when the mass spectrometer was operated in the full-scan mode. However, when the sample was analyzed in the more sensitive selected-ion mode, with the mass spectrometer focussed only on ions of mass 149 and 167, which are prominent in the spectrum of bis(2-ethylhexyl) phthalate (8), the presence of this compound was indicated.

Careful reassessment of the entire oxprenolol assay revealed that the only plastic material used was about 2 m of polyvinyl chloride tubing attached to a Pasteur pipet; it was employed to blow nitrogen over the tubes in a water bath for solvent removal. When this polyvinyl chloride tubing was replaced with polytetrafluoroethylene tubing, clean blanks were achieved.

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Effects of Spermine and Spermidine on Gastric Emptying in Rats

Keyphrases □ Spermine—effects on gastric emptying in rats, structure–activity relationships □ Spermidine—effects on gastric emptying in rats, structure–activity relationships □ Structure–activity relationships—spermidine and spermine, effects on gastric emptying in rats

To the Editor:

Spermine and spermidine have been intensively studied with regard to their function in cellular metabolism and, more recently, their role in normal and neoplastic growth (1). These biogenic amines were reported (2) to occur in relatively high concentrations in the GI tract, but no precise physiological role has been attributed to them.

Recently, we reported that a branched-chain polyethyleneamine (mol. wt. >600) greatly inhibited gastric emptying in the rat while an isomeric linear version of this same polymer was essentially inactive (3). Since the repeating unit in both branched and linear polyethyleneimine is somewhat similar to that of spermine and spermidine, we decided to measure the effect of spermine, spermidine, and related small molecule polyamines on the stomach emptying rate in the rat.

Table I—Effects of Polyamines on Gastric Emptying in the Rat

Compound	Molecular Weight	Dose, mg/kg po	Inhibition at 4 hr, %[a]
Diethylenetriamine	103	250	0
Triethylenetetramine	146	250	0
N,N^1-Bis(3-aminopropyl)piperazine	200	250	23
(*N*-Aminoethyl)-1,4-diaminobutane	131	250	36
Spermidine	145	250	87
Polyethyleneimine (commercial product)	>40,000	250	92
Polyethyleneimine (linear)	>10,000	250	11

[a] Resin bead method; see Ref. 3

The results of initial studies (Table I) indicate that the naturally occurring polyamines, spermine and spermidine, are highly effective in reducing gastric emptying in the rat. Certain closely related commercially available polyamines, such as diethylenetriamine and triethylenetetramine, are completely inactive. Other analogs such as (*N*-aminoethyl)-1,4-diaminobutane and N,N^1-bis(3-aminopropyl)piperazine have weak activity.

The structure–activity (inhibition of gastric emptying) of these compounds may be summarized as follows:

$$H_2N(CH_2)_mNH(CH_2)_nNH(CH_2)_mNH_2$$

$m = 3, n = 4$ spermine (very active)
$m = 2, n = 2$ triethylenetetramine (inactive)

$$H_2N(CH_2)_mNH(CH_2)_nNH_2$$

$m = 3, n = 4$ spermidine (very active)
$m = 2, n = 4$ *N*-aminoethyl-1,4-diaminobutane (low activity)
$m = 2, n = 2$ diethylenetriamine (inactive)

$m = 3$ N,N^1-bis(3-aminopropyl)piperazine (low activity)

These results indicate that gastric emptying inhibition in the rat by both polymeric and low molecular weight polyamines is clearly dependent on chemical structure. The reason for this structural specificity is not known. The results suggest, however, that endogenous spermine and spermidine may have some unrecognized GI secretomotor activity that can be duplicated by conformationally similar synthetic materials.

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