Table 2. Plasma renin activity, plasma aldosterone, aldosterone secretion rate, and catecholamine excretion values in five patients with Parkinson's disease under metabolic ward conditions. The patients were then treated with 3 to 5 g per day of L-dopa and the plasma renin was activity measured again.

Measurement	Intake conditions	Results (mean ± S.E.M.)
Renin activity (ng $liter^{-1}$ min^{-1})	Unrestricted Na	2.2 ± 1.6
Renin activity (ng $liter^{-1}$ min^{-1})	135 meq/day Na	3.6 ± 1.7
Renin activity (ng $liter^{-1}$ min^{-1}) (after treatment)	135 meq/day Na 3–5 g/day L-dopa	Undetectable
Plasma aldosterone (ng/100 ml)	135 meq/day Na	14.8 ± 4.5
Aldosterone secretion rate (μg/24 hr)	135 meq/day Na	42.3 ± 12.1
Urine dopamine (μg/24 hr)	135 meq/day Na	267.0 ± 70.7
Urine noradrenaline (μg/24 hr)	135 meq/day Na	22.3 ± 9.3
Urine adrenaline (μg/24 hr)	135 meq/day Na	16.0 ± 2.8
Urine homovanillic acid (mg/24 hr)	135 meq/day Na	4.6 ± 0.6

acid excretion. These results are compatible with, but of course not diagnostic of, peripheral sympathetic nervous system hypofunction. In further support of this hypothesis are the following observations (in six patients balance studies were carried out). A change from 135 to 10 meq of Na per day (K, 90 meq/day kept constant) was manifested within 3 to 4 days by the expected drop in Na excretion to less than 15 meq/day. This was followed by a marked positive balance immediately upon return to 135 meq of Na per day. The pattern of Na homeostasis is therefore within normal limits in these patients. Plasma renin activity was studied in the same six patients fed a diet of 135 meq of Na and 90 meq of K per day. The results were 2.53 ± 0.87 ng $liter^{-1}$ min^{-1}. After a further 3 days of diet with 10 meq of Na and 90 meq of K per day, there was a rise to 13.10 ± 4.74 ng $liter^{-1}$ min^{-1}. This rise is within the lower limits of the normal range (*2*).

Our study indicates that one of the possible underlying mechanisms for the low or low normal blood pressures in akinetic Parkinson's disease is a decreased activity of the renin-aldosterone system. This may be secondary to a deficient sympathetic nervous system or may in some way be related to the reported defect in dopamine metabolism (*9, 10*). The occurrence of basal ganglia symptoms resembling the rigidity of Parkinson's disease in cases of autonomic insufficiency or so-called "idiopathic orthostatic hypotension" where the renin-aldosterone system is also deficient (*5, 11*) has been reported. In one report (*11*), pathological findings similar to Parkinson's disease were found in the substantia nigra, locus ceruleus, and sympathetic ganglia.

After 1 and 3 months of treatment with high doses of L-dopa (3 to 5 g/day, given orally), the plasma renin activity in five Parkinsonian patients decreased and became undetectable (Table 2). In two more patients with relatively high blood pressure (above 110 mm-Hg diastolic) we succeeded in obtaining normal blood pressure readings after 3 months of L-dopa therapy alone. This decrease in plasma renin activity with L-dopa should be explored in relation to the orthostatic hypotensive episodes frequently noted during this form of therapy. The above results also warrant further studies into the relation between sodium, dopamine, and the renin-aldosterone system as well as a trial of L-dopa in the treatment of neurogenic hypertension.

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Photoperiod in Three Xanthium Populations from the Tropic of Cancer in Mexico

Abstract. *Diverse photoperiodic responses were shown by three populations of* Xanthium strumarium *L. originating between 22° and 25°N on the western coast near Culiacán, Sinaloa; in the Chihuahuan Desert near Matehuala, San Luis Potosí; and on the Gulf Coast near Ciudad Mante, Tamaulipas, respectively. A combination of differences in critical night length and in ripeness-to-flower response (maturity) appears to be the basis for reproductive adaptation of these populations to different climatic regimes that prevail at the same latitude (and photoperiodic regime).*

During an investigation of photoperiodism in populations of *Xanthium strumarium* L. (*1*) from Texas and Mexico, different requirements for night length were shown by three populations originating between 22° and 25°N. Greater similarity had been anticipated because the three populations are exposed to nearly identical sequences of day length and corresponding night length (Fig. 1) (*2*). Variation in photoperiod was suggested, however, by differences in time of collecting mature burrs at the three sites—mid-August, Culiacán, Sinaloa (24°48′N, 107°24′W); November, Matehuala, San Luis Potosí (23°39′N, 100°39′W); and late December, Ciudad Mante, Tamaulipas (22°44′N, 98°57′W). This study emphasizes the role of photoperiod in timing activities of plant populations in diverse ecosystems at the same latitude.

Ray and Alexander (*1*) have documented the latitudinal shift in photoperiodic response among *Xanthium* populations in the United States. Northern populations (Minnesota to New York) have an apparent critical night length of 7.75 to 8.5 hours for floral induction, and southern populations (central Texas to Georgia) require 9.5 to 10.5 hours. Although some variation in photoperiod was noted among U.S. populations from the same latitude, it did not encompass the range of the three populations reported below.

All three Mexican populations occur in typical roadside depressions but within three very different ecosystems (Fig. 1) (*3*). The population near Culiacán, on the western coast of the mainland, receives scant rainfall, most of it falling during July, August, and September. The Matehuala populations occur in a creosote bush–desert ecosystem (Chihuahuan Desert) where rainfall averages less than 7.5 cm/mo and more than 5.0 cm only during May through September. The Ciudad Mante population of the eastern coast of Mexico occurs in a semiarid region receiving more than 10 cm of rain per month only from May through October. The dry season is longest at Culiacán (through May) but is pronounced in all three areas from November to April. Although the Culiacán and Ciudad Mante ecosystems are situated below 100 m, Matehuala is at 1581 m.

Seedlings germinated in sand (burrs soaked overnight in Consan-20, a fungicide) were kept under continuous light at 30°C during the day and 24°C during the night until exposed to experimental dark periods (*4*). The 2-week-old seedlings were transplanted into polystyrene cups of sandy loam and perlite and given regular nutrient additions. Five seedlings (66-day) of each Mexican population along with various other populations from Mexico and Texas were placed in Percival growth chambers operated at 30°C during the day and 24°C during the night at night lengths of 9, 10.25, 11, 11.5 hours. After 7 days, night length was increased by 15 minutes. After the initial 14-day comparison, additional seedlings of various ages were tested under diverse night lengths—8.5, 9.5, 10.75, and 12 hours. In order to determine the effects of ripeness-to-flower response (maturity), 88-day-old seedlings were exposed to inductive nights. Illinois (Chicago) plants were grown in the study in order to compare them with plants inducible in night lengths of less than 9 hours.

In order to separate effects of maturity from photoperiodic response, seedlings of various ages were given inductive treatments (five or more dark periods of 12 hours each) to determine differences in maturity (Table 1). Among seedlings exposed to five dark periods and then returned to continuous light, those of Matehuala plants were the youngest induced to flower, and those of Ciudad Mante plants were the oldest induced. Although the Matehuala population developed floral buds in plants 40 or more days old, the length of time required for the buds to appear was 28 days in the youngest plants and was reduced to 5 days in 70-day plants. In contrast, none of the Ciudad Mante plants younger than 65 days showed any bud development after being returned to continuous light and 65- to 80-day-old plants showed questionable bud development even a month after being returned to continuous light.

Table 1. Photoperiodic responses of three populations of *Xanthium strumarium* from Mexico.

Critical night length (hours)	Manifest interval (days)	Time to bud appearance* (days)	Inducible age† (days)
	Culiacán, Sinaloa		
8.5	8–9	13–17	60
	Matehuala, San Luis Potosí		
10.5	5–7	5	40
	Ciudad Mante, Tamaulipas		
10.75	14–16	16–23	65–80‡

* Time until buds appeared in 44-day-old plants on 12-hour nights. † Age of plants induced by five 12-hour nights. ‡ Bud development questionable.

The intermediate response by Culiacán plants included floral bud development in 60-day-old plants 20 days after being returned to continuous light. Among 44-day-old plants left continuously in 12-hour nights, Matehuala plants showed floral buds in the shortest interval and Ciudad Mante plants in the longest interval.

Critical night length differed among the three populations (Table 1). Although Culiacán plants showed bud development 8 to 9 days after exposure to night lengths varying from 8.5 to 12 hours, the Matehuala plants showed bud development only in night lengths varying from 10.5 to 12 hours. The night length requirement for Ciudad Mante plants was most difficult to determine because of the consistently long manifest interval; however, plants kept for 2 weeks at night lengths from 11 to 11.25 and from 11.5 to 11.75 hours showed floral bud initiation in 14 to 16 days, which suggests that the critical night length was 11 hours or less. Subsequent testing at 10.75 and 12 hours showed similar slow bud development (14 to 16 days) under these conditions. Differences in critical night length or manifest interval, or both, separated the three populations under every photoperiod tested.

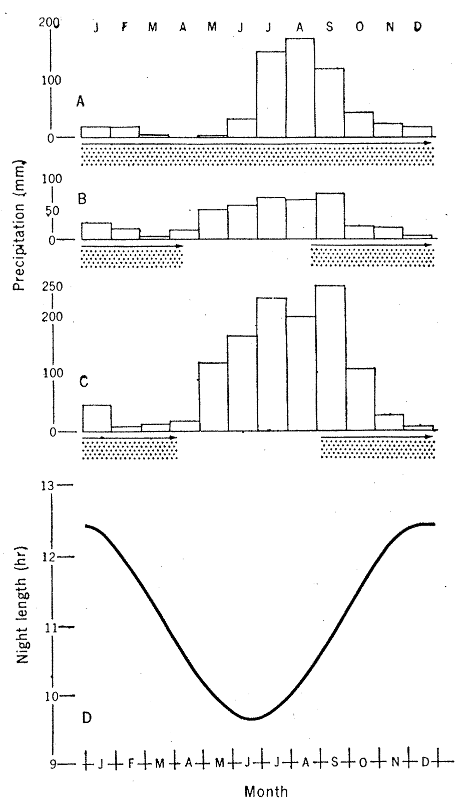

Fig. 1. Period of inductive night lengths (indicated by arrows) for three *Xanthium* populations [(A) Culiacán, (B) Matehuala, (C) Ciudad Mante] plotted under the average monthly precipitation for each locality and with (D) the annual sequence of night lengths (hours) for 22.5°N. The period of inductive night lengths at Ciudad Mante corresponds to the progression plotted for 22.5°N but at Matehuala for 23.5°N.

The rapid floral induction and subsequent floral development of plants from Illinois was not equaled by any plants from Mexico at night lengths greater than 11 hours. Plants from Illinois reached anthesis (shedding of pollen) in 17 to 19 days after exposure to inductive nights. Matehuala plants showed the earliest development among the Mexico populations, reaching anthesis in 22 to 26 days. Culiacán plants reached anthesis in 29 to 32 days, but only 50 percent of the Ciudad Mante plants were in anthesis in 33 to 52 days. The entire developmental pattern of the Ciudad Mante plants reflected their late ripeness-to-flower response.

Seedlings (50 days old) that were planted outside in Austin, Texas, during July showed a diversity of flowering times. The earliest to flower were Culiacán plants; anthesis occurred late in August, and brown mature burrs were harvested in late September. Matehuala plants received their critical night lengths about 5 September in Austin, had swollen floral buds by 13 September, reached anthesis by 2 October, and produced brown burrs by early November. The Ciudad Mante plants probably received their critical night length about 15 September, had swollen floral buds on 25 September, reached anthesis by mid-October, and produced brown burrs by mid-December. Only one other experimental population (plants from Tampico, Tamaulipas), also from the Gulf Coast, flowered as late as did plants from Ciudad Mante.

After germination of the plants their time of flowering probably is determined by interaction of ripeness-to-flower and critical night length. Because seed from all three populations could germinate as soon as moisture and temperature permit, germination could occur at the end of the dry season (May–June) or later in the wet season. The differences in their patterns of maturation and photoperiod would then control time of flowering.

Because nights at Culiacán (about 9.5 to 12.5 hours) exceed critical night length, flowering may be largely under control of the ripeness-to-flower response. The development of flower buds under experimental night lengths suggests that the plants at Culiacán possibly are inducible on any day of the year. Because the interval when moisture may be available is chiefly between June and September, this factor may have been the most important in timing the flowering requirements of this population.

Matehuala plants are apparently opportunistic, a characteristic of many desert plants. The uncertainty of the time of available moisture and the probable brief nature of its availability may have been an important factor in the selection of the rapid maturity of this population. The critical night length of 10.5 hours probably restricts the time of flowering to the period after 27 August. The chance of induction occurring prior to mid-April due to critical night length seems slight because of the timing of the dry season. Plants flowering in Matehuala in late August and September would have a high probability of producing mature fruit prior to the cool period, from November to January. Because temperatures as low as $-4.4°C$ have been recorded in Matehuala, *Xanthium* development is apt to be confined to the warmer part of the year. Although plants are at various stages of development at Matehuala in November and December, most plants bear mature or nearly mature fruit.

Plants from Ciudad Mante, the ecosystem with the greatest likelihood of moisture from May through October, may have developed their ripeness-to-flower in response to this potentially long growing period. Because of the long dry season and mild winter (temperatures to $-1.2°C$ have been recorded), *Xanthium* is probably induced only after 5 September. The slightly later occurrence, 15 September, of proper night length at Austin, Texas, probably delayed the flowering slightly in the outdoor planting compared to the wild population. Despite this difference, the garden population and the native population near Ciudad Mante were in very similar condition when they were observed in late November.

The ripeness-to-flower responses of the Ciudad Mante plants are similar to, but not as extreme as, those of Hawaiian collections shown by Ray and Alexander (*1*) to perform slowly and erratically under inductive photoperiods. Thus, a combination of differences in critical night length and in ripeness-to-flower response appears to be the basis for reproductive adaptation to different climatic regimes that prevail at the same latitude (and same photoperiodic regime) in *Xanthium strumarium*.

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References and Notes

1. The terminology follows that of D. Löve and P. Dansereau [*Can. J. Bot.* **37**, 173 (1959)] who regarded all races of *Xanthium* (except *X. spinosum* which was not included in the present study) as being within *X. strumarium* L. As they indicated, morphological intermediates between the named types are common, and the classification is, therefore, somewhat arbitrary. The three Mexican populations are closest to the *italicum* "complex" of Löve and Dansereau. Similarity of different "complex" types in photoperiodism from the same latitude has been shown by P. M. Ray and W. E. Alexander [*Amer. J. Bot.* **53**, 806 (1966)].
2. Calculations of day length (and corresponding night length) for 22.5°N were from Smithsonian Meteorological Tables [*Smithson. Misc. Collect.* **114**, 506 (1951)]. The civil twilight before and after sunset was added to the period between sunrise and sunset for the day-length calculation. The photoperiodic effect of twilight has been reported by V. A. Greulach [*Ohio J. Sci.* **42**, 71 (1942)] and by A. Takimoto and K. Ikeda [*Plant Cell Physiol.* **2**, 213 (1961)].
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5. Supported by NSF grant GB-6097. I thank T. K. Moore, who participated as a summer student, and P. N. Dixon for assistance. P. M. Ray offered helpful comments on the manuscript.

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Myotonic Muscular Dystrophy: Abnormalities in Fibroblast Culture

Abstract. *Skin fibroblasts in culture, derived from four unrelated patients with myotonic muscular dystrophy, contain abnormally large amounts of material with the staining characteristics of acid mucopolysaccharide. These cells also differ from normal cells in their pattern of growth at a high density in culture.*

Myotonic muscular dystrophy, which is inherited in an autosomal dominant pattern, is a disorder that affects skeletal, cardiac, and smooth muscle, the central nervous system, the reproductive system, the lens of the eye, the skull, and scalp hair (*1*). No single metabolic aberration has been adduced to explain the many different physiological and anatomical abnormalities (*2–4*) observed in this disorder. These widespread manifestations made it appear likely that fibroblast cultures derived from patients with myotonic muscular dystrophy (MMD) would express the inherited disorder in some way. The first MMD cell strain that we studied in culture grew in a sheet that was unusually dense and cohesive for a human diploid fibroblast strain. When microelectrode punctures were made for transmembrane measurements of membrane potential (*5*), the MMD cells often adhered tenaciously to the electrode as it was withdrawn. Because these observations suggested that some product of the cells might be abnormal or excessive, four MMD cell strains were grown in culture and stained for acid mucopolysaccharide.

Table 1. Acid mucopolysaccharide staining in fibroblast cultures. A total of 200 cells per cover slip were stained and scored according to the method described in the text.

Patient	Percentage of cells with alcian blue–positive granules covering more than 20 percent of cytoplasmic area
Patients with myotonic muscular dystrophy	
A1	36
B6	55
B7	59
B17	60
Normal individuals and patients with other neurological or muscle diseases	
Mean	11 ± 7 (8 cases)
Range	3 to 26

Cultures were initiated from skin obtained by punch biopsy or in the course of muscle biopsy; control cultures were derived from normal individuals or patients with other neurological or muscle diseases. The explants and subsequent subcultures were grown in the Dulbecco-Vogt modification of Eagle's medium, supplemented with 10 percent calf serum. Between the fourth and tenth passages in cultures, cells were grown in