References

- 1 Pearson RC, McCloy RF. Blowing hot and cold on peptic disorders. *Br J Surg* 1987; **74**: 1160.
- 2 Pearson RC, McCloy RF, Cutler WC, Levitt JR, Richards B, Vickery JC. Multichannel digital recording of intraluminal temperature in the upper gastro-intestinal tract of man: techniques and analyses. *Clin Phys Physiol Meas* 1988 (In press).
- 3 Respass JC, Ingelfinger FJ, Kramer P, Hendrix TR. Effect of cold on esophageal motor function. *Am J Med* 1956; **20**: 955.
- 4 Winship DH, Viegas De Andrade SR, Zboralske FF. Influence of bolus temperature on human esophageal motor function. *J Clin Invest* 1970; **49**: 243-50.
- 5 Ritschel WA, Erni W. The influence of temperature of ingested fluid on stomach emptying time. *Int J Clin Pharmacol* 1977; **15**: 172-5.

Reply

SIR,—We read with interest the comments made by Pearson and McCloy on our paper studying the effect of meal temperature on gastric emptying (*Gut* 1988; **29**: 302-5). We agree that intraluminal temperature in the upper gastrointestinal tract during normal daily life may sometimes be higher than the maximum temperature used in our study. We, however, chose to select a maximum temperature that was acceptable to all our volunteers, thus ensuring that none of our volunteers were unduly stressed, which itself may inhibit gastric motility and delay gastric emptying.

We do not agree with their assumption that because intraduodenal temperature remains below 35°C for nearly six minutes after a cold drink, that cold liquids must empty from the stomach faster than warm ones. We have shown that up to 10 minutes after ingestion, when cold (4°C) liquids are emptying more slowly than liquids at body temperature, intra-gastric temperature is below 35°C. Consequently, liquids entering the duodenum over this period of time would have a temperature of less than 35°C, and the intraduodenal temperature could well stay below 35°C. Furthermore, our data have shown that intra-gastric temperature is well below 35°C (between 21 and 30°C) for the first six minutes after ingestion of a cold drink.

Their use of Ritschel and Erni's paper (*Int J Clin Pharmacol* 1977; **15**: 172-5) in support of cold liquids emptying faster than warm ones is also inaccurate. Ritschel and Erni investigated the effect of the temperature of ingested water on the emptying time of a telemetric pH capsule. The emptying time of the water was not studied and it is not known whether the capsule left the stomach before or after all the water had emptied from the stomach.

Finally, we agree that it would be preferential for investigators to report the temperature of test

meals used to study upper gastrointestinal motility, especially when using fatty meals with higher thermal inertia.

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Cimetidine, carbenoxolone and gastric mucus

SIR,—Reading the paper by Ene *et al*¹ I was rather surprised to find that someone took the trouble to try to reproduce my eight to 10 year old studies on the effects of cimetidine and carbenoxolone on gastric mucus, a topic which seems a little outdated in 1988. Nevertheless, having been quoted and criticised so much by these authors, I cannot refrain from replying to some of their issues.

First, perusing Glass' papers I did not have the impression, as Ene and colleagues seem to think, that he considered acid mucoproteins as the component of mucus responsible for mucosal protection. Of course this great pioneer in mucus researches is beyond the possibility of entering the debate. In my opinion, however, the viscous and protective properties of mucus are more related to neutral than to acid mucoproteins.² This should be apparent by some of my papers quoted by Ene *et al*, where in fact I was using as a parameter of mucosal protection the ratio of neutral to total mucoproteins (so-called Mucoprotective Index).^{2,4} What we actually found at that time was that cimetidine treatment increases acid mucosubstances and induces a marked, significant decrease of neutral mucoproteins.^{3,4} Carbenoxolone, in contrast, promotes a rise of both mucin components, the effect being more dramatic on neutral mucoproteins, with a consequent increase in the values of Mucoprotective Index.⁴ The key point is that we undertook our studies in peptic ulcer patients treated for four weeks with either cimetidine 1 g daily or carbenoxolone 150 mg daily (300 mg the first week). Ene's experiment included normal subjects who received either drug for only two weeks and in lower doses. Thus it is hard to compare Ene's results with ours.

Furthermore I am not quite sure that the method used by the authors, sophisticated as it may be from a biochemical point of view, provides a better insight of the effects of drugs on mucus secretion. On the other hand the adverse influence of cimetidine on gastric mucus has been also observed by others.⁵ As for the mucogenic activity of carbenoxolone, this was reported, by means of various techniques, by different investigators⁶⁻⁹ before and after the appearance of my