"ORGANISM X," PROBABLY OF THE CORYNE-BACTERIUM GROUP: ITS DIFFERENTIATION FROM *B. DIPHTHERIÆ* AND ALLIED ORGANISMS. ITS PATHOGENICITY IN MAN, ESPECIALLY IN BRONCHOPNEUMONIA, AND ITS RELATION TO GENERAL PARALYSIS OF THE INSANE.

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ARTICLE NO. 1 — INTRODUCTORY.

As this work has already consumed a long time,¹ but as still more work seems necessary before recording a final opinion, I take this occasion, omitting here its systematic study, to present briefly such data as bear more particularly upon the differentiation of this organism, besides indicating in a general way such topics as I wish to consider subsequently. I shall omit a consideration of the literature in this introductory article and shall, for the present, call the bacillus of this paper "Organism X" for convenience.

SOURCE OF DATA ON ORGANISM X.

The bacteriological data here presented comprise: (a) One clinical case of pulmonary infection with organism X; (b) a bacteriological and pathological study of 150 insane patients coming to autopsy; (c) a bacteriological study of 2,310 throat cultures on blood serum from 1,000 insane (these during a mild diphtheria epidemic); (d) comparative study on 6 sugars of acid production and coagulation in blood-serum-water-litmus-sugar media of *Bacillus diphtheriæ*, organism X and bacillus Hoffmanni by means of 175 observations; (e) comparative study on 7 sugars of acid production in broth of *B. diphtheriæ*, organism X, *B. xerosis*, *B. Hoffmanni* and Ruediger's bacillus, by means of 517 titrations with controls; and (f) a study of cultural and morphological characteristics based upon a stock of 199 pure cultures of the "diphtheroid" group, which includes:

Cultures of Organism X,	146
" " <i>B. diphtheriæ</i> from Danvers epidemic,	17
" " <i>B. pseudo-diphth.</i> (<i>B. Hoffmanni</i>),	4
" " <i>B. xerosis</i> ,	3
" " <i>B. coryzæ segmentosus</i> ,	1
" " Ruediger's organism (from Dr. Hamilton),	4
" " a media-staining pseudo-diphth. bacillus,	1
Other forms not identified, largely falling into one or other of these groups,	23
Total stock of diphtheria and diphtheroid organisms,	199

The organism I call here "Organism X" I regard as a distinct bacteriological entity; what I record deals with but one species; in short, I have temporarily designated the bacillus Organism X to avoid confusion in terms, and because as yet I have been unable to find an

adequately described and unquestionably differentiated and named species which seems identical with Organism X, but eventually I shall doubtless be able to place the organism. Descriptions, etc., on Organism X are based on cultures of the bacillus, which have been studied with care with regard to morphology, cultural peculiarities, biochemical reactions and animal inoculation, and over an extended period of time. This has been absolutely necessary, because Organism X may so closely resemble in a single point (morphology or other feature) *B. diphtheriæ*, *B. xerosis*, *B. Hoffmanni* or *B. coryzæ segmentosus* as to be indistinguishable from each in a given respect.

SOURCE OF CULTURES OF ORGANISM X.

Organism X has been found and obtained in pure culture on blood serum:

From the throat,	62 times
" " lung,	48 "
" " pleural cavity (empyema),	6 "
" " larynx,	4 "
" " ear ² (suppurative),	4 "
" " esophagus,	3 "
" " heart's blood,	3 "
" " eye,	2 "
" " stomach,	2 "
" " spleen,	2 "
" " liver,	1 time
" " kidney,	1 "
" " brain,	1 "
" " sputum, ²	1 "
" tonsil pus,	1 "
" cancer pus,	1 "
" tuberculous glands of the neck, ³	1 "
" tuberculous abscess, ³	1 "
" contused and lacerated wound, ³	1 "
" osteomyelitis, ³	1 "

It may be said that the lung has proved the most productive region for this organism, especially as regards purity of culture; in several cases I have obtained pure cultures directly from the lung, and again many times the first culture from the lung showed a predominance of colonies of Organism X, but with those of the common organisms as well. For the internal organs and heart's blood the same may be said, — the initial cultures have sometimes shown a pure growth of Organism X, sometimes a mixed growth.

Then I have a few cases showing great growth of the bacillus in the lung and either pure or mixed growth of the same in the internal organs or heart's blood; and always, with one exception, when appearing in the throat, it was found in the lung where examination was made.

For these reasons I regard the lung as the important seat of action. But I am satisfied the normal lung at autopsy is not a likely source for cultures. Lungs showing marked bronchopneumonia, often somewhat peculiar in the gross, both

¹ My first pure culture of this organism I isolated while on service at the Danvers Insane Hospital in March, 1904; many subsequent cultures and other forms of "material" were obtained there also, and I want to thank the Superintendent, Dr. Charles W. Page, the Trustees, and my fellow physicians of the staff of the Danvers Insane Hospital for their interest and co-operation in this work, and particularly am I indebted to Dr. A. M. Barrett, pathologist to the hospital at that time.

Of others who have assisted me I desire especially to thank Dr. Theobald Smith for his aid and advice, and Burt H. Rickards, director of the Boston Board of Health Laboratory, for his many favors.

² During certain studies of diphtheria-like organisms in sputum which are in progress under Mr. B. R. Richards, he has stated to me that among others he has isolated organisms from the sources indicated which respond to many of the tests and are probably identical with "Organism X."

³ The above four cultures are the only ones appearing above not isolated by me; they were sent to me through the kindness of Dr. D. H. Bergey, of the University of Pennsylvania, under the name of "Bacterium Pseudo-diphtheriticum." They have been proved by me to be identical with Organism X; therefore I interpolate them here. See table.

early and late, with associated gangrene, have in all cases yielded the most positive results, and in such the internal organs or heart's blood were sometimes found to yield cultures, not infrequently pure, of this organism. Suppurations have yielded good growths of the organism also.

It has been found associated in the same case, the same site and culture with many common pathogenic and saprophytic bacteria; also with *B. diphtheriae*; one such case is that from which culture No. 1 (*B. diphtheriae*) and No. 2 ("Organism X") were isolated by me from a throat in 1904.

I have found Organism X at autopsy both in the general paralytic and in those presenting no definite symptoms of general paralysis.

MORPHOLOGY ON BLOOD SERUM OF ORGANISM.⁴

Very variable as to size and type. Commonly a small bacillus, rarely showing suggestion of rudimentary branches like *B. diphtheriae*. Organism X, in culture, does not usually reach the average size of *B. diphtheriae*. Small types are sometimes much smaller than *B. Hoffmanni* and often coccoid. Large types as large as medium-sized *B. diphtheriae*. Shape: straight rods, slightly curved rods, conical like *B. Hoffmanni*, or coccoid. Involution types common, smaller than similar *B. diphtheriae* types, but may be ten or twenty times the volume of their fellows, often "pear," "club" or huge "coccoid" in form. Arrangement either strictly palisade or in open "V" or "jackstraw," the latter less marked than with *B. diphtheriae*. Relative dimensions like typical but diminutive diphtheria bacilli or often more thick and short. Granulation variable; this runs by strains very persistently, some strains mostly of small bipolar bacilli, others practically free of granules. A conspicuous type has well-defined large (relatively) bipolar and body granules, or with a single body or polar granule; body often very pale, in marked contrast with granule or granules. Barred or closely granular and even streptococcoid types are not rare.

STAINING.

Young individuals stain well with common stains. Old forms paler than corresponding *B. diphtheriae* types. Here again certain strain peculiarity exists. Stains by Gram usually. Some strains are very pale with Gram, however. Involution types retain Gram better; they may be the only individuals in a "field" which unquestionably are Gram-stained when a counter stain is used. Granular types stain like *B. diphtheriae* by Neisser's method; granules are usually smaller, however.

Non-capsulated; sometimes a non-staining interval between the sides of adjacent bodies in closely packed "fields" is seen.

No spores have been seen.

Motion: Non-motile, sometimes exhibits active Brownian oscillation, however.

⁴ Morphology in tissues here omitted, to be treated in subsequent article.

The organism is an aërobe.

No gas production observed on glucose or saccharose broth in fermentation tube.

GROWTH.

Blood serum: More moist, more creamy and rapid in growth than *B. diphtheriae*. Under good conditions of growth on blood serum most strains show, after a few days, a decided pale salmon pink tint; when old, often faint buff. Rarely, under bad conditions of growth, a yellow or a buff. The salmon pink is sometimes pronounced and is common in vigorous cultures. Media not usually stained until growth is very old.

On potato the faint salmon pink or salmon buff is readily seen.

Agar: More rapid than *B. diphtheriae* and more moist, usually gray, sometimes dirty gray, and sometimes very faintly salmon tinted.

Gelatin not liquefied. Growth slow; very fine, disseminated, spherical, in depths. Surface growth dry, yellowish, elevated.

Broth: Grows well in plain or sugar broth. Marked turbidity with or without pellicle or marginal ring growth; usually the latter is present.

In glucose broth, produces marked acid formation as intense as is the case with *B. diphtheriae*.

PATHOGENESIS.

Commonly non-pathogenic in the usual sense of the term to guinea-pigs, rabbits and white rats in ordinary doses. I have seen, however, decided local purulent infiltrations follow subcutaneous inoculations of the organism in guinea-pigs, in two cases followed by death. From such, "Organism X" has been recovered apparently in pure culture from the local lesion and a neighboring lymph node. I speak guardedly on this subject, as it requires further investigation.

DIFFERENTIATION OF ORGANISM X.

As the bacillus closely resembles *B. xerosis*, *B. diphtheriae*, *B. Hoffmanni* and *B. coryze segmentosus*, its differentiation is somewhat difficult. In 1904 I differentiated the organism in question from *B. diphtheriae* by means of serum-water-sugar-media of Hiss. I found the same characteristics to be shown much better by direct titration of sugar broths, a method recommended to me by Dr. Theobald Smith. Therefore I offer in tabular form my results with this method on the differentiation of Organism X from *B. diphtheriae*, *B. xerosis*, *B. Hoffmanni* and the organism of Ruediger.

The sugar broth used for acid production in the table below contained .95% of sugar in a bouillon made up with Liebig's meat extract. One half cubic centimeter of a 20% solution of each of the following sugars — dextrose, saccharose, lactose, maltose, dextrin, mannite and inulin — was placed in sterile test tubes and sterilized by steaming sixteen minutes. To this 10 cc. of a filtered sterile sugar-free broth (rendered so by a growth of "bird colon" bacillus at 37.5° C. for eighteen hours) was added to every tube already containing

FERMENTATION TABLE SHOWING ACID PRODUCTION IN 84 HOURS AT 37.5° C. ON VARIOUS .95% SUGAR BROTHS OF "ORGANISM X," *BACILLUS DIPHThERIE*, *BACILLUS XEROSIS*, *BACILLUS PSEUDO-DIPHThERIE* (HOFFMANN'S *BACILLUS*), RUEDIGER'S *BACILLUS*, AND OTHERS.

Figures indicate acidity in % "normal" acid or alkali of the several inoculated suger broths under appropriate columns. Initial reaction of media .6%+. Sign+ means acid; sign— means alkaline.

	Private Culture Number	Source	.95% Glucose Broth	.95% Saccharose Broth	.95% Lactose Broth	.95% Maltose Broth	.95% Dextrin Broth	.95% Mannite Broth	.95% Inulin Broth
Organism X.	2	Throat	4.8 +	4.4 +	.4 +	3.30+	.85+	.3 +	.35+
	3	Kidney	4.3 +	4.75+	.4 +	3.30+	.8 +	.4 +	.5 +
	5	Lung	4.0 +	4.70+	.25+	3.45+	.75+	.2 +	.25+
	6	Liver	4.05+	4.8 +	.7 +	3.4 +	1.0 +	.00+	.6 +
	9	Sputum	4.7 +	4.8 +	.45+	3.0 +	.6 +	.45+	.45+
	13	Lung	4.7 +	4.8 +	.25+	3.4 +	.5 +	.1 +	.25+
	37	Throat	4.7 +	4.8 +	.35+	3.4 +	.6 +	.2 +	.5 +
	38	Throat	4.65+	4.50+	.15—	3.5 +	.7 +	.2 +	.05+
	48	Lung	4.80+	4.5 +	.2 +	2.8 +	.6 +	.35+	.05—
	50	Throat	5.0 +	4.95+	.3 +	3.05+	.8 +	.2 +	.1 +
	70	Lung	4.25+	4.7 +	.15+	3.35+	.7 +	.00+	.25+
	72	Lung	4.2 +	4.7 +	.1—	3.1 +	.6 +	.4 +	.2 +
	81	Lung	3.2 +	4.85+	.3 +	3.5 +	.8 +	.5 +	.6 +
	86	Lung	4.20+	4.7 +	.4 +	3.4 +	.85+	.2 +	.45+
	97	Lung	5.0 +	4.8 +	.2 +	3.75+	.6 +	.3 +	.1 +
	99	Heart	3.2 +	4.40+	.6 +	3.4 +	.85+	.35+	.65+
	124	Heart's Bl.	4.7 +	4.30+	.12+	3.25+	.65+	.1 +	.25+
	135.47	Lung	4.65+	5.00+	†	3.00+	1.5 +	.25+	.15+
	135.68	Brain	4.7 +	4.85+	.1 +	3.35+	.05—	.1—	.05+
	A 1025 Pl.	Empyema	4.65+	4.75+	†	3.4 +	.65+	.4 +	.25+
	A 1037 R.L.	Lung	4.8 +	4.75+	.0 +	3.45+	.65+	.15+	.2 +
	A 1041 R. Pl.	Empyema	4.45+	4.75+	.75+	†	†	.1 +	.05—
	A 1044 R. eye	Eye	5.05+	5.40+	†	3.2 +	.7 +	.6 +	.45+
	"Bergey 6 "	Note W	4.65+	4.6 +	.3 +	3.6 +	.95+	.8 +	.35+
	"Bergey 7 "	Note X	4.15+	4.7 +	.7 +	3.3 +	.7 +	.8 +	.4 +
	"Bergey 34 "	Note Y	4.15+	4.1 +	.2—	3.2 +	.55+	.2—	Broken
	"Bergey 68 "	Note Z	5.25+	4.35+	.25+	3.10+	.75+	.15—	.55+
B. Diphtherie	1	Throat	4.9 +	.9 +	.8 +	4.35+	2.15+	.75+	.85+
	18	Lung	4.25+	.0 +	.65+	4.7 +	3.1 +	.5 +	.9 +
	22	Throat	5.00+	.65+	.7 +	4.75+	3.4 +	.7 +	.85+
	66	Throat	4.65+	.75+	1.2 +	4.8 +	1.9 +	.85+	.65+
	95	Throat	5.70+	§	.6 +	5.0 +	2.15+	.8 +	.65+
	96	Throat	¶ .60+	.9 +	¶ .6 +	¶ .6 +	¶ .6 +	¶ .6 +	†
	108	Eye	4.25+	.5 +	.8 +	5.05+	2.9 +	.5 +	.8 +
	111	Throat	3.00+	.45+	1.3 +	3.4 +	2.0 +	1.3 +	.85+
B. Xer-osis.	2131	Eye	3.4 +	.25+	.05+	2.9 +	.5 +	.00+	.1 +
	"Bergey 7 "		3.4 +	.1 +	.0 +	2.8 +	.55+	.1 +	.1 +
	B. Hoff- 61	Throat	.25+	.1—	.1—	.4 +	.25+	.00+	.00+
	manni 133	Throat	.1—	.05—	.4—	.45+	.1 +	.00+	.15—
	B. Hoff- 131	Throat	.6 +	.55+	.15+	.9 +	.6 +	.1 +	.3 +
	manni (?) 27	Throat	.6 +	.45+	.4 +	1.00+	.4 +	.3 +	.4 +
(?)	4	Throat	4.1 +	.5 +	.6 +	2.85+	1.1 +	.3 +	.4 +
	"Ruediger 4 "		.0 +	.2 +	.2 +	.2 +	.1—	.55+	.2—
	"Reddington "	Eye	¶ .6 +	.5 +	.7 +	1.05+	¶ .6 +	.7 +	¶ .6 +
(?)	"Q.L.N."	Nose	4.65+	4.85+	.95+	3.45+	2.55+	2.4 +	.85+
	Controls †	I+S	.6 +	.5 +	.6 +	.....	.....	.....	.....
	Not inoculated	NI+S	.....	.....	.....	.6 +	.....	.....	.....
		NI+NS	.6 +	.....	.....	1.05+	.85+	.....	.6 +
			.....	.....	.....	1.00+	.6 +	.....	.6 +
			.....	.....	.....	.9 +	.....	.....	.6 +
		NI+B	.....	.....	.....	.75+	.....	.....	.....

† = Sterile controls, not inoculated, titrated with and without previous incubation and steaming, are indicated thus:

†I+S Incubated 84 hours and steamed 16 minutes before titration.

†NI+S Not incubated but steamed 16 minutes before titration.

†NI+NS Not incubated and not steamed before titration.

†NI+B Not incubated but boiled three minutes before titration.

Note W "Tuberculous glands of neck."

.. X "Tuberculous abscess."

NOTE Y "Contused and lacerated wound."

.. Z "Osteomyelitis."

† Contaminated.

§ Contaminated. Earlier titration figures of culture No. 95 ran very close on saccharose to those produced by No. 108 on the same sugar.

¶ = No growths, broth absolutely clear. (Such are useful as controls, as conditions of growth, titration, etc., have been exactly the same as for inoculated cultures.)

sterile sugar solution. The tubed media were at once steamed in an "Arnold" for sixteen minutes, and after remaining for a period of fourteen hours at about 22° C., they received a final steaming for sixteen minutes. They were planted within two days, and all tubes were subjected to the same conditions of growth.

After eighty-four hours at 37.5° C. the cultures were steamed in an Arnold for sixteen minutes in convenient lots and rapidly titrated without agitation after the usual method in volumetric work, except that the above steaming was substituted for boiling. Indicator, Phenolphthalein. Initial reaction of all media .6 +.

Four of the cultures of *B. diphtheriæ* appearing in the table were obtained from patients of the institution during a mild epidemic of diphtheria there. Diphtheria bacillus culture No. 108 was obtained in nearly pure culture from the eye of a patient exhibiting marked local clinical signs of xerosis conjunctivæ, while previously and subsequently the eye yielded abundant cultures of true *B. xerosis*; No. 2131 is one of these.

FERMENTATION TABLE SHOWING ACID PRODUCTION IN EIGHTY-FOUR HOURS AT 37.5° C. ON VARIOUS .95% SUGAR BROTHS, OF "ORGANISM X," *BACILLUS DIPHThERiÆ*, *BACILLUS XEROSIS*, *BACILLUS PSEUDO-DIPHThERiÆ* (HOFFMANN'S *BACILLUS*), *RUEDIGER'S BACILLUS* AND OTHERS.

The table needs no explanation; bacillus Hoffmanni I use as synonymous with the term "pseudo-diphtheria bacillus." Of the *B. xerosis* cultures, 2131 has been referred to. It is well, however, to state that it always gave the dry, granular, clinging and friable surface growth on solid media which is so typical of *B. xerosis*; the same characteristic was shown even in the water of condensation and liquid media. Culture "Bergey No. 7," which was also typical in all respects, was obtained through the courtesy of Dr. Bergey. Of the cultures of *B. Hoffmanni*, two, Nos. 131 and 27, were not absolutely typical but probably they are correctly placed. "Ruediger 4" is one of Dr. Ruediger's organisms sent me by Dr. A. Hamilton.

Analysis of the table shows marked differences in the groups included. Organism X ferments glucose and saccharose rapidly and to the same degree, each reaching in eighty-four hours an acidity of from 4. + to 5. +. On maltose inoculated with Organism X the medium rises to 3. or 4. acid; little effect on the other sugars is produced by "Organism X."

B. diphtheriæ produces in eighty-four hours from 4. to 5. acid on glucose and maltose broth, also rises to 2. or 3. acid on dextrine broth, but shows no ability to ferment the other sugars to practical degree.

B. xerosis rises in this time to about 3.4 acid on glucose and about 3. + on maltose, but fails to produce acid on the other sugars, including saccharose.

B. Hoffmanni and Ruediger's bacillus fail to ferment even glucose.

"Organism X" is then clearly differentiated

from *B. diphtheriæ* by its ability to ferment saccharose with just as much ease as it ferments glucose, while *B. diphtheriæ*, *B. xerosis*, *B. Hoffmanni* and the bacillus of Ruediger are incapable of attacking saccharose to any marked degree. I therefore regard the differentiation of Organism X from these organisms as demonstrated.

Another organism closely resembling in morphology, etc., "Organism X" is *B. coryzæ segmentosus*. This organism (culture "Reddington") failed to grow satisfactorily in the plantings for the table already presented, but can still, I believe, be distinguished without uncertainty from "Organism X." "Organism X" is a hardy organism growing much better and faster than *B. coryzæ segmentosus*, which grows slowly with much smaller, less conspicuous colonies, which die out readily if not watched. *B. coryzæ segmentosus* is said to produce acid on saccharose, to less degree, however, than Organism X, and it should not, I think, be mistaken for the latter.

CONCLUSION.

"Organism X" resembles closely certain members of the corynebacterium group. Having failed thus far to more satisfactorily identify this organism, I offer, omitting here lesser peculiarities, for the organism temporarily designated "Organism X," the following major differential characteristics: (1) "Organism X" ferments rapidly and to like degree both glucose and saccharose broth (.95% sugar broth as prepared by me, rises from .6+ to 4. + to 5. + in either sugar in eighty-four hours at 37.5° C.). (2) Commonly under good conditions of growth on coagulated blood serum of about .5+, if not subjected to conditions inimical to pigment formation in general, "Organism X" produces a pigment of a faint salmon pink color which does not stain the media until after weeks or months. This appears in two to four days under favorable conditions. In very old cultures the pink is replaced by buff. Very rarely yellow is produced, but only after the salmon pink has been seen in previous generations for months, and then under unfavorable conditions. The tendency of transplants from such cultures, if started under good conditions, is to regain the power of producing a faint salmon-colored pigment.

The above characteristics differentiate "Organism X" from *B. diphtheriæ*, *B. xerosis*, *B. pseudo-diphtheriæ* (*B. Hoffmanni*), *B. coryzæ segmentosus* and from Ruediger's bacillus.

"Organism X" has been found by me a number of times at autopsy as well as during life, both in pure culture and mixed, in various pathological lesions and also when not associated with local disease. It has been found conspicuously in the bronchopneumonic lung in the insane, both in general paralytics and in non-general paralytics. It has been found in the internal organs and heart's blood at autopsy, but in such it has occurred in great numbers in the bronchopneumonic lung and associated empyema of the same case, when the latter complication existed. It has been found during life in pure culture in sputum from a

patient who showed such clinical signs as are consistent with the common post-mortem findings of other cases; when such clinical signs of purulent bronchitis and bronchopneumonia ceased, the common flora of the mouth could alone be seen in cultures, and "Organism X" appeared to be absent in the little mucus that could be raised from the upper air passages by coughing and gagging. I have found it in suppurating conditions elsewhere than in the respiration system.

Therefore I regard Organism X as a factor in disease, especially as at this time so much is heard of the rôle of "diphtheroids" in this and that condition. It is my desire to present later some evidence bearing on the rôle of Organism X in man, particularly its significance in bronchopneumonia and its occurrence in the general paralytic. Likewise, after considering the literature of diphtheria-like organisms, etc., I hope to offer some statistics on the "diphtheroids" in the throats of the insane.

PAINLESS LABOR. REPORT OF A CASE DUE TO A DESTRUCTIVE LESION OF THE SPINAL CORD.*

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CASES of painless labor, due to lesions of the central nervous system, are sufficiently unusual to warrant report. Such cases occur but seldom either in the experience of obstetricians or pathologists, and, therefore, may be regarded as of theoretical rather than practical interest. As a matter of fact, gross destructive lesions of the spinal cord during pregnancy serve as a physiological experiment, the significance of which should not be overlooked.

The case which has suggested the presentation of this subject before this society has already been reported at length in its various clinical and pathological details.¹ In this report the course and termination of pregnancy were alluded to as incidents in the process which was more particularly under consideration. I shall, therefore, not attempt to give the history of the case again in detail, except so far as it relates to the matters now under consideration.

The patient was a woman of twenty-four whom I first saw toward the end of her first pregnancy. She was at that time suffering from a beginning paralysis of the legs, together with sensory and sphincteric disorder, which within a few days developed into a complete motor and sensory paraplegia extending to a point about midway between the umbilicus and the pubes. The evidence from the clinical signs was conclusive that there was a complete transverse destructive lesion of the spinal cord involving the entire lumbar region. Under these conditions of complete motor and sensory paralysis of the lower extremities the baby was born.

Dr. J. C. Hubbard was in charge of the patient at this time, and up to Jan. 13 had noticed nothing exceptional in the course of the pregnancy. The severe character of the underlying lesion of the central nervous

system overshadowed the obstetrical condition. On Jan. 13 a routine examination by Dr. Hubbard showed definite uterine contractions as felt through the abdominal wall. No vaginal examination was made. The patient was conscious of these contractions, but made absolutely no complaint of pain and evidently experienced none. The fetal membranes had ruptured during the night. Dr. Hubbard expressed the opinion that labor was probably beginning, but did not feel that the situation was sufficiently urgent to demand his remaining with the patient. When he returned, about three hours later, the head was on the perineum, labor having been accomplished up to this point absolutely without pain and practically without the consciousness of the patient. The uterine contractions had evidently been adequate up to this time,* though probably somewhat lacking in force. The abdominal muscles, so far as ascertained, took no part in the process. There was no evidence that further progress would be made and delivery of a healthy, ordinary sized girl baby was effected without difficulty through the application of forceps. The perineum was torn and was at once sewed up without the slightest evidence of pain. There was no post-partum hemorrhage; the uterus contracted in perfectly normal fashion and without further incident. The entire labor had, therefore, been accomplished absolutely without pain, and the birth of the baby was merely an incident in the day, of small significance in comparison with the pain and distress caused by the underlying disease. There was some slight complaint when the placenta was expressed by the hand on the abdomen. The convalescence from labor was entirely uneventful, even the perineal wound healing without complication in spite of the complete anesthesia of the part and the urinary incontinence. The baby was not nursed. Dr. Hubbard has called my attention to the following points of special interest in the labor: first, its painless character; second, the absence of any distinctive use of the auxiliary muscles during the second stage; and third, the satisfactorily firm contractions of the uterus after delivery.

The patient died March 25, the paralysis of the legs remaining complete and the entire illness associated with much pain unexplained during life. The autopsy showed a completely destructive, sarcomatous tumor of the whole lumbar and sacral region of the cord, thence extending upward on its dorsal surface into the cervical region. The details of pathological findings are given at length in the paper to which I have already referred.

I wish now merely to call attention to the points which are of particular interest from an obstetrical standpoint, and especially to consider the following matters: first, the conditions under which painless labor may occur; second, the relation of the accessory abdominal muscles to the pains of labor; third, the general innervation of the uterus.

I. Olshausen² has pointed out that painless labor may occur in placenta previa with succulent soft parts, and also calls attention to the fact that under very rare conditions a labor may be wholly painless in normal persons. In this connection a recent paper by Wolff is of importance. Wolff³ reports the case of a primipara of twenty-eight, who had no pain whatever in spite of normal contractions of the uterus, and likewise made no use

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¹ BOST. MED. AND SURG. JOUR., 1907, clvi, 161.

² Olshausen: Zeitschr. für Geburtsh. und Gynäk., 1897, xxxvi, 369.

³ Bruno Wolff: Ueber Schmerzlose Geburtswehen. Arch. für Gynäk., 1906, lxxxvii, 402.