important point to be noted especially while making impact assessments of DDT input and output in aquatic environments.

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Phosphoglucomutase-I, esterase-D, acid phosphatase, glyoxalase-I and phosphoglucoisomerase in hair sheath of cadavers

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One hundred and three cadavers were typed for five red cell enzymes detected in the hair sheath. Matching probabilities for the five enzymes were highly significant. The complementary discrimination probability, which measures the likelihood that two individuals do not match, was examined. Satisfactory results were obtained for all the enzymes, even when samples stored at room temperature for up to 18 days were used. Hair sheath typing of these enzymes thus constitutes a powerful method of identification of individuals in cases of advanced putrefaction and mass disaster, where hair may be the only clue material.

EXAMINATION of hair for personal identification from the forensic point of view is important in those cases where the only clue material found is hair. The enzymes phosphoglucomutase (PGM), adenosine deaminase (ADA), esterase-D (EsD), phosphohexose isomerase (PHI) and 6-phosphogluconate dehydrogenase (6-PGD) have been found in sufficient concentration to allow typing by starch and agarose–starch electrophoresis, and by isoelectric focusing for some of the enzymes. Although typing of hair sheath from healthy donors for the determination of various enzymes has been reported by many workers[1-6], typing of cadavers has not been reported. In the present study hair sheaths from 103 cadavers from a North Indian population were typed for five red cell enzymes. Samples were also stored at room temperature to determine the stability of enzyme for typing.

Hair samples, with sheaths, were obtained from 103 cadavers sent for autopsy. Blood samples from the cardiac region were also taken. Red blood cells and hair samples of known PGM, EsD, acid phosphatase (AP), glyoxalase-I (GLO-I) and phosphoglucoisomerase (PGI) type were also taken as controls.

Plucked hair, bearing sheath cells, were attached to a glass slide using cellotape in such a way that the roots were completely exposed to air. The hair samples were stored at room temperature for up to 6 weeks.

Hair sheaths from five or six hairs from each case were scraped with a scalpel and then macerated with a few drops of distilled water. Extracts prepared from old samples were treated with a drop of Cleands reagent for 4–5 min before electrophoresis.

Electrophoresis and detection of PGM, AP and GLO-I were carried out according to the *Biological Manual* (Metropolitan Police Forensic Science Laboratory, London) except that the gel was a mixture of agarose and starch, and some of the conditions of electrophoresis were changed: PGM, 1:2 agarose–starch, 16–17 V/cm, 2.5 h; GLO-I, 2:1 agarose–starch, 10–11 V/cm, 105 min; AP, 1:2 agarose–starch, 18 V/cm, 3 h. Samples were typed for EsD according to Harris and Hopkinson except that a mixed gel was prepared (2:1 agarose–starch) and the run was at 15 V/cm for 2 h. PGI isoenzymes were separated by horizontal starch gel electrophorosis as described by Papiha and Chahal[7] using fructose 6-phosphate (disodium salt) in the staining mix,

The results are given in Table 1. The gene frequencies obtained for PGM, GLO-I, EsD, AP and PGI agree with those obtained for northern Indian populations[8-12].

The results of tests of enzyme typability of stored

Table 1. Phenotypes and allele frequencies for five enzymes detected in blood and hair sheath of cadavers from North India.

Enzyme	Phenotype	No. of samples*	Allele frequency
PGM	1–1	53	*PGM1* 0.684
	2–1	35	*PGM2* 0.315
	2–2	15	
EsD	1–1	62	*EsD1* 0.771
	2–1	35	*EsD2* 0.228
	2–2	6	
AP	p^{a+b-}	13	p^a 0.33
	p^{a+b-}	42	p^b 0.669
	p^{a-b+}	48	
GLO-I	1–1	8	*GLO1* 0.266
	2–1	39	*GLO2* 0.733
	2–2	56	
PGI	1–1	101	*PGI1* 98.05
	3–1	2	*PGI3* 1.90

*Total number of samples tested, 103.

Table 2. Typability for five enzymes in hair sheath of cadavers stored at room temperature.

		No. of samples* positive after storage for days										
Enzyme	Phenotype	1–7	8–11	12–15	16–18	19–21	22–24	25–27	28–31	32–33	34–35	36–37
PGM	1–1	53	53	53	53	50	42	32	21	16	7	—
	2–1	35	35	35	35	31	26	18	11	6	1	—
	2–2	15	15	15	15	14	9	3	—	—	—	—
EsD	1–1	62	62	62	61	61	58	51	43	40	33	21
	2–1	36	36	36	35	34	30	23	18	16	11	3
	2–2	5	5	5	5	5	3	1	—	—	—	—
AP	p^{a+b-}	13	13	13	13	12	7	4	2	1	1	—
	p^{a+b+}	42	42	42	41	40	35	31	21	14	7	2
	p^{a-b+}	48	48	48	45	43	36	33	26	18	11	4
GLO-I	1–1	8	8	8	7	5	1	—	—	—	—	—
	2–1	39	39	39	32	27	18	11	3	—	—	—
	2–2	56	56	56	46	40	26	17	7	—	—	—
PGI	1–1	101	101	101	97	90	81	72	67	51	39	22
	3–1	2	2	2	—	—	—	—	—	—	—	—

*Total number of samples tested, 103.

hair sheath samples are given Table 2. Samples were typable for PGM for up to 18 days, after which more and more samples known to be positive for a given phenotype typed negative. Several workers have studied activity of PGM in hair. Oya *et al.*[3] reported activity of PGM for up to 14 days on starch gels, while Yoshida *et al.*[5] detected it for up to 10 days on the same medium.

The variants of both EsD and AP were detected in stored samples for up to 15 days, but the intensity of the bands started to decrease after 13 days. In an earlier study on a Japanese population, Yoshida *et al.*[5] detected EsD for only up to 4 days.

GLO-I was detected for up to 15 days. Stability of GLO-I for up to 7 days, using cellogel membranes, has been reported earlier[13].

In the case of PGI, high frequency of the *PGI1* allele has been reported. We did not find any rare variant other than *PGI3*. Both were detectable for up to 15 days.

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Synergistic oviposition deterrence activity of extracts of *Glycosmis pentaphyllum* (Rutaceae) and other plants for *Phthorimaea operculella* (Zell) control

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Acetone extracts of *Glycosmis pentaphyllum* combined with equal amounts of extracts of *Catharanthus roseus*, Neemrich, *Salvadora oleododes*, *Breneya* species exhibited significant increase in ovipositional deterrence activity against *Phthorimaea operculella* compared to the activity of the individual extracts. Important practical implications are adduced for such synergistic enhancement of bioactivity by combinations of plant extractives.

USEFULNESS of natural compounds in insect control has been emphasized recently[1]. Extracts of naturally occurring plants have been assessed for their attractant, repellent, insecticidal, hormonal and behavioural activities against insects. New pest control strategies based on such programmes are being constantly developed[2]. Insect oviposition can be deterred by chemical or other stimuli having tendency to increase locomotor activity[3]. Acetone extracts of the *Glycosmis pentaphyllum* (Rutaceae) exhibit various insectistatic properties[4]. Two important activities from this plant are antifeedant action and oviposition deterrence (OD) against various insects of