in order to be similar to those of other studies. For example, the time of sacrifice post-injection was 1 h in the i.p. studies (Experiment 1), which is compatible with the period of increased L-DOPA uptake in the presence of DMSO as measured by De La Torre[8]. Similarly, the time of sacrifice postinjection was 10 min in i.v. studies (Experiments 2 and 3), and this time is compatible with the period of increased epinephrine and norepinephrine uptake in the presence of DMSO as measured by Hanig et al.[9].

Also, the concentrations used in Experiment 1 for i.p. injection of DA and DMSO are 75 mg/kg and 700 mg/kg, respectively. These are basically identical to those utilized by De La Torre[8] in testing i.p. injected L-DOPA (75 mg/kg) and DMSO (750 mg/kg). Under these experimental conditions there was a large DMSO-mediated increase of L-DOPA in the brain[8]. In other experiments in our laboratory we have seen that this amount of L-DOPA given i.p. to rats even without DMSO will result in large increases in DOPAC and HVA levels.

In Experiments 2 and 3 the i.v. dosage of DA (6 mg/kg) compares well with the intravenous doses of epinephrine and norepinephrine (5 mg/kg) utilized by Hanig et al.[9].

In Experiment 2, limitations on the maximum volume of 70% DMSO solution injectable by tail vein (approximately 0.4 ml of 1400 mg/kg solution) preclude an exact comparison with the injections of DMSO/epinephrine and DMSO/norepinephrine in jugular vein, in which 2750 mg/kg was injected[9]. However, 1400 mg/kg DMSO (Experiments 2 and 3) is approximately twice the concentration used for facilitating L-DOPA entry into the brain with intraperitoneal DMSO[8].

Experiment 3 was designed to increase the amount of DMSO injected and because of the report that horseradish peroxidase only entered the brain significantly if both i.v. and i.p. routes of administration of DMSO were utilized simultaneously along with an intravenous bolus of the peroxidase[10]. However, in our experiments this combination approach had little effect since statistical significance was not reached between DA alone and DA with DMSO (12% increase) (table 3). This can be compared with the 34% and 38% increase found with epinephrine and norepinephrine, respectively, in the presence of DMSO[9]. Any differences might be attributable to the fact that the results for norepinephrine and epinephrine were obtained in neonate chicks where the blood brain barrier is not fully developed[18].

Our results are consistent with non-passage of large amounts of DA through the blood brain barrier. Considering the large doses of DA and DMSO given and the need to inject DMSO i.v., the small increases we found would not warrant a therapeutic trial of DMSO and DA in Parkinson's disease.

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Preadult lethality in four populations of *Drosophila melanogaster* treated with formaldehyde

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Summary. Samples from 4 populations of *D. melanogaster* were treated with formaldehyde by the larval feeding method, and induced lethality was scored. The results showed relevant differences among the populations analyzed.

Formaldehyde is a contaminant and mutagen originating from many sources, and distributed widely in the human environment[1]. It is used in the textile industry, in agriculture and also in the manufacturing of paper, cosmetics, resins, etc.[2].

Formaldehyde is a strong mutagen for *D. melanogaster*, inducing high increases of sex-linked recessive lethals, visible mutations, gynandromorphs, dominant lethals, deficiencies, duplications, translocations, and inversions[3,4]. Mutagenic properties of formaldehyde have also been described for *Neurospora crassa*[5], *Escherichia coli*[6], and *Saccharomyces cerevisiae*[7].

In spite of the wide distribution of this toxin, no studies have been performed to demonstrate its effects on partial components of the fitness of an organism, such as fertility, developmental rate, etc. This paper shows preliminary results on the effects of formaldehyde on the lethality in 4 populations of *D. melanogaster* from different sources.

Material and methods. The flies used in this work were caught during 1972 and 1975 in Asturias (Spain). Each population was established by the capture of at least 40 pairs, and maintained by mass culture. The Felguera and Oviedo populations were obtained in those towns, which are exposed to several kinds of contamination. The populations Teverga and Naranco were caught in the village of Teverga and on Naranco mountain, places apparently less contaminated. Two types of

culture media were used; control medium, mainly composed of baker's yeast and sucrose, and treated medium in which formaldehyde (Panreac) was added to the control medium to obtain a concentration of 0.2% (v/v). Control or treated food was poured into vials (10 × 2.5 cm), using 10 ml per vial.

Virgin males and females were taken from each population and introduced into plastic cylinders (3.60 × 7.80 cm) containing control medium. In these receptacles females laid eggs for 24 h. Eggs were transferred to the vials by using a lancet (50 eggs/vial). Adult males and females from these vials were counted, and the overall lethality (100 minus (adults/eggs) × 100) and induced lethality[8,9] computed. All experiments were performed at 21 °C.

Results and discussion. The table shows that in all populations formaldehyde induced a high percentage of lethality. For each population, the difference between the number of adults from control and treated samples was analyzed by means of 2 × 2 contingency table, and the differences were always highly significant ($p < 0.001$). In addition to this, relevant results appeared when comparing on the one hand the overall lethality percentages from the 4 control samples with each other, and on the other hand the corresponding percentages from the 4 treated samples. The comparisons were carried out by homogeneity analysis of proportion through a chi-square[10]. The result for the control samples was: Naranco > Teverga–Oviedo > Felguera with a $\chi^2 = 88.60$; and for the treated samples: Felguera–Oviedo–Teverga > Naranco with a $\chi^2 = 71.00$ (the Felguera and Teverga populations showed significant difference at the 5% level). Thus, it was not possible to establish any connection between the natural environment of populations and the overall lethality, since no significant difference was shown between the Teverga and Oviedo populations. However, the Naranco population, showing the highest control lethality, was at the same time the least sensitive to the formaldehyde. In contrast to this, the Felguera population with the lowest control lethality was the most sensitive to the toxic.

Other methods of formaldehyde treatment, analysis of other traits and a larger number of populations, will help to clarify the possible existence of any specific adaptation.

Overall and induced lethality by formaldehyde food in 4 populations of *D. melanogaster*

Populations		Eggs	Adults	Overall lethality ± SE (%)	Induced lethality (%)
Teverga	Control	500	385	23.00 ± 1.88	–
	Treated	500	74	85.20 ± 1.58	80.78
Felguera	Control	1000	869	13.10 ± 1.06	–
	Treated	1000	99	90.10 ± 0.94	88.60
Oviedo	Control	1000	794	20.60 ± 1.27	–
	Treated	1000	111	88.90 ± 0.99	86.02
Naranco	Control	1000	697	30.30 ± 1.45	–
	Treated	1000	219	78.10 ± 1.30	68.57

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Beta$_1$-adrenoceptor mediated salivary gland enlargement in the rat[1]

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Summary. In the rat, prolonged activation of β_1-adrenoceptors causes a gain in salivary gland weight, whereas prolonged blockade of these receptors causes a reduction in weight.

Prolonged treatment with the nonselective beta-adrenoceptor agonist isoprenaline causes the parotid and submaxillary glands of the rat to increase markedly in weight[2]. In the rat, isoprenaline also evokes a flow of saliva from these glands; that from the parotid gland is rich in amylase[3]. The beta-adrenoceptors that are responsible for mediating secretion of fluid from the parotid and submaxillary glands of the rat belong to the β_1-subtype[4-6], and this is also the case for those mediating secretion of amylase from the parotid gland[7]. Treatment with dobutamine, a β_1-adrenoceptor selective agonist, but not with terbutaline, a β_2-adrenoceptor selective agonist, has been found to cause a gain in weight of the rat submaxillary gland[8]. However, terbutaline has also been reported to cause an increase in the weight of the rat parotid gland[9,10]. In the present study the effects on the weight of the 3 major salivary glands of the rat of prolonged treatment with the β_1-adrenoceptor selective agonist prenalterol, terbutaline and the β_1-adrenoceptor selective antagonist metoprolol were examined.

Materials and methods. Adult female rats, weighing about 225 g, of a Sprague-Dawley strain were used. There were 3 experimental groups. The rats of each group were litter-mates. The groups were as follows: 1. control (7 animals) and prenalterol-treated animals (7); 2. control (8) and terbutaline-treated animals (8); 3. control (5), metoprolol-treated (5) and metoprolol + terbutaline-treated animals (5). The drugs were given twice daily, dissolved in 0.2 ml saline, over a period of 14 days. Prenalterol HCl (AB Hässle) 3.5 mg (15.5 mg/kg) and terbutaline sulphate (AB Draco) 3.7 mg (16 mg/kg) were given s.c., while metoprolol tartrate (AB Hässle) 5 mg (22 mg/kg) was given i.p.; when metoprolol and terbutaline treatments were combined, the former drug was given 20 min in advance. At the end of the experiment the animals were killed by inhalation of ether; the parotid, submaxillary and sublingual glands were removed and weighed (wet weight). The glands were then heated at 110 °C for at least 3 days (dry weight). Gland weights (mg) were expressed in relation to body-weight (g). Student's t-test for unpaired data was used.

Results and discussion. The body-weights of treated animals did not differ from those of the respective controls.

Prenalterol, β_1-selective agonist, increased both wet (by 30%) and dry (by 21%) weights of the parotid glands (fig. 1), but not significantly those of the submaxillary glands (fig. 2). Terbu-