NOTE
ON
PATHOLOGICAL ABSORPTION SPECTRA.

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LIKE many other animal fluids, urine absorbs the shorter light waves indiscriminately. The absorption is of course in proportion to the thickness of the stratum of fluid examined. If the stratum is too thick, or the tint too deep, any delicate characteristics which may exist are masked. An ordinary test tube about $\frac{3}{4}$ inch bore holds a convenient thickness of urine for absorption observation. The intensity of the light, and the dispersive power of the spectroscope, are also important preliminary considerations. An instrument with a single water prism or one of Browning's convenient little direct-vision spectroscopes will give better results than a more powerful apparatus, for a faint band of absorption is not easily seen

when it is dispersed over a large part of the field of sight. The great range of colour possessed by various urines does not display an equally conspicuous diversity of absorption spectra, and the complicated chemical colouring matters, such as uropittine, paramelanine, or omicholine, fortunately bring none of their confusion into spectroscopic operations of fresh urine.

Other fluids mixed with urine give of course the absorption characteristics of their colouring matters, and thus the spectroscope yields the earliest evidence of the hæmaturia of Bright's disease. In a case of that affection recently under my observation, the Sorby blood bands in the urine preceded any definite identification of albuminuria by the ordinary tests, though the daily quantity of urine was already increased. In this case one retina only presented the white extension from the disc, and it was so slight as to require careful focussing to display it.

The existence of blood bands in the absorption spectrum of urine gives far more definite evidence than mere smokiness, albuminuria, or even the subsidence of shrivelled and altered corpuscles, and their presence or absence in albuminous urine, may throw some light upon the capricious way in which the proteine compounds act when subjected to the so-called albumen tests.

From time to time during a series of observations now unavoidably interrupted I came across absorption bands in various parts of the spectrum—generally in the yellow and green—which were of temporary occurrence, and which I failed to connect with any other phenomenon. A case of cirrhosis of the liver, however, supplied a urine which, for the three weeks I had the opportunity of watching it, gave a permanent absorption band of an interesting character. This band is not mentioned in Dr. Thudichum's exhaustive paper in the Tenth Public Health Report; I therefore suppose it to be novel, though I have not been able to obtain the results of Hoppe-Seyler or Valentin's inquiries. This case in addition to

the ordinary urinary absorption, diffused more or less equally over the whole blue end of the spectrum, exhibited a well-defined and intense band (see Plate V) lying between 1700 and 2100 of Kirchoff's scale, and thus just including the F solar line in its right edge.

The band became more intense as the urine became staler and more acid. Boiling also intensified it, irrespective of any condensation of tint from evaporation. It was also darkened by the addition of acid. Nitric acid upon some occasions brought out a faint additional band, lying its own width to the right of the sodium line in the position of a deoxidized blood band. Permanganate of potash, added in quantity less than sufficient to produce its own complicated bands¹ permanently, also increased the absorption in this spot. It naturally suggested itself that this band might have something to do with the existence in the urine of biliary products. Pettenkofer's test did not yield the cholic-acid play of colours, though a change from orange into purplish magenta, caused probably by the action of the acid used on biliary colouring matter, might have been mistaken for it (the acid was acetic, used on Lehmann's authority). It is remarkable that the band in question was very conspicuous in this magenta solution and remained so for more than a week; its right edge, however, was more distinct than in the original urine. Various experiments on the bile of such animals as I could procure, including ox, sheep, deer, racoon, &c., failed to produce any similar absorption band. Meconium, which, according to Simon and Frerich, is almost unchanged bile—was the nearest approximation to human bile available; it also failed to yield it, however manipulated. I at length found it in normal acid fæces; the absorption of a fæculent solution occupied precisely the same position and behaved in every respect like the

¹ The conspicuous way in which the spectroscope told the exact point of saturation of the urine with potash permanganate suggested its usefulness in many instances of volumetric analyses in which the saturation tint is not sharply defined.

abnormal urine band. It was altogether absent in healthy alkaline fæces, but appeared almost invariably on keeping on acidulation, or on the addition of potash permanganate. This band in the spectrum of urine and fæces disappeared on neutralisation with ammonia, and reappeared on reacidulation. The substance yielding it seems to be some free acid. It is soluble in alcohol but not in ether.

The foregoing notes are altogether fragmentary, and have been put together in unavoidable haste, but they may in some humble measure tend towards the eventual application of the spectroscope to practical medicine—an application which appears to me capable of deciding, for example, whether the high-coloured urine of a tropical pyrexia owes its tint to the altered bile of bilious, or the disorganised blood of yellow fever.

DESCRIPTION OF PLATE V.

Morbid urinary absorption spectrum occurring in a case of cirrhosis of liver. In addition to the obscuration of the blue, indigo, and violet which urine generally produces, there is a band of intense absorption occupying the space between 1700 and 2100 of Kirchoff's scale, and covering the F solar line in its right edge.

A similar absorption band is frequently yielded by normal acid fæces.

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Mintern Bros. imp.