small amount of *veratria* (by estimation 3 to 5 centigrammes) on the point of a scalpel was inserted beneath the skin of the back, just over the upper lumbar vertebra. The cat immediately licked the wound.

- 5'. Champing of jaws and salivation; eyes closed; sneezing and retching; no loss of power over limbs; continued twitching of tail, occasionally crying; head held up with her nose in the air.
- 35'. Another dose (of equal amount) is administered in the same manner. Seems to cause much pain, from the crying induced. Apparent loss of muscular power in posterior extremities; great uneasiness and distress.
- 40'. Has a dejection; after which, seems disinclined to move.
- 1.9'. Eyes shut; when opened, pupils appear round and bright.
- 1.45'. Another defecation.
- 2.0'. Retching with cries, followed immediately by others, which were continued with much violence.

- 2.5'. Another more violent attack of retching, the cat dragging her face along the floor for six inches.
- 2.15'. Vomits a small portion of liquid food. Some loss of muscular power in posterior extremities.
- 2.20'. More veratria administered, followed by continuous moaning; violent spasms, pawing at mouth, loss of muscular control; respiration very rapid; violent efforts at vomiting, drawing her up and off her feet.
- 2.35'. Convulsions and vomiting; respiration diaphragmatic. No loss of sensation.
- 2.55'. Ejection of urine followed by tetanic spasms and muscular twitchings.
- 2.55'. No respiration, no cardiac pulsation—death.
- Post-mortem examination.* Heart normal—lungs congested, ecchymosed and emphysematous, the lower lobes covered with white spots. Stomach rather pale; liver and intestines show no peculiarities; bladder empty; muscles of heart showed broken-up fibrillæ with the striæ somewhat irregular. In a muscle from the thigh the striæ were distinct.

[To be continued.]

DISLOCATION OF THE ELBOW; A NEW METHOD OF REDUCTION.

By THOMAS WATERMAN, M.D., Boston.

FINDING no record in the surgical text-books of the method described below, I have thought the following case and comments worthy of publication.

On the 9th of May last, I was called to visit Mrs. L., æt. 30. She stated that, when near the bottom of a flight of stairs, she had tripped and fallen down the last three steps, striking with the whole weight of the body on her extended hand. As the accident had happened but half an hour previously, there was no swelling to mask the lesion. The left elbow was flexed at a right angle, and all motions were attended with great pain. After etherization, the ulna was found to be dislocated directly backwards at the elbow, as shown by the unusual prominence of the olecranon, depressions on either side of the triceps tendon, and resistance to complete extension of the forearm, which was twisted and pronated. The head of the radius rotated in its normal position, and no other lesion—neither dislocation nor fracture—could be detected.

Assuming that the patient's statement

was correct, it seems strange, in view of the intimate connection of the carpal bones with the lower extremity of the radius, that Colles's fracture of that bone did not occur; or, failing this, that the head of the radius was not forced out of place, either alone or in addition to the dislocation of the ulna.

Faithful trials of Sir Astley Cooper's method of bending the arm over the knee, and Mr. Skey's method of extending the forearm directly downwards in a line with the upper arm, failed to produce any effect.

I then succeeded in reducing the dislocation by bending the forearm backwards beyond a straight line, when, without any extension downwards, the ulna returned to its normal position with a slight shock. An internal angular splint was applied, and evaporating lotions recommended. In eight days the splint was removed, the patient allowed to carry the arm in a sling and to execute slight motions in the joint daily.

The *modus operandi* of this method is as follows, viz.:—when the ulna is dislocated backwards at the elbow without fracture of the coronoid process, the latter occupies the olecranon depression of the lower end of the humerus, and often requires considerable force to remove it from its abnormal position. By the method above described, the forearm is used as a lever, with the power (hand of the surgeon) at one end, the fulcrum (olecranon) at the other end, and the weight to be moved (coronoid process) between. As the forearm is extended backwards beyond a straight line, the olecranon impinges against the lower end of the humerus and becomes a fixed point or fulcrum; by continuing the forced extension, the coronoid process is lifted out of the olecranon depression of the humerus, and, when this is accomplished, the tonic contraction of the brachialis anticus muscle restores the ulna to its natural place.

It will be seen that this method of reduction is exactly the reverse of the process by which the bone becomes dislocated, although it returns by the same path by which it escaped; these two facts, it seems to me, should be borne in mind in the reduction of all dislocations, and additional proof of this statement may be derived from a study of Prof. H. J. Bigelow's system of reducing dislocations of the hip by manipulation, and Dr. Crosby's method of reducing dislocations of the thumb.

The method is capable of the most decisive demonstration with macerated speci-