fruits by suppressing the gibberellin level in the fruit[4]. This idea could be valid for daminozide-treated tomatoes[6]. Daminozide may also exert its effect on ripening by inhibiting tryptamine oxidation[9] or by increasing peroxidase and IAA oxidase activities[10] thus, leading to a lower level of auxin. Recently, the onset of ripening has been attributed to oxidative turnover of auxins in the fruit[11]. In tomatoes daminozide may also reduce auxin synthesis and stimulate auxin breakdown which may, in turn, enhance the ripening process. Nevertheless, the indication is that daminozide may function in the regulation of fruit ripening by affecting more than one of the naturally occurring plant hormones.

1 Acknowledgment. This investigation was supported by Agriculture Canada and the Ontario Ministry of Agriculture and Food.
2 N.E. Looney, Pl. Physiol. *43*, 1133 (1968).
3 N.E. Looney, J. Am. Soc. hort. Sci. *96*, 350 (1971).
4 R.E. Byers and F.H. Emerson, J. Am. Soc. hort. Sci. *94*, 641 (1969).
5 N.E. Looney, W.B. McGlasson and B.G. Coombe, Aust. J. Pl. Physiol. *1*, 77 (1974).
6 J.K. Babbitt, J.J. Powers and M.E. Patterson, J. Am. Soc. hort. Sci. *98*, 77 (1973).
7 H.K. Pratt and M. Workman, Proc. Am. Soc. hort. Sci. *81*, 467 (1962).
8 J.M. Lyons and H.K. Pratt, Proc. Am. Soc. hort. Sci. *84*, 491 (1964).
9 D.J. Reed, T.C. Moore and J.D. Anderson, Science *148*, 1469 (1965).
10 A.H. Halevy, Pl. Physiol. *38*, 731 (1963).
11 C. Frenkel, in: Fracteurs et regulation de la maturation des fruits. Int. Colloq. Nat. Centre Sci. Recherche, Paris, No. *238*, 201 (1974).

Responses of *Drosophila* to environmental ethanol from ecologically optimal and extreme habitats

P.A. Parsons[1]

Australian Drosophila Research Unit, Department of Genetics and Human Variation, La Trobe University, Bundoora (Victoria 3083, Australia), 30 November 1979

Summary. Adult tolerances and larval behaviour in the presence of ethanol is more variable in populations derived from optimal habitats than those from extreme habitats. Since the habitat types are defined ecologically in terms of climatic and biotic factors, this result has biological significance for defining the properties of populations from extreme habitats.

Recent studies provide comparative data on resource utilization of *Drosophila* species attracted to fermented-fruit baits[2,3]. For example, ethanol is a fermentation product utilized as a resource to a threshold where it becomes toxic in all such species so far tested[4-7]. *D. melanogaster* shows variability for ethanol tolerance inside and outside a winery, as well as before, during and after vintage, which can be directly attributable to ethanol as a selective factor[8,9]. At the broad biogeographic level, the threshold between ethanol as a benefit and cost tends to fall towards the tropics in the northern hemisphere[10]. Since resources vary among localities these variations are not surprising.

Comparing 3 Australian east-coast localities, Melbourne, Brisbane and Townsville, LT_{50} values on 12% ethanol fit the northern hemisphere trend of falling ethanol thresholds towards the tropics (table). On biogeographic grounds, a greater diversity of resources would be expected in tropical compared with temperate zones[12], so that the threshold fall may be expected to be associated with increasing variability. Comparisons among isofemale strains within populations, which is a quantitative genetic technique of value in comparing natural populations[13], confirm this prediction (table).

Larvae, at the stage of maximum feeding, are additionally good indicators of resource utilization[14]. As expected the mean number of newly-hatched larvae out of 10 choosing ethanol in 15 min falls towards the tropics for the same 3 localities, and variability among isofemale strains increases especially for Townsville.

Townsville has a non-stressful humid tropical climate, as has Brisbane to a lesser extent, when compared with the temperate climate of Melbourne where temperature extremes are greater. The finding of parallel climatic races in *D. melanogaster* and its sibling species, *D. simulans*, whereby Melbourne populations are more resistant to both desiccation and cold stresses than Townsville populations show the importance of direct climatic selection upon *Drosophila* populations[15]. The number of sympatric *Drosophila* species commonly attracted to fermented-fruit baits

Adult ethanol tolerances and larval preferences for ethanol in *D. melanogaster*

	Latitude (°S)	No. of isofemale strains	LT_{50} for adults on 12% ethanol (h)	F-values for variability among isofemale strains	No. of larvae out of 10 choosing 6% ethanol	F-values for variability among isofemale strains
Melbourne	37	8	60	8.3[b]	8.2	1.6
Brisbane	28	9	29	12.0[b]	6.8	3.1[a]
Townsville	19	9	9	70.8[b]	6.4	4.7[b]
Darwin	12	10	41	8.2[b]	5.4	2.2

Adult tolerances are expressed as mean LT_{50}'s (number of h at which 50% of flies had died) exposed to 12% ethanol using techniques described by Parsons et al.[11], based upon 5 replicates of 25 flies per sex per isofemale strain. Larval preferences are expressed as means of the number of newly-hatched larvae out of 10 choosing agar containing 6% ethanol after 15 min when given a choice of plain agar and ethanol containing agar (8 replicates per isofemale strain). [a] $p<0.05$; [b] $p<0.01$.

additional to *D. melanogaster* are Townsville 5, Brisbane 3, and Melbourne 2. This is presumably a reflection of high heterogeneity of available resources in tropical habitats. In any case, temperate zone habitats are clearly more uniform for *Drosophila* resources especially in the vicinity of wineries[16].

The Darwin population, further to the north (and west) of those considered so far, appears exceptional. However, the climate is very extreme since mean maximum temperatures exceed 30 °C every month of the year including winter. In agreement is the biological indicator of only 1 additional sympatric species *D. ananassae*, known from unpublished data to be very desiccation-resistant. The extreme nature of the climate is also shown by the absence of *D. simulans* which is found in the 3 other localities, and is known to be more sensitive to environmental extremes than *D. melanogaster*[15]. In other words, Darwin must be regarded as ecologically marginal in spite of its latitude. A consequence is relatively low variability among isofemale strains at similar levels to the ecologically marginal temperate-zone Melbourne population (table), even though the means are lower in Darwin as found in the other tropical populations.

The genetic characteristics of marginal populations have been considered in the literature with varying conclusions[17,18]. For example, in certain but not all *Drosophila* species, chromosomal polymorphism levels fall towards the (geographic) margins but this is not a general result. The situation is even more obscure for allozyme frequencies[19]. Here 2 populations, Melbourne and especially Darwin, are defined as ecologically marginal or extreme, in terms of climatic and biotic factors. In such extreme populations, low genetic variability for traits of direct significance in the field occurs. This follows from the demonstration that ethanol occurs in the field, occasionally to high concentrations[16]. Such low variability may preclude the possibility of spreading into even more extreme habitats even if resources are available, although as in the Queensland fruit fly, *Dacus tryoni*, such a possibility cannot be excluded[20].

1 I thank Garry Spence for technical assistance, and the Australian Research Grants Committee for partial financial support.
2 W. Atkinson and B. Shorrocks, Oecologia (Berl.) *29*, 223 (1977).
3 P.A. Parsons, Aust. J. Zool. *27*, 413 (1979).
4 W.T. Starmer, W.B. Heed and E.S. Rockwood-Sluss, Proc. natl Acad. Sci. USA *74*, 374 (1977).
5 J. van Herrewege and J.R. David, Experientia *34*, 163 (1978).
6 P.A. Parsons and G. Spence, Am. Nat., in press (1980).
7 J.R. David, J. van Herrewege, M. Monclus and A. Prevosti, Comp. Biochem. Physiol. *63C*, 53 (1979).
8 J.A. McKenzie and P.A. Parsons, Genetics *77*, 385 (1974).
9 J.A. McKenzie and S.W. McKechnie, Nature *272*, 75 (1978).
10 J.R. David and C. Bocquet, Nature *257*, 588 (1975).
11 P.A. Parsons, S.M. Stanley and G.E. Spence, Aust. J. Zool. *27*, 747 (1979).
12 R.H. MacArthur, Geographical Ecology. Harper & Rowe, New York 1972.
13 P.A. Parsons, in: Quantitative Genetic Variation, p.61. Ed. J.N. Thompson, Jr, and J.M. Thoday. Academic Press, New York 1979.
14 P.A. Parsons, Behav. Genet. *8*, 511 (1978).
15 P.A. Parsons, Evolution *33*, 131 (1979).
16 J.A. McKenzie and S.W. McKechnie, Oecologia (Berl.) *40*, 299 (1979).
17 H.L. Carson, in: The Genetics of Colonizing Species, p.503. Ed. H.G. Baker and G.L. Stebbins. Academic Press, New York 1965.
18 Th. Dobzhansky, in: The Genetics of Colonizing Species, p.535. Ed. H.G. Baker and G.L. Stebbins. Academic Press, New York 1965.
19 R.C. Lewontin, The Genetic Basis of Evolutionary Change. Columbia University Press, New York 1974.
20 R.C. Lewontin and L.C. Birch, Evolution *20*, 315 (1966).

Steady-state distribution of lithium during cultivation of dissociated brain cells[1]

Z. Janka, I. Szentistványi, A. Juhász and A. Rimanóczy

Department of Neurology and Psychiatry, University Medical School, H-6701 Szeged (Hungary), 26 November 1979

Summary. The formation of a steady-state intracellular lithium level was studied in the course of cultivation of dissociated nerve cell cultures obtained from chick embryonic brains. When lithium was given at a concentration of 2 mM, in the nutrient medium, at day 5, a steady state intracellular lithium content was achieved after about 30 min of incubation and it did not change significantly during the time of cultivation up to the 13th day in vitro.

Lithium salts have a beneficial effect in the treatment and prophylaxis of manic-depressive illnesses[2]. An uneven steady-state distribution of lithium (Li) between the red cells and plasma has been observed during long-term Li therapy[3]. In very recent years the transport mechanisms which result in this unequality of Li distribution in the blood have been characterized[4,5]. Studying the properties of Li transport across the membranes of nerve cells is of importance for an understanding of the characteristics of the regulation of Li homeostasis in the brain, and of the therapeutic mode of action of Li.

Richelson reported that Li entered neuroblastoma cells through the sodium channel and that ouabain, a potent inhibitor of Na, K ATPase, did not affect this Li uptake[6]. Tumorous lines of glial cells in culture accumulate Li, attaining an intra-/extracellular Li distribution ratio of 3–5[7]. In earlier papers we detected a Na^+-dependence of the Li uptake and an ouabain-insensitivity of the Li fluxes in primary nerve cell cultures[8,9]. In the present work we have studied the intra/extracellular Li distribution in the course of cultivation in dissociated cultures prepared from embryonic brain.

Material and methods. Primary cultures of a population of neuronal and glial cells were prepared from 7-day-old chick embryonic brains after the method of Sensenbrenner et al.[10]. The cerebral hemispheres were dissected, cleaned of their meningeal membranes, then passed through a nylon sieve (48 µm pore size). Only mechanical dissociation was used. Cells were grown in Falcon plastic Petri dishes (60 mm diameter) containing Eagle's Minimal Essential Medium supplemented with 20% fetal calf serum (Gibco). The medium was changed 3 times per week. The cultures