TABLE 1

TOLERANCE OF VARIOUS PLANTS TO CHRONIC GAMMA IRRADIATION

Plant	Minimum exposure (weeks)	Effect at indicated dose rate* (r units per day)	
		Mild	Severe†
Lilium longiflorum	15	20(?)	30
Tradescantia paludosa	15	20	40
Tradescantia ohiensis	15	35	65
Vicia faba	15	60	90
Impatiens sp.	18	60	90
Coleus blumei	13	100	240
Melilotus officinalis	14	100	240
Nicotiana rustica	15	100	300
Phytolacca americana	15	100	350
Datura stramonium	7	110	360
Gossypium hirsutum	15	110	250
Dahlia (hybrid)	10	110	275
Althea rosea	12	120	250
Luzula purpurea	10	125	300
Chrysanthemum (hybrid)	18	140	250
Canna generalis	18	180	350
Lactuca sativa	7	180	600
Chenopodium album	15	250	450
Antirrhinum majus	18	250	400
Lycopersicon esculéntum	15	250	400
Xanthium sp.	15	250	500
Solanum tuberosum	10	300	600
Petunia hybrida	10	300	700
Celosia cristata	18	300	750
Lupinus albus	12	400	—
Kalanchoë daigremontiana	12	400	800
Allium cepa	18	400	800
Linum usitatissimum‡	10	600	1100
Digitaria (crabgrass)	12	1000	1800
Brassica oleracea (broccoli)	10	1400	2500
Gladiolus (hybrid)	8	4100	6000

* Dose rate is in roentgens/24-hr day; however, the actual dosage/day averaged about 90% of the dose rate shown.

† This dose rate is not necessarily the lowest rate which will produce a severe effect.

‡ Data supplied by C. Konzak.

on these same species. An even greater range may reasonably be expected to appear when the investigation is extended to include a larger number of species.

There is little doubt that a large number of factors operate to determine the radiosensitivity of a given plant species. Changes in auxin (*5*) and ascorbic acid levels (*2*) in irradiated plants indicate that these substances may be involved in determining radiosensitivity. Our data also suggest that plants with large chromosomes (*Tradescantia, Lilium, Vicia*) have a higher sensitivity to chronic gamma irradiation than do most plants with small chromosomes.

References

1. SPARROW, A. H., and SINGLETON, W. R. *Am. Naturalist*, **87**, 29 (1953).
2. COOKE, A. *Science*, **117**, 588 (1953).
3. GUNCKEL, J. E., *et al. Am. J. Botany*, **40**, 317 (1953).
4. GUNCKEL, J. E., and SPARROW, A. H. In: *Brookhaven Symposia Biol.*, No. 6 (1954).
5. GORDON, S. A., and WEBER, R. P. *Am. J. Botany*, **37**, 678 (1950).

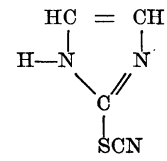
Manuscript received September 23, 1953.

Antithyroid Activity of Thiocyanoimidazoles[1]

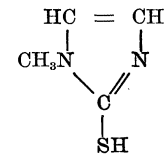
Roger E. Koeppe and John L. Wood

Department of Biochemistry, University of Tennessee, Memphis

The 2-thiocyanoimidazoles (I) are a new group of compounds recently prepared in our laboratory (*1*). Since these substances are structurally related to known antithyroid agents, e.g., 1-methyl-2-mercaptoimidazole (II), we have determined their inhibition of iodine uptake by rat thyroids. The method used



(I)



(II)

was essentially that of McGinty *et al.* (*2*). Adult white rats of comparable weight were injected intraperitoneally with 1-ml suspensions of the test compounds in 10% gum acacia. Approximately 1 hr later a tracer amount of I^{131} was injected and, after a 4-hr interval, the thyroids were removed and assayed for total radioactivity. The results of 2 experiments are summarized in Table 1 and show the 2-thiocyanoimidazoles to be thyroid inhibitors. 2-Thiocyanoimidazole and its 1-methyl derivative, in the doses employed, caused an inhibition of iodine uptake comparable to that of 1-methyl-2-mercaptoimidazole

TABLE 1

IODINE UPTAKE BY THYROIDS OF RATS GIVEN ANTITHYROID COMPOUNDS

Compound	No. rats	Dose mg/rat	% uptake of administered I^{131}		% of controls
			Av.	Range	
Expt. 1					
Propylthiouracil	8	0.5	0.21	0.14– 0.27	6.8
2-Thiocyanoimidazole	7	1	0.33	0.10– 0.60	10.6
2-Thiocyanoimidazole	3	5	0.13	0.07– 0.19	4.2
None (control)	8	—	3.1	2.2 – 4.8	100
Expt. 2					
Propylthiouracil	6	0.5	0.9	0.58– 1.38	9.9
1-Methyl-2-mercaptoimidazole	6	1	0.51	0.30– 0.75	5.6
2-Thiocyanoimidazole	4	1	0.54	0.38– 0.71	5.9
1-Methyl-2-thiocyanoimidazole	6	1	0.52	0.38– 0.76	5.7
4(5)-Methyl-2-thiocyanoimidazole	4	1	2.3	1.0 – 3.6	25.3
None (control)	6	—	9.1	5.9 –12.2	100

[1] These studies were supported by the Atomic Energy Commission under Contract AT-(40-1)-283, Title VII.

(Tapazol). 4(5)-Methyl-2-thiocyanoimidazole was considerably less effective although exhibiting definite antithyroid activity.

References

1. KOEPPE, R. E., and WOOD, J. L. *J. Am. Chem. Soc.*, **75**, 4655 (1953).
2. MCGINTY, D. A., *et al. J. Pharmacol. Exptl. Therap.*, **93**, 246 (1948).

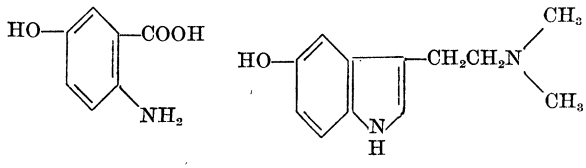
Manuscript received August 27, 1953.

Synthesis of 5-Hydroxykynurenine[1]

Katashi Makino and Hitoshi Takahashi[2]

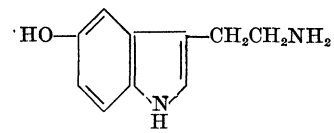
Department of Biological Chemistry,
Kumamoto University Medical College,
Kumamoto, Japan

Kotake (*1*) isolated 5-hydroxyanthranilic acid (I) from the urine of rabbits injected with anthranilic acid. This fact and the isolation of the 5-hydroxytryptophan metabolites bufotenine (*2*) (II) and serotonine (*3*) (III) from the natural sources suggested the synthesis of 5-hydroxykynurenine (IV).

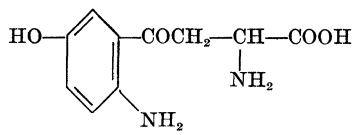


I

II



III



IV

The synthesis was performed as follows. 6-Nitro-3-methoxybenzoic acid was converted to its chloride by warming slightly with thionyl chloride. The resultant chloride (m.p. 34°) was condensed in dry chlorobenzene with the magnesium diethyl malonate and then decomposed to 6-nitro-3-methoxyacetophenone (m.p. 67° found : C 55.07, H 5.44, N 6.79; calc. for $C_9H_9O_4N$: C 55.4, H 4.7, N 7.19%) by warming with hydrochloric acid and acetic acid. This was then converted to 6-nitro-3-methoxy-ω-bromoacetophenone (m.p. 90° found : C 39.43, H 3.19, N 4.72; calc. for $C_9H_8O_4NBr$: C 39.42, H 2.92, N 5.11%) and then condensed with ethyl acetaminomalonate in the presence of sodium in absolute alcohol. The resultant ethyl acetamino-6-nitro-3-methoxyphenacyl malonate (m.p. 145° found : C 53.21, H 5.69, N 6.8; calc. for $C_{18}H_{22}O_9N_2$: C 52.7, H 5.4, N 6.83%) was decomposed by refluxing with hydrochloric acid and acetic acid to 6-nitro-3-methoxyphenacyl glycine hydrochloide (m.p. 199°) which gave with ninhydrin a yellow color.

This nitro amino acid was dissolved in diluted sulfuric acid and hydrogenated in the presence of palladium black. The 5-methoxykynurenine sulfate thus obtained melted at 191° with decomposition and showed with ninhydrin a reddish purple color. On paper chromatogram developed with butanol-acetic acid-water system it separated in two spots with Rf 0.32 and Rf 0.36 which presumably correspond to D and L isomers.

5-Hydroxykynurenine sulfate was obtained by refluxing methoxykynurenine sulfate with hydrobromic acid in an atmosphere of carbon dioxide. 5-Hydroxykynurenine sulfate (found : C 37.28, H 4.26, N 8.35; calc. for $C_{10}H_{14}O_8N_2S$: C 37.27, H 4.38, N 8.69%) was a colorless small prismatic needle and began to darken at 225° and carbonized completely at 255°. Its aqueous solution showed a marked green fluorescence and gave with ninhydrin a purple color, with diazotized sulfanilic acid a purple color, with dimethylaminobenzaldehyde in hydrochloric acid an orange color, with ferric chloride a brown color and decolorized chameleon solution. Its Rf value was 0.24 on the paper chromatogram developed with the supernatant of the mixture of acetic acid, butanol, and water in ratio 1 : 4 : 5. Its ultraviolet absorption spectra had a maximum at 405 mμ at pH 11.4 and a maximum at 378 mμ at pH 4.8.

[1] This work was aided by a grant from the Scientific Research Fund of the Ministry of Education of Japan.

[2] We wish to express our thanks to the Takeda Research Laboratory for making elementary analyses.

References

1. KOTAKE, Y. *J. Japan. Biochem. Soc.*, **22**, 173 (1950).
2. WIELAND, H., KONZ, W., and MITTASCH, H. *Ann.*, **513**, 1 (1934).
3. RAPPORT, M. M. *J. Biol. Chem.*, **180**, 961 (1949).

Manuscript received September 10, 1953.