Letters to the Editor

To the Editor:

Swelling-Controlled Release, Swelling/Erosion Mechanisms, and Front Synchronization: Comments on the Paper by Devi *et al.* (1)

The recently published work by Devi *et al.* (1) discusses oxprenolol hydrochloride release systems exhibiting zero-order release by control of polymer swelling and erosion. We wish to express our strong concern that the authors of the contribution have disregarded prior scientific knowledge on this subject. In fact, in the introductory section of their work (1), the significant literature on this subject in the past 12 years is ignored, and the formulation of such systems should not have been presented as an idea that was initiated by these authors.

The possibility of adjusting the swelling and erosion rates of a polymer matrix in order to achieve zero-order release was recognized as early as 1980 by Lee (2), who offered approximate solutions of the relevant mathematical equations and showed that the synchronization of front velocities is needed to achieve zero-order release from such systems. This idea was further developed into successful pharmaceutical preparations by Colombo and his associates (3–7), who confirmed experimentally (3), as early as 1985, the link between front synchronization and zero-order release. In addition, by utilizing the recently developed dissolution model of Lee and Peppas (8), Harland *et al.* (9) were able to show that synchronization of the swelling and erosion (dissolution) fronts was a necessary condition for zero-order release, as originally predicted by Lee's calculations (2) and Colombo and co-workers' (3–5) preliminary data.

It must also be noted that the use of swelling-controlled release systems for zero-order release of solutes was first proposed by Hopfenberg and Hsu (10). It was adopted and developed for pharmaceutical applications by Lee (11–13) and Peppas and his collaborators (14–16) and it has been analyzed both theoretically and with a series of pharmaceutical experiments.

In reference to the specific experiments conducted by Devi *et al.* (1), we wish to point out that the formulations reported are basically the same as those of Colombo and associates (6), for controlled delivery of alprenolol utilizing hydroxypropyl methylcellulose.

REFERENCES

1. K. P. Devi, K. V. Ranga Rao, S. Baveja, M. Fathi, and M. Roth. *Pharm. Res.* 6:313–317 (1989).
2. P. I. Lee. *J. Membr. Sci.* 7:255–275 (1980).
3. P. Colombo, A. Gazzaniga, C. Caramella, U. Conte, and A. LaManna. *Proc. Int. Symp. Control. Rel. Bioact. Mater.* 12:47–48 (1985).
4. P. Colombo, A. Gazzaniga, U. Conte, M. E. Sangalli, and A. LaManna. *Proc. Int. Symp. Control. Rel. Bioact. Mater.* 14:83–84 (1987).
5. P. Colombo, A. Gazzaniga, C. Caramella, U. Conte, and A. LaManna. *Acta Pharm. Technol.* 33:15–20 (1987).
6. P. Catellani, G. Vaona, P. Plazzi, and P. Colombo. *Acta Pharm. Technol.* 34:38–41 (1988).
7. U. Conte, P. Colombo, A. Gazzaniga, M. E. Sangalli, and A. LaManna. *Biomaterials* 9:489–492 (1988).
8. P. I. Lee and N. A. Peppas. *J. Control. Release* 6:207–215 (1987).
9. R. S. Harland, A. Gazzaniga, M. E. Sangalli, P. Colombo, and N. A. Peppas. *Pharm. Res.* 5:488–494 (1988).
10. H. B. Hopfenberg and K. C. Hsu. *Polym. Eng. Sci.* 18:1186–1191 (1978).
11. P. I. Lee. *Polymer* 25:973–978 (1984).
12. P. I. Lee. *J. Pharm. Sci.* 73:1344–1347 (1984).
13. P. I. Lee. *J. Control. Release* 2:277–288 (1985).
14. R. W. Korsmeyer and N. A. Peppas. *J. Membr. Sci.* 9:211–222 (1981).
15. R. W. Korsmeyer and N. A. Peppas. *J. Control. Release* 1:89–98 (1984).
16. N. A. Peppas. In B. W. Muller (ed.), *Controlled Drug Delivery*, Wissenschaftlich Verlagsgesellschaft, Stuttgart, FRG, 1987, pp. 161–173.

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To the Editor:

Colombo, Lee, and Peppas (1; preceding letter) contend that we neglected to cite previous publications in our recent paper in *Pharmaceutical Research* (2). We have been working in the area of swelling controlled-release tablets using cellulose derivatives at the Department of Pharmaceutical Sciences, Panjab University, Chandigarh, India, over the past decade (3) and have extensively published our work (2–15). Sustained-release tablet formulations of beta-adrenergic blockers, namely, metoprolol tartrate, alprenolol hydrochloride, and propranolol hydrochloride, releasing the drug at a nearly zero-order rate for 12 hr using hydroxypropylmethylcellulose (HPMC) and sodium carboxymethylcellulose (Na CMC) were prepared. Therefore the work with another beta blocker, oxprenolol hydrochloride (2), is a continuation of

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the work published by us earlier in 1986 and 1987, which in fact precedes similar work published in 1988 by Catellani *et al.* (16). A large number of papers are published every year in the area of swelling controlled-release systems using various polymers such as hydroxyalkylmethacrylates and their copolymers, PVA, EVA, cellulose ethers, etc. Since it is beyond the scope of the Introduction of our paper (2) to mention all the literature published in this area, two recent reviews (17,18) incorporating most of the work were quoted. Therefore, omitting the references of selected papers was not meant specifically to dilute other contributions. As the polymers used by us are cellulose ethers, we preferred to cite papers dealing only with cellulose polymers. There is no reason therefore to suspect that my coauthors and I deliberately ignored the work of Colombo, Lee, and Peppas as suggested by them.

REFERENCES

1. P. Colombo, P. I. Lee, and N. A. Peppas. *Pharm. Res.* 7:431 (1990).
2. K. Padmalatha Devi, K. V. Ranga Rao, S. K. Baveja, M. Fathi, and M. Roth. *Pharm. Res.* 6:313–317 (1987).
3. K. V. Ranga Rao. Ph.D. thesis, Faculty of Pharmaceutical Sciences, Panjab University, Chandigarh, India, 1984.
4. K. V. Ranga Rao, K. Padmalatha Devi, and P. Buri. In J. M. Aiache and J. Hirtz (eds.), *Proc. 3rd Eur. Cong. Biopharm. Pharmacokinet., Vol. I. Biopharmaceutics,* Imprimerie de l'Université de Clermont-Ferrand, France, 1987, pp. 473–482.
5. K. V. Ranga Rao, K. Padmalatha Devi, and P. Buri. In M. H. Rubinstein (ed.), *Proc. 7th Pharm. Technol. Conf., Vol. I, London, April 1988, pp. 1–22.*
6. K. V. Ranga Rao, K. Padmalatha Devi, F. Kubel, and P. Buri. *Proc. Int. Symp. Control. Rel. Bioact. Mater.* 15:101–102 (1988).
7. K. V. Ranga Rao, A. Ben-amor, and P. Buri. *Proc. 5th Int. Technol. Conf., Paris, Vol. I,* 1989, pp. 15–21.
8. K. V. Ranga Rao, K. Padmalatha Devi, and P. Buri. *Proc. 5th Int. Technol. Conf., Paris, Vol. V,* 1989, pp. 242–249.
9. S. K. Baveja, K. V. Ranga Rao, and K. Padmalatha Devi. *Int. J. Pharm.* 27:157–162 (1985).
10. S. K. Baveja and K. V. Ranga Rao. *Int. J. Pharm.* 31:169–174 (1986).
11. S. K. Baveja, K. V. Ranga Rao, and K. Padmalatha Devi. *Int. J. Pharm.* 39:39–45 (1987).
12. S. K. Baveja, K. V. Ranga Rao, and K. Padmalatha Devi. *Int. J. Pharm.* 47:133–139 (1988).
13. S. K. Baveja, K. V. Ranga Rao, A. Singh, and V. K. Gombar. *Int. J. Pharm.* 41:55–62 (1988).
14. K. V. Ranga Rao, K. Padmalatha Devi, and P. Buri. *Drug Dev. Ind. Pharm.* 14:2299–2320 (1988).
15. K. V. Ranga Rao, K. Padmalatha Devi, and P. Buri. *J. Control. Release* (in press).
16. P. Catellani, G. Vaona, P. Plazzi, and P. Colombo. *Acta Pharm. Technol.* 34:38–41 (1988).
17. K. V. Ranga Rao and K. Padmalatha Devi. *Int. J. Pharm.* 48:1–13 (1988).
18. E. Doelker, In N. A. Peppas (ed.), *Hydrogels in Medicine and Pharmacy, Vol. II. Polymers,* CRC Press, Boca Raton, Fla., 1987, pp. 115–160.

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To the Editor:

Comments on the Rebuttal by Devi

We have carefully reviewed the rebuttal of Devi (preceding letter) to our original Letter to the Editor entitled "Swelling-Controlled Release, Swelling/Erosion Mechanisms, and Front Synchronization." Although we do not doubt that these authors have done tablet research in the past, their rebuttal does not address the main issue raised in our letter, i.e., zero-order drug release due to synchronization of erosion and swelling fronts was published by us as early as 1980, and it is not novel as purported in the Introduction and Results and Discussion of their paper (*Pharm. Res.* 6:313–317, 1989).

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