gests the explanation of a potential action of tranquilizers in enhancing hallucination when tranquilizers are administered in the right dosage range. Finding only a protective action (*2*) would be in agreement with the interpretation that an additive effect is an aspect of the competition for receptors between LSD and CPZ that requires a special ratio of one to the other. As already noted, the "toxic psychosis" from large doses of CPZ is consistent with the interpretation. Although the alleged experience of the drug abusers suffers from the vagaries of drug contamination and concomitant use of additional drugs, it does suggest that occasional fortuitous arrival at just the right ratio of hallucinogen to tranquilizer might indeed worsen matters. Trials of DOM in animals and man should provide a further test of this concept. In man one can measure the dissociation underlying hallucinogenic action (*10*) by quantitative, instrumental recording of perceptual changes resulting from subclinical test doses producing no symptoms (*11*).

The accumulated data show that a tranquilizer acts as weak psychotogen protecting against a stronger one by substituting for it at receptor sites, but in large enough doses adding to or even producing the effect it was intended to correct. This accounts for the reported occasional aggravation of hallucinogenic action by tranquilizers.

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Glycine in the Spinal Cord of Cats with Local Tetanus Rigidity

Abstract. *In cats, significant loss of glycine occurred in spinal grey matter on the side of local tetanus, whereas the γ-aminobutyric acid concentration remained unaltered. These findings suggest that tetanus rigidity is due to the blocking of the spinal inhibitory transmission by decrease of inhibitory transmitter and that glycine is an effective inhibitory transmitter in cat spinal cord.*

The possibility that amino acids may act as synaptic transmitters has been demonstrated for invertebrates (*1*). However, little is known about the excitatory and inhibitory transmitters in the mammalian central nervous system.

Glycine may be an inhibitory transmitter involved at synapses in cat spinal cord (*2–4*), and γ-aminobutyric acid (GABA) may be an inhibitory transmitter released from neurons located in the rostral level of central nervous system in vertebrates (*5*). An injection of tetanus toxin in one extremity of cats produces a strictly localized rigidity, which has been called local tetanus. It is also clear that the action of tetanus toxin is at inhibitory synapses on motoneurons (*6*). We have studied local tetanus rigidity in connection with the chemical transmitter involved. Tetanus toxin [10×10^4 MLD (minimum lethal doses for mice) in 0.1 ml] was injected into the right gastrocnemius muscle of mature cats. Symptoms of local tetanus appeared in the injected muscle in 24 hours, and rigidity involved the whole right lower extremity in 72 hours. The left lower and the upper extremities remained unaffected. With nembutal anesthesia, laminectomy of the lower lumbar and the upper sacral vertebrae was carried out.

The sixth and seventh lumbar segments and first sacral segment of the cord were removed, rinsed in saline, blotted, and frozen on dry ice. Thin sections (2 to 3 mm) of the cord were cut and divided into the grey matter and white matter on the control and the local tetanus sides, respectively. All dissections were performed at −20°C on an aluminum plate on which dry ice bags containing acetone were placed.

Table 1. Contents of glycine, GABA, and total amino acids in the right side with local tetanus and in the left control side of cat spinal cord. Student's t test in paired experiments was used to test the data. $t_{(N-1)} = \bar{d}/S\bar{d}$; where $\bar{d}$ is the mean of the difference in each experiment, $S\bar{d}$ is the standard error, and N is the number of experiments. N.S., not significant.

Case No.	Grey matter (μmole/g)			White matter (μmole/g)		
	Control side (L)	Local tetanus side (R)	Difference	Control side (L)	Local tetanus side (R)	Difference
			Glycine			
1	5.7	4.6	− 1.1	3.0	3.6	+ 0.6
3	6.1	5.9	− 0.2	3.2	2.7	− 0.5
4	5.6	5.3	− 0.3	2.7	2.9	+ 0.2
5	6.1	5.8	− 0.3	3.3	3.4	+ 0.1
6	6.7	6.6	− 0.1	2.9	3.8	+ 0.9
7	5.4	5.3	− 0.1	3.0	2.8	− 0.2
8	5.9	5.5	− 0.4	3.3	3.1	− 0.2
18	5.9	5.4	− 0.5	3.9	3.5	− 0.4
19	5.7	5.2	− 0.5	2.8	3.6	+ 0.8
20	4.8	4.4	− 0.4	2.6	2.6	0.0
21	5.8	4.9	− 0.8	2.7	3.2	+ 0.5
			$P < .005$			N.S.
			GABA			
1	1.00	0.81	− 0.19	0.10	0.05	− 0.05
9	1.46	1.69	+ 0.23	0.18	0.24	+ 0.06
10	1.57	1.18	− 0.39	0.15	0.12	− 0.03
11	1.04	1.27	+ 0.23	0.17	0.13	− 0.04
12	0.98	1.12	+ 0.14	0.22	0.26	+ 0.04
13	0.88	0.62	− 0.26	0.14	0.15	+ 0.01
19	0.77	0.79	+ 0.02	0.11	0.15	+ 0.04
20	1.24	1.41	+ 0.17	0.14	0.14	0.00
			N.S.			N.S.
			Total amino acids			
3	30.3	31.3	+ 1.0	22.9	18.6	− 4.3
4	33.0	32.4	− 0.6	24.7	25.0	+ 0.3
6	34.6	34.6	0.0	24.6	26.4	+ 1.8
7	33.2	31.8	− 1.4	24.2	23.5	− 0.7
8	33.2	33.8	+ 0.6	24.0	24.3	+ 0.3
12	35.0	34.1	− 0.9	20.2	18.3	− 1.9
13	33.0	32.9	− 0.1	20.9	16.2	− 4.7
18	35.0	38.0	+ 3.0	19.7	19.7	0.0
19	38.0	35.0	− 3.0	17.4	20.0	+ 2.6
20	38.5	36.0	− 2.5	24.2	22.1	− 2.1
			N.S.			N.S.

The tissue samples were weighed and stored at −20°C until used. Ethanol extraction of the tissue and microprocedures (based on fluorometric measurements and enzymic methods) for the assay of GABA were carried out according to Graham *et al.* (*7*); glycine and total amino acids were determined by the procedures described by Graham *et al.* (*2*).

We observed a significant decrease of glycine in the grey matter on the side of local tetanus ($t = 4.72$, $P < .005$); changes in concentration in the white matter on either the control or local tetanus side were not significant. Concentrations of GABA and total amino acids in both grey and white matter on the side of local tetanus did not differ significantly from those found on the control side (Table 1).

Glycine and GABA are viable candidates for an inhibitory transmitter in the mammalian central nervous system. Glycine may be considered a likely inhibitory transmitter in cat spinal cord, by virtue of demonstration of association between glycine and lumbosacral interneurons (*3*), and by electrophysiological analysis of the effect of glycine on spinal motoneurons (*4*). Tetanus rigidity has been explained as the result of blockade of inhibitory transmission to the α-motoneuron of cat spinal cord (*6*) and to the γ-motoneuron (*8*).

Our interest is focused on the inhibitory transmitter in the spinal cord of cats with tetanus rigidity. Our results indicate an association between loss of glycine and presence of local tetanus rigidity, while GABA concentration did not change, and are consistent with findings on anoxic rigidity (*3*). These together suggest that glycine acts as an inhibitory transmitter in cat spinal cord and that tetanus toxin blocks spinal inhibitory transmission by decreasing a transmitter. γ-Aminobutyric acid does not appear to be an inhibitory transmitter in cat spinal cord.

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Translocation in Perennial Monocotyledons

Abstract. *Gross autoradiography, historadiography, and electron microscopy provide evidence that enucleate sieve elements in basal internodes of relatively old* Tradescantia *plants are still functional.*

Commonly, the sieve elements of angiosperms are characterized as short-lived cells, presumably functioning in the conduction of assimilates for only one season. *Tilia,* the linden tree, has often been cited as an exception—the sieve elements of *T. americana* living, and presumably remaining functional, for as many as 5 years (*1*); those of *T. cordata* living for as many as 10 years (*2*). The concept of short longevity of sieve elements in angiosperms comes mainly from investigations on deciduous dicotyledons. Until recently the sieve elements of the perennial monocotyledons seemed to have been forgotten. Yet it would seem reasonable to assume that in this group of plants, most of which lack secondary tissues, some sieve elements function for many years or for the life of the plant parts in which they occur.

It was not surprising, therefore, that Ervin (*3*) found living sieve elements in 8-year-old stem segments of *Smilax hispida* and in 10-year-old rhizome segments of *Polygonatum canaliculatum,* or that Parthasarathy and Tomlinson (*4*) demonstrated living sieve tubes at the base of a *Sabal palmetto* stem at least 50 years old. Tomlinson (*5*) estimates that in some of the slower-growing arborescent monocotyledons the age of the conducting tissues must exceed a century.

The mature, presumably functional, sieve element of angiosperms is generally described as an enucleate, tonoplast-free cell. As the sieve element approaches maturity its nucleus and tonoplast (the membrane separating vacuolar contents from cytoplasm) disappear, and the contents of adjacent sieve elements become continuous through newly formed pores in their common walls. Recently, it was demonstrated that aphids were able to feed on mature sieve elements of secondary phloem in their 2nd year in *T. americana,* evidence that such sieve elements were still functional (*6*). No such evidence is available to show that sieve elements of the oldest part of the primary phloem of monocotyledons are able to conduct, for aphids do not feed on old stems of monocotyledons. Therefore, a monocotyledonous species

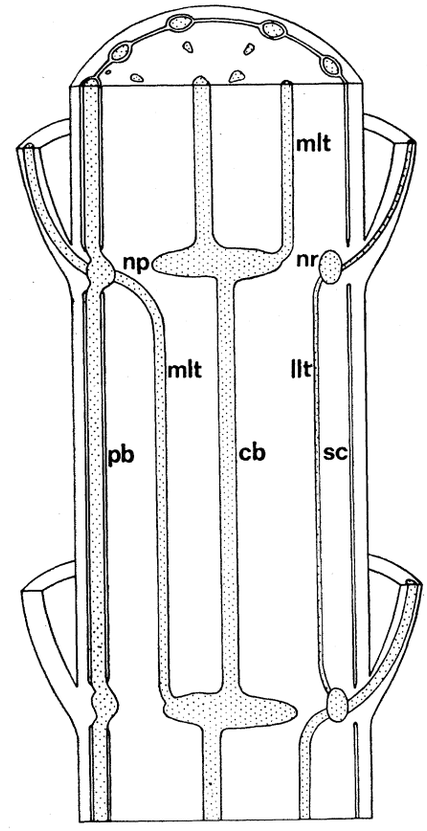

Fig. 1. Arrangement and relationships of the vascular bundles (stippled) in the stem of *Tradescantia albiflora.* Abbreviations: *cb,* central bundle; *llt,* lateral leaf trace; *mlt,* median leaf trace; *np,* nodal plate; *nr,* nodal ring; *pb,* peripheral bundle; and *sc,* sclerified endodermis.