to cause intimate mixture of the milk and reagent. The contents of the flask were then diluted to the 500 cc. mark, mixed by shaking and filtered through a dry filter. 100 cc. of this filtrate with 50 cc. Fehling's solution were used for each determination. The following figures are the results secured:

SERIES I.

Source.	Sample.	Percentage lactose (removing the protein by copper-alkali method).	Percentage lactose (removing the protein with $Al(OH)_3$).
Cow	1	4.57	4.52
Cow	2	4.73	4.78
Cow	3	4.54	4.66
Human	4	6.59	6.44
Human	5	6.09	6.10
		SERIES II.	
Cow	6	4.64	4.69
Cow	7	4.71	4.74
Cow	8	4.71	4.71
Cow	9	4.79	4.79
Human	10	6.28	6.29
Human	11	7.02	7.02

These results are in all cases the averages of very closely agreeing duplicate determinations. On the basis of our results, we believe that aluminium hydroxide can be used to advantage in the removal of protein, in the determination of lactose in milk. The use of an excess of aluminium hydroxide does not influence the final results and the filtration is more rapid than in the copper-alkali method, thus enabling one to complete a determination in considerably less time than by the latter method.

CHEMILUMINESCENT REACTIONS WITH PHYSIOLOGIC SUBSTANCES.

BY F. ALEX MCDERMOTT.

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In the fall of 1912, the writer's attention was called[1] to the fact that if a lump of potassium cyanide be dropped into urin, a faint light will be observed if the vessel be taken into a dark room after a few minutes and shaken so as to mix the strata formed. In a series of tests with this phenomenon, the writer has been able to observe only a very faint light when using a 99% KCN, but it was found that if to the solution of cyanide in urin, a strong, alkaline solution of hydrogen peroxide be added, a considerably brighter emission of light would occur. Subsequent experiments showed that potassium formate or formaldehyde could be used in place of the cyanide, with equally good results. As yet it is not known just what constituent of urin is responsible for the reaction; urin ap-

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[1] By Dr. Otto Meyer, of Richmond, Va.

pears sometimes to give a very faint light, when the alkaline peroxide solution alone is used, but urea, uric acid and hippuric acid, either alone or mixed, and with or without added formate, formaldehyde or cyanide, have so far yielded negative results. There are a few cases of the passage of "phosphorescent" urin on record, which have been attributed to temporary infection with photogenic bacteria, but the phenomenon described above seems to indicate that the latter cases may have been due to some substance in the urin.

These experiments led rather indirectly to some others which proved of interest: Montuori[1] has found that the products of the alkaline hydrolysis of Witte's peptone in an atmosphere free from oxygen, absorb oxygen readily and in considerable amount, and that in so doing they can accomplish the oxidation of other reducing substances present with them, thus functioning as oxygen-carriers. It seemed to the writer that if these properties could be properly utilized, light-emission should be observed.

Upon actual trial it was found that if Witte's peptone be hydrolyzed in an atmosphere of natural gas by several hours' boiling with alkali, there is a faint emission of light when strong alkaline hydrogen peroxide solution is run into the liquid. If, however, before the addition of the peroxide solution, several cubic centimeters of commercial formaldehyde solution be added, the intensity of the light is considerably augmented. The light appears to be of a very pale green color, like that of Radziszewski's lophin solution, but less intense. Formaldehyde alone gives, at most, only a very faint light under these conditions, though it is known to be chemiluminescent under some conditions of alkaline oxidation. The experiment has been repeated a number of times, and always with the same result, when the conditions were not varied greatly.

Glue, hydrolyzed and oxidized in the same way, also gave a faint light, but negative results were obtained with Merck's egg albumin and a specimen of dried casein; the excessive foaming in the latter cases seemed to prevent mixing of the liquids. Glutenin, leucine, asparagine and glutaminic acid also yielded negative results, as did also specimens of nucleinic acids from yeast and from animal cell nuclei, and phytin.

At this time it is not quite clear what bearing these phenomena have on the theories of chemiluminescence and biophotogenesis. The reactions as carried out are modifications of the reaction of Trautz and Schorigin,[2] which consists in the simultaneous oxidation in alkaline solution of an aldehyde and a polyphenol; the same is probably true of the reaction of Dubois,[3] since esculin is a compound of dihydroxycumarin and glucose. Weitlaner[4] has recently found that the humus acids also give a chemilumines-

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[1] *Arch Ital. biol.*, 55, 197–220 (1911); *Mem. soc. Ital. sci.*, [iii] 16, 237–314 (1910).

[2] *Z. wissensch. Photo.*, 3, 123 (1905); *Z. physik. Chem.*, 53, 1–111 (1905).

[3] *Compt. rend.*, 132, 431 (1901).

[4] *Verhandl. zoöl.-bot. Ges., Wien*, 61, 192–202 (1911).

cent reaction of this type. The experiments would also tend to lend further color to Dubois'[1] enzyme theory of biophotogenesis. Emmerling[2] has found a number of the ordinary physiologic amino acids among the products of the acid hydrolysis of the *Noctiluca miliaris*, which, as is well-known, is the frequent cause of "phosphorescent" sea-water, but his results do not appear suggestive in this connection. The view has been expressed that in living organisms, the light emission is due to the oxidation of a waste-product and some support to this view might be derived from these experiments.

The writer is indebted to Dr. Jacob Rosenbloom and to Dr. Leonard M. Little, for certain specimens used in these experiments.

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THE OCCURRENCE OF BARIUM IN TOBACCO AND OTHER PLANTS.[3]

BY J. S. MCHARGUE.

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The occurrence of barium in plants was first observed by Scheele[4] in 1788. He obtained barium sulfate from the ashes of beech trees as follows. The ash was leached with distilled water until soluble salts were removed. The insoluble material remaining was digested in a mixture of hydrochloric and nitric acids, filtered and washed. A few drops of sulfuric acid were added and a small white precipitate was thus obtained which Scheele called barium sulfate.

In 1855 Forchammer[5] also detected the presence of barium in the ashes of beech, oak and birch trees. About the same time Eckhard and Boedeker[6] confirmed the presence of barium in beech wood and found it in the sandstone near Göttingen.

In 1874 Knop[7] of Leipzig, while investigating the fertility of the mud carried down by the Nile River, found barium present in samples of the mud collected near the banks and for a considerable distance back on either side of the river. Knop treated 400 grams of the soil with dilute hydrochloric acid, filtered out the insoluble residue and added dilute sulfuric acid to the filtrate. He obtained by this method 0.021 and 0.017% of barium calculated as carbonate.

In the following year, 1875, Dwarzak[8] confirmed the tests made by Knop on the presence of barium in the Nile mud and examined samples

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[1] *Orig. Communications, 8th Intern. Congr. Applied Chem.*, **19**, 83–90 (1912).

[2] *Biochem. Z.*, **18**, 372–374 (1909).

[3] Read before the Lexington Section, American Chemical Society, Feb. 12, 1913.

[4] C. G. Scheele, *Opuscula Chemica et physica. Lip.*, 1788, Vol. 1, 258.

[5] *Poggend. Ann.*, **91**, 568 (1854).

[6] *Ann.*, **100**, 294 (1856).

[7] *Landw. Vers. Sta.*, **17**, 65.

[8] *Ibid.*, **17**, 398.