*Nature of Bence Jones's Protein:* Reuben Ottenberg and William J. Gies.

Bence Jones's protein and crude elastose not only have several proteose properties in common, but unlike the ordinary proteoses, each is precipitated from its aqueous solution when the latter is gently warmed. Bence Jones's protein occurs in the urine of patients suffering from sarcoma of bone marrow or from osteomalacia. Bone contains considerable elastin-like material (osseoalbumoid). The possibility that Bence Jones's protein may be a derivative of osseoalbumoid, and the great desirability of making our knowledge of this elusive protein more definite, led the authors to undertake a study of a preliminary phase of the work that will be necessary to determine the points at issue.

They sought first to ascertain whether crude elastose, when injected subcutaneously or intraperitoneally, is eliminated in the urine and whether it can be detected there by the heat-precipitation test. When thus introduced in dogs, crude elastose, obtained by peptolysis of ligament elastin prepared by Richards and Gies's method, not only promptly appears in the urine, but may be identified in it by the heat-precipitation test. This observation makes it clear that if elastose is formed in bone or in any other tissue by any pathological process, the elastose thus produced may pass into the urine without material alteration of the characteristic property referred to.

Before proceeding further in this connection, the authors intend to prepare osseoalbumoid (bone elastin?) in sufficient quantity to permit of a determination of the nature of its proteoses and their fate when injected into animals.

William J. Gies,
*Secretary*

### THE AMERICAN PHILOSOPHICAL SOCIETY

A stated meeting of the society was held on Friday, October 4. The following papers were read:

Dr. Edgar F. Smith: "New Results in Electrolysis."

Professor Simon Newcomb: "A Study of Correlations among Terrestrial Temperatures, as indicating Fluctuations in the Sun's Thermal Radiation."

R. H. Mathews, L.S.: "Language of the Burdhawal Tribe in Gippsland, Victoria."

## *DISCUSSION AND CORRESPONDENCE*

### SMELTER SMOKE

In an article recently published in the *Journal of the American Chemical Society* (July, 1907) on gases *vs.* solids, an investigation of the injurious ingredients of smelter smoke, by Professor W. Clarence Ebaugh, the results of the investigation are contrary to previous experiments along this line as well as to the experience of the writer, and it appears to him that the conclusions are based on misleading and inadequate data.

The writer is very much averse to criticizing the work of a brother scientist, but since the results of this work, if uncontradicted, will undoubtedly be used in many cases between smelters and injured parties, it would only seem proper to point out the fallacy of the arguments. Not to be misunderstood in the beginning, the writer wishes to explain that he is firmly of the opinion that the solid emanations which arise from a smelter (including perhaps, soluble copper, arsenic and lead compounds) are injurious to vegetation in so far as they reach it, but that such emanations reach as far as sulphur dioxide or have so injurious an action appears to be decidedly doubtful and has certainly not been proven in the paper published by Professor Ebaugh.

On page 953, of his article, Professor Ebaugh says:

> In the first place, the injury (in the Salt Lake Valley) does not occur simultaneously over a large area; on the contrary, it seems to be restricted in its range. Secondly, it is rarely found that a number of crops grown successively in a given locality show the effect of smelter smoke, etc.

The above assertions are, of course, only the personal opinion of Professor Ebaugh but in the main they are diametrically opposed to the experience of the writer who has examined smelter injury at Redding, Cal., Ducktown, Tenn., and at Anaconda, Mont. In every case examined by the writer the injury *did* occur

simultaneously over a large area, if by a large area is understood the country around the smelter for from five to twenty miles, depending upon the direction of the prevailing winds. Again, it has been the writer's experience that successive crops in a given locality *did* show the effect of smelter fumes. This is especially shown in the vicinity of Ducktown, Tenn., where the same deciduous trees surrounding the smelter are injured each year until they finally succumb.

On page 953, Professor Ebaugh also gives a table showing the amount of sulphur dioxide per million parts of air found in the atmosphere in the vicinity of the smelters in the Salt Lake Valley and in his discussion of this table ends it by saying, "Nevertheless, the very small amount of sulphur dioxide found is certainly surprising." The force of this last sentence is to lead one who knows nothing about the matter to believe that such amounts as were found are insignificant and would not be injurious. Let us look at the figures of 524 cases examined. In 213 cases, or 40.66 per cent., the amount of sulphur dioxide is one part per million, or more, of the air. By actual experiments of careful workers[1] it has been shown that plants are injured by repeated treatments of one part sulphur dioxide per million parts of air. Again, as explained by Professor Ebaugh himself, such results as were obtained in the above table are practically valueless since the concentration of sulphur dioxide might be, say, one to 1,000, for a short while and hence do serious injury, while if this amount were spread over an average time of twelve to twenty-four hours, it would amount to a very little.

On page 954, Professor Ebaugh with the following data: (*a*) size of stacks, (*b*) sulphur dioxide content of stack gases, (*c*) width and thickness of the visible smoke column at a given time and place, calculates roughly what the sulphur dioxide content of the atmosphere would amount to. The writer is unable to see with the above data how such a calculation could be made with even rough accuracy. Even if such calculation could be made, however, the results are valueless in judging what the sulphur dioxide content of the atmosphere might be at varying distances from the smelter, since on some days and when the fumes float in certain directions, as up ravines, etc., the sulphur dioxide content of the atmosphere of these ravines might be ten times that of a point on the level country much nearer the smelter and yet in both cases the three factors above be practically the same.

On page 956, Professor Ebaugh says:

> Concerning paragraph 5, it should be noted that in the open country one seldom finds sulphur dioxide acting for a long-continued time in one place, etc.

The writer has in some of the regions which he has visited seen the smelter smoke act on the same side of a mountain range and on the same plants for days at a time and has been told by competent parties residing in the country, that this action in the same direction often continued for weeks.

On pages 957 and 958, Professor Ebaugh gives his data in regard to the injurious effect of sulphur dioxide on foliage. Note that in every case but one (where one part sulphur dioxide to 50,000 parts of air were used and twelve fumigations on sugar beets) injurious results were noted. Even with the above data, which at the best were not conclusive, because more fumigations should have been used on the sugar beets not injured by twelve fumigations, Professor Ebaugh draws the following conclusion on page 969:

> By no means is sulphur dioxide to be considered as harmless, especially in an enclosed space and in a moist climate, but we are forced by the weight of the evidence to the conclusion stated in the introduction, viz., that heretofore undue emphasis has been laid upon the injurious effect of sulphur dioxide upon growing plants, and that the harmful action of the solid emanations from the smelters—the so-called flue dust—has been seriously underestimated.

The writer is absolutely unable to see that the weight of evidence points in the direction indicated by the above quotation. Judging by the results on fumigation with sulphur dioxide carried out by him in conjunction with the

[1] See Haselhoff and Lindau's work on "Injury to Vegetation by Fumes."

results obtained by using the solid emanations on plants, we can at least say, "not proven."

On pages 962, 963, 964, 965, 966 and 967, are given tables showing: (1) the chemical composition of the flue dust; (2) the lead, copper and arsenic content of hay around a smelter; (3) the lead, copper and arsenic content of the dust from rafters in barns around the smelter; (4) the action of mixtures of flue dust and soil on sugar beets; (5) the action of aqueous solution of flue dust on sugar beets.

His results on the composition of the samples of hay around the smelter and the composition of the dust from rafters in barns, etc., are of only limited value since he does not give the distances from the smelter at which each of these samples was taken. His results on the effect of the mixture of flue dust and soil, as well as his results with the water solution on sugar beets, are practically valueless, since the actual amount of flue dust added to the leaves and its relative weight as compared with the leaves are not given. In other words, it is impossible from the data given to judge how much of the flue dust (including arsenic, copper, etc.) was added to each leaf. Without the above data it is impossible to tell whether the amount of lead, copper and arsenic added by dusting or spraying corresponds to the amount of these substances actually found in the hay around the smelter, or not. Here again the experiments are incomplete and here again one may say, "not proven."

On the whole, then, it is at once evident that the series of experiments carried out by Professor Ebaugh do show that the solid emanations from a smelter in certain strengths are extremely toxic to plants. They do not show, however, that such solid emanations are injurious when added in the strengths which may settle on the leaves around a smelter.

Again, all the fumigation experiments with sulphur dioxide, carried out in the above article, except one, show that the leaves were injured and many of the experiments (such as they were) on treating plants with the diluted solid emanations show injury, yet with the proofs as evenly balanced as they are, the author of the article claims that "we are forced by the weight of evidence to the conclusion stated in the introduction, *viz*, that heretofore undue emphasis has been laid upon the injurious effect of sulphur dioxide upon growing plants, and that the harmful action of the solid emanations from the smelters—the so-called flue dust—has been seriously underestimated."

Finally, the writer would draw attention to the country in the vicinity of Ducktown, Tenn. Here, well-marked injury to forests can be noted at a distance of about twenty-five miles from the smelter, yet solid emanations which might have any injurious effect on foliage consist almost entirely of copper compounds since arsenic is not present in appreciable amounts, if at all. It is well known that grape foliage, apple foliage and foliage of certain other plants can be treated with about 1 part of copper sulphate, to 400 to 500 parts of water, without injury. It is hardly possible to believe that the copper compound from the smelter could be carried in more than a trace (if even to this extent) for a distance of twenty-five miles. It is less possible to believe that they could be carried in such quantities as to amount to 1/400 of the rain that might fall upon them, yet here we have a case of decided injury at a distance of twenty-five miles. Add to the above reasoning the fact that the sulphur trioxide content of the injured foliage can be shown to be greater than that of the uninjured foliage beyond the range of damage and that the leaves of the trees have the nearly characteristic appearance of sulphur dioxide injury, and it is impossible to reach any conclusion except that the trees were injured by sulphur dioxide.

While it is possible, in fact extremely probable, that in actual practise solid emanations in the vicinity of a smelter do injure vegetation to a greater or less extent, this fact has not been proven by the above experiments.

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