

Sharpless expressed the view that by following the blood level and urine excretion one cannot accurately determine if fever increases the utilization of vitamin C; tissue analysis as performed in the guinea pig studies would seem to yield more direct evidence. The reliability of data on the urinary excretion in regard to the utilization or need for vitamin C is questioned by Abt and Farmer<sup>9</sup> and Wolff, Banning and van Eekelen.<sup>10</sup> The blood plasma level would appear to be more reliable, since the level at which vitamin C appears in the urine is subject to considerable individual variation. Further, Hawley, Frazer, Button and Stephens<sup>11</sup> present evidence indicating that the reaction of the urine is concerned in determining the excretion of vitamin C. Finally, in man, considerable vitamin C is lost through the sweat according to the observations of Cornbleet, Klein and Pace.<sup>15</sup> This, however, is denied by Wright and MacLenathan.<sup>16</sup> Since we could not find a satisfactory method applicable to our patients for the determination of the loss in the sweat, we relied on the assumption that the blood plasma level is the best indicator for the body level of vitamin C. According to this view, a body temperature of from 104 to 104.6 F for 4 hours did not significantly or detectibly increase the rate of utilization of vitamin C.

*Conclusions.* A study of 77 observations made on 17 patients showed no significant changes in the ascorbic acid concentration as the result of elevating the body temperature to 104°F and maintaining it for 4 hours, using a combination of air conditioned cabinet and inductotherm.

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#### Destruction of Phenylalanine by Ultraviolet Radiant Energy.

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The following changes have been observed to occur when *dl*-phenylalanine is exposed to ultraviolet radiant energy:

1. Spiegel-Adolf<sup>1</sup> reported that solutions of phenylalanine ex-

<sup>14</sup> Hawley, E. E., Frazer, J. P., Button, L. L., and Stephens, D. J., *J. Nut.*, 1936, **12**, 215.

<sup>15</sup> Cornbleet, T., Klein, R. J., and Pace, E. R., *Arch. Derm. Syph.*, 1936, **34**, 253.

<sup>16</sup> Wright, I. S., and MacLenathan, E., *J. Lab. and Clin. Med.*, 1939, **24**, 806.

<sup>1</sup> Spiegel-Adolf, M., *Biochem. J.*, 1937, **31**, 1303.

posed to ultraviolet rays become pigmented. Pigment formation was most marked in neutral solution, but acid and alkaline solutions also became red-brown after prolonged irradiation. During the present investigation, these findings were confirmed. Moreover, when dilute sulfuric acid or hydrochloric acid solutions of the amino acid were exposed to the ultraviolet rays, a small amount of dark brown material precipitated; this material formed colloidal solutions in dilute sodium hydroxide solution, but was insoluble in dilute acid solution. Much of the soluble pigment of the irradiated solutions could be removed by alternate additions of strong sodium hydroxide and sulfuric acid solutions; or by extraction from strongly acid solution with butyl alcohol.

2. Irradiated neutral, acid, or alkaline solutions of phenylalanine were found in the present investigation to give positive Millon tests, indicating the formation of a phenol. When this test was carried out under standard conditions,<sup>2</sup> a precipitate (composed chiefly of unchanged phenylalanine) formed. Removal of this precipitate by centrifugation left a clear, red solution whose color closely resembled that of a tyrosine solution tested in the same way.

3. Irradiated solutions developed a faint, orange-red color when they were treated with the nitrite-molybdate reagent.<sup>2</sup> Since irradiated tyrosine solutions give a similar color with this reagent as a result of the formation of dopa,<sup>3</sup> it may be inferred that a portion of the phenol (tyrosine?) formed during the phenylalanine irradiation was converted to a catechol (dopa?).

4. Spiegel-Adolf<sup>1</sup> suggested that the characteristic odor produced by irradiating phenylalanine solutions might be due to the formation of phenylacetaldehyde, but she offered no chemical evidence in support of this guess. In the present investigation, it was found that irradiated solutions of the amino acid gave strongly positive Schiff tests. Moreover, the solutions responded to the phenylhydrazine test by the formation of an insoluble crystalline phenylhydrazone. Much of the characteristic odor appeared to be concentrated in an oily, ether-soluble material that floated on top of the irradiated solutions.

5. Dry phenylalanine powder was exposed to the rays for long periods of time (about 10 days). The irradiated material then was analyzed for phenylalanine by the Kapeller-Adler procedure.<sup>4</sup> This test indicated that at least 20% of the phenylalanine had been destroyed.

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<sup>2</sup> Arnow, L. E., *J. Biol. Chem.*, 1937, **118**, 531.

<sup>3</sup> Arnow, L. E., *J. Biol. Chem.*, 1937, **120**, 151.

<sup>4</sup> Kapeller-Adler, R., *Biochem. Z.*, 1932, **252**, 195.