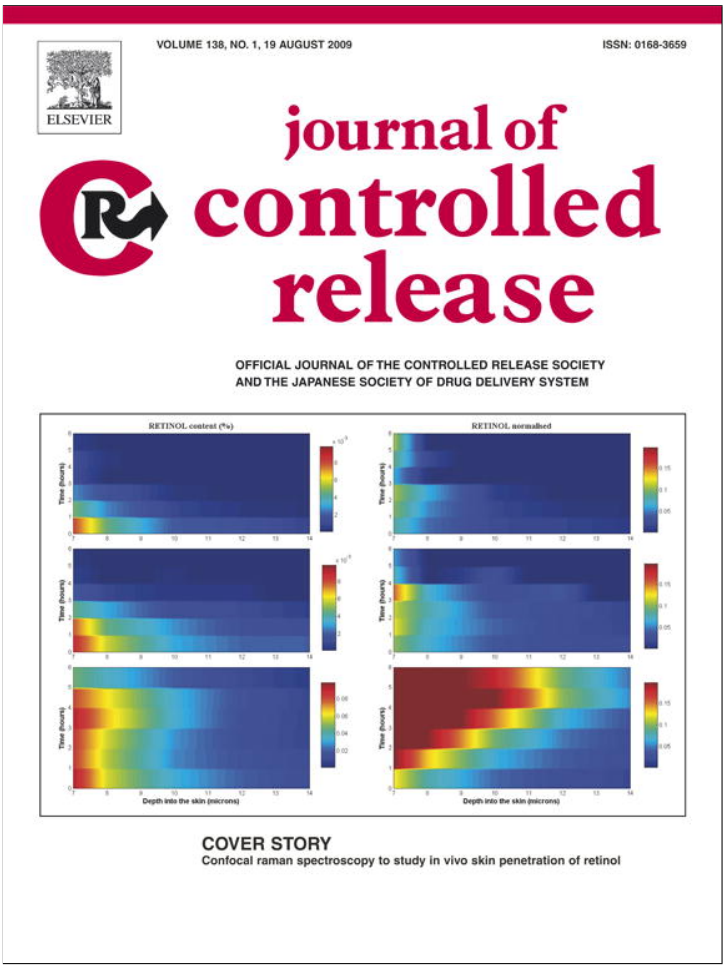

Journal of Controlled Release 138 (2009) 1

Contents lists available at ScienceDirect

Journal of Controlled Release

journal homepage: www.elsevier.com/locate/jconrel

Cover Story

Confocal Raman spectroscopy to study *in vivo* skin penetration of retinol

Understanding the penetration of pharmaceutical or cosmetic actives through the skin is increasingly important to enhance the bioavailability of the actives. Validating the transport through the skin and subsequent improved efficacy of the delivered actives is critically important not only for formulation development but also for obtaining approvals from the regulatory agencies. For this reason, clear understanding of penetration of actives into the skin at the molecular level is required to optimize the transdermal delivery systems. Due to experimental difficulties, however, most work on transdermal delivery has utilized methods that are mostly *ex vivo* and invasive, such as tape stripping and biopsies. Thus, techniques that can be used for *in vivo* measurement can provide great potential benefits for researchers in the transdermal area.

One optical technique that is uniquely useful in the study of skin permeation is confocal Raman spectroscopy, which is a powerful method to examine various compounds without any labeling. Recent advances in the instrument allowed fast imaging of spatial distribution of chemical compounds inside biological samples. The technique has been used for *in vivo* assessment of concentrations of absorption enhancers and actives in topical drug delivery [1,2]. The article by Mélot et al. in this issue [3] has demonstrated that confocal Raman spectroscopy is indeed a powerful tool for *in vivo* studies of drug delivery through the stratum cornea. The authors of the study have clearly shown that one can visualize penetration of retinol through the stratum cornea into the living, target tissue. The time-lapse measurement shows whether penetration of retinol through the skin is aided by the use of the penetration enhancers, and if so, how much and how fast. The work by Mélot et al. further shows that confocal Raman spectroscopy is able to differentiate the efficiency of different types of penetration enhancers on *in vivo* retinol delivery. This is the first detailed study showing the relative efficiencies of different penetration enhancers applied in human skin. There is no doubt that confocal Raman microscopy will make unique contributions to the *in vivo* study of skin permeation of various drugs, and thus to the development of novel vehicles for transdermal delivery.

References

[1] P.J. Caspers, A.C. Williams, E.A. Carter, H.G.M. Edwards, B.W. Barry, H.A. Bruining, G.J. Puppels, Monitoring the penetration enhancer dimethyl sulfoxide in human stratum corneum *in vivo* by confocal Raman spectroscopy, Pharm. Res. 19 (2002) 1577–1580.

[2] C. Herkenne, I. Alberti, A. Naik, N.K. Yogeshvar, F.-X. Mathy, V. Preat, R.H. Guy, *In vivo* methods for the assessment of topical drug bioavailability, Pharm. Res. 25 (2008) 87–103.

[3] M. Mélot, P.D.A. Pudney, A.-M. Williamson, P.J. Caspers, A. Van Der Pol, G.J. Puppels, Studying the effectiveness of penetration enhancers to deliver retinol through the stratum cornea by *in vivo* confocal Raman spectroscopy, J. Control. Release 138 (2009) 32–39.

Kinam Park
Purdue University,
Departments of Biomedical Engineering and Pharmaceutics,
West Lafayette, Indiana, USA
E-mail address: kpark@purdue.edu.

0168-3659/$ – see front matter
doi:10.1016/j.jconrel.2009.06.013