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ORIGINAL COMMUNICATIONS.

ARTICLE I. *Contributions to the Natural History of Specific Yellow Fever. Composition and Character of the Urine in Yellow Fever.* By JOSEPH JONES, M. D., Professor of Chemistry and Clinical Medicine, Medical Department, University of Louisiana, Visiting Physician of Charity Hospital, New Orleans.

Up to the present time our knowledge as to the composition of the urine in yellow fever has been imperfect. Beyond a few crude observations, and the important fact first announced in the work of Daniel Blair, that in this disease albumen appears in the urine, the medical profession has been without any quantitative determination of this excretion.

It will be my object in the present paper to extend our knowledge of the natural history of the terrible scourge of tropical and sub-tropical America, by presenting the results of careful and accurate quantitative analyses of the urine in cases of different degrees of severity.

REACTION OF THE URINE IN YELLOW FEVER.

The reaction of the urine in yellow fever is acid. Even in the gravest cases, attended with suppression of the urinary ex-

cretion, jaundice, and *alkaline black vomit*, the urine, however small the quantity excreted, maintains an acid reaction.

SPECIFIC GRAVITY OF THE URINE IN YELLOW FEVER.

As a general rule, the specific gravity of the urine in yellow fever does not vary greatly from that of health, and ranges from 1009. to 1028. In those specimens which gave the highest specific gravity, the increase in density was clearly referable to the increase of *albumen;* for when this constituent was coagulated by heat and removed by filtration, the urine was of low specific gravity.

Thus in a case in which the specific gravity of the urine was 1026, after the removal of the albumen the specific gravity was reduced to 1012.

In some of the gravest cases the specific gravity of the urine was only 1010, and presented a yellow color, and was turbid from the presence of cells and casts of the excretory tubes of the kidney and granular fibroid matters and colorless corpuscles.

COLOR OF THE URINE IN YELLOW FEVER.

During the early stages of the disease the urine is normal in color, clearness and quantity; as the disease proceeds, the urine becomes of a deep yellow color, from the admixture of bile, and at this stage, after the full establishment of the febrile excitement, about the third, fourth or fifth day, becomes turbid from the presence of the excretory cells, tube casts, and yellow granular albuminoid or fibroid matters. The color may deepen to orange red as the disease progresses; or if the case terminates fatally from diminution and suppression of the urinary excretion, it maintains a yellow color, sometimes presenting an oily appearance and motion, and consists of but little else than albumen, bile, excretory cells and casts of the tubuli uriniferi, in a weak solution of the urinary constituents.

In some cases of suppression, although the *urea* is greatly diminished in the small amount of urine excreted, it is rarely if ever entirely absent.

If the case ends in convalescence, the urine is copious and the color progressively increases in depth, and may even appear black when viewed *en masse*.

ALBUMEN IN THE URINE OF YELLOW FEVER.

As far as my investigations extend, albumen is an invariable constituent of the urine in well marked cases of yellow fever, and may appear as early as the first day of the disease, but most generally it appears upon the second, third or fourth day.

The first fact recorded with reference to the occurrence of albumen in the urine of yellow fever is to be found in the following note, by Dr. John Davy, to the 3d edition of Dr. Daniel Blair's work on the Yellow Fever of British Guiana:

"In many instances, in the fatal cases of yellow fever in Barbadoes, the kidneys have exhibited a congested state, with ecchymosis of the investing membrane; and the urine, during life, has been found to be albuminous, coagulating when heated on the addition of nitric acid: this I have learned from staff surgeon, Dr. Collings, who has made many observations and experiments on the subject. In a letter with which he has favored me on the 28th of December, 1848, he says—'In every case of decided yellow fever I have found the urine highly albuminous, a condition which it assumes about the second or third day, and maintains throughout, increasing as the disease advances, and in cases of protracted convalescence, continuing long after all symptoms but debility have left the patient.' Most of the albuminous precipitates he mentions were of a brownish color; in some cases, just before the fatal termination, the presence of blood in the urine may be recognized by the microscope. In two instances he found the albumen of the blood replaced by a substance having the properties of casein."—(Note by Dr. John Davy to 3d edition of "Some Account of the last Yellow Fever epidemic of British Guiana, by Daniel Blair, M. D., London, 1852, pp. 98-99.)

Blair, in his subsequent report, records similar facts—(*British and Foreign Medico Chirurgical Review*, April, 1856: vol. xvi., appendix, pp. 9-13.)

Crocker Pennel says that albumen is always present in the urine of yellow fever, and sometimes in such quantity as to make the urine quite solid with heat. (*Medico Chirurgical Trans.;* vol. xxxvi., p. 245.)

Ballot found albumen invariably in 300 cases.

Dr. Robert D. Lyons gives, as the result of his examination of the urine during the Lisbon epidemic of 1857, with reference to the presence of albumen:

"Albumen was found in the urine in the following order of association—

(*a*) "As the only abnormal element, with or without other blood element.

(*b*) "In company of abundant deposits of lithates, with or without deposits of purpurin, or other coloring matters in excess.

(*c*) "In connection with biliary coloring matters, the presence of which was shown by the usual reagents.

(*d*) "In connection with pyrexial states, and

(*e*) "In connection with apyrexial states."

Various other observers, as Dr. B. F. Gibbs, surgeon U. S. N., and Dr. Peyre Porcher, of Charleston, have confirmed the accuracy of the original observations of Dr. Collings, as contained in the work of Daniel Blair.

BILE IN URINE OF YELLOW FEVER.

The constituents of bile are almost universally present in the urine, even in those cases which progress favorably and end in convalescence, as will be illustrated by the following case:

Urine collected from a stout young man in Charity Hospital, September 30th, 1871, on 5th day of disease; patient at this time prostrated, with sluggish capillary circulation, slow pulse, and yellow color of conjunctiva. The symptoms, however, were favorable; the patient expressed a desire for food, and there was no restlessness, nausea, delirium, or aberration of nervous action. The urine presented a reddish yellow color, and upon chemical examination, was found to be acid in its reaction.

Specific gravity, 1020; bile and albumen present in considerable quantities.

Upon standing, the urine let fall a moderately heavy deposit of urate of soda, in the form of granules and globules, with stellate points attached; also prismatic crystals of triple phosphates.

The urine contained but few casts or cells from the excretory tubes of the kidney.

Neither vibrios nor vegetable cells, nor animalculæ of any description, were observed in the urine when freshly drawn.

The kidneys acted freely in this case, and the urine presented a reddish yellow color, and the patient progressed regularly and afely to complete health.

In grave cases of yellow fever, on the other hand, the urine is much less abundant, and at the same time it is of a much lighter color.

In many cases which recover, the urine presents a deep reddish yellow and brown color.

WHEN THERE IS NO SUPPRESSION OF THE URINARY EXCRETION, THE UREA IS INCREASED ABOVE THE STANDARD OF HEALTH, DURING THE ACTIVE STAGES OF THE DISEASE, AND DURING THE PERIOD OF EXHAUSTION OR CALM.

The following cases illustrating the preceding important proposition, render it evident, that the febrile excitement of the disease now under consideration, like fever generally, from whatever cause arising, or however excited, is attended with an increase of those excrementitious products which result from the chemical changes of the blood, organs and tissues. And we will show by another series of cases, that even when there is complete absence of the urinary excretion on account of congestion and structural alteration of the kidneys, urea is still formed in large amount, and accumulates in the blood and in certain organs, as the liver and brain.

CASE OF YELLOW FEVER ILLUSTRATING THE COMPOSITION OF THE URINE.

Albert Bugeu, age 37, native of Germany; light hair, light eyes; florid complexion; muscles well developed. Admitted into Charity Hospital, August 5th, 1871. At the time of admission patient had slight fever; hemorrhage from nose; conjunctiva congested; sclerotic coat of eyes, presents a yellow discoloration, with capillary congestion. The patient had suffered with fever for about 70 hours, before entering the hospital, and he appeared to be passing from the febrile stage to that of calm. Temperature of axilla this morning 98°; pulse 82. Temperature of axilla, in the evening, 100° F. Urine red colored, and loaded with albumen.

October 6th, 9 a. m.—Temperature 98°; pulse 82; 9 p. m., temperature 100°.

Examination of Urine.—Amount of urine collected from October 7th, 10 a. m. to October 8th, 10 a. m. (24 hours), 900 cubic centimetres (grains, 14341.2). Specific gravity 1020. Reaction

of urine strongly acid, which it retained apparently undiminished for several days. Upon standing, the urine let fall a light yellow flocculent deposit. This deposit was found, under the microscope, to consist of casts of the tubuli uriniferi, excretory cells of the tubuli uriniferi, colorless corpuscles, oil globules, granular, fibroid or albuminoid matter, and urates of soda and ammonia. The casts of the tubuli uriniferi and the excretory cells contained granular fibroid matter and oil globules.

Immediately after its passage, the urine was examined with magnifying powers ranging from 500 to 1080 diameters; but no living animal or vegetable organisms were discovered.

Upon standing, vibrios were developed.

When seen in mass, the urine presented a yellowish red color; but in thin layers it presented a decided orange yellow color. The yellow color was due to the presence of the coloring matter of the bile.

Upon analysis the urine yielded the following results.

900 *cc* (14, 341. 2 *grains of urine, excreted during* 24 *hours, contained):*

Urea	grains 611.42
Uric acid	16.50
Phosphoric acid	36.12
Sulphuric acid	42.71
Chloride of sodium	15.81
Chlorine in chloride of sodium	9.63
Phosphorus in phosphoric acid	15.86
Sulphur in sulphuric acid	17.08
Dried albumen	85.86

As this patient was in a state of absolute rest, and almost absolute starvation, it is evident that the urea, uric acid, and phosphorus and sulphur compounds were greatly increased; being almost three or four fold more than in the urine of a healthy individual similarly situated.

October 8th a. m.—Temperature 100°; pulse 85; p. m., temperature 100°. October 9th, temperature 98°; pulse 85, morning: temperature 100, evening. Patient weak, but continues to improve. Is able to take light nourishment with relish. Complexion sallow and slightly jaundiced.

Amount of urine collected during 24 hours, from October 8th, a. m. to October 9th a. m., 750 cc (grains 11.139.8). Specific gravity 1022. Reaction of urine strongly acid; the acid reaction

continued for several days upon standing. Urine, orange red color, with a yellow tinge, from the presence of bilary matter. The yellow color was very marked, when spread upon a white porcelain surface in thin layers.

Upon standing, the urine deposited a yellow layer of urinary casts and excretory cells, with oil globules and granular albuminoid matter and amorphous, urate of ammonia and soda. Under objectives ranging from 1-5 to 1-18 of an inch no vegetable or animal organisms were discovered in the fresh urine.

750 cc (grains 11.189.8) of urine collected during 24 hours contained:

Urea	grains 474.78
Uric acid	7.50
Phosphoric acid	30.88
Sulphuric acid	39.45
Chloride of sodium	21.29
Chlorine in chloride of sodium	12.20
Phosphorus in phosphoric acid	13.56
Sulphur in sulphuric acid	15.70
Dried albumen	56.25

October 10th, a. m.—Temperature axilla 98°; pulse 80. P. m.—Temperature 98°.

October 11th, a. m.—Temperature axilla 98°; pulse 80; p m. temperature 98°.

The patient continued to improve slowly but steadily. The urine gradually assumed the color of health; the albumen progressively decreased, and disappeared entirely on the 15th of October. The jaundiced appearance of the skin and eyes disappeared very slowly, and even after the apparent complete restoration to health, the skin and "whites" of the eyes presented a thoroughly jaundiced appearance.

Patient discharged on the 17th of October.

Commentary.—It is evident from the preceding analysis of the urine, in this case of yellow fever, that the *urea is increased at least four fold*, even in the stage of calm or depression: that is, the urea is at least four times more abundant than the amount of this constituent which would be excreted by a patient in health, similarly situated, lying perfectly quiet in bed, and taking little or no nourishment.

The same observation applies to the phosphoric and sulphuric acids. As the pulse and temperature had very nearly returned

to the normal standard we must refer the increased elimination of the urea, and phosphoric and sulphuric acids, to the effect of the preceding febrile stage; that is, to the changes excited by the febrile poison, during the first stage of incubation and active febrile excitement.

The urine collected on the 5th day of the disease yielded 36.12 grains of phosphoric acid, which is equivalent to 15.86 grains of phosphorus; and 42.71 grains of sulphuric acid, which is equivalent to 17.08 grains of sulphur.

As the patient, at this time, was taking no medicine, and little or no nourishment, it is fair to refer the source of the phosphoric and sulphuric acids to the changes of those constituents into the composition of which sulphur and phosphorus enter.

We have in these facts, determined by the analysis of the urine, data for the calculation of the amount of the constituents of the living solids and fluids, undergoing such changes as resulted in the formation of sulphuric and phosphoric acids. In such calculations, and in considering the several phenomena which mark the progress of yellow fever, we should never lose sight of the great importance of albumen in the living body. "It is met with," says Lehmann, "in the largest quantity, in the blood, and in all those animal juices which contribute towards the nutrition of the organs; and a more careful examination of many of the animal tissues shows that albumen requires only some very slight modifications to become consolidated under different forms; as, for instance, when it contributes towards the formation of the solid contractile parts, under the form of syntonin (muscle fibrin), by which alone both the voluntary and involuntary movements of the animal body are effected. We find it both in a dissolved and undissolved form in the most delicate organic combinations; as, for instance, in the contents of the nerve tubes." The essential condition for the conversion of this principle into organized living tissue, is the continuous supply and chemical action of oxygen; and the changes thus excited under the most various circumstances, give origin to the numerous metamorphoses which the molecules of albumen undergo, before their final change into urea and similar substances. We may therefore calculate the amount of albumen undergoing change in the body, either from the amount of urea, or sulphuric acid, resulting from the decomposition or chemical change of its individual constituents.

Chemists now recognize three well defined albuminoid principles: viz., albumen, fibrin and casein, the others are little known, and are possibly only mixtures. In a chemical point of view fibrin presents all the characters of insoluble albumen; it only differs from it by its fibrous form and its property of decomposing oxygenated water. The different substances in question appear identical in their elementary composition, the slight differences given by analysis being most probably due to impurities, for these uncrystalizable substances cannot be completely purified: and we may reasonably suppose that in reality there exists a single albuminoid substance, acting in the same manner as a weak acid, and capable, like certain well known bodies, of existing both in a soluble and in a coagulable state; if, therefore, the name albumen be reserved for this principle, fibrin should be considered as insoluble albumen, more or less mixed with earthy phosphates; albumen, as an acid albuminate of sodium, and casein as the neutral albuminate of sodium. As is well known, many chemists call in question the identity of composition of the albuminoid substances, holding it to be impossible to prove the identity of a body whose molecule is so complex, especially as the compounds cannot be obtained in a pure state for analysis. Whilst admitting that this reasoning may be sound, on the other hand it cannot be shown by analysis, that these substances are not identical, and moreover, they give the same products of decomposition; we shall, therefore, for the purpose of the present calculation, adopt the preceding hypothesis.

Rüling found the amount of sulphur in eighty analyses of albumen to vary from 1.29 to 1.39 in the 100 parts, with a mean of 1.3 per cent. In adopting, for the present calculation, the actual determinations of sulphur in albumen, by these chemists, it is not necessary that we should adopt the hypothesis of Mulder, that albumen is a compound of (hypothetical) protein, with (hypothetical) sulphamide.

The view held by Mulder and some other chemists, that albumen and fibrin contain a small quantity of phosphorous, as an organic constituent, does not appear to be tenable, and this substance cannot form the basis of calculation for the metamorphosis of the albuminoid substances in the living body; on the other hand, the sulphuric acid, appearing in the urine during rest and fasting, may be correctly assumed as a measure of the changes

of the albuminoid substances, as the proportion of sulphur appears to be very nearly the same in fibrin and albumen; and so intimate is its chemical union in these bodies, that it cannot be completely abstracted by the action of the alkalies.

If, therefore, every 100 grains of the dried albumen of the blood and tissues contain 1.3 grains of sulphur, it is evident that the 17.08 grains of sulphur excreted during 24 hours by this patient, represents 1308.3 grains of dried albumen; and as albumen forms 7 per cent. of the blood, 17.08 grains of sulphur excreted in the form of sulphuric acid during 24 hours, represented the metamorphosis of the albumen of 18,690 grains of blood.

If we assume that the phosphoric acid in the urine resulted from the metamorphosis of the nervous structures, and assume as the basis of the calculation the mean of certain chemical analyses, which give 1.6 per cent. of phosphorus in dried brain substances, then the 15.86 grains of phosphorus excreted, as phosphoric acid, during 24 hours, in this case of yellow fever, represented 991.2 grains of dried brain substance, or between 3964.8 grains and 4956 grains of fresh cerebral substance.

Such a calculation, however, would represent the changes of the cerebral and nervous substance in an exaggerated light, because a considerable amount of the phosphoric acid in the urine is derived from the phosphates of the alkalies, and alkaline earths, existing in the blood and organs, and especially in the osseous tissue.

The 85.5 grains of dried albumen excreted by the kidneys during 24 hours, represented the amount of this substance contained in 1220.94 grains of blood.

In many cases the albumen appears in much larger quantities, amounting to near one ounce of *dried albumen* during the 24 hours, which would represent the albumen of 14.28 ounces of blood, or nearly of one pound avoirdupois, or nearly 1.1-5 pounds troy of blood.

It is evident, therefore, that the loss of albumen by the urinary excretion in yellow fever must play an important part in the progress and result of the diseased actions, and that from this cause alone most important physical changes must be induced in the blood, while it is undergoing a loss of more than one seventeenth of the entire amount of albumen in 24 hours.

In this connection it is important to bear in mind, not only the great instability which characterizes and distinguishes the albu-

minoid from other organic principles, but also that certain substances in this group, simply by their presence, cause the hydration of other bodies by means of certain chemical changes.

Thus diastase, which is extracted from germinated barley, possesses this property in a high degree; but M. Pasteur having demonstrated that fermentation is owing to the development of living organisms, to which the name ferment should properly be applied, the name ferment is not suitable for certain forms of the albuminoid constituents which, by their presence, are capable of exciting certain chemical changes.

We are not justified, in the present state of our knowledge, in referring the chemical changes of the albuminoid substances which are so characteristic of yellow fever to the action of ferments, if this term is applied to living organisms; for, aside from the fact that living organisms characteristic of this fever have not been detected in the blood of the living patient, the phenomena may be explained by the supposition that the changes are induced by compounds which, like certain bodies, as the iodide of nitrogen, chloride of nitrogen, fulminate of mercury, nitro-glycerine and pyroxylin, are in a state of unstable equilibrium, but which are not themselves endowed with life.

The transformation of salacine into glucose and saliginin, and of amygdalin into glucose, bitter almond oil and hydrocyanic acid, by the emulsion of almonds (synaptase), the formation of volatile oil of mustard, in consequence of the action of the emulsion—like substance contained in it on the myronic acid, the rancid putrefaction of fixed oils in the presence of albuminous compounds, the rapid conversion of starch into glucose by diastase, as well as the remarkable changes of the blood and organs, characteristic of *acute atrophy* of the *liver* and *acute phosphorus poisoning*, are clearly not referable to the action of living organisms and germinal matter.

CASE ILLUSTRATING THE OCCURRENCE OF BLOODY URINE IN YELLOW FEVER.

N. O., medical student; resident student, Charity Hospital; native of Washington, St. Landry Parish, Louisiana; age 32. Large, well built, powerful man. States that he had an attack of yellow fever, August, 1870. The fever was prevalent at that

time in Washington. During the spring and latter part of the winter of 1872, I treated Mr. O. for severe and obstinate intermittent fever, attended with enlarged spleen and jaundice, under the persistent use of quinine and iron, with careful attention to the bowels, Mr. O. was completely restored to health. Mr. O. entered the Charity Hospital, March, 1872. Several cases of yellow fever were treated during the months of October, September and November in the wards to which Mr. O. was attached, he also assisted in several post-mortem examinations of yellow fever subjects, in the dead-house of Charity Hospital. The last case of yellow fever treated in the wards to which Mr. O. was attached, entered about the 1st of November, 1872.

November 19th, 1872, a. m.—Mr. O. says that he felt unwell, with pain in the head and back, and with oppression of breathing during the preceding night. I found him in bed. Appears drowsy and dull; complains of headache, oppression of breathing, sore throat, cough, and soreness over the whole body. No appetite Says that he has taken a violent cold, and fears pneumonia.

November 20th—During the night had hot fever which lasted several hours and was not followed by sweating. 10 o'clock a. m.—Fever; moderately rapid and full pulse; skin hot, tongue furred, red at tip and edges; capillaries of face, and of conjuntiva of eyes, congested; no appetite; restless; complains of headache and pain in back and thighs; oppression of breathing, sore throat, cough; soreness over the whole body: says that he "has taken a violent cold." Percussion revealed dulness over right lung; and upon auscultation, the vesicular murmur was found to be decreased, whilst the vocal fremitus was increased.

℞—Quiniæ sulph., grs. xv; pulv. ipecac et opii, grs xviij; mix: divide into three powders. One powder every three hours. Sinapism over right mammary, inferior mammary, and axillary and inferior axillary regions.

P. M.—The fever, which had increased at 6 a. m. this morning, continued unabated until 7 p. m., when there was a marked decline in its intensity; fever, however, continued during the night, and the restlessness and dyspnœa increased.

November 21st, 10 a. m.—Patient expectorates tenaceous yellow mucus, apparently tinged with the coloring matter of bile. Expectoration difficult; bowels constipated. Right lung congested, with increased vocal fremitus, and tubular breathing and

diminution of respiratory murmur. Capillaries of face, and of extremities and of eyes congested; capillary circulation sluggish. The countenance has a dusky, congested, unhealthy appearance.

℞—Pilulæ comp.: cathartic No.: iij; administer at once and follow with effervescing powder in three hours; and after action of cathartic, repeat mixture of quinine and Dovers powder (5 grains of quinine and 6 grains of Dovers powder) every three hours, until three doses have been taken.

8 o'clock, p. m —Fever has continued during the day; medicine acted promptly upon the bowels. Fever continued to increase until midnight, when the patient labored under great dyspnœa, fear and anxiety, and general congestion of capillary circulation. In my absence, the Resident House Surgeon of Charity Hospital was summoned, and administered 10 grains of quinine and 20 drops of laudanum (tincture of opium), which induced sleep and perspiration.

November 22d, 7 a. m.—Feels somewhat relieved; still under influence of opium; and appears dull and lethargic; at 9 a. m., dull and stupid, drops into a doze, and then wakes again. Disinclined to converse, anxious and restless. Capillaries of face congested, complexion of a dusky unhealthy hue, as in adynamic fevers. Capillaries of extremities and of the surface greatly congested, giving a mottled purplish hue. Liver found upon percussion to be considerably enlarged, and tender upon pressure. Expectoration of yellow sputa has ceased, and the congestion of the right lung has greatly diminished. Slight bright yellow tinge of surface. Abdomen tense and swollen. Intense pain in back and head. Pulse full and only moderately accelerated. Temperature elevated, about 105° F. Urine orange color, abundant, and contains bile and small quantities of albumen, with a few granular casts of urinary tubes, and excretory cells of kidney. After the first day, I watched this case with great interest, and upon this day announced that it was undoubtedly a case of yellow fever. The fact that the patient affirmed positively that he had suffered with yellow fever in Louisiana; the fact that he had been for some time a resident student of Charity Hospital, and had been upon many occasions in contact with yellow fever subjects in the wards and in the dead house, and the still more striking fact, that he had in the beginning of the attack suffered with sore throat, cough, oppression of breathing, congestion of the right lung, attended with the expectoration of tena-

ceous yellow sputa, led at first to a cautious examination and analysis of the symptoms, and a suspension of the final verdict as to the true nature of the disease: viz., yellow fever.

Examination of Urine.—Whole amount of urine not collected, but the kidneys are acting freely. There is no deficiency of urea, as each 10 cc. of that portion of the urine collected for examination, yielded 350 millegrammes of urea. The urine also contained albumen, 30 cc. of urine yielding upon analysis 0.4 grain of albumen. Reaction of urine strongly acid, which remained so, for more than one week. Red color, or rather, of deep orange red, presenting the appearance of deep yellow bile when seen in thin layers, and of a deep red color when seen in mass. Urine slightly turbid. Under the microscope (objectives varying from ¼ to 1.18 inch), it was found to contain a number of colored blood corpuscles, epithelial cells of the excretory tubes of the kidneys, casts of the tubuli uriniferi, filled with yellow granular albuminoid or fibroid matter. At the end of four days the reaction of the urine was still decidedly acid, and contained a number of vibrios and cells of sarcina ventriculi and of the torulæ cervisiæ.

November 22d, a. m.—Sluggish; attention not easily aroused; capillaries of face of conjunctiva and extremities greatly congested. Dusky, mottled hue of complexion. Abdomen swollen, and the patient complains that it feels "uncomfortably tight." Liver congested and enlarged; dullness, and tension or visible enlargement for 1½ inches below border of false ribs on right side. Pain in region of liver, spleen and kidneys—greatest in small of back, in region of kidneys. Kidneys acting freely; urine orange red; strong acid reaction; contains bile, albumen, blood corpuscles and casts of tubuli uriniferi. Intellect sluggish, not easily aroused; and after answering questions, relapses into a doze, as if under the action of some potent poison. Has fever; pulse frequent, but full.

Evening.—Pulse 108; respiration 24; temperature of axilla 102°. Urinates freely. Urine contains albumen, bile and casts of tubuli uriniferi, and blood corpuscles. The skin over the entire body has assumed a yellow, jaundiced hue. Tenderness over abdomen.

November 24th.—Rested well during the night. Patient says that during the night he felt as if something was giving way in his abdomen, and after this obtained relief. Some improvement in capillary circulation. 8 a. m.—Pulse 100; respiration 28; tem-

perature of axilla 101.75. Head quite clear. Lies on right side. Tenderness over abdomen disappearing, but pain increasing in region of spleen and kidneys. Skin dry and yellow. Stomach irritable. Sclerotic coat of eyes, yellow and injected. Tongue red, furred, and fissured in middle. Right lung relieved of congestion. No special feeling of congestion or oppression in breathing. Skin moist, and at times bathed in perspiration. Kidneys acting freely. Capillary circulation sluggish. Urine contains bile, albumen, casts, excretory cells of kidney and yellow granular matter. Urine abundant. Amount of urine passed during last 24 hours—Nov. 23d, 10 a. m., Nov. 24th, 10 a. m.—56 oz.(—1750 cc.); specific gravity 1016. Reaction strongly acid. Upon standing, the urine let fall a flocculent deposit, which consisted of numerous casts of the tubuli uriniferi and excretory cells, and granular albuminoid matter, and urate of soda and ammonia, colored yellow by the coloring matter of the bile. The tubuli uriniferi were filled with yellow granular matter. Urine also contained colored blood corpuscles and oil globules.

Rapid desquamation of the excretory cells of the congested kidneys is evidently proceeding. Upon standing, the urine retained its acid reaction, and numerous vibrios and torulæ cervisiæ, were developed. Urine presents a red color when seen in mass, and a yellow color, like bile, in thin layers.

Bile and albumen present; also *grape sugar* (diabetic sugar glucose) in small quantities. When dropped upon bibulous paper, a golden ring is formed by the coloring matter of the bile. After acidulation with a small quantity of acetic acid, boiling and filtration, so as to separate the albumen and casts, and excretory cells, the clear hot filtrate became turbid upon cooling, and let fall a heavy crystalline deposit of highly colored crystals of uric acid. Well formed *torulæ cervisiæ* also formed in the urine after boiling and filtration. No effort, however, was made rigidly to exclude the atmosphere after boiling the urine, and after the separation of the albumen by filtration, and this experiment is of importance as seeming to illustrate or indicate the fact, that the torulæ originally observed in the urine were developed from germs introduced from without, and not from those which might have been supposed to have been separated from the blood by the kidneys.

The development of these plants appear to have been favored by the presence of the grape sugar. The presence of the grape

sugar appears to have been due to the same causes which induced the bile in the urine, and also, perhaps, to the sluggish capillary circulation.

As the kidneys were apparently doing their full duty, I prescribed no drugs—only water charged with carbonic acid, and a small quantity of good French brandy diluted with the carbonic acid water, at intervals of three or four hours.

1750 *cubic centimetres of urine excreted during* 24 *hours—November* 23*d–*24*th—contained:*

Urea	grains, 693 00
Uric acid	19.50
Phosphoric acid	25.31
Sulphuric acid	49.70
Chloride of sodium	7.84
Albumen	12.50

10 o'clock, p. m.—Pulse 102; respiration 30; temperature of axilla 102° F. Urinary excretion continues abundant. Sinapisms have been freely applied over region of spleen and kidney. Complains of great pain over right kidney. (Apply mustard foot bath and continue carbonic acid water.)

November 25th, morning.—Rested pretty well during the night; complains of thirst; drinks freely of carbonic acid water; urinates freely. Free from pain and muscular soreness, with the exception of the pain in the region of the kidneys, which is now greatly mitigated. Temperature of axilla 98° 5′ F.; pulse 82; respiration 32. Complains of some pain in head. Amount of urine passed during 24 hours up to November 25th, 10 a. m., 1575 cc; specific gravity 1014; red color in mass, golden yellow in thin layers; turbid when passed, from presence of blood and casts, and cells of tubuli uriniferi; reaction strongly acid. The flocculent deposit, under the microscope, consists of casts of the tubuli uriniferi, and the excretory cells of the kidney, cells from mucous membrane of the bladder and pelvis of the kidney, blood corpuscles, and yellow granular matter and amorphous urates. The colored blood corpuscles have greatly increased in numbers, and present a regular form, with bi-convex outline. All the morphological elements (cells and casts) were colored by bile. When a piece of white bibulous paper was dipped in the urine, it was colored of a bright golden hue. Upon standing, the reaction of the urine continued acid, and numerous vibrios and cells of the torulæ, were developed. Urine contained a small quantity of

grape sugar. When the urine was slightly acidulated with acetic acid, boiled, and the coagulated albumen removed by filtration, upon cooling, the urine thus treated let fall a heavy deposit of lozenge-shaped crystals of uric acid.

1575 cc of urine collected during 24 hours contained:

Urea	grains, 593.50
Uric acid	10.50
Phosphoric acid	48.51
Sulphuric acid	41.74
Chloride of sodium	6.93
Dried Albumen	3.00

6 o'clock p. m.—Pulse 106; respiration 30; temperature of axilla 102° F. Skin deeply jaundiced. Patient resting quiet. No medicine prescribed: light nourishment at regular intervals, with carbonic acid water.

November 26th, 6 a. m.—"Rested badly during the night;" mouth very dry; much thirst; restless; oppressed; complains of feeling a "painful burning spot upon the top of the head." Lower extremities feel cool. Mustard frictions promoted capillary circulation and warmth, with some perspiration. There was no abatement of the pain in the head, however, after the establishment of the perspiration. Great pain and oppression in the head. Marked congestion of capillaries. Surface of face and extremities mottled and of a deep yellow color. Nausea, restlessness and sleeplessness during entire night, until 2. a. m., when ice was applied to head. The ice appeared to relieve the pain in the head, and the patient fell into a calm sleep, from which he awoke in the morning refreshed.

8.40 o'clock, a. m.—Temperature of axilla 101° F.; pulse 80; respiration 29. Amount of urine passed during the last 24 hours 1700 cc. Specific gravity 1016. Strong acid reaction. Urine turbid when passed, from presence of tube casts, excretory cells of tubuli uriniferi, mucus cells of bladder, ureter and pelvis of kidney, colored blood corpuscles, yellow granular fibroid matter and amorphous urate of ammonia and soda. Color of urine deep reddish brown. Under the microscope tube casts and excretory cells of kidneys abundant, also colored blood corpuscles, and cells from mucus membrane of bladder, ureter and pelvis of kidney. The casts were filled with yellow granular matter. All the cells as well as the casts and amorphous granular matter and water were colored of a deep yellow by the coloring matter of the bile.

Upon standing, numerous vibrios and cells of the torulæ were developed. I examined microscopically at the same time samples of urine passed by a distinguished member of the medical profession, who was laboring under diabetes melitus, and could perceive no difference in the mode of development and appearance of the fibres and cells and thallus of the torulæ developed in the diabetic urine and that of this case of yellow fever, which contained grape sugar as well as albumen and blood corpuscles.

1700 *cc of urine excreted during* 24 *hours, November* 25*th* 10 *a. m.–November* 26*th*, 10 *a. m., contained*

Urea	grains 827.76
Uric acid	21.42
Phosphoric acid	52.36
Sulphuric acid	45.61
Chloride of Sodium	6.54
Dried albumen	1.69

It is evident from the small amount of albumen, only 1.69 grains in 1700 cc of urine, that the amount of blood is comparatively small; although the colored blood corpuscles are seen in numbers in every drop of the fluid submitted to microscopic examination. After the slight acidulation of the urine with acetic acid, the application of heat, and the removal of the coagulated albumen by filtration, the fluid, upon cooling, let fall a heavy deposit of highly colored crystals of uric acid.

November 26th p. m.—Patient has been quite comfortable during the day, and appears to be improving. 10 o'clock p. m.—Pulse 68, slow and intermittent. Pulse intermits every three or four beats. Respiration 26. Temperature of axilla 100° 25′ F. Had a hard stool at 11 o'clock p. m.

November 27th—Slept well during the night. 7.30 o'clock a. m.—temperature of axilla 101° F.; pulse 80; respiration 20. Patient complains of some pain in muscles of legs; otherwise in excellent condition. No medicine. Light diet. Amount of urine passed during last 24 hours, November 26th, 10 a. m.–November 27th, 10 a. m.—1685 cc; specific gravity 1016; deep red color; clouded when passed, and heavy flocculent yellow deposits upon standing. Deposit consists of colored blood corpuscles, yellow granular matter, excretory cells and casts of the tubuli uriferi, and malpighian corpuscles and broken capillaries and cells from mucus membrane of bladder, ureters and pelvis of kidney, and granular amorphous matter and urates deeply colored

by coloring matter of bile. Reaction of urine acid. Small quantities of grape sugar present in urine; and upon standing, cells of the torulæ were developed.

1685 *cc of urine, excreted during* 24 *hours November* 26*th–November* 27*th, contained*

Urea	grains 778.47
Uric acid	16.85
Phosphoric Acid	56.01
Sulphuric Acid	41.68
Chloride of sodium	6.46
Dried albumen	2.52

During health it is probable that the blood chiefly supplies the elements of chemical change, but it is evident from the large amount of phosphoric acid and sulphuric acid excreted by the patient in a state of absolute rest and almost absolute starvation, that the nervous and muscular machinery themselves are involved in the increased chemical changes. After acidulating the urine with acetic acid, and after the removal of the albumen by filtration, the liquid, upon cooling, let fall a heavy deposit of high colored lozenze-shaped crystals of uric acid.

8 o'clock, p. m.—Pulse 96; respiration 22; temperature of axilla 100° 5′ F. Pulse still intermittent.

November 28th.—Rested well during the night; patient says that he feels well this morning- 8 o'clock a. m—Tongue moist, soft and clean. Temperature of axilla 99° 2′ F.; pulse 86; respiration 23. Capillary congestion greatly diminished; entire surface of body of a deep golden color. Has some appetite, and feels more cheerful; up to present time his spirits have been greatly depressed.

Amount of urine passed during 24 hours—November 27th, November 28th—1350 cc; specific gravity 1016; reaction acid; slightly turbid when passed, from presence of urinary casts, cells and granular matter. Blood corpuscles and tube casts diminishing in numbers. Color of urine brownish red.

1350 *cc of urine passed during* 24 *hours—November* 27*th, November* 28*th—contained:*

Urea	grains, 680.07
Uric acid	16.20
Phosphoric acid	46.81
Sulphuric acid	39.82
Chloride of sodium	6.23
Dried Albumen	1.125

After acidulation with acetic acid, boiling and removal of albumen by filtration, the urine, upon cooling, let fall heavy deposits of high colored lozenge-shaped crystals of uric acid.

The patient was comfortable and cheerful during the day. Capillary circulation restored. All appearances of congestion and mottling of surface have disappeared, and the deep golden color of the skin is beginning to fade gradually. 9 p. m.—Pulse 76; respiration 24; temperature of axilla 99° F.

November 29th, 8 o'clock, a. m.—Pulse 72; respiration 24; temperature of axilla 99° 2′ F. Patient continues to improve; jaundice disappearing; capillary circulation good; color of surface assuming a normal appearance, and the yellow hue is changing to a greenish cast. Appetite improving. Tongue clean. Says that he feels well, with the exception of a slight heaviness of the head. Bowels have been moved regularly during the past four days. Amount of urine passed during the last 24 hours—November 28th, 29th—1340 cc; specific gravity 1016; light red color, but much less deeply colored than during the active stages of the disease. Colored blood corpuscles, urinary casts and excretory cells still present, but in small numbers.

1340 *cc of urine, excreted during 24 hours—November 28th–29th—contained:*

Urea	grains, 660.35
Uric acid	10.92
Phosphoric acid	41.27
Sulphuric acid	——
Chloride of sodium	4.12
Dried albumen	0.67

P. M.—Continues to improve; complains of slight pain in head. Pulse 80; respiration 23; temperature of axilla 99° 4′. Bowels moved once.

November 30th, a. m.—Pulse 76; respiration 22; temperature of axilla 98° F. Continues to improve; good appetite. P. M.—Pulse 68; respiration 22; temperature of axilla 99° 4′. Continues to improve. Urine much lighter in color; abundant; and the albumen, blood corpuscles and casts, have disappeared; specific gravity 1016.

The convalescence of this patient was now rapid; he continued to gain strength, and was in a short time able to resume his post in the Charity Hospital.

On the 17th of December, he suffered with a paroxysm of malari-

al fever (chill followed by high fever). I ordered 10 grains of calomel and 5 grains of quinine, to be followed in six hours by saline cathartic; and after the bowels were unloaded, 5 grains of quinine every two hours, until twenty grains were taken.

Under this treatment relief was speedy, and up to the present time, August 24th, 1873, Mr. O. has enjoyed good health, and is stouter than ever before, weighing 200 pounds.

It will be observed that in the preceding case of yellow fever there was a marked increase in the urea, uric acid, phosphoric and sulphuric acid excretion; whilst there was a marked diminution of chloride of sodium.

There was no hæmorrhage from the stomach, but blood was discharged by the kidneys.

It is also worthy of note that grape sugar (diabetic sugar) appeared in the urine, during the active stages of the disease. I have never failed to detect both animal starch and glucose in the yellow fever liver, whilst grape sugar I have found to be absent from the liver of malarial paroxysmal paludal fevers.

In the following case of yellow fever large quantities of albumen were excreted in the urine, and which also contained in addition to bile, leucine, tyrosin and hæmatin.

CASE OF YELLOW FEVER COMPLICATED WITH CIRRHOSIS OF LIVER: INTENSE JAUNDICE: URINE LOADED WITH ALBUMEN, AND CONTAINED ALSO BILE, LEUCINE, TYROSINE AND HÆMATIN; PRECEDING MALARIAL FEVER AND INTERCURRENT PNEUMONIA.

Charles Bell, age 25, native of St. Louis, Missouri, entered Charity Hospital, ward 13, bed 189, October 15th, 1871. Patient states that he had been working on the Jackson Railroad for some time and came to New Orleans about two weeks ago (that is about the 1st of October), and about the 13th was taken with some fever, and being destitute was brought to the Charity Hospital for treatment.

On the morning of his admission, 3d day of disease, was found laboring under a severe fever; frontal headache and anorexia; conjuntiva and skin tinged of a red color; capillary circulation sluggish, giving a mottled, dusky, congested appearance to the surface; urine of a deep red color when seen in mass, and of a

bright golden color when seen in thin layers, or spread upon a piece of paper.

The urine was loaded both with bile and albumen, and resembled to a great extent the urine of yellow fever, only it was more deeply colored and of a redder hue than is usual in grave cases. Nitric acid produced a heavy precipitate colored of a deep green color from the presence of biliary matter, and more especially of the coloring matter of the bile. The patient appeared to be much prostrated from the fever, anorexia and profuse perspiration. Skin hot and moist.

On the morning of admission, I ordered 10 grains of quinine to be taken every four hours until 30 grains were administered. On the following morning the patient complained of pain in the right side, fever, and oppression of breathing; bowels constipated. Viewing this case as one intimately connected with, if not dependent upon the action of malaria, especially too, as the patient had been laboring in a low swampy region, along the Jackson and New Orleans Railroad, in the most sickly period of the year, 8 grains of calomel combined with 10 grains of quinine were administered at the morning visit. Light but nutritious diet; beef tea with small quantities of milk punch were ordered at regular intervals.

October 16th; morning.—The calomel has acted freely, but the patient is still suffering with high fever; is very restless. Marked capillary congestion in the extremities and upon the forehead, and dependent portions of the trunk. Surface presents a reddish and purplish mottled color. Lower lobe of right lung dull upon percussion; complains of pain in this region.

Urine copious, high colored, and loaded with albumen and bile.

Five grains of quinine and five drops of tincture of opium (laudanum) were ordered every four hours, and this combination of the sulphate of quinine with the officinal tincture of opium was administered three times a day, at intervals of four hours, until the 20th, without producing any perceptible change in the progress of the disease. It was evident that this was not a case of ordinary bilious remittent fever, and that quinine had no power to arrest the progress of the disease.

October 20th.—Fever still continues, with anorexia, restlessness, and great capillary congestion. When the fingers are pressed upon the dusky, purplish yellow surface of the forehead

and extremities, white or yellowish white marks remain, into which the blood sluggishly returns.

Color of urine when seen in mass, of a deep red color; when spread upon paper or a porcelain plate in thin layers, of a deep golden yellow. The urine contained a flocculent deposit, which, upon microscopical examination, was found to consist of golden yellow excretory cells of the tubuli uriniferi, casts of the tubuli uriniferi filled with yellow granular matter, and numerous bright red annular and acicular crystals, and globular masses of leucine tyrosine and heamatin; blood corpuscles, mucus corpuscles, and exudation corpuscles. The red acicular conglomerated crystals were not dissolved by acetic acid. The excretory cells of the kidney contained numerous yellow granules. There were no oil globules, as in the urine of many severe cases of yellow fever. The casts of the tubuli uriniferi were more delicate, and less distended, and contained less granular matter and oil globules than similar deposits in grave cases of yellow fever.

Reaction of urine strongly acid, and remained so at the end of 60 hours; specific gravity of urine 1026.

Heavy deposits of golden colored albumen upon boiling, and the albumen was coagulated in such large amount as to transform the whole quantity of urine thus treated into a thick gelatinous mass, resembling "boiled custard."

After the coagulation and removal of the albumen, the specific gravity of the urine passing through the filter was 1012; thus by the removal of the albumen the specific gravity was reduced from 1026 to 1012.

650 *cc.* (*grains* 11,901.60) *of urine collected during* 24 *hours contained:*

Urea	grains 401.44
Uric acid	9.75
Phosphoric acid	15.93
Sulphuric acid	17.49
Chloride of sodium	3.84
Chlorine in chlorides	1.20
Dried albumen	452.40

A portion of urine was lost during its collection, on account of the extreme illness and restlessness of the patient; it is evident, however, that there is a marked increase of urea and uric acid above the standard of health, during rest and starvation. The

loss of albumen by the urine is also very great, being one ounce in the portion of urine collected.

There is also a marked diminution of the chlorides; and such diminution is characteristic of the urine in yellow fever, as it is also of the urine of pneumonia, small pox, and some cases of typhoid fever.

Patient complains of severe pain in right side (dulness upon percussion over region of lower lobe of right lung); great difficulty of breathing; slight, painful cough, but no expectoration. Surface bathed in perspiration; this symptom does not possess the same significance that it does in malarial fever. Skin of a deep jaundiced hue; capillary circulation very much embarrassed. Tongue red at tip and edges, and furred in the centre. The nurse reports that the patient threw up a small quantity of black material, like black vomit, during the night; but as the matter ejected was not preserved, it was impossible to determine its chemical and microscopical character. In order to influence the capillary circulation, and, if possible, to arrest black vomit, upon the supposition that it might in a measure depend upon a want of tonicity in the capillaries, in some measure at least, I ordered 40 drops of the tincture of ergot every three hours.

October 21st, 10 a. m.—Patient very restless and feeble; great difficulty and oppression of breathing; great capillary congestion of surface and dependent portions of body. Eyes watery. Conjunctiva and skin deeply jaundiced. At times slight wandering of intellect. The patient complains of pain in right side. Tongue red at tip and edges, and coated in the centre. Anxious countenance. Patient complains of pain in head and side. Some appetite for food. Pulse 130; respiration 18; temperature of axilla 102° 5′. The nurse states that the patient again threw up black vomit during the night; matter again not saved. ℞—Pulv. ergot, grs. xv; divide into three powders: one powder every four hours. ℞—Olei terebinth, f℥iij; syrupi simp., f℥vj; mix: tablespoonful every three or four hours during the day.

Amount of urine collected during the past 24 hours, 500 cc.; a portion appeared to have been lost. Urine of red color, when seen in mass; in thin layers, of a golden color; when shaken in a bottle, it presents an oily appearance; when dopped upon white bibulous paper, it gave a golden yellow stain like bile. The urine contained a flocculent deposit; the deposit was found, upon

microscopical examination, to consist chiefly of casts of the tubuli uriniferi, excretory cells of the kidney, granular fibroid and albuminoid matter, altered colored blood corpuscles, and accicular, globular, and stellate conglomerate crystals of leucine, tyrosine and heamatin.

Reaction of urine strongly acid, even at the end of 60 hours. Urine heavily loaded with bile and albumen. Specific gravity of urine 1026; specific gravity after removal of albumen by heat and filtration, 1012.

When heated, the urine formed a yellow gelatinous mass, of the consistence and color of *"boiled custard."*

The following is the analysis of that portion of the urine which was collected:

500 cc (8013.06 grains) of urine, collected during 24 hours, contained:

Urea	grains 308.80
Uric acid	7.50
Phosphoric acid	21.61
Equivalent of phosphorus in phosphoric acid	9.50
Sulphuric acid	13.72
Equivalent of sulphur in sulphuric acid	5.48
Chloride of sodium	3.03
Chlorine in chloride of sodium	1.84
Dried albumen	348.00

The patient became more restless during the night. In the evening, 8 p. m., pulse 140; respiration 52; temperature of axilla 103° 5 F. Later in the night, although the patient was unable to articulate distinctly, he appeared to suffer excruciating pain in the right side and in the head.

The great difficulty of breathing, and livid color of the blood in the capillaries, during the past four or five days, appeared to be due to the congestion of the lungs.

11 p. m.—Pulse 130; respiration 52; temperature of axilla 103° 5.

Died at 5 o'clock, a. m., October 22d.

Amount of urine collected during the last 24 hours of life, 300 cc.; specific gravity 1028; red color, when seen *en masse;* golden yellow in thin layers. Heavy flocculent deposit, consisting of casts of the tubuli uriniferi, excretory cells of the kidney, altered colored blood corpuscles, and crystals of leucine, tyrosine and heamatin.

Reaction of urine decidedly acid, and continued so for two days. Upon standing, the urine emitted a foul, stinking odor.

Urine loaded with albumen and bile; specific gravity of urine after coagulation and removal of the albumen 1014; it is evident that the albumen had increased the density to 1028.

The microscopical and chemical characters of the urine were similar in all respects to those observed in the preceding samples.

300 *cc of urine (grains* 4731.6) *collected during the last* 24 *hours of life contained:*

Urea	grains 198.17
Uric acid	4.50
Phosphoric acid	5.55
Equivalent of phosphorus in phosphoric acid	2.44
Sulphuric acid	14.92
Equivalent of sulphur in sulphuric acid	5.96
Chloride of sodium	3.68
Chlorine	1.91
Dried albumen	207.14

We have in this case, a progressive diminution of the urinary excretion whilst the temperature remained at an elevated point; urea must, therefore, to a certain extent, have accumulated in the blood; but this accumulation was much less than in many grave cases of yellow fever attended with great nervous agitation, restlessness, convulsions, vomiting of alkaline black vomit and coma.

The elevation of temperature as well as the rapid pulse and rapid labored respiration were evidently due to pleuro-pneumonia engrafted upon yellow fever.

We observe a great relative increase of the sulphuric acid, and a marked decrease of the chlorides, and an abundant transudation of albumen and bile, together with hæmatin, colored blood corpuscles, leucine and tyrosine.

AUTOPSY FIVE HOURS AFTER DEATH.

Exterior.—Dependent portions of head, neck, trunk, and extremities of a deep purplish and yellowish purple mottled color. Superior portions of the face, trunk and extremities, where the capillary congestion was less, of a bright yellow, jaundiced color.

Thorax.—The sinapism had produced a decided blister, upon

the right side, the cuticle being denuded, and the raw surface presented a dark purplish hue.

Pleura of right side, firmly bound, in several places, by adhesions of coagulable lymph, which appeared to have been thrown out for some time, and was undergoing transformation into organized fibrous tissue.

Superior portion and surface of pericardium of heart also covered with golden colored coagulable lymph.

Muscular structures of heart pale, and more flabby than usual, but of a deeper color than in cases of yellow fever which ran their course without any inflammatory complication.

Cavities of heart filled with loosely coagulated blood.

Lungs.—Greatly congested; lower portions of right lung congested with blood, as if there had been rupture of the vessels, and effusion of blood among the tissues. The congested or hepatized portion of lung sank when immersed in water.

The cut surface of the muscles of the thorax and abdomen changed to a bright hue when exposed to the atmosphere.

Abdomen.—Mucus membrane of stomach rose colored and punctated, but less congested than is usual in yellow fever. The stomach contained no black vomit.

Liver.—Of a yellow mottled appearance, the lobuli beingdistinct, with congested centres, of a purplish yellow color, and peripheral portions of a deep yellow. The lobuli started out when cut, and the organ was evidently cirrhosed previous to the supervention of the fever, and was firmer than is usual in uncomplicated yellow fever.

The liver contained numerous oil globules, but they were neither so large nor so numerous as in yellow fever livers, which were in a healthy state previous to the supervention of the disease. The liver cells also were paler, and contained less oil and granular matter than in uncomplicated yellow fever.

Masses of altered hematin were observed chiefly in the periphery of the lobules of the liver. The presence of these black pigment granules, and masses of altered hæmatin, indicated that this patient had suffered with malarial fever before, and perhaps at the time of the recent fatal illness, and the correctness of the diagnosis was thus established.

Spleen.—Somewhat enlarged and softened, but not, however, to so marked an extent as in uncomplicated malarial fever.

Kidneys.—Of a yellow granular appearance. The yellow granu-

lation was most marked in the cortical portions. Color of kidneys orange yellow. Under the knife the kidneys appeared firmer than usual, and as if cirrhosed. Capillaries of kidneys congested; the congestion was greatest in the capillaries of the malpighian corpuscles.

When carefully prepared sections of the kidneys were viewed under the microscope, the capillaries of the malpighian corpuscles were filled with colored corpuscles, whilst the tubuli uriniferi were encumbered, in some cases impacted, with yellow granular matter, exfoliated excretory cells, and oil globules. Acetic acid rendered more evident the granular albuminoid or fibroid matter in the urinary tubes, and also revealed degeneration of many of the excretory cells.

Gall Bladder.—Only partially filled with bile, only 200 grains being obtained. Specific gravity of bile 1041; bile thick and turbid. Numerous cells from the mucus membrane of the gall bladder floating in the bile. When seen en masse, the bile presented a deep greenish yellow color; in thin layers, a golden yellow color.

COMMENTARY.—The preceding case of yellow fever appears to have been preceded by cirrhosis of the liver and kidneys and malarial fever, and to have been complicated during its progress by the supervention of pneumonia, pleuritis and pericarditis.

The fatal issue of the case appeared to have been determined chiefly by the inflammatory complications, and to the same causes must be referred the rapid pulse, rapid labored respiration and elevated temperature. The preceding cirrhosis of the liver and structural alterations of the kidneys were probably the result of the prolonged action of the malaria. I have carefully observed a number of cases of cirrhosis of the liver caused by the prolonged action of malaria, and am convinced that this condition of the liver, resulting from malaria, may be clearly distinguished from that induced by alcoholic stimulants, by the presence of numerous black pigment granules scattered through the lobuli, and by the absence of any marked increase of oil globules in and around the hepatic cells, capillaries and ducts.

I have never observed black pigment granules occurring in cirrhosis induced by spirit drinking, and uncomplicated by the action of malaria.

How far the increase of albumen in the urine may have been

due to the preceding alterations of the kidneys I am unprepared to say; but that this condition was not without some effect upon the urinary excretion must be admitted.

During the three last days of the life of this patient 1007.54 grains of dried albumen escaped in the urine; and the actual quantity was probably much greater. The albumen was separated with the greatest care, and was carefully washed with diluted nitric acid and with alcohol and ether before desiccation.

In these analyses, as well as in all the others recorded in these pages, the sulphuric acid of the urine was precitipated with the nitrate or chloride of barium, after the complete removal of the albumen by heat and coagulation and filtration; and the nitrate of silver was in like manner employed for the precipitation and determination of the chlorine. The balance, and not the method by tritration, was employed in these determinations, and the results were as accurate as it was possible to make them by the careful performance of all the various processes.

1007.54 grains of albumen, excreted during the last days of life, represented the albumen of 14,397.64 grains of blood.

It will be a question for future research, as to the occurrence of *globulin* in the urine of yellow fever, associated with the albumen.

In some recent observations, E. Hefsen affirms, with some degree of confidence, that he has found *globulin* in thirty-one cases of albuminuria (Virchow's Archives, vol. lx., p 437); it must be admitted, however, that the separation and determination of the globulin, with any approach to accuracy, is attended with difficulties and even uncertainties, especially when the globulin exists only in small quantities.

We will consider, in the next place, those cases of yellow fever in which the urine is either greatly diminished in amount or wholly suppressed.

DIMINUTION AND SUPPRESSION OF URINE IN YELLOW FEVER.

Case of Yellow Fever: Suppression of Urine—Jaundice—Copious Alkaline Black Vomit—Fatal Termination—Post-mortem Examination—Lesions Characteristic of Yellow Fever—Urea and Bile Detected in the Brain, Heart, Liver and Spleen—Little or no Urea Detected in the kidneys.

Newton Simpson; age 21; native of Western Virginia; admitted into Charity Hospital October 12th, 1871.

Patient gives an imperfect account of his sickness; says that he has been living in St. Louis for some time; came down to New Orleans ten days ago; was taken sick a few days after his arrival.

On questioning the patient closely, it appears that he was taken sick about six days ago with fever, thirst, anorexia and pain in the head, back and limbs. Patient is unable to state how long these symptoms lasted, but not getting better, he came to the Charity Hospital. On admission he complained of pain in the back, head, and over the region of the stomach, thirst and fever. At the present time, eyes, tongue, skin and mucus membrane of mouth, congested; tenderness upon pressure over abdomen. Urine of a golden color, loaded with albumen, and greatly diminished in amount. Urine turbid from the presence of urinary cells and casts.

October 13th; evening.—Patient says that he feels better, but he is still in an unnatural state, like one intoxicated. Temperature of axilla 100° F.; pulse 80; respiration 16. Ordered the urine saved at 1 o'clock p. m. The nurse and attendants were strictly charged to save every particle of urine passed by the patient.

October 14th, morning.—Vomited some bread which he had eaten against orders; complains of nausea. Temperature of axilla 101° F.; pulse 72; respiration 16 per minute. Mustard plaster ordered over region of stomach. Diet, beef tea; fragments of ice in mouth to allay thirst.

Amount of urine collected during 24 hours—October 13th, 11 a. m., to October 14th, 11 a. m—110 cc. (grains 2833.6); specific gravity 1012. Urine of a golden yellow color, slightly turbid. The urine contained a light flocculent deposit, which under the microscope (powers varying from 1-5 to 1-20 of an inch) was resolved into oil globules, casts of the tubuli uriniferi, and granular, fibroid and albuminoid matter. The casts of the tubuli uriniferi were composed chiefly of yellow granular fibroid matter. When first passed, the urine contained no living microscopical plants or animals perceptible under the highest powers, but after standing for some time, vibrios made their appearance. Vibrios form in this moist, warm climate, in very short periods of time, in all organic solutions, especially when albumen is present. When treated with acetic acid, lozenge shaped crystals of uric acid made their appearance. The yellow granular matter of the

urine in this case appeared clearly to have been derived from the kidneys, as it was insoluble in acetic acid and in the mineral acids, and often presented the form of the tubuli uriniferi, as if the agglomerations had been formed in the tubuli uriniferi, and were subsequently expelled. The tubuli uriniferi, and excretory cells of the kidney, were loaded with yellow granular matter and oil globules, and were numerous.

A portion of the yellow granular matter forming the deposit in the urine consisted of urate of ammonia, for acetic and hydrochloric acids caused the separation of well defined lozenge shaped crystals of uric acid.

180 cc. (grains 2833.6) of urine was the whole amount passed during this period, and the bladder at this time contained no urine, as was conclusively shown by the failure of the catheter to draw off any urine.

Specific gravity of urine 1011; urine of a light yellow color. Reaction slightly acid. The acid reaction of the urine continued even to the end of the third day, although the temperature of the surrounding atmosphere was high. At the end of this time it gave only a faint urinous odor.

As far as my observation extends, the urine of yellow fever, when fresh is free from any disagreeable odor, and in some instances, when freshly drawn, emits a faint sweetish aromatic odor.

180 *cc.* (*grains* 2833.6) *of urine contained:*

Urea	grains, 77.81
Uric acid	14.40
Phosphoric acid	11.106
Equivalent of phosphorus in phosphoric acid	4.87
Sulphuric acid	6.175
Equivalent of sulphur in sulphuric acid	2.46
Chloride of sodium	3.649
Actual amount of chlorine in urine	2.224
Dried albumen	5.82
Fixed saline constituents	10.80

We observe from the preceding analysis, that the urine presented very nearly the composition of a similar amount of this excretion in health, with the exception of a great increase of uric acid (14.4 grains), and a relative increase of phosphoric acid, and the presence of albumen, granular albuminoid matter, and urinary casts and excretory cells.

October 14th.—Patient restless and in a state of delirious intoxication; has passed no urine since early in the morning. Tongue dry, very red at tip and edges, and coated in the middle. Mucus membrane of gums, mouth and eyes, congested; countenance dull and lethargic. The patient, however, when roused, says he is well and feels hungry and desires something to eat.

The patient, however, is in an unnatural state, resembling that induced by alcohol and certain narcotic poisons, in some individuals. The muscles of the face twitch nervously; the patient is very restless and appears to be wholly oblivious to his distressing condition.

The skin of the face presents a dusky, jaundiced hue; there is great capillary congestion, especially of the extremities. When the dusky, purplish, red surface is pressed with the finger a white spot is left, into which the blood slowly returns.

Patient has passed no urine during the day, and the use of the catheter shows the urine to be completely absent from the bladder. Temperature of axilla 100° 8′; pulse 80; respiration 18.

October 15th, 9 a. m.—Complains of pain in region of stomach; has been vomiting black vomit during the night and morning. Patient very restless, with a mottled, congested appearance of the surface. Tongue dry and red; pulse full, regular, and apparently good, 80 per minute; respiration 20; temperature of axilla 101° F.; patient dull, lethargic, but not actively delirious.

The black vomit was carefully collected, and subjected to an immediate examination.

This specimen corresponded in its general character to the typical black vomit of many writers. It consisted of a thin fluid, holding in suspension dark flocculi and coffee-like, or dark brownish black granules. The dark masses tended to settle, and above the dark granules the liquid was clear.

Reaction of black vomit, acid.

Under the microscope numerous altered blood corpuscles were observed diffused through the liquid, and the dark flocculent masses were found to be composed of altered blood corpuscles and fragments of the coloring matter of the blood. Numerous cells of the mucus membrane of the stomach were also present; and the cells appeared to have undergone a change similar to that observed in the excretory cells of the tubuli uriniferi, and were filled with numerous small granules and oil globules.

When the black vomit was carefully examined under magnify-

ing powers varying from 1-5 to 1-18 of an inch, a few vibrios and a delicate branching fungus were seen, resembling those commonly developed in putrid fluids with great rapidity in this warm, moist climate.

The blood poured out into the stomach in yellow fever rapidly undergoes change from the loss of digestive power in the stomach, and from the presence of the urinary constituents eliminated by the gastric mucus membrane: the blood oozing from the gums and lips also undergoes decomposition and forms the nidus for the development of numberless plants and animalculæ of simple organization.

I have as yet been able to establish no relationship between the organic forms of black vomit and the characters, symptoms and progress of the disease. There appears to be no relationship of cause and effect between them: the presence of these forms appears to be a mere coincidence.

I also clearly observed under the microscope a number of broken capillaries in this sample of black vomit, which were filled with blood corpuscles variously altered in shape.

Specific gravity of black vomit.....1008
Reaction of black vomit.....Acid.
Solid matter in 100 parts of black vomit.....grains, 2.3
" " " 1000 " " " 23.00
Water " " " " " 977.00

Solid matters of black vomit consisted chiefly of colored blood corpuscles, coloring matter of the blood, and albumen.

Saline matters in 100 parts of black vomit.....0.2
" " " 1000 " " " 2.00
Organic matters in 1000 parts of black vomit.....23.00 { Organic matters.....21.00 / Saline matters.....2.00

On account of the great restlessness of the patient, one-third of a grain of morphia was administered by subcutaneous injection.

Evening.—No urinary secretion; complete suppression of urine during the past 24 hours. The morphia induced some rest, and appeared to arrest the vomiting. Capillary circulation greatly embarrassed. The injection of morphia was repeated, but with no perceptible effect, the stagnation of the blood in the capillaries apparently preventing its absorption. Pulse slow and moderately full.

The patient died at 10 o'clock, p. m., and up to the time of death no urine had been passed.

There was complete suppression of urine during the last 40 hours of life.

AUTOPSY TEN HOURS AFTER DEATH.

Exterior.—Black vomit running from the mouth. Superior portion of skin and face golden colored. Lower dependent portions of a mottled, dark purplish and yellow hue, as if the body had been beaten with a club. Muscular, well built subject.

Head.—The membranes of the brain were congested, but not to a greater extent than is usual in fevers. There were no marks of inflammation or of exudation upon the membranes of the brain. The congestion appeared to be of the nature of a simple stasis of blood.

Weight of brain 55½ ounces.

Structure of brain moderately firm; no serous accumulations. In ventricles of brain only a small amount of serous fluid. The suppression of urine was not in this case attended with increase of the serous fluid of the ventricles of the brain.

After careful microscopical examination, with powers varying from ¼ to 1-18 of an inch objective, and the various occularies, I was unable to detect any structural alterations in the ganglionic cells or commissures of the brain; neither were any living animal or vegetable cells or spores, however small, discovered.

When the brain was finely comminuted in a porcelain mortar, and distilled water added in sufficient amount to make a thin paste, and then boiled, and the fluid filtered off from the coagulated nervous structures, the decoction presented a golden yellow color. Careful chemical examination showed that this color was due to the presence of bile.

The watery extract was then slowly evaporated to dryness and treated with alcohol. The alcoholic extract in like manner presented a golden yellow color, and contained some of the constituents of bile. When the alcoholic extract thus obtained was allowed to evaporate slowly under the microscope upon a glass slide or in a watch glass, crystals of leucine, phosphate of ammonia, chloride of ammonium and of urea, made their appearance. When chemically pure nitric acid was added, numerous lozenge shaped and tabular, rectangular, thin crystals of urea made their

appearance. The urea appeared to be at least one thousand fold more abundant in the textures of this yellow fever brain than in the brain of those subjects whose kidneys have acted fully and freely up to the moment of death.

The existence of urea in this brain, in considerable quantities, was clearly demonstrated to several distinguished physicians of New Orleans, as well as to a large number of students of the Medical Department of the University of Louisiana.

Both bile and urea were thus shown to have accumulated in the brain of this yellow fever subject.

Thorax.—Lungs congested with blood. The capillary congestion was especially intense in the more dependant portions.

The tendency to capillary congestion in yellow fever is one of the most marked characteristics, and affects all the organs and tissues. The distension of the capillaries with blood, and the bloody appearance of the muscular structures, cellular tissue, and lungs especially, are due in great measure to the arrest of the functions of the kidneys and liver, and the retention, not only of the excrementitious materials, but also of the watery element of the bile and urine.

When careful sections of the lungs were made, with Valentin's knife, the microscope revealed a distended and congested state of the capillaries, which were impacted with colored blood corpuscles. Nothing further, however, was discovered in this examination; no animal or fungoid forms were discovered in the blood of the capillaries of the lungs, or in the air cells.

Heart.—The heart contained in all its cavities dark fluid blood. The muscular structures of the heart presented a yellow color, like that of the kidneys, and appeared as if they were undergoing fatty degeneration. The muscular textures were softer than usual. The muscular structures of the heart were carefully examined under the microscope, and the fibres were found to have lost their distinct transverse markings, and to have become loaded with oil globules. Oil was deposited throughout the textures of the heart.

Weight of heart, 8½ ounces.

When the fibres of the heart were crushed in a mortar, and subjected to similar treatment to that employed in the examination of the brain, the watery and alcoholic extracts presented a golden color, from the presence of the coloring matter of the bile. The watery extract, or rather, decoction of the heart, before fil-

tration, resembled a rich soup made from marrow of bones, the surface of the porcelain evaporating dish containing the decoction being covered with a thick scum of yellow oil.

When the alcoholic extract from the evaporated residue of the watery extract of the heart was evaporated slowly in a watch glass, crystals of chloride of ammonium, leucine and of urea, were clearly observed under the microscope.

Chemically pure nitric acid, added to the watery extract, obtained from the residue of the alcoholic extract or solution (which was itself obtained from the residue of the water extract obtained directly from the structures of the heart), developed numerous characteristic lozenge shaped and tabular crystals of nitrate of urea.

EXAMINATION OF THE BLOOD FROM THE CAVITIES OF THE HEART.

Reaction of the blood from the cavities of the heart, acid. Under the microscope many of the blood corpuscles presented a crenated wrinkled appearance, others were swollen, whilst others, again, presented a normal appearance.

I could not, after careful examination with high powers, detect any animalculæ or simple vegetable forms in the blood, although the search was conducted with great care, with powers of various degrees, from the 1–4 to the 1–18 inch objectives, the magnifying power with the highest objective reaching 1050 diameters.

The blood was fluid, with little or no fibrin or fibrinous clots.

The fibrin was in so small amount, and in such a soft (readily dissolved) condition that it was impossible to estimate the amount.

Specific gravity of blood		1046
1000 *parts of blood contained:*		
Water		852.70
Solid residue, 147.30	Organic matter	137.50
	Fixed saline constituents	9.80

The specific gravity of the blood from the heart was lower, and the solid matters less than in the blood of the vena cava.

From experiments which I have conducted, it appears that the specific gravity of the blood in the cavities of the heart, after death from yellow fever, is less than that contained in the large blood-vessels.

This appears to be due to several causes, as the effusion of the more watery elements of the muscular structures of the heart through its walls after death, into its cavities, and also because this organ continues to circulate the blood, or rather, to force it through its cavities during the last moments of life; the red blood corpuscles are thus gradually arrested in the capillaries, and only the more tenuous or serous portions of the blood are returned to its cavities during the last moments of life.

Alimentary Canal.—Mucus membrane of stomach intensely congested. The stomach contained only a small quantity—about f℥j—of dark, thick black vomit, which emitted a foul, offensive smell, and contained numerous blood corpuscles, and cells of the mucus membrane of the stomach, and fragments of capillaries, loaded with colored blood corpuscles. With the exception of a few vibrios, no vegetable or animal forms were observed.

The mucus membrane of the stomach presented an intensely injected appearance, and a deep purplish color.

The reaction of the black vomit and mucus membrane of the stomach was alkaline, and a rod, dipped in hydrochloric acid and held over the stomach, gave forth dense white fumes, from the presence of ammonia and carbonate of ammonia. The reaction between the hydrochloric acid and volatile alkali of the black vomit was marked, and the fumes of chloride of ammonia very dense. The urea eliminated by the stomach had been partially converted into ammonia and carbonate of ammonia: we say partially, because I found upon analysis, urea in considerable amount.

The extract of the different organs also contained carbonate of ammonia; and this fact indicates either that the urea was partially converted into carbonate of ammonia in the blood, or else that this substance was reabsorbed from the gastro-intestinal mucus membrane.

Reaction of small intestines alkaline. The fluid contents of small intestines contained ammonia.

Spleen.—Weight of spleen, 12½ ounces; somewhat enlarged, and somewhat softer than usual in yellow fever. Splenic mud consisted of numerous colored corpuscles, and oil globules and granular masses; but no animal or vegetable forms were observed.

Blood corpuscles of spleen not specially altered in appearance. Oil globules abundant in spleen. The spleen, as well as the

heart and brain, contained urea. The decoction of the spleen presented a mahogany brownish red color, from the presence of the coloring matter of the blood.

Liver.—Of a yellow box-wood color, resembling a fatty liver. Under the microscope the liver appeared to be filled with oil. The liver cells were distended with oil and granular matter, and the hepatic ducts appeared to be blocked up with oil globules and granular matter.

The liver cells presented a swollen, spherical appearance, and were distended with oil and granular matter. The changes of the liver were similar to those of the heart and kidneys. The matter deposited in the liver was not, however, entirely oil, but was of a fibroid and albuminous character, and was coagulable by heat.

Weight of liver, 42 ounces.

After standing 24 hours, the blood from the cut surface of the liver gave an acid reaction, and was found under the microscope to contain numerous prismatic crystals of the phosphate of ammonia, magnesia and lime.

The blood of the liver contained numerous oil globules, but no specific animalculæ or vegetable organisms. The reaction of the cut surface of the liver, when first removed from the body, was in like manner acid.

Bile—Gall-Bladder.—Only partially filled with bile, and presented a flaccid appearance. The coats of the gall-bladder appeared to be thickened.

Specific gravity of bile, 1042.5.

The bile gave forth, after standing a few hours, a most disagreeable, stinking odor.

The bile was thick, grumous and ropy. When viewed *en masse*, the bile presented a dark greenish brown, almost black appearance.

The gall-bladder contained only 100 grains of this thick ropy bile. Upon careful evaporation, the 100 grains of bile yielded 14.25 grains of solid residue; and upon incremation, 1.1 grains of saline matter.

1000 *parts of bile contained:*

Water			857.40
Solid residue, 142.50	}	Organic matter	131.50
	}	Saline matter	11.00

In this case the bile was almost as rich in solid matter (rela-

tively) as the blood. Æther throws down the coloring matter from the alcoholic extract of the bile in yellow fever, but the etherial extract, as is usual with human bile, yields upon evaporation no crystals under the microscope.

Under the microscope the bile was found to contain some blood corpuscles, and epithelial cells and casts of the biliary tubes, composed of granular, fibroid or albuminous matters, similar to those found in the tubuli uriniferi of the kidneys.

Kidneys.—Weight, 10¾ ounces. These organs presented a light yellow color, similar to that of the liver. Under the microscope, it was found that both the cortical and medullary substance of the kidneys were filled with oil globules.

When careful sections of the kidneys were made, with Valentin's knife, and examined under different powers of the microscope, the malpighian corpuscles were greatly congested with blood, and the tubuli uriniferi and excretory cells filled with oil globules and yellow, granular fibroid matter.

The bladder of this patient contained after death 100 cc. of urine; this was the entire amount excreted by the kidneys, from October 14, 11 a. m., to October 15th, 10 p. m., the moment of death.

During a period of 35 hours, therefore, only 100 cc. of urine were separated from the blood.

The urine presented a light golden yellow color, and turbid, oily appearance.

Specific gravity of urine, 1012.

The urine, upon standing, let fall a heavy light-colored flocculent deposit. Under the microscope this deposit was found to consist of casts of the tubuli uriniferi, filled with granular matter. Sections of the kidney of this yellow fever patient were carefully compared with the deposits under the microscope, and the tubuli uriniferi in both were found to have undergone a similar change. In fact, the tubuli uriniferi of the kidney itself were loaded with oil globules and granular matter, of a yellow color, in a precisely similar manner.

Somewhat similar appearances are presented in the urine of malarial heamaturia; that is, in some cases, after congestion of the kidneys resulting in hæmorrhage has continued for varying lengths of time, exfoliation of the excretory tubes and cells takes place; but the casts and cells are not of the golden hue of yellow fever, they are frequently either stained with the heamatin of the

blood, or else the urinary tubes are loaded with altered blood corpuscles and the altered coloring matter of the blood.

ANALYSIS OF THE URINE ABSTRACTED FROM THE BLADDER OF THIS PATIENT AFTER DEATH.

Amount of urine excreted during the last 35 hours of life, 100 cc. (grains 1580.74); reaction, acid; specific gravity 1012.

100 *cc. of urine (grains* 1580.74) *excreted during* 35 *hours contained:*

Urea	grains, 33.96
Uric acid	2.00
Phosphoric acid	4.32
Equivalent of phosphorus in phosphoric acid	1.89
Sulphuric acid	2.74
Equivalent of sulphur in sulphuric acid	1.09
Chloride of sodium	7.70
Chlorine in urine	4.69
Fixed saline constituents	6.00
Dried albumen	9.00

This sample of urine approached more nearly to the standard of health, in its chemical constitution, than that excreted on the 14th of October. Thus in the latter the uric acid was greatly increased, amounting to 14 grains.

If the two analyses of the urine of this patient be combined, we will thus have a correct view of the amount and character of the urinary excretion during the last 59 hours of life.

Urine Excreted during 24 *Hours—October* 13, 11 *a. m., October* 14*th*, 11 *a. m.*—180 *cc. (grains* 2833 6) *contained:*		*Urine Excreted during* 35 *Hours—October* 14*th*, 11 *a. m., to October* 15*th*, 10 *p. m.*—100 *cc. (grains* 1580.70) *contained:*	
Urea	grs. 77.81	Urea	grs. 33 96
Uric acid	14.40	Uric acid	2.00
Phosphoric acid	11.10	Phosphoric acid	4.32
Phosphorus in phosphoric acid	4.87	Equivalent of phosphorus	1,89
Sulphuric acid	6.17	Sulphuric acid	2 74
Sulphur in sulphuric acid	2.44	Sulphur in sulphuric acid	1.09
Chloride of sodium	3.64	Chloride of sodium	7.70
Chlorine	2 22	Chlorine	4.69
Fixed saline constituents	10.8	Fixed saline constituents	6.00
Dried albumen	5.82	Dried albumen	9.00

If the preceding analyses be combined, we will then have the analysis of the urine excreted during 59 hours, as in the following table.

Urine excreted during 59 hours—October 13th, 11 a. m., to October 15th, 10 p. m.—280 cc. (grains 4414.30) contained:

Urea	grains 111.77
Uric acid	16.40
Phosphoric acid	15.42
Equivalent of phosphorus in phosphoric acid	6.76
Sulphuric acid	8.91
Equivalent of sulphur in sulphuric acid	3.55
Chloride of sodium	11.34
Chlorine in urine (chloride of sodium)	6.91
Fixed saline constituents	16.80
Dried albumen	14.82

It is thus established that during the last 59 hours of life, only 111.77 grains of urea were excreted by this patient, notwithstanding that there was fever and great nervous agitation, restlessness, and aberration of intellect, which are always accompanied by an increased formation of urea.

It would be just to estimate the amount of urea actually formed within the system, during the last 59 hours of life, at not less than 1500 grains; the amount may have greatly exceeded this calculation: if from this be subtracted the actual amount excreted by the disabled kidneys, we have, as the result, not less than 1388.23 grains of urea remaining in the system. The amount was probably much greater, as the cessation of the function of the kidneys was most probably gradual and not sudden.

We have in this large amount of urea retained in the blood and various organs, and especially in the brain, as shown by actual analysis, an explanation of the peculiar state of intoxication manifested by the patient, as well as the existence of alkaline black vomit.

CASE OF YELLOW FEVER: ALKALINE BLACK VOMIT; SUPPRESSION OF URINE; DEATH; PATHOLOGICAL LESIONS.

Jacob Siegarest; age 26; native of Germany; admitted into Charity Hospital October 14th, 1871.

Patient states that he came from Havre, three months ago, to New Orleans, since which time he has been living at 433 Tchoupitoulas street. "Was taken sick with fever" five days ago. At the present time—October 14th, evening—intellect dull, and the patient appears to be unable to express his feelings or explain

his symptoms. Commenced vomiting blood shortly after his admission into the hospital, and this vomiting has continued up to the present time, at short intervals. The blood is gulped up with little or no effort.

Patient lies quiet; does not complain of any pain, or even uncomfortable feeling. When, however, pressure is made over the region of the epigastrium, shows signs of distress. Complexion jaundiced and dusky; tongue dry, red at tip and edges; tracheal mucus membrane of mouth and gums congested; dark blood oozing from gums. Capillary circulation feeble and depressed. When pressure is made upon the discolored mottled surface, the blood is forced out of the sluggish capillaries and a white spot remains, which gradually assumes the dusky, congested appearance, as the dark blood slowly returns. Pulse 84, full and apparently of good volume; respiration 16; temperature of axilla 100° 5′.

It is worthy of note, that in cases of uncomplicated yellow fever, during the most dangerous period, viz., that characterized by exhaustion, passive hæmorrhages, black vomit, jaundice, and suppression of the urine, neither the respiration nor the pulse are increased in frequency, and may be even slower than in health.

When, however, an inflammatory disease is engrafted upon yellow fever, as pneumonia, pleuritis, pericarditis, or abscess, the pulse and respiration are both increased in frequency.

October 14th, morning.—Bowels opened once during the night; vomited black blood this morning. Condition of patient much the same, only he appears weaker and more lethargic; appears to be wholly unconscious of his condition, notwithstanding that dissolution appears to be imminent. Temperature of axilla 101° F.; pulse 92; respiration 20. Has passed no urine since admission into the hospital; catheter introduced, and only about one drachm (60 drops) of turbid yellow urine were drawn off. Reaction of urine, acid. Urine contained bile, and was also loaded with albumen. Under the microscope, the turbidity of the urine was found to be due to the presence of numerous casts of the urinary tubes, filled with granular, fibroid matter and oil globules: the excretory cells of the tubuli uriniferi, and from the pelvis of the kidney, were also present in large numbers.

Evening.—Patient has remained in the same listless, depressed state, without active delirium, and apparently wholly unconscious of his distressed state. Still vomiting small quantities of dark,

defebrinated blood. Has passed no urine during the day; it is impossible to draw off any by the catheter, and the bladder is entirely empty. The kidneys have ceased to act.

Temperature of axilla 100° F; pulse 80; respiration 18.

EXAMINATION OF BLACK VOMIT.

It should be borne in mind that this patient has suffered with complete suppression of urine since his entrance into the hospital. The catheter was introduced, as we have said, several times, and only upon the first introduction was about one drachm of light colored yellow turbid urine drawn off, which, as we have stated, was loaded with albumen and urinary casts and cells. This represents the whole amount of urine excreted during 30 hours.

At the present time, October 15th, the patient gulps up, with little or no apparent effort, what resembles almost pure dark defibrinated blood. As we have stated, this vomiting of blood was noticed shortly after his entrance into the hospital.

The black vomit resembles in appearance and in color, dark defibrinated blood.

Under the microscope, the black vomit was found to consist of numerous blood corpuscles, with some mucus cells and broken capillaries filled with blood corpuscles; but no living vegetable or animal organisms were discovered with the highest powers of the microscope. I have kept blood drawn from yellow fever patients, also sections of the liver, taken from the bodies of yellow fever patients after death, upon my table, freely exposed for days and weeks, and months, in this warm, moist climate, and examined with the microscope and with the naked eye, the vegetable structures which formed within and upon the surface, reasoning thus—that if the disease had been caused by fungi, they would sooner or later make their appearance upon the surface of the organs and blood, which were supposed to form a nidus for their development.

Up to the present time, nothing peculiar to yellow fever has been discovered. Blood now standing upon my table, exposed in an open beaker glass (said blood having been drawn, some two weeks before, from the arm of a yellow fever patient), has upon its surface a light white mould, which presents under the microscope the appearance of the yeast plant. Similar growths appeared upon starch and urine, and albuminous fluids, and

upon organic substances which had no connection whatever with yellow fever.

ANALYSIS OF BLACK VOMIT, EJECTED BY THIS PATIENT DURING LIFE.

Black vomit resembles dark grumous defibrinated blood.

Black vomit emits a disgusting putrid odor.

Specific gravity of black vomit 1020.

Reaction of black vomit, alkaline.

Heavy fumes of chloride of ammonium evolved, when a glass rod dipped in hydrochloric acid is held over the black vomit.

Careful chemical analysis demonstrated the presence, in the black vomit, of both AMMONIA and UREA.

The UREA was separated from the black vomit with great care, and every precaution was employed in the analysis to secure accurate results.

1000 *parts of black vomit contained:*

Water		935.20
Solid residue, 74.80	Organic matter, consisting chiefly of colored blood corpuscles, altered coloring matters of the blood	72.20
	Albumen	
	Urea	
	Ammonia	
	Fixed saline constituents	2.60

The black vomit was carefully examined for *iron*, and this constituent was present in the same relative proportion that would have been present in an equivalent amount of ordinary blood.

The presence of unaltered blood corpuscles, as well as of the broken capillaries, in the black vomit, is proof that there is a solution of continuity of the mucous membrane of the stomach in some cases of yellow fever; and that black vomit is not a secretion, strictly so called, although it may be intimately associated with the elimination of certain elements of the urine, by the gastric mucus membrane.

The cells of the mucus membrane of the stomach were filled with granular matter and oil globules; thus indicating that a similar change takes place in the mucus membrane of the stomach, which is so marked in the excretory structures of the kidneys.

This patient died, October 16th, at 6 a. m., without becoming actively delirious, although the intellect was sluggish and wandering.

AUTOPSY THREE HOURS AFTER DEATH.

Exterior.—Black vomit had run out of the mouth down the sides of the face and along the chest. Complexion, golden yellow; dependent portions of body mottled with yellow and purple; intense capillary congestion of dependent portions of the trunk and extremities.

Thorax.—Heart of a light yellow color, relaxed and flabby. Weight of heart, 8½ ounces. Under the microscope, the textures of the heart were found to be loaded with oil globules.

The decoction of the heart was covered with a thick layer of golden-yellow oil, resembling the rich soup from marrow bones.

The alcoholic extract from the watery extract gave crystals of leucine, and chloride and phosphate of ammonia, and urea, under the microscope.

When treated with nitric acid, numerous well formed lozenge-shaped crystals of nitrate of urea were developed.

Both cavities of the heart contained warm fluid blood, which gave a slight acid reaction to litmus blue, and upon standing, coagulated, forming a soft gelatinous clot, which possessed no contractile power.

The aorta, vena cava, and pulmonary arteries and veins, in like manner, contained warm fluid blood, which coagulated imperfectly upon standing.

EXAMINATION OF FLUID BLOOD, FROM CAVITIES OF HEART, THREE HOURS AFTER DEATH.

The blood, after its abstraction, coagulated, forming a loose clot; the fibrin, however, rapidly dissolved, and no serum was separated.

Under the microscope, the blood corpuscles presented no special alteration: when spread upon the glass slide, and also during the coagulation of the blood, they rapidly agglomerated together, forming rouleaux, as in inflammatory diseases.

The running together of the colored blood corpuscles was as rapid and complete as in cases of well marked inflammation.

It was impossible to determine the weight of the fibrin, or to

collect pure serum, free from the colored blood corpuscles and the coloring matter of the red corpuscles, as the fibrin rapidly dissolved.

The fibrin appeared to be in very small amount; it was not more than one-twentieth of the quantity usually found in healthy blood.

Specific gravity of blood from the cavities of the heart, 1047.

1000 *parts of blood from the cavities of the heart contained:*

Water			821.57
Solid residue, 178.43	Organic matter		
	Colored corpuscles		
	Albumen-fat		170.59
	Urea ammonia, extractives		
	Fixed saline constituents		7.84
	Fibrin		Trace.

EXAMINATION OF FLUID BLOOD FROM VENA CAVA ASCENDENS, THREE HOURS AFTER DEATH.

Specific gravity of blood from vena cava, 1062. Blood of vena cava fluid and warm when first drawn; coagulated, forming a very loose coagulum, which did not enclose the whole amount of colored blood corpuscles.

This coagulum gradually dissolved, and it was impossible to determine the amount of fibrin, or to obtain clear serum free from colored corpuscles.

Reaction of blood from vena cava, slightly acid.

1000 *parts of blood from vena cava contained:*

Water			775.00
Solid residue, 225.00	Organic matters		
	Colored blood corpuscles		217.13
	Albumen fat and extractives		
	Urea and ammonia		
	Fibrin		Trace.
	Fixed saline constituents		7.69

It will be observed from the preceding analysis, that the blood in the vena cava contained more solid matter than that obtained from the cavities of the heart. It would appear that the returning current of blood from the capillaries and venous system, owing to the tendency to coagulation, and to the settling of the colored corpuscles, contained more solid matter than the blood of the heart.

After careful microscopical examination, I was unable to discover any animal or vegetable organisms in the blood.

Abdominal Cavity—Stomach.—The stomach contained a small quantity—about one fluid drachm—of black vomit, which gave a strong alkaline reaction. Under the microscope, the black vomit was found to consist chiefly of colored blood corpuscles, cells of the mucus membrane of the stomach, and broken capillaries, floating in an alkaline albuminous fluid.

Reaction of mucus membrane of stomach, strongly alkaline.

When a rod dipped in hydrochloric acid was held over the mucus membrane of the stomach, dense white fumes of chloride of ammonium were given off.

Reaction of intestinal canal, in like manner, alkaline from the presence of ammonia.

After careful microscopical search for living organisms, no vegetable cells or animalculæ were discovered in the contents of the stomach or intestines.

The cells of the mucus membrane of the stomach were filled with oil and granular matter (the oil in the form of small globules), and presented an appearance similar to those of the kidneys and liver.

This observation appears to throw some light upon the causes of black vomit, and indicates that the poison of yellow fever affects the mucus membrane of the stomach, producing profound alterations, similar to those existing in the liver, kidneys and heart, as if the most active organs were those most subject to its action: this would most probably be the case if the poison acted chiefly upon the blood.

Liver.—Weight of liver, 48¾ ounces. Liver of a uniform yellow color; the appearance and color of this organ was characteristic of yellow fever.

Liver loaded with golden yellow oil. Oil, in the form of globules, existed within and around the liver cells and capillaries.

The hepatic capillaries contained oil globules and granular matter. The structures of the liver also contained much yellow granular albuminoid matter.

The granular matter found in the liver of yellow fever is similar to that observed in the kidneys, and is different from that black granular pigmentary matter of malarial fever, which is thickly deposited in the lobuli of the liver, being, as a general rule, most abundant upon the periphery of the lobuli, and in the capillaries of the portal system.

I have never observed in the yellow fever liver the disorganized red corpuscles and masses of hæmatin characteristic of malarial fever. This observation applies to uncomplicated yellow fever. When, however, yellow fever is engrafted upon malarial fever, or occurs in one who had suffered at some previous time with a prolonged attack of malarial fever, the pigment granules are present. And without doubt, the contradictory statements of the appearance of the liver in yellow fever, may to a certain extent be referred to the presence or absence of the effects upon this organ of the malarial poison.

Both the watery and alcoholic extracts of the liver were of a golden color, and contained bile. Leucine and urea, and ammonia salts, were detected in the alcoholic extract obtained from the watery extract of the liver.

Urea in considerable amount was determined by the standard chemical method.

After standing 24 hours in a porcelain dish, the blood which flowed gradually from the cut surface of the liver was found, under the microscope, to contain numerous prismatic crystals of triple phosphate and oil globules, but no specific animal or vegetable organisms.

The GALL-BLADDER was flaccid, and contained only 110 grains of dark green, almost black, *bile*. In thin layers the bile presented a golden yellow color: a few drops of this concentrated bile were sufficient to color, of a decided yellow color, a large basin full of water.

Specific gravity of bile, 1040.

110 *grains of bile contained:*

Water	grains,	86.55
Organic matters		13.45
Saline constituents		1.26

1000 *parts of bile contained:*

Water		877.73
Solid residue, 122.27	Organic matters	110.82
	Fixed saline constituents	11.45

The coloring matters of the bile were precipitated by æther from the solid residue in considerable amount; but, as is usual with human bile, no crystalline substances were obtained.

Kidneys.—Somewhat congested. The kidneys presented a yellowish color, or rather brownish yellow color, of a similar but deeper shade to that of the liver and heart.

The structures of the kidney cut under the knife like those of

the liver. There were no granular appearances, as in cirrhosis, or granular degeneration. Tubuli uriniferi filled with oil globules and granular matters.

The decoction of the kidney contained bile, but yielded little or no urea. This was the case with the kidneys in the previous case. It would appear that the urea was in greater amount in the brain, next in the heart, then in the liver and blood, and lastly, in the kidneys. This organ without doubt continued to excrete the constituents of urine, as long as life lasted, in very small amount, and it is to this cause that we must attribute the small amount of this constituent in these organs. We have in such facts a refutation of the views held by certain physiologists, that urea is formed in the kidneys. I could get only traces from these organs, by processes which yielded abundant crops of crystals from the brain. Weight of kidneys, 12½ ounces.

The bladder, after death, contained only 115 cc. of urine, which was the whole amount excreted by the kidneys from the entrance of the patient into the hospital up to the time of death.

The urine gave an acid reaction immediately after its removal from the bladder, three hours after death. The urine, however, changed in 24 hours to an alkaline reaction, and then threw down an abundant crop of crystals of triple phosphate, and emitted a most foul stench, resembling that of the American Polecat. The odor was disgusting in the extreme.

Specific gravity of urine, 1012.

The urine contained a flocculent deposit, consisting of granular matter, casts of the tubuli uriniferi, and cells from the excretory structures of the kidney.

Here, then, in these two cases of yellow fever, lying side by side, in the same ward, in adjoining beds, almost, precisely the same amount of urine was obtained from the bladder after death; the physical and microscopical characters were the same; the chemical characters also were alike.

Specific grvity of urine 1012.

Amount of urine obtained from bladder after death, 115 cc. (grains 1821.6) representing the whole amount of urine excreted during the last 45 hours of life.

Urine excreted during 45 hours (grains 1821.6) contained:

Urea	grains 35.74
Uric acid	Undetermined.
Phosphoric acid	2.12
Phosphorus in phosphoric acid	0.93
Sulphuric acid	7.10
Sulphur in sulphuric acid	2.84
Chloride of sodium	4.66
Chlorine in chloride	2.83
Fixed saline constituents	5.75
Dried albumen	11.42

Spleen.—Weight, 5½ ounces. Spleen not enlarged but normal in appearance; under the microscope the splenic mud contained, in addition to altered colored corpuscles, numerous oil globules. Decoction of spleen contained both urea and uric acid.

The urea was in less relative amount in the spleen than in the liver and brain.

The whole amount of urea excreted during the last 45 hours of life amounted to only 35.14 grains. The amount of urea retained in the blood of this patient, in consequence of the suppression of the action of the kidneys, was therefore as great as in the preceding case, and the peculiar state of intoxication must be referred, in like manner to the retention of the urinary excretion.

It is evident that during the active stage of yellow fever profound changes take place in the organs and tissues, and especially in the *kidneys*, heart and liver; and oil and granular fibroid or fibroid matters transude through the capillaries, and fill up the cells and excretory ducts, and arrest the functions of these organs.

The appearance of albumen in the urine of yellow fever is attended also with the presence of casts of the tubuli uriniferi, and also of the excretory cells of the kidney. This phenomenon resembles that of scarlet fever, and also of malarial hæmaturia.

In intermittent, remittent and pernicious malarial paroxysmal fever, uncomplicated by hemorrhage from the kidneys; albumen and casts are almost always absent, as I have demonstrated by numerous careful chemical and microscopical examinations, and the urine presents periodic changes in its constitution corresponding with those of the paroxysms.

Thus, during the chill, and at the commencement of the hot stage of malarial paroxysmal fever, phosphoric acid dis-

appears almost entirely from the urine; as the hot stage progresses, and the febrile action and the heat commence to decline, there is an augmentation of phosphoric acid, and most generally heavy crystalline deposits of the triple phosphates and amorphous urates; uric acid is either increased or remains at the normal standard during the chill, disappears almost entirely during the fever, and then increases rapidly, and rises to a high figure after the subsidence of the febrile excitement, and very often continues, for days, two, three, and even six times more abundant than in the normal state.

Both urea and chloride of sodium appear in increased quantities during the chill and fever. If the disease be prolonged, the chloride of sodium progressively decreases, from the diminution of the usual supply of food during the fever, whilst the urea remains in large amount.

The fever of the *first stage* of yellow fever, like *fever in general*, however caused, consists essentially in elevation of temperature, arising from chemical changes in the blood and tissues, and is attended with changes in the physical and chemical constituents of the blood, and aberrated nervous action. As long as the skin, kidneys, lungs, and gastro-intestinal canal perform their functions, this stage is characterized, as in other fevers, by an increase in the amount of solids excreted. But this increased elimination of the products of chemical change is not, in yellow fever, a constant concomitant of the increased temperature, because, in virtue of the lesions of certain organs, as the kidneys and skin, the constituents of the urine and bile accumulate in the blood, and become the active agents in the production of aberrated nervous and muscular actions, and even of death itself.

Not only are large quantities of the products of oxidation formed during the hot stage of yellow fever, but, as we have shown by numerous analyses of the blood, black vomit, urine, brain, heart, liver, spleen and kidneys, in this disease, they are altered to a certain extent from those conditions characteristic of health; the albumen of the blood, under the action of the poison, being transformed into nitrogenous and non-nitrogenous compounds, a portion of which, as the fatty matter and altered fibrin, being arrested, or accumulated in certain organs, as the heart, liver and kidneys.

The importance of the preceding observations, upon the con-

stitution and changes of the urine in yellow fever, are placed in a clear light, when they are considered in connection with the causes of death in this disease. Thus death may be caused in yellow fever: 1st; *by the direct action of the febrile poison upon the* BLOOD and NERVOUS SYSTEM, *depressing and deranging the action of the one, and rendering the other unfit for the proper nutrition of the tissues; 2d—by the suppression or alteration, or diminution of the functions of certain organs, as the* KIDNEYS *and the* LIVER, *and the retention in the blood of the excrementitious matters normally eliminated by these organs; 3d—by the structural alterations of the* HEART, *and consequent loss of power in this organ; 4th—by profuse* HÆMORRHAGE *from the* STOMACH *and* BOWELS; *5th—by the absorption from the stomach and bowels of* PUTRID BLACK VOMIT, *which acts as a powerful poison, deranging the blood, and prostrating the nervous and muscular forces.*

493 ST. CHARLES STREET, NEW ORLEANS, LA.

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