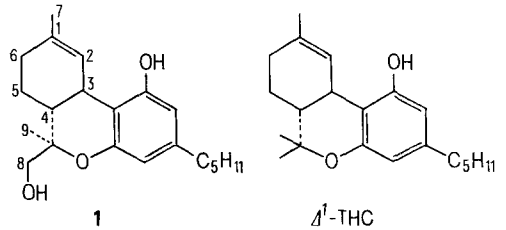
ataxia test is well documented[7,8] and is known to provide the best correlation with activity in man[7]. This test has been further refined and semiquantitated by one of us[9]. After drug administration (i.v. in ethanol and Emulphor) independent observers rate the effect of each dose on



1 Δ^1-THC

every dog using a behavioral rating scale of zero (no effect) to 6 (dog lies prostrate on the floor) and the mean of their scores at peak activity is calculated. A comparison of compound **1** with Δ^1- and $\Delta^{1(6)}$-THC's[9b] in this test is shown below. The mean scores are given with the number of dogs tested in parenthesis. In addition, compound **1** showed a minimum effective dose (MED) for ataxia and 'popcorn effect'[10] at 1.0 mg/kg (i.v.) in mice. In the same tests Δ^1- and $\Delta^{1(6)}$-THC's were active at 0.5 mg/kg. In the spontaneous motor activity test in mice at 10 mg/kg (i.p.), the activity was decreased 36.6 $\pm$ 4.5%[11] by compound **1**, 41.2%[11] by Δ^1-THC and 69.3%[11] by $\Delta^{1(6)}$-THC. Compound **1** was inactive in the hot-plate procedure upto 10 mg/kg (i.p.). These pharmacological tests were carried out according to procedures described by us earlier[10].

It is thus clearly seen that the substitution of a methyl by a hydroxymethyl group in the 8β-position in Δ^1-THC results in a compound as active as Δ^1-THC.

Relative effect on the overt behavior of dogs

Dose (mg/kg)	Compound **1**	Δ^1-THC	$\Delta^{1(6)}$-THC
0.1	1 + (2)	0 (1)	0 (1)
0.2	3 (2)	3 + (2)	0 (1)
0.4	4 (1)	4 (2)	2 (2)

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Direct Fluorination of Carcinogenic Polycyclic Aromatic Hydrocarbons. 6-Fluorobenzo[a]pyrene[1]

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Summary. Xenon difluoride reacts with benzo[a]pyrene(BaP) in dichloromethane solution in an open system to give 6-fluorobenzo[a]pyrene. This method constitutes a direct route to fluorine substituted carcinogenic polycyclic aromatic hydrocarbons.

Polycyclic aromatic hydrocarbons (PAH) are present in tobacco smoke and are common contaminants of the urban environment. They are suspected of contributing to the increasing incidence of cancer of the human respiratory tract. One of the most intriguing problems in cancer research concerns the mechanism by which the relatively inert PAH initiate tumors[2]. Fluorine substituted carcinogenic PAH have been prominent in the study of structure-activity relationships of chemical carcinogens in this series[3–5]. Hitherto, the syntheses of such fluorine derivatives were based on the following 2 general methods: a) A 'tailormade' sequence analogous to the one applied in a well-established synthesis of the corresponding polycyclic hydrocarbon but with a fluorine-substituted starting material (e.g., the synthesis of 3-fluorobenzo[rst]pentaphene[6]). b) A direct electrophilic substitution of the PAH followed by appropriate transformations of the substituent to fluorine. Neither method is satisfactory, especially in the higher members of the PAH series. We report a straightforward synthesis of 6-fluorobenzo[a]pyrene (I) by a direct fluorination of benzo[a]pyrene (BaP) with xenon difluoride. The notorious BaP has played a leading role in this area of cancer research and still ranks among the most powerful all around carcinogenic substances[3–7].

The reaction of xenon difluoride and BaP was carried out in dichloromethane solution in a Kel-F tube in an open system, under anhydrous conditions. Initiation was

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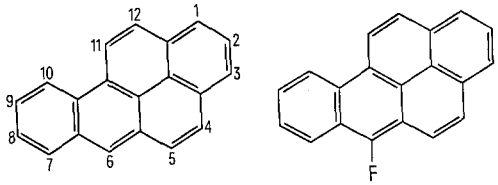
effected at −45 °C. Subsequently, the reaction mixture was kept at −78 °C for 24 h. The dark brown complex was decomposed with aqueous sodium bicarbonate. Careful column chromatography of the crude product on silica gel, petroleum ether (40–60°) serving as eluent, afforded I as yellow needles, m.p. 156 °C (from 1-butanol) in 26% yield. The structure of I (including the site of fluorination) was established by the elemental analyses, the molecular ion at *m/e* 270 in the mass spectrum and the



BaP I

chemical shift and pattern of the ^{19}F NMR-spectrum (δ = 132.0 ppm, singlet)[8]. Compound I is the only fluorobenzo[a]pyrene isomer which should give rise to a ^{19}F NMR singlet. The ^{19}F chemical shift of I closely resembles that of 9-fluoroanthracene (δ = 131.8 ppm)[8]. It should be noted that the ^{19}F NMR-spectrum of the crude reaction mixture did not contain any absorptions which could be attributed to other fluorobenzo[a]pyrene isomers or to addition products. The ^{1}H NMR-spectrum of I lacked the characteristic singlet at 8.42 ppm in the corresponding spectrum of BaP, attributed to H-6[9]. The UV-spectrum of I ($\lambda_{max}^{cyclohexane}$ = 226 nm (log ε 4.45), 255 (4.60), 266 (4.62), 275s (4.45), 286 (4.61), 296 (4.74), 336s (3.68), 356 (4.05), 372 (4.29), 383s (4.22), 387 (4.25), 393 (4.28) and 408 (4.60)) is very similar to that of BaP and 4-fluorobenzo[a]pyrene[10]. The formation of I as the predominant product of the fluorination is not surprizing, in view of the enhanced reactivity of position 6 of BaP towards electrophilic reagents[11].

The blocking of the most reactive position of BaP by a fluorine atom, together with the introduction of a fluorine in the neighbourhood of the K-region (C_4–C_5) (but not at the K-region itself) is particularly attractive to structure-activity relationships studies of chemical carcinogenesis in the BaP series[3]. The direct fluorination of BaP with XeF_2 illustrates the applicability of the route to the synthesis of fluorine substituted carcinogenic polycyclic aromatic hydrocarbons[12].

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Defensive Substances from Stink Bugs of Cydnidae

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Summary. The odorous and physiologically active substances of the secretions of Japanese stink bugs (Cydnidae) were investigated. The main components of the secretions of *M. japonensis* and *A. nigritus* are *n*-tridecane and *n*-pentadecane together with 2-octenal and 2-decenal, while 2-hexenal is the main components in the secretion of *A. magna*.

In recent years, the nature of pheromone and other considerable chemical release used by insects has aroused considerable interest. Some investigations have been published on the chemical structures or physiological functions of the stink bugs: BLUME et al.[2] reported the presence of 2-heptenal and *n*-tridecane from rice stink bugs, *Oebalus pugnax*. ROTH[3] identified pentanal, heptanal, and octenal from *Scaptocoris divergens* (Cydnidae). WATERHOUSE[4] reported the presence of 2-hexenal, 2-decenal from *Nezara viridula*. 2-hexenal and 2-octenal from *Rhoecocaris sulciventris* and *n*-hexenal from *Mictis profana*. SCHILDKNECHT[5] identified as 2-hexenal, 2-octenal, 2-decanal from *D. baccarum* L. 2-hexenal, 2-octenal from *Eurogaster sp.* and 2-hexenal, 2-octenal, 2-decanal from *P. viridissima*. TSUYUKI et al.[6] reported the following constituents from the stink bugs in Japan: *Nezara viridula* (L.), *trans*-decenal. *Graphosoma rubrolimatum* (Westw.), *trans*-2-decenal, *n*-hexenal. *Aelia fieberi* Scott, *trans*-2-decenal. *Scotinophara lurida* Burmeister, *trans*-2-decenal. *Acanthocoris sordidus* (Thunberg), *n*-hexenal, *trans*-2-hexenal. *Hygica opaca* F., *n*-hexenal. *Plinachtus bicoloripes* Scott, *n*-hexenal, octanal. GILBY et al.[7], *N. viridula* var. *smaregdula*, *trans*-2-propenal, *trans*-2-butenal, methylethyl ketone, ethylpropyl ketone, 4-keto-2-hexene, *trans*-2-hexenal, 4-keto-*trans*-2-hexenal, *trans*-2-hexenyl acetate, *trans*-2-octenal, methylheptyl ketone, *n*-undecane, 4-keto-2-octenal, *trans*-2-octenyl acetate, *n*-undecane, *trans*-2-decenal, *cis*-2-decenal, *n*-tridecane, *trans*-2-decenyl acetate. CALAM et al.[8], *Dysderus inter-*

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