Spectral Data on New Compounds

	Ultraviolet					Infrared Frequencies in Cm.$^{-1}$		
	Wave lengths of maxima and inflections (*) in 95% ethanol are given in mμ with intensities in (log ϵ)					Medium	NH	NO$_2$ (Aliphatic)
I	275 (3.83)	296* (3.70)		307* (3.54)		CHCl$_3$ Nujol	3520 3380	1558, 1387 1553, 1385
II	275 (3.85)	295* (3.74)		308* (3.60)		CHCl$_3$ Nujol	3440 3400	1552, 1380 1550, 1380
III	275 (3.81)	295* (3.73)		309* (3.57)		CHCl$_3$ Nujol	3450 3390	1550, 1387 or 1360 1547, 1385 or 1355
Ia	275* (3.92)	297 (3.85)		309 (3.85)	357 (4.20)	Nujol	3400	
IIa	277* (3.91)	297 (3.87)	302* (3.87)	309 (3.87)	357 (4.20)	Nujol	3360	
IIIa	277* (3.90)	298 (3.88)	304* (3.87)	309 (3.89)	357 (4.20)	Nujol	3400	

232° dec., calcd. for C$_{23}$H$_{21}$N$_5$O$_8$ (495.44): C, 55.75; H, 4.27; N, 14.14; found: C, 55.69; H, 4.58; N, 14.07; IIa (94% yield from II), red crystals from ethanol, m.p. 176–176.5°, calcd. for C$_{29}$H$_{25}$N$_5$O$_8$ (571.53): C, 60.94; H, 4.41; N, 12.25; found: C, 60.96; H, 4.74; N, 12.08; IIIa (62% yield from III), bright red crystals from ethanol, m.p. 213–215°, calcd. for C$_{30}$H$_{27}$N$_5$O$_8$ (585.56): C, 61.53; H, 4.65; N, 11.96; found: C, 61.83; H, 4.91; N, 12.09. The tryptamine from I was also characterized as the hydrochloride, which had m.p. 245–247° dec., in agreement with that reported, 248–250°.[6]

Hydrogenation of I at 2 atm. over 10% palladium on charcoal catalyst, resulting in concomitant reduction of the nitro group and debenzylation, gave serotonin in 69% yield as the hygroscopic creatinine sulfate monohydrate salt, m.p. 212–214°, mixed m.p. with an authentic sample (of m.p. 214–216°), 212–216°. The infrared spectra of the two samples in Nujol were identical and in agreement with the spectrum described in the literature[6]—λ_{max} in water: 220 mμ (log ϵ 4.40), 274 (3.72), 293 inflection (3.63). Reported λ_{max} in water: 275 mμ and 293 inflection.[7] Calcd. for C$_{14}$H$_{23}$N$_5$O$_7$S (405.43): C, 41.47; H, 5.72; N, 17.28; S, 7.91; found: C, 41.43; H, 5.73; N, 17.54; S, 8.14. This new synthesis of serotonin in two steps from 5-benzyloxyindole is simpler than previously described methods. The over-all yield (31%) from 5-benzyloxyindole appears to be higher than that reported for all other methods except those of Speeter and Anthony[8] (probably greater than 60%) and Young (34%).[9]

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Formylation of Aromatic Amines with Dimethylformamide[1]

Sir:

A variety of methods are available for the preparation of formamides.[2] However, only several procedures exist for the direct formylation of amines with more readily available formamides.

In 1886, Just described the formylation of phenylhydrazine with formamide at 130°.[3] Several years later Hirst and Cohen obtained formanilides from a number of aromatic amines using formamide in glacial acetic acid.[4] A more recent procedure employs the amine hydrochloride and formamide.[5]

We now wish to report the facile formylation of aromatic amines with dimethylformamide in the presence of sodium methoxide. Conversion to the formanilide is accomplished by heating a mixture of sodium methoxide (0.3 mole), the aniline (0.15 mole) and dimethylformamide (150 ml.) at reflux for 30 min. The reaction is accompanied by the evolution of dimethylformamine. Generally, the formanilide, obtained by diluting the reaction mixture with water, does not require further purification. Typical examples include 2-iodoformanilide, colorless needles, m.p. 113–113.5°, 68% yield (*Anal.* Calcd. for C$_7$H$_6$INO: C, 34.04; H, 2.45; N, 5.67.

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Found: C,33.71; H, 2.27; N, 5.84), 4-bromoformanilide (70.5% yield, m.p. 117–119°; lit.[6] m.p. 119°), 2-chloroformanilide (88.4% yield, m.p. 77.5–78°, lit.[7] m.p. 77°), 3-chloro-4-methylformanilide, colorless needles, m.p. 97–97.5°, 68.5% yield (*Anal.* Calcd. for C_8H_8ClNO: C, 56.79; H, 4.77; N, 8.28. Found: C, 56.60; H, 4.66; N, 8.11), and 4-formamidobenzoic acid (45.6% yield, m.p. 270° dec., lit.[8] m.p. 268° dec.).

The composition of a water labile intermediate and the scope of this formylation reaction are presently under investigation.

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