

Publications about Thiomers:

Reviews:

- Akhtar, N., Ahad, A., Khar, R.K., Jaggi, M., Aqil, M., Iqbal, Z., Ahmad, F.J., Talegaonkar, S. (2011) The emerging role of P-glycoprotein inhibitors in drug delivery: a patent review. *Expert Opin. Ther. Pat.* **21**, 561-576.
- Albrecht, K., Bernkop-Schnürch, A. (2007) Thiomers: forms, functions and applications to nanomedicine. *Nanomedicine (Lond)*. **2**, 41-50.
- Bernkop-Schnürch, A., Hoffer, M.H., Kafedjiiski, K. (2004) Thiomers for oral delivery of hydrophilic macromolecular drugs. *Expert Opin. Drug Deliv.* **1**, 87-98.
- Bernkop-Schnürch A. (2005) Thiomers: a new generation of mucoadhesive polymers. *Adv. Drug Deliv. Rev.*, **57**, 1569-1582.
- Bernkop-Schnürch, A., Krauland, A.H., Leitner, V.M., Palmberger, T. (2004) Thiomers: potential excipients for non-invasive peptide delivery systems. *Eur. J. Pharm. Biopharm.*, **58**, 253-63.
- Bernkop-Schnürch, A., Hornof, M., Guggi, D. (2004) Thiolated chitosans. *Eur. J. Pharm. Biopharm.* **57**, 9-17.
- Bernkop-Schnürch, A., Kast, C.E., Guggi D. (2003) Permeation enhancing polymers in oral delivery of hydrophilic macromolecules: thiomers/GSH systems. *J. Control Release*, **93**, 95-103.
- Bonengel, S., Bernkop-Schnürch, A. (2014) Thiomers--from bench to market. *J. Control. Release*, **195**, 120-129.
- Cano-Cebrián, M.J., Zornoza, T., Granero, L., Polache, A. (2005) Intestinal absorption enhancement via the paracellular route by fatty acids, chitosans and others: a target for drug delivery. *Curr. Drug Deliv.*, **2**, 9-22.
- Chaudhury, A., Das, S. (2011) Recent advancement of chitosan-based nanoparticles for oral controlled delivery of insulin and other therapeutic agents. *AAPS PharmSciTech.*, **12**, 10-20.
- Chen, M.C., Mi, F.L., Liao, Z.X., Hsiao, C.W., Sonaje, K., Chung, M.F., Hsu, L.W., Sung, H.W. (2013) Recent advances in chitosan-based nanoparticles for oral delivery of macromolecules. *Adv. Drug Deliv. Rev.*, **65**, 865-879.
- Chopra, S., Mahdi, S., Kaur, J., Iqbal, Z., Talegaonkar, S., Ahmad, F.J. (2006) Advances and potential applications of chitosan derivatives as mucoadhesive biomaterials in modern drug delivery. *J. Pharm. Pharmacol.*, **58**, 1021-1032.
- Di Colo, G., Zambito, Y., Zaino, C. (2008) Polymeric enhancers of mucosal epithelia permeability: synthesis, transepithelial penetration-enhancing properties, mechanism of action, safety issues. *J. Pharm. Sci.* **97**, 1652-1680.
- Dünnhaupt, S., Kammona, O., Waldner, C., Kiparissides, C., Bernkop-Schnürch, A. (2015) Nano-carrier systems: Strategies to overcome the mucus gel barrier. *Eur. J. Pharm. Biopharm.*, **96**, 447-453.
- Hauptstein, S., Bernkop-Schnürch, A. (2012) Thiomers and thiomers-based nanoparticles in protein and DNA drug delivery. *Expert Opin. Drug Deliv.*, **9**, 1069-1081.
- Ijaz, M., Bernkop-Schnürch, A. (2015) Preactivated thiomers: their role in drug delivery. *Expert. Opin. Drug Deliv.*, **12**, 1269-1281.
- Islam, M.A., Park, T.E., Reesor, E., Cherukula, K., Hasan, A., Firdous, J., Singh, B., Kang, S.K., Choi, Y.J., Park, I.K., Cho, C.S. (2015) Mucoadhesive Chitosan Derivatives as Novel Drug Carriers. *Curr. Pharm. Des.*, **21**, 4285-4309.
- Islam, M.A., Firdous, J., Choi, Y.J., Yun, C.H., Cho, C.S. (2012) Design and application of chitosan microspheres as oral and nasal vaccine carriers: an updated review. *Int. J. Nanomedicine*, **7**, 6077-6093.
- Laffleur, F., Bernkop-Schnürch, A. (2012) Thiomers: promising platform for macromolecular drug delivery. *Future Med. Chem.*, **4**, 2205-2216.
- Salamat-Miller, N., Chittchang, M., Johnston, T.P. (2005) The use of mucoadhesive polymers in buccal drug delivery. *Adv. Drug Deliv. Rev.*, **57**, 1666-1691.
- Werle, M., Takeuchi, H., Bernkop-Schnürch, A. (2009) Modified chitosans for oral drug delivery. *J. Pharm. Sci.*, **98**, 1643-1656.
- Werle, M., Bernkop-Schnürch, A., Thiolated chitosans: useful excipients for oral drug delivery. *J. Pharm. Pharmacol.*, **60**, 273-281.
- Werle, M. (2008) Natural and synthetic polymers as inhibitors of drug efflux pumps. *Pharm. Res.*, **25**, 500-511.

Mucoadhesion:

- Albrecht, K., Greindl, M., Kremser, C., Wolf, C., Debbage, P., and Bernkop-Schnürch, A. (2006) Comparative *in vivo* mucoadhesion studies of thiomers formulations using magnetic resonance imaging and fluorescence detection. *J. Control. Release*, **115**, 78-84.
- Baloglu, E.; Ay Senyigit, Z.; Karavana, S.Y.; Vetter, A.; Metin, D.Y.; Hilmioglu Polat, S.; Guneri, T.; Bernkop-Schnürch, A. (2011). *In vitro* evaluation of mucoadhesive vaginal tablets of antifungal drugs prepared with thiolated polymer and development of a new dissolution technique for vaginal formulations. *Chem. Pharm. Bull.*, **59**, 952-958.
- Bernkop-Schnürch, A., Schwarz, V., and Steininger, S. (1999) Polymers with thiol groups: A new generation of mucoadhesive polymers? *Pharm. Res.*, **16**, 876-881.
- Bernkop-Schnürch, A. and Steininger, S. (2000) Synthesis and characterisation of mucoadhesive thiolated polymers. *Int. J. Pharm.*, **194**, 239-247.
- Bernkop-Schnürch, A., Clausen, A.E., and Hnatyszyn, M. (2001) Thiolated polymers: Synthesis and *in vitro* evaluation of polymer-cysteamine conjugates. *Int. J. Pharm.*, **226**, 185-194.
- Bernkop-Schnürch, A., Kast, C.E., and Richter, M.F. (2001) Improvement in the mucoadhesive properties of alginate by the covalent attachment of cysteine. *J. Control. Release*, **71**, 277-285.
- Bernkop-Schnürch, A. and Hopf, Th.E. (2001) Synthesis and *in vitro* evaluation of chitosan-thioglycolic acid conjugates. *Sci. Pharm.*, **69**, 109-118.
- Bernkop-Schnürch, A., Hornof, M. and Zoidl, T. (2003) Thiolated polymers – thiomers: modification of chitosan with 2-iminothiolane, *Int. J. Pharm.*, **260**, 229-237.
- Bernkop-Schnürch, A., Hornof, M.D. and Guggi, D. (2004) Thiolated chitosans. *Eur. J. Pharm. Biopharm.*, **57**, 9-17.
- Bernkop-Schnürch, A., Leitner, V., and Moser, V. (2004) Synthesis and *in vitro* characterisation of a poly(acrylic acid)-homocysteine conjugate, *Drug Dev. Ind. Pharm.*, **30**, 1-8.
- Bernkop-Schnürch, A. (2005) Mucoadhesive polymers: strategies, achievements and future challenges. *Adv. Drug Del. Rev.*, **57**, 1553-1555.
- Bernkop-Schnürch, A. (2005). Mucoadhesive systems in oral drug delivery. *Drug Discovery Today: Technologies*, **2**, 83-87.
- Bernkop-Schnürch, A. (2005) Thiomers: A new generation of mucoadhesive polymers. *Adv. Drug Del. Rev.*, **57**, 1569-1582.
- Bernkop-Schnürch, A. and Greimel, A. (2005). Thiomers: The next generation of mucoadhesive polymers. *Am. J. Drug. Deliv.*, **3**, 141-154.
- Bhalekar, M.R., Bargaje, R.V., Upadhaya, P.G., Madgulkar, A.R., Kshirsagar, S.J. (2016) Formulation of mucoadhesive gastric retentive drug delivery using thiolated xyloglucan. *Carbohydr. Polym.*, **136**, 537-542.
- Bhatia, M., Ahuja, M., Mehta, H. (2015) Thiol derivatization of Xanthan gum and its evaluation as a mucoadhesive polymer. *Carbohydr. Polym.*, **131**, 119-124.
- Bhatia, M., Ahuja, M. (2013) Thiol modification of psyllium husk mucilage and evaluation of its mucoadhesive applications. *ScientificWorldJournal*, **2013**, 284182.
- Bonengel, S., Hauptstein, S., Leonaviciute, G., Griessinger, J., Bernkop-Schnürch, A. (2015) Thiolated alkyl-modified carbomers: Novel excipients for mucoadhesive emulsions. *Eur. J. Pharm. Sci.*, **75**, 123-130.
- Bravo-Osuna, I., Vauthier, C., Farabollini, A., Palmieri, G.F., and Ponchel, G. (2007) Mucoadhesion mechanism of chitosan and thiolated chitosan-poly(isobutyl cyanoacrylate) core-shell nanoparticles. *Biomaterials*, **28**, 2233-2243.
- Cevher, E., Taha, M.A., Orlu, M., and Araman A. (2008) Evaluation of mechanical and mucoadhesive properties of clomiphene citrate gel formulations containing carbomers and their thiolated derivatives. *Drug Deliv.*, **15**, 57-67.
- Cevher, E., Sensoy, D., Taha, M.A., and Araman, A. (2008) Effect of thiolated polymers to textural and mucoadhesive properties of vaginal gel formulations prepared with polycarbophil and chitosan. *AAPS PharmSciTech.*, **9**, 953-965.
- Chen S, Cao Y, Ferguson LR, Shu Q, Garg S. (2013) Evaluation of mucoadhesive coatings of chitosan and thiolated chitosan for the colonic delivery of microencapsulated probiotic bacteria. *J. Microencapsul.*, **30**, 103-115.
- Chopra, S., Mahdi, S., Kaur, J., Iqbal, Z., Talegaonkar, S., and Ahmad, F.J. (2006) Advances and potential applications of chitosan derivatives as mucoadhesive biomaterials in modern drug delivery. *J. Pharm. Pharmacol.* **58**, 1021-1032.

- Davidovich-Pinhas, M., Harari, O., and Bianco-Peled, H. (2009) Evaluating the mucoadhesive properties of drug delivery systems based on hydrated thiolated alginate. *J. Contr. Release*, **136**, 38-44.
- Denora, N., Lopodota, A., Perrone, M., Laquintana, V., Iacobazzi, R.M., Milella, A., Fanizza, E., Depalo, N., Cutrignelli, A., Lopalco, A., Franco, M. (2016) Spray-dried mucoadhesives for intravesical drug delivery using N-acetylcysteine- and glutathione-glycol chitosan conjugates. *Acta Biomater.*, **43**, 170-184.
- Ding, J., He, R., Zhou, G., Tang, C., Yin, C. (2012) Multilayered mucoadhesive hydrogel films based on thiolated hyaluronic acid and polyvinylalcohol for insulin delivery. *Acta Biomater.*, **8**, 3643-3651.
- Duggan, S., Hughes, H., Owens, E., Duggan, E., Cummins, W., O' Donovan, O. (2016) Synthesis and characterisation of mucoadhesive thiolated polyallylamine. *Int. J. Pharm.*, **499**, 368-375.
- Duggan, S., O'Donovan, O., Owens, E., Duggan, E., Hughes, H., Cummins, W. (2016) Comparison of the mucoadhesive properties of thiolated polyacrylic acid to thiolated polyallylamine. *Int. J. Pharm.*, **498**, 245-253.
- Duggan, S., O'Donovan, O., Owens, E., Cummins, W., Hughes, H. (2015) Synthesis of mucoadhesive thiolated gelatin using a two-step reaction process. *Eur. J. Pharm. Biopharm.*, **91**, 75-81.
- Dünnhaupt, S.; Barthelmes, J.; Hombach, J.; Sakloetsakun, D.; Arkhipova, V.; Bernkop-Schnürch, A. (2011). Distribution of thiolated mucoadhesive nanoparticles on intestinal mucosa. *Int. J. Pharm.*, **408**, 191-199.
- Fabiano, A., Chetoni, P., Zambito, Y. (2015) Mucoadhesive nano-sized supramolecular assemblies for improved pre-corneal drug residence time. *Drug Dev. Ind. Pharm.*, **41**, 2069-2076.
- Grabovac, V., Guggi, D., and Bernkop-Schnürch, A. (2005) Comparison of the mucoadhesive properties of various polymers. *Adv. Drug Del. Rev.*, **57**, 1713-1723.
- Gradauer, K.; Vonach, C.; Leitinger, G.; Kolb, D.; Fröhlich, E.; Roblegg, E.; Bernkop-Schnürch, A.; Prassl, R. (2012). Chemical coupling of thiolated chitosan to preformed liposomes improves mucoadhesive properties. *Int. J. Nanomedicine*, **7**, 2523-2534.
- Guggi, D., Marschütz, M.K., and Bernkop-Schnürch, A. (2004) Matrix tablets based on thiolated poly(acrylic acid): pH-dependent variation in disintegration and mucoadhesion. *Int. J. Pharm.*, **274**, 97-105.
- Hauptstein, S., Bonengel, S., Rohrer, J., Bernkop-Schnürch, A. (2014) Preactivated thiolated poly(methacrylic acid-co-ethyl acrylate): synthesis and evaluation of mucoadhesive potential. *Eur. J. Pharm. Sci.*, **63**, 132-139.
- Hauptstein, S., Bonengel, S., Griessinger, J., Bernkop-Schnürch, A. (2014) Synthesis and characterization of pH tolerant and mucoadhesive (thiol-polyethylene glycol) chitosan graft polymer for drug delivery. *J. Pharm. Sci.*, **103**, 594-601.
- Hauptstein, S., Müller, C., Dünnhaupt, S., Laffleur, F., Bernkop-Schnürch, A. (2013) Preactivated thiomers: evaluation of gastroretentive minitables. *Int. J. Pharm.*, **456**, 473-479.
- Hombach, J., Palmberger, T.F. and Bernkop-Schnürch, A. (2009) Development and in vitro evaluation of a mucoadhesive vaginal delivery system for nystatin. *J. Pharm. Sci.*, **98**, 555-564.
- Iqbal, J.; Shahnaz, G.; Dünnhaupt, S.; Müller, C.; Hintzen, F.; Bernkop-Schnürch, A. (2012). Preactivated thiomers as mucoadhesive polymers for drug delivery. *Biomaterials*, **33**, 1528-1535.
- Jindal AB, Wasnik MN, Nair HA. (2010) Synthesis of thiolated alginate and evaluation of mucoadhesiveness, cytotoxicity and release retardant properties. *Indian J Pharm Sci.*, **72**, 766-774.
- Juntapram K, Praphairaksit N, Siraleartmukul K, Muangsin N., (2012) Electrospayed polyelectrolyte complexes between mucoadhesive N,N,N-trimethylchitosan-homocysteine thiolactone and alginate/carrageenan for camptothecin delivery. *Carbohydr Polym.*, **90**, 1469-1479.
- Kast, C.E., and Bernkop-Schnürch, A. (2001) Thiolated polymers: Development and *in vitro* evaluation of chitosan-thioglycolic acid conjugates. *Biomaterials*, **22**, 2345-2352.
- Kast, C.E., and Bernkop-Schnürch, A. (2002) Polymer-cystamine conjugates: new mucoadhesive excipients for drug delivery? *Int. J. Pharm.*, **234**, 91-99.
- Kaur H, Yadav S, Ahuja M, Dilbaghi N., (2012) Synthesis, characterization and evaluation of thiolated tamarind seed polysaccharide as a mucoadhesive polymer. *Carbohydr Polym.*, **90**, 1543-1549.
- Kongsong, M., Songsurang, K., Sangvanich, P., Siralermukul, K., Muangsin, N. (2014) Design, synthesis, fabrication and in vitro evaluation of mucoadhesive 5-amino-2-mercaptobenzimidazole chitosan as low water soluble drug carriers. *Eur. J. Pharm. Biopharm.*, **88**, 986-997.

- Leitner, V., Marschütz, M., and Bernkop-Schnürch, A. (2003) Mucoadhesive and cohesive properties of poly(acrylic acid)-cysteine conjugates with regard to their molecular mass. *Eur. J. Pharm. Sci.*, **18**, 89-96.
- Leitner, V., Walker, G.F., and Bernkop-Schnürch, A. (2003) Thiolated polymers: Evidence for the formation of disulphide bonds with mucus glycoproteins. *Eur. J. Pharm. Biopharm.*, **56**, 207-214.
- Leonaviciute, G., Trivic, Adamovic. N., Thanh Lam H., Rohrer, J., Partenhauser, A., Bernkop-Schnürch, A. (2016) Self-emulsifying drug delivery systems (SEDDS): Proof-of-concept how to make them mucoadhesive. *Eur. J. Pharm. Biopharm.*, in press.
- Leonaviciute, G., Bonengel, S., Mahmood, A., Ahmad Idrees, M., Bernkop-Schnürch, A. (2016) S-protected thiolated hydroxyethyl cellulose (HEC): Novel mucoadhesive excipient with improved stability. *Carbohydr Polym.*, **144**, 514-521
- Li X, Yu G, Jin K, Yin Z. (2012) Hyaluronic acid L-cysteine conjugate exhibits controlled-release potential for mucoadhesive drug delivery. *Pharmazie*, **67**, 224-228.
- Madgulkar, A.R., Bhalekar, M.R., Asgaonkar, K.D., Dikpati, A.A. (2016) Synthesis and characterization of a novel mucoadhesive derivative of xyloglucan. *Carbohydr Polym.*, **135**, 356-362.
- Mahmood, A., Bonengel, S., Laffleur, F., Ijaz, M., Idrees, M.A., Hussain, S., Huck, C.W., Matuszczak, B., Bernkop-Schnürch, A. (2016) Can thiolation render a low molecular weight polymer of just 20-kDa mucoadhesive? *Drug Dev. Ind. Pharm.*, **42**, 686-693.
- Menzel, C., Bonengel, S., Pereira de Sousa, I., Laffleur, F., Prüfert, F., Bernkop-Schnürch, A. (2016) Preactivated thiolated nanoparticles: A novel mucoadhesive dosage form. *Int. J. Pharm.* **497**, 123-128.
- Millotti, G., Samberger, C., Fröhlich, E., and Bernkop-Schnürch, A. (2009) Chitosan-graft-6-mercaptopnicotinic acid: synthesis, characterization, and biocompatibility. *Biomacromolecules*. **10**, 3023-3027.
- Millotti, G.; Hoyer, H.; Engbersen, J.F.J.; Bernkop-Schnürch, A. (2010). 6-mercaptopnicotinamide-functionalized chitosan: A potential excipient for mucoadhesive drug delivery systems. *J. Drug Del. Sci. Tech.*, **20**, 181-186.
- Naz, K., Shahnaz, G., Ahmed, N., Qureshi, N.A., Sarwar, H.S., Imran, M., Khan, G.M. (2016) Formulation and In Vitro Characterization of Thiolated Buccoadhesive Film of Fluconazole. *AAPS PharmSciTech.*, in press.
- Nowak, J., Laffleur, F., Bernkop-Schnürch, A. (2015) Preactivated hyaluronic acid: A potential mucoadhesive polymer for vaginal delivery. *Int. J. Pharm.*, **478**, 383-389.
- Oh, S., Wilcox, M., Pearson, J.P., Borrós, S. (2015) Optimal design for studying mucoadhesive polymers interaction with gastric mucin using a quartz crystal microbalance with dissipation (QCM-D): Comparison of two different mucin origins. *Eur. J. Pharm. Biopharm.*, **96**, 477-483.
- Partenhauser, A., Laffleur, F., Rohrer, J., Bernkop-Schnürch, A. (2015) Thiolated silicone oil: synthesis, gelling and mucoadhesive properties. *Acta Biomater.*, **16**, 169-177.
- Pengpong, T., Sangvanich, P., Sirilertmukul, K., Muangsin, N. (2014) Design, synthesis and in vitro evaluation of mucoadhesive p-coumarate-thiolated-chitosan as a hydrophobic drug carriers. *Eur. J. Pharm. Biopharm.*, **86**, 487-497.
- Prüfert, F., Bonengel, S., Menzel, C., Bernkop-Schnürch, A. (2016) Enhancing the efficiency of thiomers: Utilizing a highly mucoadhesive polymer as backbone for thiolation and preactivation. *Eur. J. Pharm. Sci.*, **96**, 309-315.
- Quan, J.S., Jiang, H.L., Kim, E.M., Jeong, H.J., Choi, Y.J., Guo, D.D., Yoo, M.K., Lee, H.G., and Cho, C.S. (2008) pH-sensitive and mucoadhesive thiolated Eudragit-coated chitosan microspheres. *Int. J. Pharm.*, **359**, 205-210.
- Roldo, M., Hornof, M., Caliceti, P. and Bernkop-Schnürch, A. (2004) Mucoadhesive thiolated chitosans as platforms for oral controlled drug delivery: Synthesis and in vitro evaluation. *Eur. J. Pharm. Biopharm.*, **57**, 115-121.
- Sakloetsakun, D.; Perera, G.; Hombach, J.; Millotti, G.; Bernkop-Schnürch, A. (2010). The impact of vehicles on the mucoadhesive properties of orally administered nanoparticles: a case study. *AAPS PharmSciTech.*, **11**, 1185-1192.
- Samprasit, W., Kaomongkolgit, R., Sukma, M., Rojanarata, T., Ngawhirunpat, T., Opanasopit, P. (2015) Mucoadhesive electrospun chitosan-based nanofibre mats for dental caries prevention. *Carbohydr. Polym.*, **117**, 933-940.

- Schmitz, T., Grabovac, V., Palmberger, T.F., Hoffer, M.H., and Bernkop-Schnürch, A. (2008) Synthesis and characterization of a chitosan-N-acetyl cysteine conjugate. *Int. J. Pharm.*, **347**, 79-85.
- Senyigit, Z.A.; Vetter, A.; Guneri, T.; Bernkop-Schnürch, A. (2011). A comprehensive in vitro and in vivo evaluation of thiolated matrix tablets as a gastroretentive delivery system. *Drug Deliv.*, **18**, 405-414.
- Senyigit, Z.A.; Vetter, A.; Guneri, T.; Bernkop-Schnürch, A. (2010). Gastroretentive particles formulated with thiomers: development and in vitro evaluation. *J. Drug Targ.*, **18**, 362-372.
- Shahnaz, G., Perera, G., Sakloetsakun, D., Rahmat, D., and Bernkop-Schnürch, A. (2010) Synthesis, characterization, mucoadhesion and biocompatibility of thiolated carboxymethyl dextran-cysteine conjugate. *J. Control. Release.*, **144**, 32-38.
- Shen, J., Wang, Y., Ping, Q., Xiao, Y., and Huang, X. (2009) Mucoadhesive effect of thiolated PEG stearate and its modified NLC for ocular drug delivery. *J. Contr. Release*, **137**, 217-223
- Singh, B., Maharjan, S., Jiang, T., Kang, S.K., Choi, Y.J., Cho, C.S. (2015) Combinatorial Approach of Antigen Delivery Using M Cell-Homing Peptide and Mucoadhesive Vehicle to Enhance the Efficacy of Oral Vaccine. *Mol. Pharm.*, **12**, 3816-3828.
- Suchaoin, W., Pereira de Sousa, I., Netsomboon, K., Rohrer, J., Hoffmann Abad, P., Laffleur, F., Matuszczak, B., Bernkop-Schnürch, A. (2016) Mucoadhesive polymers: Synthesis and in vitro characterization of thiolated poly(vinyl alcohol). *Int. J. Pharm.*, **503**, 141-149.
- Tonglairoum, P., Ngawhirunpat, T., Rojanarata, T., Panomsuk, S., Kaomongkolgit, R., Opanasopit, P. (2015) Fabrication of mucoadhesive chitosan coated polyvinylpyrrolidone/cyclodextrin/clotrimazole sandwich patches for oral candidiasis. *Carbohydr. Polym.*, **132**, 173-179.
- Wasnik, M.N., Godse, R.D., Nair, H.A. (2014) Development and evaluation of buccoadhesive tablet for selegiline hydrochloride based on thiolated polycarbophil. *Drug Dev. Ind. Pharm.*, **40**, 632-638.
- Zambito Y, Felice F, Fabiano A, Di Stefano R, Di Colo G (2013) Mucoadhesive nanoparticles made of thiolated quaternary chitosan crosslinked with hyaluronan. *Carbohydr Polym.*, **92**, 33-39.

Permeation enhancement:

- Bernkop-Schnürch, A. and Clausen A.E. (2002) Membranes as targets for drug design: Biomembrane permeability of peptides: Strategies to improve their mucosal uptake. *Mini Reviews in Medicinal Chemistry*, **2**, 295-305.
- Bernkop-Schnürch, A. Kast, C.E. and Guggi, D. (2003). Permeation enhancing polymers in oral delivery of hydrophilic macromolecules: Thiomers / GSH systems. *J. Control. Release*, **93**, 95-103.
- Bernkop-Schnürch, A., Clausen, A.E. and Guggi, D. (2004). The use of auxiliary agents to improve the mucosal uptake of peptides. *Med. Chem. Rev.*, **1**, 1-10.
- Bernkop-Schnürch, A., Guggi, D., and Pinter, Y. (2004). Thiolated chitosans: development and in vivo evaluation of a mucoadhesive permeation enhancing oral drug delivery system. *J. Control. Release*, **94**, 177-186.
- Boateng, J.S., Mitchell, J.C., Pawar, H., Ayensu, I. (2014) Functional characterisation and permeation studies of lyophilised thiolated chitosan xerogels for buccal delivery of insulin. *Protein Pept. Lett.*, **21**, 1163-1175.
- Clausen, A.E., and Bernkop-Schnürch, A. (2000) *In vitro* evaluation of the permeation-enhancing effect of thiolated polycarbophil. *J. Pharm. Sci.*, **89**, 1253-1261.
- Clausen, A.E., and Bernkop-Schnürch, A. (2001) Thiolated carboxy- methylcellulose: *In vitro* evaluation of its permeation enhancing effect on peptide drugs. *Eur. J. Pharm. Biopharm.*, **51**, 25-32.
- Clausen, A.E., Kast, C.E. and Bernkop-Schnürch, A. (2002) The role of glutathione in the permeation enhancing effect of thiolated polymers. *Pharm. Res.*, **19**, 602-608.
- Di Colo, G., Zambito, Y., and Zaino, C., (2008) Polymeric enhancers of mucosal epithelia permeability: synthesis, transepithelial penetration-enhancing properties, mechanism of action, safety issues. *J. Pharm. Sci.*, **97**, 1652-1680.
- Dünnhaupt, S.; Barthelmes, J.; Rahmat, D.; Leithner, K.; Thurner, C.C.; Friedl, H.; Bernkop-Schnürch, A. (2012). S-protected thiolated chitosan for oral delivery of hydrophilic macromolecules:

- Evaluation of permeation enhancing and efflux pump inhibitory properties. *Mol. Pharm.*, **9**, 1331-1341.
- Greimel, A., Bernkop-Schnürch, A., Del Curto, M.D., and D'Antonio, M. (2007) Transport characteristics of a beta sheet breaker peptide across excised bovine nasal mucosa. *Drug Dev. Ind. Pharm.*, **33**, 71-77.
- Guggi, D. and Bernkop-Schnürch, A. (2004). Improved paracellular uptake by the combination of permeation enhancers acting in different ways. *Int. J. Pharm.*, **288**, 141-50.
- Hornof, M.D. and Bernkop-Schnürch, A. (2002) *In vitro* evaluation of the permeation enhancing effect of polycarbophil - cysteine conjugates on the cornea of rabbits. *J. Pharm. Sci.*, **91**, 2588-2592.
- Kast, C.E. and Bernkop-Schnürch, A. (2002) Influence of the molecular mass on the permeation enhancing effect of different poly(acrylates). *STP pharma*, **12**, 351-356.
- Krauland, A. and Bernkop-Schnürch, A. (2004) Thiomers: Development and *in vitro* evaluation of a peroral microparticulate peptide delivery system. *Eur. J. Pharm. Biopharm.*, **57**, 181-187.
- Laffleur, F., Psenner, J., Suchaoin, W. (2015) Permeation enhancement via thiolation: *in vitro* and *ex vivo* evaluation of hyaluronic acid-cysteine ethyl ester. *J. Pharm. Sci.*, **104**, 2153-2160.
- Langoth, N., Kalbe, J. and Bernkop-Schnürch, A. (2005). Development of a mucoadhesive and permeation enhancing buccal delivery system for PACAP (pituitary adenylate cyclase-activating polypeptide). *Int. J. Pharm.*, **296**, 103-111.
- Mazzaferro, S., Bouchemal, K., Skanji, R., Gueutin, C., Chacun, H., Ponchel, G. (2012) Intestinal permeation enhancement of docetaxel encapsulated into methyl- β -cyclodextrin/poly(isobutylcyanoacrylate) nanoparticles coated with thiolated chitosan. *J. Control. Release*, **162**, 568-574.
- Palmberger, T.F., Albrecht, K., Loretz, B., and Bernkop-Schnürch, A. (2007) Thiolated polymers: evaluation of the influence of the amount of covalently attached L-cysteine to poly(acrylic acid). *Eur. J. Pharm. Biopharm.*, **66**, 405-412.
- Perera, G.; Barthelmes, J.; Vetter, A.; Krieg, C.; Uhlschmied, C.; Bonn, G.K.; Bernkop-Schnürch, A. (2011). Thiolated polycarbophil/glutathione: Defining its potential as a permeation enhancer for oral drug administration in comparison to sodium caprate. *Drug Deliv.*, **18**, 415-423.
- Rahmat, D., Müller, C., Barthelmes, J., Shahnaz, G., Martien, R., Bernkop-Schnürch, A. (2013) Thiolated hydroxyethyl cellulose: design and *in vitro* evaluation of mucoadhesive and permeation enhancing nanoparticles. *Eur. J. Pharm. Biopharm.*, **83**, 149-155.
- Rahmat, D.; Sakloetsakun, D.; Shahnaz, G.; Sarti, F.; Laffleur, F.; Bernkop-Schnürch, A. (2012). HEC-cysteamine conjugates: Influence of degree of thiolation on efflux pump inhibitory and permeation enhancing properties. *Int. J. Pharm.*, **422**, 40-46.
- Wang, X., Zheng, C., Wu, Z., Teng, D., Zhang, X., Wang, Z., and Li, C., (2009) Chitosan-NAC nanoparticles as a vehicle for nasal absorption enhancement of insulin. *J. Biomed. Mater. Res. B Appl. Biomater.*, **88**, 150-161.
- Zambito, Y., Fogli, S., Zaino, C., Stefanelli, F., Breschi, M.C., and Di Colo, G. (2009) Synthesis, characterization and evaluation of thiolated quaternary ammonium-chitosan conjugates for enhanced intestinal drug permeation *Eur. J. Pharm. Sci.*, **38**, 112 – 120.
- Zambito Y, Di Colo G., (2010) Thiolated quaternary ammonium-chitosan conjugates for enhanced precorneal retention, transcorneal permeation and intraocular absorption of dexamethasone. *Eur. J. Pharm. Biopharm.*, **75**, 194-199.

Controlled drug release:

- Bahulkar, S.S., Munot, N.M., Surwase, S.S. (2015) Synthesis, characterization of thiolated karaya gum and evaluation of effect of pH on its mucoadhesive and sustained release properties. *Carbohydr. Polym.*, **130**, 183-190.
- Bernkop-Schnürch, A., Scholler, S., and Biebel, R.G. (2000) Development of controlled drug release systems based on polymer-cysteine conjugates. *J. Control. Release*, **66**, 39-48.
- Bernkop-Schnürch, A., Guggi, D., and Pinter, Y. (2004) Thiolated chitosans: development and *in vivo* evaluation of a mucoadhesive permeation enhancing oral drug delivery system. *J. Control. Release*, **94**, 177-186.
- Clausen, A.E., and Bernkop-Schnürch, A. (2001) Development and *in vitro* evaluation of a peptide drug delivery system based on thiolated polycarbophil. *Pharm. Ind.*, **63**, 312-317.

- Kast, C.E., Valenta, C., Leopold, M. and Bernkop-Schnürch, A. (2002) Design and *in vitro* evaluation of a novel bioadhesive vaginal drug delivery system for clotrimazole. *J. Control. Release*, **81**, 347-354.
- Langoth, N., Kalbe, J. and Bernkop-Schnürch, A. (2003) Development of buccal drug delivery systems based on a thiolated polymer. *Int. J. Pharm.*, **252**, 141-148.
- Sarti, F.; Iqbal, J.; Müller, C.; Shahnaz, G.; Rahmat, D.; Bernkop-Schnürch, A. (2012). Poly(acrylic acid)-cysteine for oral vitamin B12 delivery. *Anal. Biochem.*, **420**, 13-19.
- Sivasubramanian, M., Kim, Y.J., Chae, S.Y., Son, S., Jo, D.G., Lee, K.C., Yoo, C.K., Park, J.H. (2012) Thiolated glycol chitosan bearing α -cyclodextrin for sustained delivery of PEGylated human growth hormone. *J. Biomater. Sci. Polym. Ed.*, **23**, 1995-2005.
- Singh, B., Jiang, T., Kim, Y.K., Kang, S.K., Choi, Y.J., Cho, C.S. (2015) Release and Cytokine Production of BmpB from BmpB-Loaded pH-Sensitive and Mucoadhesive Thiolated Eudragit Microspheres. *J. Nanosci. Nanotechnol.*, **15**, 606-610.
- Valenta, C., Walzer, A., Clausen, A.E., and Bernkop-Schnürch, A. (2001) Thiolated polymers: development and evaluation of transdermal delivery systems for progesterone. *Pharm. Res.*, **18**, 211-216.
- Valenta, C., Kast, E.C., Harich, I., and Bernkop-Schnürch, A. (2001) Development and *in vitro* evaluation of a mucoadhesive vaginal delivery system for progesterone. *J. Control. Release*, **77**, 323-332.
- Wu, Z.M., Zhang, X.G., Zheng, C., Li, C.X., Zhang, S.M., Dong, R.N., and Yu, D.M. (2009). Disulfide-crosslinked chitosan hydrogel for cell viability and controlled protein release. *Eur. J. Pharm. Sci.*, **37**, 198-206.
- Yandrapu, S.K., Kanujia, P., Chalasani, K.B., Mangamoori, L., Kolapalli, R.V., Chauhan, A. (2013) Development and optimization of thiolated dendrimer as a viable mucoadhesive excipient for the controlled drug delivery: an acyclovir model formulation. *Nanomedicine*, **9**, 514-522.

Enzyme inhibition:

- Bernkop-Schnürch, A. and Thaler, S. (2000) Polycarbophil-cysteine conjugates as platforms for oral (poly)peptide delivery systems. *J. Pharm. Sci.*, **89**, 901-909.
- Bernkop-Schnürch, A., Zarti, H., and Walker, G.F. (2001) Thiolation of polycarbophil enhances its inhibition of soluble and intestinal brush border membrane bound aminopeptidase N. *J. Pharm. Sci.*, **90**, 1907-1914.
- Bernkop-Schnürch A, Obermair K, Greimel A, Palmberger TF., (2006) In vitro evaluation of the potential of thiomers for the nasal administration of Leu-enkephalin. *Amino Acids*. **30**, 417-423.
- Leitner, V. and Bernkop-Schnürch, A. Polymer-enzyme inhibitor conjugates: Influence of the molecular mass on the inhibition of membrane-bound aminopeptidase N activity. *Drug Del. Sci. Tech.*, **14**, 495-498.
- Perera G, Greindl M, Palmberger TF, and Bernkop-Schnürch A. (2009) Insulin-loaded poly(acrylic acid)-cysteine nanoparticles: stability studies towards digestive enzymes of the intestine. *Drug Deliv.*, **16**, 254-260.
- Valenta, C., Marschütz, M., Egyed, Ch., and Bernkop-Schnürch, A. (2002) Evaluation of the inhibitory effect of thiolated poly(acrylates) on vaginal membrane bound aminopeptidase N. *J. Pharm. Pharmacol.*, **54**, 603-610.

Efflux pump inhibition:

- Bernkop-Schnürch, A. and Grabovac, V. (2006) Polymeric efflux pump inhibitors in oral drug delivery. *Am. J. Drug Del.*, **4**, 263-272.
- Föger, F., Schmitz, Th., and Bernkop-Schnürch, A. (2006) In vivo evaluation of an oral delivery system for P-gp substrates based on thiolated chitosan. *Biomaterials*, **27**, 4250-4255.

- Föger, F., Hoyer, H., Kafedjiiski, K., Thaurer, M., and Bernkop-Schnürch, A. (2006) In vivo comparison of various polymeric and low molecular mass inhibitors of intestinal P-glycoprotein. *Biomaterials*, **27**, 5855-5860.
- Föger, F., Malaivijitnond, S., Wannaprasert, T., Huck, C., Bernkop-Schnürch, A., and Werle, M. (2008) Effect of a thiolated polymer on oral paclitaxel absorption and tumor growth in rats. *J. Drug Target.*, **16**, 149-55.
- Föger, F., Kafedjiiski, K., Hoyer, H., Loretz, B., and Bernkop-Schnürch, A. (2007) Enhanced transport of P-glycoprotein substrate saquinavir in presence of thiolated chitosan. *J. Drug Target.*, **15**, 132-139.
- Grabovac, V., Laffleur, F., Bernkop-Schnürch, A. (2015) Thiomers: Influence of molecular mass and thiol group content of poly(acrylic acid) on efflux pump inhibition. *Int. J. Pharm.*, **493**, 374-379.
- Iqbal, J.; Hombach, J.; Matuszczak, B.; Bernkop-Schnürch, A. (2010). Design and in vitro evaluation of a novel polymeric P-glycoprotein (P-gp) inhibitor. *J. Control. Rel.*, **147**, 62-69.
- PalMBERGER TF, Hombach J, and Bernkop-Schnürch, A. (2008) Thiolated chitosan: development and in vitro evaluation of an oral delivery system for acyclovir. *Int. J. Pharm.* **348**, 54-60.
- Rahmat, D.; Sakloetsakun, D.; Shahnaz, G.; Sarti, F.; Laffleur, F.; Bernkop-Schnürch, A. (2012). HEC-cysteamine conjugates: Influence of degree of thiolation on efflux pump inhibitory and permeation enhancing properties. *Int. J. Pharm.*, **422**, 40-46.
- Sakloetsakun, D.; Iqbal, J.; Millotti, G.; Vetter, A.; Bernkop-Schnürch, A. (2011). Thiolated chitosans: influence of various sulfhydryl ligands on permeation-enhancing and P-gp inhibitory properties. *Drug Dev. Ind. Pharm.*, **37**, 648-655.
- Schmitz, T., Hombach, J. and Bernkop-Schnürch, A. (2008) Chitosan-N-acetyl cysteine conjugates: in vitro evaluation of permeation enhancing and P-glycoprotein inhibiting properties. *Drug Deliv.*, **15**, 245-252.
- Trapani, A., Palazzo, C., Contino, M., Perrone, M.G., Cioffi, N., Ditaranto, N., Colabufo, N.A., Conese, M., Trapani, G., Puglisi, G. (2014) Mucoadhesive properties and interaction with P-glycoprotein (P-gp) of thiolated-chitosans and -glycol chitosans and corresponding parent polymers: a comparative study. *Biomacromolecules*, **15**, 882-893.
- Werle, M. and Hoffer, M. (2006) Glutathione and thiolated chitosan inhibit multidrug resistance P-glycoprotein activity in excised small intestine. *J. Control. Release*, **111**, 41-46.
- Werle, M. (2008) Natural and synthetic polymers as inhibitors of drug efflux pumps. *Pharm Res.*, **25**, 500-511.
- Dünnhaupt, S.; Barthelmes, J.; Rahmat, D.; Leithner, K.; Thurner, C.C.; Friedl, H.; Bernkop-Schnürch, A. (2012). S-protected thiolated chitosan for oral delivery of hydrophilic macromolecules: Evaluation of permeation enhancing and efflux pump inhibitory properties. *Mol. Pharm.*, **9**, 1331-1341.

Thiomer Micro- and Nanocarriers:

- Abdullah-Al-Nahain, Lee, H., Lee, Y.S., Lee, K.D., Park, S.Y. (2011) Development of disulfide core-crosslinked pluronic nanoparticles as an effective anticancer-drug-delivery system. *Macromol. Biosci.*, **11**, 1264-1271.
- Akhlaghi S.P., Saremi S., Ostad S.N., Dinarvand R., Atyabi F., (2010) Discriminated effects of thiolated chitosan-coated pMMA paclitaxel-loaded nanoparticles on different normal and cancer cell lines. *Nanomedicine*, **6**, 689-697.
- Alamdarnejad, G., Sharif, A., Taranejoo, S., Janmaleki, M., Kalae, M.R., Dadgar, M., Khakpour, M. (2013) Synthesis and characterization of thiolated carboxymethyl chitosan-graft-cyclodextrin nanoparticles as a drug delivery vehicle for albendazole. *J. Mater. Sci. Mater. Med.*, **24**, 1939-1949.
- Albrecht, K. and Bernkop-Schnürch, A. (2007) Thiomers: forms, functions and applications to nanomedicine. *Nanomedicine*, **2**, 41-50.
- Albrecht, K., Zirm, E.J., Palmberger, T.F., Schlocker, W. and Bernkop-Schnürch, A. (2006) Preparation of thiomer microparticles and in vitro evaluation of parameters influencing their mucoadhesive properties. *Drug Dev. Ind. Pharm.*, **32**, 1149-1157.
- Algarra, M., Campos, B.B., Gomes, D., Alonso, B., Casado, C.M., Arrebola, M.M., Diez de los Rios, M.J., Herrera-Gutiérrez, M.E., Sellar-Pérez, G., Esteves da Silva, J.C. (2012) Thiolated DAB dendrimer/ZnSe nanoparticles for C-reactive protein recognition in human serum. *Talanta.*, **99**, 574-579.

- Anitha, A., Deepa, N., Chennazhi, K.P., Lakshmanan, V.K., Jayakumar, R. (2014) Combinatorial anticancer effects of curcumin and 5-fluorouracil loaded thiolated chitosan nanoparticles towards colon cancer treatment. *Biochim. Biophys. Acta.*, **1840**, 2730-2743.
- Atyabi, F., Moghaddam, F.A., Doinarvand, R., Zohuriaan-Mehr, M.J., and Ponchel, G. (2008) Thiolated Chitosan coated poly hydroxyethyl methacrylate nanoparticles: Synthesis and characterization. *Carbohydrate Polymers* **74**, 59-67.
- Atyabi, F., Talaie, F., and Dinarvand, R. (2009) Thiolated chitosan nanoparticles as an oral delivery system for Amikacin: in vitro and ex vivo evaluations. *J. Nanosci. Nanotechnol.* **9**, 4593-4603.
- Barthelmes, J.; Dünnhaupt, S.; Hombach, J.; Bernkop-Schnürch, A. (2011). Thiomer nanoparticles: Stabilization via covalent cross-linking. *Drug Deliv.*, **18**, 613-619.
- Barthelmes, J.; Perera, G.; Hombach, J.; Dünnhaupt, S.; Bernkop-Schnürch, A. (2011). Development of a mucoadhesive nanoparticulate drug delivery system for a targeted drug release in the bladder. *Int. J. Pharm.*, **416**, 339-345.
- Bernkop-Schnürch, A., Heinrich, A. and Greimel, A. (2006). Development of a novel method for the preparation of submicron particles based on thiolated chitosan. *Eur. J. Pharm. Biopharm.*, **63**, 166-172.
- Bernkop-Schnürch, A., Weithaler, A., Albrecht, K., and Greimel, A. (2006) Thiomers: Preparation and in vitro evaluation of a mucoadhesive nanoparticulate drug delivery system. *Int. J. Pharm.*, **317**, 76-81.
- Bilicic, M.B., Filipovic-Grcic, J., Hafner, A., Zorc, B., and Cetina-Cizmek, B. (2006) Development and characterization of mucoadhesive PHEA-TGA microspheres. *J. Drug Del. Sci. Tech.* **16**, 339-343.
- Bouchemal, K., Ponchel, G., Mazzaferro, S., Campos-Requena, V., Gueutin, C., Palmieri, G.-F., and Vauthier, C. (2008) A new approach to determine loading efficiency of Leu-enkephalin in poly (isobutylcyanoacrylate) nanoparticles coated with thiolated chitosan. *J Drug Del. Sci. Tech.* **18**, 392-397
- Bravo-Osuna, I., Schmitz, T., Bernkop-Schnürch, A., Vauthier, C., and Ponchel G. (2006) Elaboration and characterization of thiolated chitosan-coated acrylic nanoparticles. *Int. J. Pharm.*, **316**, 170-175.
- Bravo-Osuna, I., Teutonico, D., Arpicco, S., Vauthier, C., and Ponchel, G. (2007) Characterization of chitosan thiolation and application to thiol quantification onto nanoparticle surface. *Int. J. Pharm.*, **340**, 173-181.
- Bravo-Osuna, I., Millotti, G., Vauthier, C., and Ponchel, G. (2007) In vitro evaluation of calcium binding capacity of chitosan and thiolated chitosan poly(isobutyl cyanoacrylate) core-shell nanoparticles. *Int. J. Pharm.*, **338**, 284-290.
- Campos-Requena, V.H. Bouchemal, K., Vauthier, C., and Ponchel, G. (2008) Encapsulation of Leu-Enkephalin in core-shell isobutylcyanoacrylate – thiolated chitosan nanoparticles for oral administration. *Chilean Chemical Society* **53**, 1677-1681.
- Cavaleri, F., Zhou, M., Caruso, F., Ashokkumar, M. (2011) One-pot ultrasonic synthesis of multifunctional microbubbles and microcapsules using synthetic thiolated macromolecules. *Chem Commun (Camb)*, **47**, 4096-4098.
- Chen, S., Cao, Y., Ferguson, L.R., Shu, Q., Garg, S. (2013) Evaluation of mucoadhesive coatings of chitosan and thiolated chitosan for the colonic delivery of microencapsulated probiotic bacteria. *J. Microencapsul.*, **30**, 103-115.
- Choi, R., Yang, J., Choi, J., Lim, E.K., Kim, E., Suh, J.S., Huh, Y.M., Haam, S. (2010) Thiolated dextran-coated gold nanorods for photothermal ablation of inflammatory macrophages. *Langmuir*, **26**, 17520-17527.
- Deutel, B., Greindl, M., Thaurer, M., and Bernkop-Schnürch, A. (2008) Novel insulin thiomers nanoparticles: in vivo evaluation of an oral drug delivery system. *Biomacromolecules*, **9**, 278-285.
- Dünnhaupt, S., Barthelmes, J., Köllner, S., Sakloetsakun, D., Shahnaz, G., Dügger, A., Bernkop-Schnürch, A. (2015) Thiolated nanocarriers for oral delivery of hydrophilic macromolecular drugs. *Carbohydr. Polym.*, **117**, 577-584.
- Grabovac, V., and Bernkop-Schnürch, A. (2007) Development and in vitro evaluation of surface modified poly(lactide-co-glycolide) nanoparticles with chitosan-4-thiobutylamidine. *Drug Dev. Ind. Pharm.*, **33**, 767-774.

- Greimel, A., Del Curto, M. D., D'Antonio, M., Palmberger, Th., Sprinzi, G. M. and Bernkop-Schnürch, A. In vitro evaluation of thiomers microparticles for nasal drug delivery. *J. Drug. Del. Sci. Tech.*, **16**, 103-108.
- Greimel A, Werle M, and Bernkop-Schnürch A. (2007) Oral peptide delivery: in-vitro evaluation of thiolated alginate/poly(acrylic acid) microparticles. *J. Pharm. Pharmacol.*, **59**, 1191-1198.
- Greindl, M., and Bernkop-Schnürch, A. (2006) Development of a novel method for the preparation of thiolated polyacrylic acid nanoparticles. *Pharm. Res.*, **23**, 2183-2189.
- Ho, Y.C., Wu, S.J., Mi, F.L., Chiu, Y.L., Yu, S.H., Panda, N., and Sung, H.W. (2010) Thiol-modified chitosan sulfate nanoparticles for protection and release of basic fibroblast growth factor. *Bioconjug Chem.*, **21**, 28-38.
- Hoyer, H., Schlocker, W., Krum, K., and Bernkop-Schnürch, A. (2008) Preparation and evaluation of microparticles from thiolated polymers via air jet milling. *Eur. J. Pharm. Biopharm.*, **69**, 476-485.
- Hoyer, H.; Schlocker, W.; Greindl, M.; Ostermann, T.; Bernkop-Schnürch, A. (2010). Preparation and evaluation of thiomers nanoparticles via high pressure homogenization. *J. Microencap.*, **27**, 487-495.
- Imam, M.E. and Bernkop-Schnürch, A. (2005). Controlled drug delivery systems based on thiolated chitosan microspheres. *Drug Dev. Ind. Pharm.*, **31**, 557-565.
- Irmukhametova, G.S., Mun, G.A., Khutoryanskiy, V.V. (2011) Thiolated mucoadhesive and PEGylated nonmucoadhesive organosilica nanoparticles from 3-mercaptopropyltrimethoxysilane. *Langmuir*, **27**, 9551-9556
- Krauland, A. and Bernkop-Schnürch, A. (2004). Thiomers: Development and in vitro evaluation of a peroral microparticulate peptide delivery system. *Eur. J. Pharm. Biopharm.*, **57**, 181-187.
- Krauland, A.H., Guggi, D., and Bernkop-Schnürch, A. (2005). Thiolated chitosan microparticles: A vehicle for nasal peptide drug delivery. *Int. J. Pharm.*, **307**, 270-277.
- Köllner, S., Dünnhaupt, S., Waldner, C., Hauptstein, S., Pereira de Sousa, I., Bernkop-Schnürch, A. (2015) Mucus permeating thiomers nanoparticles. *Eur. J. Pharm. Biopharm.*, **97**, 265-272.
- Lee, D.W., Shirley, S.A., Lockey, R.F., and Mohapatra, S.S. (2006) Thiolated chitosan nanoparticles enhance anti-inflammatory effects of intranasally delivered theophylline. *Respir. Res.* **7**, 112.
- Lee W.J., Cha S., Shin M., Jung M., Islam M.A., Cho C.S., Yoo H.S., (2012) Efficacy of thiolated eudragit microspheres as an oral vaccine delivery system to induce mucosal immunity against enterotoxigenic *Escherichia coli* in mice. *Eur J Pharm Biopharm.* **81**, 43-48.
- Leitner, V.M., Guggi, D. and Bernkop-Schnürch, A. (2004). Nasal Delivery of human growth hormone: in vitro and in vivo evaluation of a thiomers/glutathione microparticulate delivery system. *J. Control. Rel.*, **100**, 87-95.
- Li, H.S., Singh, B., Park, T.E., Hong, Z.S., Kang, S.K., Cho, C.S., Choi, Y.J. (2015) Mannan-decorated thiolated Eudragit microspheres for targeting antigen presenting cells via nasal vaccination. *Eur. J. Pharm. Sci.*, **80**, 16-25.
- Llabot, J.M.; Salman, H.; Millotti, G.; Bernkop-Schnürch, A.; Allemanni, D.; Manuel Irache, J. (2011). Bioadhesive properties of poly(anhydride) nanoparticles coated with different molecular weights chitosan. *J. Microencap.*, **28**, 455-463.
- Maculotti, K., Genta, I., Perugini, P., Imam, M., Bernkop-Schnürch, A. and Pavanetto, F. (2005) Preparation and in vitro evaluation of thiolated chitosan microparticles. *J. Microencapsul.*, **22**, 459-470.
- Makhlof A, Werle M, Tozuka Y, Takeuchi H, (2010) Nanoparticles of glycol chitosan and its thiolated derivative significantly improved the pulmonary delivery of calcitonin. *Int. J. Pharm.*, **397**, 92-95.
- Meng, J., Zhang, T., Agrahari, V., Ezoulin, M.J., Youan, B.B. (2014) Comparative biophysical properties of tenofovir-loaded, thiolated and nonthiolated chitosan nanoparticles intended for HIV prevention. *Nanomedicine (Lond)*, **9**, 1595-1612.
- Millotti, G., Vetter, A., Leithner, K., Sarti, F., Shahnaz Bano, G., Augustijns, P., Bernkop-Schnürch, A. (2014) Development of thiolated poly(acrylic acid) microparticles for the nasal administration of exenatide. *Drug Dev. Ind. Pharm.*, **40**, 1677-1682.
- Millotti, G.; Perera, G.; Vigl, C.; Pickl, K.; Sinner, F.M.; Bernkop-Schnürch, A. (2011). The use of chitosan-6-mercaptopropionic acid nanoparticles for oral peptide drug delivery. *Drug Deliv.*, **18**, 190-197.

- Moghaddam, F.A., Atyabi, F., and Dinarvand, R., (2009). Preparation and in vitro evaluation of mucoadhesion and permeation enhancement of thiolated chitosan-pHEMA core-shell nanoparticles. *Nanomedicine*, **5**, 208-215.
- Mortazavian, E., Dorkoosh, F.A., Rafiee-Tehrani, M. (2014) Design, characterization and ex vivo evaluation of chitosan film integrating of insulin nanoparticles composed of thiolated chitosan derivative for buccal delivery of insulin. *Drug Dev. Ind. Pharm.*, **40**, 691-698.
- Narayanan, D., Anitha, A., Jayakumar, R., Chennazhi, K.P. (2014) PTH 1-34 loaded thiolated chitosan nanoparticles for osteoporosis: oral bioavailability and anabolic effect on primary osteoblast cells. *J. Biomed. Nanotechnol.*, **10**, 166-178.
- Nema, T., Jain, A., Jain, A., Shilpi, S., Gulbake, A., Hurkat, P., Jain, S.K. (2013) Insulin delivery through nasal route using thiolated microspheres. *Drug Deliv.*, **20**, 210-215.
- Oh, S., Borrós, S. (2016) Mucoadhesion vs mucus permeability of thiolated chitosan polymers and their resulting nanoparticles using a quartz crystal microbalance with dissipation (QCM-D). *Colloids Surf. B Biointerfaces*, **147**, 434-441.
- Patel, D., Naik, S., Chuttani, K., Mathur, R., Mishra, A.K., Misra, A. (2013) Intranasal delivery of cyclobenzaprine hydrochloride-loaded thiolated chitosan nanoparticles for pain relief. *J. Drug Target.*, **21**, 759-769.
- Patel D, Naik S, Misra A., (2012) Improved transnasal transport and brain uptake of tizanidine HCl-loaded thiolated chitosan nanoparticles for alleviation of pain. *J. Pharm. Sci.*, **101**, 690-706.
- Pedrosa, S.S., Gonçalves, C., David, L., Gama, M. (2014) A novel crosslinked hyaluronic acid nanogel for drug delivery. *Macromol. Biosci.*, **14**, 1556-1568.
- Perera, G.; Barthelmes, J.; Bernkop-Schnürch, A. (2010). Novel pectin-4-aminothiophenole conjugate microparticles for colon-specific drug delivery. *J. Control. Rel.*, **145**, 240-246.
- Pradines, B., Lievin-Le Moal, V., Vauthier, C., Ponchel, G., Loiseau, P.M., Bouchemal, K. (2015) Cell line-dependent cytotoxicity of poly(isobutylcyanoacrylate) nanoparticles coated with chitosan and thiolated chitosan: Insights from cultured human epithelial HeLa, Caco2/TC7 and HT-29/MTX cells. *Int. J. Pharm.*, **491**, 17-20.
- Sakloetsakun, D., Dünnhaupt, S., Barthelmes, J., Perera, G., Bernkop-Schnürch, A. (2013) Combining two technologies: multifunctional polymers and self-nanoemulsifying drug delivery system (SNEDDS) for oral insulin administration. *Int. J. Biol. Macromol.*, **61**, 363-372.
- Sakloetsakun, D., Perera, G., Hombach, J., Millotti, G., Bernkop-Schnürch, A. (2010) The impact of vehicles on the mucoadhesive properties of orally administered nanoparticles: a case study with chitosan-4-thiobutylamidine conjugate. *AAPS PharmSciTech.*, **11**, 1185-1192.
- Saboktakin M.R., Tabatabaie R.M., Maharramov A., Ramazanov M.A., (2011) Development and in vitro evaluation of thiolated chitosan--Poly(methacrylic acid) nanoparticles as a local mucoadhesive delivery system. *Int. J. Biol. Macromol.*, **48**, 403-407.
- Sajeesh S, Vauthier C, Gueutin C, Ponchel G, Sharma CP., (2010) Thiol functionalized polymethacrylic acid-based hydrogel microparticles for oral insulin delivery. *Acta Biomater.*, **6**, 3072-3080.
- Sajeesh, S., Bouchemal, K., Sharma, C.P., and Vauthier, C. (2010) Surface-functionalized polymethacrylic acid based hydrogel microparticles for oral drug delivery. *Eur. J. Pharm. Biopharm.* **74**, 209-218.
- Saremi, S., Dinarvand, R., Kebriaeezadeh, A., Ostad, S.N., Atyabi, F. (2013) Enhanced oral delivery of docetaxel using thiolated chitosan nanoparticles: preparation, in vitro and in vivo studies. *Biomed. Res. Int.*, **2013**, 150478.
- Saremi S., Atyabi F., Akhlaghi S.P., Ostad S.N., Dinarvand R., (2011) Thiolated chitosan nanoparticles for enhancing oral absorption of docetaxel: preparation, in vitro and ex vivo evaluation. *Int. J. Nanomedicine.*, **6**, 119-28.
- Schmitz, T., Bravo-Osuna, I., Vauthier, C., Ponchel, G., Loretz, B., and Bernkop-Schnürch, A. (2007) Development and in vitro evaluation of a thiomers-based nanoparticulate gene delivery system. *Biomaterials*, **28**, 524-531.
- Şenyiğit, Z.A., Karavana, S.Y., İlem-Özdemir, D., Çalışkan, Ç., Waldner, C., Şen, S., Bernkop-Schnürch, A., Baloğlu, E. (2015) Design and evaluation of an intravesical delivery system for superficial bladder cancer: preparation of gemcitabine HCl-loaded chitosan-thioglycolic acid nanoparticles and comparison of chitosan/poloxamer gels as carriers. *Int. J. Nanomedicine*, **10**, 6493-6507.

- Senyigit, Z.A., Vetter, A., Guneri, T., and Bernkop-Schnürch, A. (2010) Gastroretentive particles formulated with thiomers: development and in vitro evaluation. *J. Drug Target.* **18**, 362-372.
- Shen, J., Deng, Y., Jin, X., Ping, Q., Su, Z., Li, L. (2010) Thiolated nanostructured lipid carriers as a potential ocular drug delivery system for cyclosporine A: Improving in vivo ocular distribution. *Int. J. Pharm.*, **402**, 248-253.
- Sonawane, S., Bhalekar, M., Shimpi, S. (2014) Preparation and evaluation of microspheres of xyloglucan and its thiolated xyloglucan derivative. *Int. J. Biol. Macromol.*, **69**, 499-505.
- Sonia, T.A., Sharma, C.P. (2013) In vitro evaluation of thiolated polydimethylaminoethylmethacrylate hydrogel sub-microparticles for oral insulin delivery. *J. Biomed. Nanotechnol.*, **9**, 590-600.
- Su Z, Liu Y, Xie Q, Chen L, Zhang Y, Meng Y, Li Y, Fu Y, Ma M, Yao S. (2012) Preparation of thiolated polymeric nanocomposite for sensitive electroanalysis of dopamine. *Biosens Bioelectron.*, **36**, 154-160.
- Thaurer, M.H., Deutel, B., Schlocker, W., and Bernkop-Schnürch, A. (2008) Development of nanoparticulate drug delivery systems based on thiolated poly(acrylic acid). *J. Microencapsul.*, **22**, 1-8.
- Verheul, R.J., Slütter, B., Bal, S.M., Bouwstra, J.A., Jiskoot, W., Hennink, W.E. (2011) Covalently stabilized trimethyl chitosan-hyaluronic acid nanoparticles for nasal and intradermal vaccination. *J. Control. Release.*, **156**, 46-52.
- Verheul R.J., van der Wal S., Hennink W.E., (2010) Tailorable thiolated trimethyl chitosans for covalently stabilized nanoparticles. *Biomacromolecules*, **11**, 1965-1971.
- Vetter, A. and Bernkop-Schnürch, A. (2010) Nasal delivery of antisense oligonucleotides: in vitro evaluation of a thiomers/glutathione microparticulate delivery system. *J. Drug Target.*, **18**, 303-312.
- Vetter, A.; Reinisch, A.; Strunk, D.; Kremser, C.; Hahn, H.W.; Huck, C.W.; Ostermann, T.; Leithner, K.; Bernkop-Schnürch, A. (2011). Thiolated polyacrylic acid-modified iron oxide nanoparticles for in vitro labeling and MRI of stem cells. *J. Drug Targ.*, **19**, 562-572.
- Weber, C., Reiss S. and Langer K. (2000) Preparation of surface modified protein nanoparticles by introduction of sulfhydryl groups. *Int. J. Pharm.* **211**, 67-78.
- Werle, M., Hironaka, K., Takeuchi, H., and Hoyer, H., (2009). Development and in vitro characterization of liposomes coated with thiolated poly(acrylic acid) for oral drug delivery. *Drug Dev. Ind. Pharm.*, **35**, 209-215.
- Yousefpour, P., Atyabi, F., Dinarvand, R., Vasheghani-Farahani, E. (2011) Preparation and comparison of chitosan nanoparticles with different degrees of glutathione thiolation. *Daru.* **19**, 367-375.
- Zhang, Y., Du, X., Zhang, Y., Li, G., Cai, C., Xu, J., Tang, X. (2014) Thiolated eudragit-based nanoparticles for oral insulin delivery: preparation, characterization, and evaluation using intestinal epithelial cells in vitro. *Macromol. Biosci.*, **14**, 842-852.
- Zhang Y, Wu X, Meng L, Zhang Y, Ai R, Qi N, He H, Xu H, Tang X., (2012) Thiolated Eudragit nanoparticles for oral insulin delivery: preparation, characterization and in vivo evaluation. *Int. J. Pharm.*, **436**, 341-50.
- Zhao, Y., Li, Y., Ge, J., Li, N., Li, L.B. (2014) Pluronic-poly (acrylic acid)-cysteine/Pluronic L121 mixed micelles improve the oral bioavailability of paclitaxel. *Drug Dev. Ind. Pharm.*, **40**, 1483-1493.
- Zhao X, Yin L, Ding J, Tang C, Gu S, Yin C, Mao Y., (2010) Thiolated trimethyl chitosan nanocomplexes as gene carriers with high in vitro and in vivo transfection efficiency. *J. Control. Release.*, **144**, 46-54.
- Zhu X, Su M, Tang S, Wang L, Liang X, Meng F, Hong Y, Xu Z., (2012) Synthesis of thiolated chitosan and preparation nanoparticles with sodium alginate for ocular drug delivery. *Mol Vis.*, **18**, 1973-1982.

In-situ gelation:

- Bian, S., He, M., Sui, J., Cai, H., Sun, Y., Liang, J., Fan, Y., Zhang, X. (2016) The self-crosslinking smart hyaluronic acid hydrogels as injectable three-dimensional scaffolds for cells culture. *Colloids Surf B Biointerfaces*, **140**, 392-402.
- Censi R., Fieten P.J., Di Martino P., Hennink W.E., Vermonden T. (2010) In-situ forming hydrogels by simultaneous thermal gelling and Michael addition reaction between methacrylate bearing thermosensitive triblock copolymers and thiolated hyaluronan. *J. Control. Release*, **148**, 28-29.

- Gao, C., Liu, T., Dang, Y., Yu, Z., Wang, W., Guo, J., Zhang, X., He, G., Zheng, H., Yin, Y., Kong, X. (2014) pH/redox responsive core cross-linked nanoparticles from thiolated carboxymethyl chitosan for in vitro release study of methotrexate. *Carbohydr. Polym.*, **111**, 964-970.
- Gyarmati, B., Vajna, B., Némethy, Á., László, K., Szilágyi, A. (2013) Redox- and pH-responsive cysteamine-modified poly(aspartic acid) showing a reversible sol-gel transition. *Macromol. Biosci.*, **13**, 633-640.
- Hintzen, F., Laffleur, F., Sarti, F., Shahnaz, G., Bernkop-Schnürch, A. (2012) Thiomers: influence of molar mass on in situ gelling properties. *Int. J. Pharm.*, **436**, 120-126.
- Hintzen, F., Laffleur, F., Sakloetsakun, D., Leithner, K., Bernkop-Schnürch, A. (2012) In situ gelling properties of anionic thiomers. *Drug Dev. Ind. Pharm.*, **38**, 1479-1485.
- Hornof, M.D., Kast, C.E., and Bernkop-Schnürch, A. (2003) *In vitro* evaluation of the viscoelastic properties of chitosan-thioglycolic acid conjugates. *Eur. J. Pharm. Biopharm.*, **55**, 185-190.
- Krauland, A.H., Leitner, V. M. and Bernkop-Schnürch, A. (2003) Improvement in the in situ gelling properties of deacetylated gellan gum by the immobilization of thiol groups. *J. Pharm. Sci.*, **92**, 1234-1241.
- Krauland, A.H., Hoffer, M.H., and Bernkop-Schnürch, A. (2005). Viscoelastic properties of a new in situ gelling thiolated chitosan conjugate. *Drug Dev. Ind. Pharm.*, **31**, 885-893.
- Liu, X., Chen, Y., Huang, Q., He, W., Feng, Q., Yu, B. (2014) A novel thermo-sensitive hydrogel based on thiolated chitosan/hydroxyapatite/beta-glycerophosphate. *Carbohydr. Polym.*, **110**, 62-69.
- Mahajan HS, Tyagi VK, Patil RR, Dusunge SB., (2013) Thiolated xyloglucan: Synthesis, characterization and evaluation as mucoadhesive in situ gelling agent. *Carbohydr Polym.*, **91**, 618-625.
- Marschütz, M.K., and Bernkop-Schnürch, A. (2002) Thiolated polymers: Advance in mucoadhesion by use of in-situ crosslinking poly(acrylic acid)-cysteine conjugates. *Eur. J. Pharm. Sci.*, **15**, 387-394.
- Sakloetsakun D, Hombach JM, and Bernkop-Schnürch A. (2009) In situ gelling properties of chitosan-thioglycolic acid conjugate in the presence of oxidizing agents. *Biomaterials*, **30**, 6151-6157.
- Zhang H, Qadeer A, Chen W., (2011) In situ gelable interpenetrating double network hydrogel formulated from binary components: thiolated chitosan and oxidized dextran. *Biomacromolecules*, **12**, 1428-1437.
- Zarembinski, T.I., Doty, N.J., Erickson, I.E., Srinivas, R., Wirostko, B.M., Tew, W.P. (2014) Thiolated hyaluronan-based hydrogels crosslinked using oxidized glutathione: an injectable matrix designed for ophthalmic applications. *Acta Biomater.*, **10**, 94-103.
- Zhao, W., Kong, M., Feng, C., Cheng, X., Liu, Y., Chen, X. (2016) Investigation of gelling behavior of thiolated chitosan in alkaline condition and its application in stent coating. *Carbohydr. Polym.*, **136**, 307-315.

Nucleic acid delivery:

- Aravindan, L., Bicknell, K.A., Brooks, G., Khutoryanskiy, V.V., Williams, A.C. (2013) A comparison of thiolated and disulfide-crosslinked polyethylenimine for nonviral gene delivery. *Macromol. Biosci.*, **13**, 1163-1173.
- Bacalocostantis, I., Mane, V.P., Goodley, A.S., Bentley, W.E., Muro, S., Kofinas, P. (2013) Investigating polymer thiolation in gene delivery. *J. Biomater. Sci. Polym. Ed.*, **24**, 912-926.
- Bacalocostantis I, Mane VP, Kang MS, Goodley AS, Muro S, Kofinas P. (2012) Effect of thiol pendant conjugates on plasmid DNA binding, release, and stability of polymeric delivery vectors. *Biomacromolecules*, **13**, 1331-1339.
- Day BS, Fiegand LR, Vint ES, Shen W, Morris JR, Norton ML., (2011) Thiolated dendrimers as multi-point binding headgroups for DNA immobilization on gold. *Langmuir*, **27**, 12434-12442.
- Kang, H.C., Kang, H.J., Bae, Y.H. (2011) A reducible polycationic gene vector derived from thiolated low molecular weight branched polyethyleneimine linked by 2-iminothiolane. *Biomaterials*, **32**, 1193-1203.
- Kommareddy S, and Amiji M. (2007) Poly(ethylene glycol)-modified thiolated gelatin nanoparticles for glutathione-responsive intracellular DNA delivery. *Nanomedicine*. **3**, 32-42.
- Lee, S.J., Lee, A., Hwang, S.R., Park, J.S., Jang, J., Huh, M.S., Jo, D.G., Yoon, S.Y., Byun, Y., Kim, S.H., Kwon, I.C., Youn, I., Kim, K. (2014) TNF- α gene silencing using polymerized siRNA/thiolated glycol chitosan nanoparticles for rheumatoid arthritis. *Mol. Ther.*, **22**, 397-408.

- Lee, D., Zhang, W., Shirley, S.A., Kong, X., Hellermann, G.R., Lockey, R.F., and Mohapatra, S.S. (2007). Thiolated chitosan/DNA nanocomplexes exhibit enhanced and sustained gene delivery. *Pharm. Res.*, **24**, 157-167.
- Loretz B, Thaler M, and Bernkop-Schnürch A. (2007) Role of sulfhydryl groups in transfection? A case study with chitosan-NAC nanoparticles. *Bioconjug Chem.*, **18**, 1028-1035.
- Martien, R., Loretz, B., Thaler, M., Majzoub, S., and Bernkop-Schnürch, A. (2007) Chitosan-thioglycolic acid conjugate: An alternative carrier for oral nonviral gene delivery? *J. Biomed. Mater. Res. A*, **82**, 1-9.
- Martien, R.; Hoyer, H.; Perera, G.; Bernkop-Schnürch, A. (2011). An oral oligonucleotide delivery system based on a thiolated polymer: Development and in vitro evaluation. *Eur. J. Pharm. Biopharm.*, **78**, 355-360.
- Peng, Q., Zhong, Z., and Zhuo, R., (2008). Disulfide cross-linked polyethylenimines (PEI) prepared via thiolation of low molecular weight PEI as highly efficient gene vectors. *Bioconjug. Chem.*, **19**, 499-506.
- Rahmat, D.; Khan, M.I.; Shahnaz, G.; Sakloetsakun, D.; Perera, G.; Bernkop-Schnürch, A. (2012). Synergistic effects of conjugating cell penetrating peptides and thiomers on non-viral transfection efficiency. *Biomaterials*, **33**, 2321-2326.
- Schmitz, T., Bravo-Osuna, I., Vauthier, C., Ponchel, G., Loretz, B., and Bernkop-Schnürch, A. (2007) Development and in vitro evaluation of a thioimer-based nanoparticulate gene delivery system. *Biomaterials*, **28**, 524-31.
- Talaei F, Azizi E, Dinarvand R, Atyabi F. (2011) Thiolated chitosan nanoparticles as a delivery system for antisense therapy: evaluation against EGFR in T47D breast cancer cells. *Int. J. Nanomedicine*, **6**, 1963-1975.
- Varkouhi AK, Verheul RJ, Schiffelers RM, Lammers T, Storm G, Hennink WE., (2010) Gene silencing activity of siRNA polyplexes based on thiolated N,N,N-trimethylated chitosan. *Bioconjug Chem.*, **21**, 2339-2346.
- Vetter A., Martien R., and Bernkop-Schnürch A. (2010) Thiolated polycarbophil as an adjuvant for permeation enhancement in nasal delivery of antisense oligonucleotides. *J. Pharm. Sci.*, **99**, 1427-1439.
- Vetter, A. and Bernkop-Schnürch, A. (2010) Nasal delivery of antisense oligonucleotides: in vitro evaluation of a thioimer/glutathione microparticulate delivery system. *J. Drug Target.*, **18**, 303-312.
- Zhao, X., Yin, L., Ding, J., Tang, C., Gu, S., Yin, C., and Mao, Y. (2010) Thiolated trimethyl chitosan nanocomplexes as gene carriers with high in vitro and in vivo transfection efficiency. *J. Control. Release.*, **144**, 46-54.

Proof of efficacy (in vivo studies):

- Albrecht, K., Greindl, M., Kremser, C., Wolf, C., Debbage, P., and Bernkop-Schnürch, A. (2006) Comparative in vivo mucoadhesion studies of thioimer formulations using magnetic resonance imaging and fluorescence detection. *J. Control. Release*. **115**, 78-84.
- Albrecht, K., Greindl, M., Deutel, B., Kremser, C., Wolf, C., Talasz, H., Stollenwerk, M.M., Debbage, P., and Bernkop-Schnürch, A. (2010) In vivo investigation of thioimer-polyvinylpyrrolidone nanoparticles using magnetic resonance imaging. *J. Pharm. Sci.*, **99**, 2008-2017.
- Bernkop-Schnürch, A. Kast, C.E. and Guggi, D. (2003). Permeation enhancing polymers in oral delivery of hydrophilic macromolecules: Thioimer / GSH systems. *J. Control. Release*, **93**, 95-103.
- Bernkop-Schnürch, A., Pinter, Y., Guggi, D., Kahlbacher, H., Schöffmann, G., Schuh, M., Schmerold, I., Del Curto, M.D., D'Antonio, M., Esposito, P. and Huck, Ch. (2005) The use of thiolated polymers as carrier matrix in oral peptide delivery - Proof of concept. *J. Control. Release*, **106**, 26-33.
- Bernkop-Schnürch, A., Krauland, A.H., Leitner, V.M. and Palmberger, Th. (2004) Thiomers: potential excipients for non-invasive peptide delivery systems. *Eur. J. Pharm. Biopharm.*, **58**, 253-263.
- Caliceti, P. Salmaso, S., Walker, G. and Bernkop-Schnürch, A. (2004) Development and in vivo evaluation of an oral insulin-PEG delivery system. *Eur. J. Pharm. Sci.*, **22**, 315-323.

- Dhaliwal, S., Jain, S., Singh, H.P., and Tiwary, A.K. (2008) Mucoadhesive microspheres for gastroretentive delivery of acyclovir: in vitro and in vivo evaluation. *AAPS J.*, **10**, 322-330.
- Dünnhaupt, S.; Barthelmes, J.; Iqbal, J.; Perera, G.; Thurner, C.C.; Friedl, H.; Bernkop-Schnürch, A. (2012). In vivo evaluation of an oral drug delivery system for peptides based on S-protected thiolated chitosan. *J. Control. Rel.*, **160**, 477-485.
- Fan, B., Xing, Y., Zheng, Y., Sun, C., Liang, G. (2016) pH-responsive thiolated chitosan nanoparticles for oral low-molecular weight heparin delivery: in vitro and in vivo evaluation. *Drug Deliv.*, **23**, 238-247.
- Föger, F., Schmitz, Th., and Bernkop-Schnürch, A. (2006) In vivo evaluation of an oral delivery system for P-gp substrates based on thiolated chitosan. *Biomaterials*, **27**, 4250-4255.
- Föger, F., Hoyer, H., Kafedjiiski, K., Thaurer, M., and Bernkop-Schnürch, A. (2006) In vivo comparison of various polymeric and low molecular mass inhibitors of intestinal P-glycoprotein. *Biomaterials*, **27**, 5855-5860.
- Gradauer, K., Barthelmes, J., Vonach, C., Almer, G., Mangge, H., Teubl, B., Roblegg, E., Dünnhaupt, S., Fröhlich, E., Bernkop-Schnürch, A., Prassl R. (2013) Liposomes coated with thiolated chitosan enhance oral peptide delivery to rats. *J. Control. Release*, **172**, 872-878.
- Greindl M, Föger F, Hombach J, and Bernkop-Schnürch A. (2009) In vivo evaluation of thiolated poly(acrylic acid) as a drug absorption modulator for MRP2 efflux pump substrates. *Eur. J. Pharm. Biopharm.*, **72**, 561-566.
- Guggi, D., Krauland, A.H., and Bernkop-Schnürch, A. (2003) Systemic peptide delivery via the stomach: *in vivo* evaluation of an oral dosage form for salmon calcitonin. *J. Control. Rel.* **92**, 125-135.
- Hongyok, T., Chae, J.J., Shin, Y.J., Na, D., Li, L., and Chuck, R.S., (2009). Effect of chitosan-N-acetylcysteine conjugate in a mouse model of botulinum toxin B-induced dry eye. *Arch. Ophthalmol.*, **127**, 525-532.
- Hornof, M.D., Weyenberg, W., Ludwig, A., and Bernkop-Schnürch, A. (2003) A mucoadhesive ocular insert: Development and in vivo evaluation in humans. *J. Control. Release*, **89**, 419-428.
- Iqbal, J.; Shahnaz, G.; Perera, G.; Hintzen, F.; Sarti, F.; Bernkop-Schnürch, A. (2012). Thiolated chitosan: Development and in vivo evaluation of an oral delivery system for leuprolide. *Eur. J. Pharm. Biopharm.*, **80**, 95-102.
- Iqbal, J.; Sarti, F.; Perera, G.; Bernkop-Schnürch, A. (2011). Development and in vivo evaluation of an oral drug delivery system for paclitaxel. *Biomaterials*, **32**, 170-175.
- Iqbal, J.; Vigl, C.; Moser, G.; Gasteiger, M.; Perera, G.; Bernkop-Schnürch, A. (2011). Development and in vivo evaluation of a new oral nanoparticulate dosage form for leuprolide based on polyacrylic acid. *Drug Deliv.*, **18**, 432-440.
- Kast, C.E., Guggi, D., Langoth, N. and Bernkop-Schnürch, A. (2003) Development and *in vivo* evaluation of an oral delivery system for low molecular weight heparin based on thiolated polycarbophil. *Pharm. Res.*, **20**, 931-936.
- Krauland, A., Guggi, D. and Bernkop-Schnürch, A. (2004) Oral insulin delivery: The potential of thiolated chitosan-insulin tablets on non-diabetic rats. *J. Control. Rel.*, **95**, 547-555.
- Krauland, A.H., Leitner, V.M., Grabovac V., and Bernkop-Schnürch, A. (2006) In vivo evaluation of a nasal insulin delivery system based on thiolated chitosan. *J. Pharm. Sci.*, **95**, 2463-2472.
- Langoth, N., Kahlbacher, H., Schöffmann, G., Schmerold, I., Schuh, M., Franz, S., Kurka, P. and Bernkop-Schnürch A. (2006) Thiolated chitosans: design and in vivo evaluation of a mucoadhesive buccal peptide drug delivery system. *Pharm. Res.*, **23**, 573-579.
- Leitner, V., Guggi, D. and Bernkop-Schnürch, A. (2004) Thiomers in noninvasive polypeptide delivery: in vitro and in vivo characterization of a polycarbophil-cysteine/glutathione gel formulation for human growth hormone. *J. Pharm. Sci.*, **93**, 1682-1691.
- Leitner, V.M., Guggi, D. and Bernkop-Schnürch, A. (2004) Nasal Delivery of human growth hormone: in vitro and in vivo evaluation of a thiomers/glutathione microparticulate delivery system. *J. Control. Rel.*, **100**, 87-95.
- Makhlof, A., Werle, M., Tozuka, Y., and Takeuchi, H., Nanoparticles of glycol chitosan and its thiolated derivative significantly improved the pulmonary delivery of calcitonin. *Int. J. Pharm.*, in press.
- Millotti, G., Laffleur, F., Perera, G., Vigl, C., Pickl, K., Sinner, F., Bernkop-Schnürch, A. (2014) In vivo evaluation of thiolated chitosan tablets for oral insulin delivery. *J. Pharm. Sci.*, **103**, 3165-3170.

- Palmberger, T.F., Laffleur, F., Greindl, M., Bernkop-Schnürch, A. (2015) In vivo evaluation of anionic thiolated polymers as oral delivery systems for efflux pump inhibition. *Int. J. Pharm.*, **491**, 318-322.
- Rekha, M.R., Sharma, C.P. (2015) Simultaneous Effect of Thiolation and Carboxylation of Chitosan Particles Towards Mucoadhesive Oral Insulin Delivery Applications: An In Vitro and In Vivo Evaluation. *J. Biomed. Nanotechnol.*, **11**, 165-176.
- Sakloetsakun, D., Perera, G., Hombach, J., Millotti, G., and Bernkop-Schnürch, A. (2010) The Impact of Vehicles on the Mucoadhesive Properties of Orally Administrated Nanoparticles: a Case Study with Chitosan-4-Thiobutylamidine Conjugate. AAPS PharmSciTech, in press.
- Sarti, F.; Perera, G.; Hintzen, F.; Kottib,K.; Karageorgioub, V.; Kammonab, O.; Kiparissides, C.; Bernkop-Schnürch, A. (2011). In vivo evidence of oral vaccination with PLGA nanoparticles containing the immunostimulant monophosphoryl lipid A. *Biomaterials*, **32**, 4052-4057.
- Schmitz, T., Leitner, V., and Bernkop-Schnürch, A. (2005) Oral heparin delivery: Design and in vivo evaluation of a stomach-targeted mucoadhesive delivery system. *J. Pharm. Sci.*, **94**, 966-973.
- Shahnaz, G.; Iqbal, J.; Rahmat, D.; Perera, G.; Laffleur, F.; Rossi, D.; Bernkop-Schnürch, A. (2012). Development and in vivo characterization of a novel peptide drug delivery system providing extended plasma half life. *J. Control. Rel.*, **157**, 375-382.
- Shahnaz, G.; Vetter, A.; Barthelmes, J.; Rahmat, D.; Laffleur, F.; Iqbal, J.; Perera, G.; Schlocker, W.; Dünnhaupt, S.; Augustijns, P.; Bernkop-Schnürch, A. (2012). Thiolated chitosan nanoparticles for the nasal administration of leuprolide: Bioavailability and pharmacokinetic characterization. *Int. J. Pharm.*, **428**, 164-170.
- Vetter, A.; Perera, G.; Leithner, K.; Klima, G.; Bernkop-Schnürch, A. (2010). Development and in vivo bioavailability study of an oral fondaparinux delivery system. *Eur. J. Pharm. Sci.*, **41**, 489-497.
- Wang, X., Zheng, C., Wu, Z., Teng, D., Zhang, X., Wang, Z., and Li, C. (2009) Chitosan-NAC nanoparticles as a vehicle for nasal absorption enhancement of insulin. *J. Biomed. Mater. Res. B Appl. Biomater.*, **88**, 150-161.
- Xu, J., Gattacceca, F., Amiji, M. (2013) Biodistribution and pharmacokinetics of EGFR-targeted thiolated gelatin nanoparticles following systemic administration in pancreatic tumor-bearing mice. *Mol. Pharm.*, **10**, 2031-2044.
- Yin, L., Ding, J., He, C., Cui, L., Tang, C. and Yin, C. (2009) Drug permeability and mucoadhesion properties of thiolated trimethyl chitosan nanoparticles in oral insulin delivery. *Biomaterials*, **30**, 5691-5700.
- Zambito, Y., and Di Colo, G. (2010) Thiolated quaternary ammonium-chitosan conjugates for enhanced precorneal retention, transcorneal permeation and intraocular absorption of dexamethasone. *Eur. J. Pharm. Biopharm.*, **75**, 194-199.
- Zhang, Y., Wu, X., Meng, L., Zhang, Y., Ai, R., Qi, N., He, H., Xu, H., Tang, X. (2012) Thiolated Eudragit nanoparticles for oral insulin delivery: preparation, characterization and in vivo evaluation. *Int. J. Pharm.*, **436**, 341-350.

Miscellaneous:

- Bae, I.H., Jeong, B.C., Kook, M.S., Kim, S.H., Koh, J.T. (2013) Evaluation of a thiolated chitosan scaffold for local delivery of BMP-2 for osteogenic differentiation and ectopic bone formation. *Biomed. Res. Int.*, **2013**, 878930.
- Barbaric, M., Kralj, M., Marjanovic, M., Husnjak, I., Pavelic, K., Filipovic-Grcic, J., Zorc, D. and Zorc B. (2007) Synthesis and in vitro antitumor effect of diclofenac and fenoprofen thiolated and nonthiolated polyaspartamide-drug conjugates. *Eur. J. Med. Chem.*, **42**, 20-29.
- Bernkop-Schnürch, A., Brandt, U.-M. and Clausen A.E. (1999) Synthesis and in vitro evaluation of chitosan-cysteine conjugates. *Sci. Pharm.*, **67**, 197-208.
- Bernkop-Schnürch, A., Hornof, M.D., Kast, C.E. and Langoth N., (2002) Thiolated polymers: Stability of thiol moieties under different storage conditions. *Sci. Pharm.*, **70**, 331-339.
- Bernkop-Schnürch, A. and Hornof, M.D. (2003). Intravaginal delivery: design, challenges and solutions. *Am. J. Drug. Deliv.*, **1**, 241-254.

- Bernkop-Schnürch, A., König, V., Leitner, V., Krauland, A. and Brodnik, I. (2004) Preparation and characterisation of thiolated poly(methacrylic acid) - starch compositions. *Eur. J. Pharm. Biopharm.*, **57**, 219-224.
- Bernkop-Schnürch, A., Hoffer, M. and Kafedjiiski, K. (2004). Thiomers for oral delivery of hydrophilic macromolecular drugs. *Expert Opinion Drug Deliv.*, **1**, 87-98.
- Bernkop-Schnürch, A., Hornof, M.D. and Guggi, D. (2004). Thiolated Chitosans. *Eur. J. Pharm. Biopharm.*, **57**, 9-17.
- Bernkop-Schnürch, A., Krauland, A.H., Leitner, V.M. and Palmberger, Th. (2004) Thiomers: potential excipients for non-invasive peptide delivery systems. *Eur. J. Pharm. Biopharm.*, **58**, 253-263.
- Bilicic, M.B., Filipovic-Grcic, J., Martinac, A., Barbaric, M., Zorc, B., Cetina-Cizmek, B., and Tudja, P. (2005) Synthesis and characterization of thiomers of polyaspartamide type. *Int. J. Pharm.* **291**, 211-219.
- Boateng, J.S., Ayensu, I. (2014) Preparation and characterization of laminated thiolated chitosan-based freeze-dried wafers for potential buccal delivery of macromolecules. *Drug Dev Ind. Pharm.*, **40**, 611-618.
- Bonengel, S., Hauptstein, S., Perera, G., Bernkop-Schnürch, A. (2014) Thiolated and S-protected hydrophobically modified cross-linked poly(acrylic acid)--a new generation of multifunctional polymers. *Eur. J. Pharm. Biopharm.*, **88**, 390-396.
- Budai-Szű, Cs. M., Horvát, G., Gyarmati, B., Szilágyi, B.Á., Szilágyi, A., Csihi, T., Berkó, S., Szabó-Révész, P., Mori, M., Sandri, G., Bonferoni, M.C., Caramella, C., Csányi, E. (2016) In vitro testing of thiolated poly(aspartic acid) from ophthalmic formulation aspects. *Drug Dev. Ind. Pharm.*, **42**, 1241-1246.
- Dudas, J.; Ilder, C.; Sprinzl, G.; Bernkop-Schnuerch, A.; Riechelmann, H. (2011). Identification of HN-1-Peptide Target in Head and Neck Squamous Cell Carcinoma Cells. *ISRN Oncology Article ID 140316*
- Dünnhaupt, S., Barthelmes, J., Thurner, C.C., Waldner, C., Sakloetsakun, D., Bernkop-Schnürch, A. (2012) S-protected thiolated chitosan: synthesis and in vitro characterization. *Carbohydr. Polym.*, **90**, 765-772.
- Felice, F., Zambito, Y., Belardinelli, E., Fabiano, A., Santoni, T., Di Stefano, R. (2015) Effect of different chitosan derivatives on in vitro scratch wound assay: a comparative study. *Int. J. Biol. Macromol.*, **76**, 236-241.
- Ferris, C., Casas, M., Lucero, M.J., de Paz, M.V., Jiménez-Castellanos, M.R. (2014) Synthesis and characterization of a novel chitosan-N-acetyl-homocysteine thiolactone polymer using MES buffer. *Carbohydr. Polym.*, **111**, 125-132.
- Fu Y, Xu K, Zheng X, Giacomini AJ, Mix AW, Kao WJ., (2012) 3D cell entrapment in crosslinked thiolated gelatin-poly(ethylene glycol) diacrylate hydrogels. *Biomaterials*, **33**, 48-58.
- Gao, Y., Kiełtyka, R.E., Jesse, W., Norder, B., Korobko, A.V., Kros, A. (2014) Thiolated human serum albumin cross-linked dextran hydrogels as a macroscale delivery system. *Soft. Matter.*, **10**, 4869-4874.
- Gaowa, A., Horibe, T., Kohno, M., Tabata, Y., Harada, H., Hiraoka, M., Kawakami, K. (2015) Enhancement of anti-tumor activity of hybrid peptide in conjugation with carboxymethyl dextran via disulfide linkers. *Eur. J. Pharm. Biopharm.*, **92**, 228-236.
- Grabovac V, Föger F, and Bernkop-Schnürch A. (2008) Design and in vivo evaluation of a patch delivery system for insulin based on thiolated polymers. *Int. J. Pharm.* **348**, 169-174.
- Grießinger, J.A., Bonengel, S., Partenhauser, A., Ijaz, M., Bernkop-Schnürch, A. (2016) Thiolated polymers: evaluation of their potential as dermoadhesive excipients. *Drug Dev. Ind. Pharm.*, **16**, 1-9.
- Guggi, D., Langoth, N., Hoffer, M.H., Wirth, M. and Bernkop-Schnürch, A. (2004) Comparative evaluation of cytotoxicity of a glucosamine-TBA conjugate and a chitosan-TBA conjugate. *Int. J. Pharm.*, **278**, 353-360.
- Hahn, S.K., Park, J.K., Tomimatsu, T., and Shimoboji, T., (2007). Synthesis and degradation test of hyaluronic acid hydrogels. *Int. J. Biol. Macromol.*, **40**, 374-380.
- Hauptstein, S., Dezorzi, S., Prüfert, F., Matuszczak, B., Bernkop-Schnürch, A. (2015) Synthesis and in vitro characterization of a novel S-protected thiolated alginate. *Carbohydr. Polym.*, **124**, 1-7.
- Hauptstein, S., Hintzen, F., Müller, C., Ohm, M., Bernkop-Schnürch, A. (2014) Development and in vitro evaluation of a buccal drug delivery system based on preactivated thiolated pectin. *Drug Dev. Ind. Pharm.*, **40**, 1530-1537.

- Hintzen, F., Hauptstein, S., Perera, G., Bernkop-Schnürch, A. (2013) Synthesis and in vitro characterization of entirely S-protected thiolated pectin for drug delivery. *Eur. J. Pharm. Biopharm.*, **85**, 1266-1273.
- Hombach J, Hoyer H, and Bernkop-Schnürch A. (2008) Thiolated chitosans: development and in vitro evaluation of an oral tobramycin sulphate delivery system. *Eur. J. Pharm. Sci.*, **33**, 1-8.
- Hongyok, T., Chae, J.J., Shin, Y.J., Na, D., Li, L., and Chuck, R.S. (2009) Effect of chitosan-N-acetylcysteine conjugate in a mouse model of botulinum toxin B-induced dry eye. *Arch. Ophthalmol.*, **127**, 525-532.
- Horn, E.M., Beaumont, M., Shu, X.Z., Harvey, A., Prestwich, G.D., Horn, K.M., Gibson, A.R., Preul, M.C., and Panitch, A., (2007). Influence of cross-linked hyaluronic acid hydrogels on neurite outgrowth and recovery from spinal cord injury. *J. Neurosurg. Spine*, **6**, 133-140.
- Hoyer H, Föger F, Kafedjiiski K, Loretz B, Bernkop-Schnürch A. (2008) Design and evaluation of a new gastrointestinal mucoadhesive patch system containing chitosan-glutathione. *Drug Dev. Ind. Pharm.* **33**, 1289-1296.
- Hoyer, H., Greindl, M., and Bernkop-Schnürch, A. (2009) Design and in vivo evaluation of a patch system based on thiolated polymers. *J. Pharm. Sci.*, **98**, 620-627.
- Iqbal, J.; Sakloetsakun, D.; Bernkop-Schnürch, A. (2011). Thiomers: Inhibition of cytochrome P450 activity. *Eur. J. Pharm. Biopharm.*, **78**, 361-365.
- Kafedjiiski, K., Hoffer, M. and Bernkop-Schnürch, A. (2005) Synthesis and in vitro evaluation of a novel thiolated chitosan. *Biomaterials*, **26**, 819-26.
- Kafedjiiski, K. (2004; Autumn/Winter). Multifunctional polymeric excipients in non-invasive delivery of hydrophilic macromolecular drugs: The thioimer-technology. *Drug Del. Comp. Rep.*, 47-50.
- Kafedjiiski, K., Föger, F., Werle, M. and Bernkop-Schnürch, A. (2005) Synthesis and in vitro evaluation of a novel chitosan-glutathione conjugate. *Pharm. Res.*, **22**, 1480-1488.
- Kafedjiiski, K., Hoffer, M., Werle, M., and Bernkop-Schnürch, A. (2006) Improved synthesis and in vitro characterization of chitosan-thioethylamidine conjugate. *Biomaterials*, **27**, 127-35.
- Kafedjiiski, K., Werle, M., Föger, F. and Bernkop-Schnürch, A. (2005) Synthesis and in vitro characterization of a novel poly(acrylic acid)-glutathione conjugate. *J. Drug. Del. Sci. Tech.*, **15**, 411-417.
- Kafedjiiski K, Jetti RK, Föger F, Hoyer H, Werle M, Hoffer M, and Bernkop-Schnürch A. (2007) Synthesis and in vitro evaluation of thiolated hyaluronic acid for mucoadhesive drug delivery. *Int. J. Pharm.*, **343**, 48-58.
- Kafedjiiski, K., Föger, F., Hoyer, H., and Bernkop-Schnürch, A., and Werle, M. (2007) Evaluation of in vitro enzymatic degradation of various thiomers and cross-linked thiomers. *Drug Dev Ind. Pharm.*, **33**, 199-208
- Kast, C.E., Frick, W., Losert, U. and Bernkop-Schnürch, A. (2003) Chitosan-thioglycolic acid conjugate: A new scaffold material for tissue engineering? *Int. J. Pharm.*, **256**, 183-189.
- Ko, E.B., Cho, H.Y., Kim, T.H., Yea, C.H., Choi, J.W. (2013) Cell chip with a thiolated chitosan self-assembled monolayer to detect the effects of anticancer drugs on breast normal and cancer cells. *Colloids Surf. B Biointerfaces*, **112**, 387-392.
- Laffleur, F., Bacher, L., Netsomboon, K. (2016) Design, characterization and in vitro evaluation of a novel thiolated polymer: preactivated carboxymethyl cellulose. *Ther. Deliv.*, **7**, 7-14.
- Laffleur, F., Fischer, A., Schmutzler, M., Hintzen, F., Bernkop-Schnürch, A. (2015) Evaluation of functional characteristics of preactivated thiolated chitosan as potential therapeutic agent for dry mouth syndrome. *Acta Biomater.*, **21**, 123-131.
- Laffleur, F., Röggla, J., Idrees, M.A., Griessinger, J. (2014) Chemical modification of hyaluronic acid for intraoral application. *J. Pharm. Sci.*, **103**, 2414-2423.
- Laffleur, F., Hintzen, F., Rahmat, D., Shahnaz, G., Millotti, G., Bernkop-Schnürch, A. (2013) Enzymatic degradation of thiolated chitosan. *Drug Dev. Ind. Pharm.*, **39**, 1531-1539.
- Langoth, N. and Bernkop-Schnürch, A. (2005) The use of multifunctional polymers as auxiliary agents in non-invasive peptide delivery. *American Pharmaceutical Review*, **8**, 80-84.
- Lee WJ, Cha S, Shin M, Islam MA, Cho CS, Yoo HS., (2011) Induction of Th1 polarized immune responses by thiolated Eudragit-coated F4 and F18 fimbriae of enterotoxigenic Escherichia coli. *Eur. J. Pharm. Biopharm.*, **79**, 226-231.
- Leonaviciute, G., Suchaoin, W., Matuszczak, B., Lam, H.T., Mahmood, A., Bernkop-Schnürch, A. (2016) Preactivated thiolated pullulan as a versatile excipient for mucosal drug targeting. *Carbohydr. Polym.*, **151**, 743-751.

- Li, Z., Cen, L., Zhao, L., Cui, L., Liu, W., and Cao, Y. (2010) Preparation and evaluation of thiolated chitosan scaffolds for tissue engineering. *J. Biomed Mater Res A*, **92**, 973-978.
- Liu, Y., Pang, Y., Toh, M.R., Chiu, G.N. (2015) Dual-functionalized poly(amidoamine) dendrimers with poly(ethylene glycol) conjugation and thiolation improved blood compatibility. *J. Pharm. Pharmacol.*, **67**, 1492-1502.
- Masuko T., Minami A., Iwasaki N., Majima T., Nishimura S., and Lee Y.C. (2005) Thiolation of chitosan. Attachment of proteins via thioether formation. *Biomacromolecules*. **6**, 880-884.
- Majzoub S, Atyabi F, Dorkoosh F, Kafedjiiski K, Loretz B, and Bernkop-Schnürch A. (2006) Pectin-cysteine conjugate: synthesis and in-vitro evaluation of its potential for drug delivery. *J. Pharm. Pharmacol.*, **58**, 1601-1610.
- Menzel, C., Silbernagl, J., Laffleur, F., Leichner, C., Jelkmann, M., Huck, C.W., Hussain, S., Bernkop-Schnürch, A. (2016) 2,2'Dithiodinicotinyl ligands: Key to more reactive thiomers. *Int. J. Pharm.*, **503**, 199-206.
- Millotti, G.; Samberger, C.; Fröhlich, E.; Sakloetsakun, D.; Bernkop-Schnürch, A. (2010). Chitosan-4-mercaptobenzoic acid: synthesis and characterization of a novel thiolated chitosan. *J. Mater. Chem.*, **20**, 2432-2440.
- Netsomboon, K., Suchaoin, W., Laffleur, F., Prüfert, F., Bernkop-Schnürch, A. (2016) Multifunctional adhesive polymers: Preactivated thiolated chitosan-EDTA conjugates. *Eur. J. Pharm. Biopharm.*, in press.
- Orlandi, R.R., Shu, X.Z., McGill, L., Petersen, E., and Prestwich, G.D., (2007). Structural variations in a single hyaluronan derivative significantly alter wound-healing effects in the rabbit maxillary sinus. *Laryngoscope*, **117**, 1288-1295.
- Palmberger, T.; Augustijns, P.; Vetter, A.; Bernkop-Schnürch, A. (2011). Safety assessment of thiolated polymers: effect on ciliary beat frequency in human nasal epithelial cells. *Drug Dev. Ind. Pharm.*, **37**, 1455-1462.
- Partenhauser, A., Zupančič, O., Rohrer, J., Bonengel, S., Bernkop-Schnürch, A. Thiolated silicone oils as adhesive skin protectants for improved barrier function. *Int. J. Cosmet. Sci.*, **38**, 257-265.
- Perera, G.; Hombach, J.; Bernkop-Schnürch, A. (2010). Hydrophobic thiolation of pectin with 4-aminothiophenol: Synthesis and in vitro characterization. *AAPS PharmSciTech.*, **11**, 174-180.
- Rahmat, D.; Sakloetsakun, D.; Shahnaz, G.; Perera, G.; Kaendl, R.; Bernkop-Schnürch, A. (2011). Design and synthesis of a novel cationic thiolated polymer. *Int. J. Pharm.*, **411**, 10-17.
- Saboktakin MR, Tabatabaie RM, Maharramov A, Ramazanov MA., (2011) Synthesis and in vitro studies of biodegradable thiolated chitosan hydrogels for breast cancer therapy. *Int. J. Biol. Macromol.*, **48**, 747-752.
- Sakloetsakun, D.; Dünhaupt, S.; Barthelmes, J.; Pfaller, W.; Bernkop-Schnürch, A. (2012). In situ crosslinkable thiolated chitosan as scaffold material for tissue engineering. *Adv. Mat. Res.*, **506**, 335-338.
- Sarti, F., Iqbal, J., Müller, C., Shahnaz, G., Rahmat, D., Bernkop-Schnürch, A. (2012) Poly(acrylic acid)-cysteine for oral vitamin B12 delivery. *Anal. Biochem.*, **420**, 13-19.
- Sarti, F.; Bernkop-Schnürch, A. (2011). Chitosan and Thiolated Chitosan. *Adv. Polym. Sci.*, **243**, 93-110.
- Sarti, F.; Staaf, A.; Sakloetsakun, D.; Bernkop-Schnürch, A. (2010). Thiolated hydroxyethylcellulose:synthesis and in vitro evaluation. *Eur. J. Pharm. Biopharm.*, **76**, 421-427.
- Suchaoin, W., Bonengel, S., Griessinger, J.A., Pereira de Sousa, I., Hussain, S., Huck, C.W., Bernkop-Schnürch, A. (2016) Novel bioadhesive polymers as intra-articular agents: Chondroitin sulfate-cysteine conjugates. *Eur. J. Pharm. Biopharm.*, **101**, 25-32.
- Suchaoin, W., Bonengel, S., Hussain, S., Huck, C.W., Ma, B.N., Bernkop-Schnürch, A. (2015) Synthesis and In Vitro Evaluation of Thiolated Carrageenan. *J. Pharm. Sci.*, **104**, 2523-2530.
- Werle, M. and Bernkop-Schnürch, A. (2008) Thiolated chitosans: useful excipients for oral drug delivery. *J. Pharm. Pharmacol.*, **60**, 273-281.
- Werle, M., Takeuchi, H., and Bernkop-Schnürch, A. (2009) Modified chitosans for oral drug delivery. *J Pharm Sci.*, **98**, 1643-1656.
- Xu, G., Wang, X., Deng, C., Teng, X., Suuronen, E.J., Shen, Z., Zhong, Z. (2015) Injectable biodegradable hybrid hydrogels based on thiolated collagen and oligo(acryloyl carbonate)-poly(ethylene glycol)-oligo(acryloyl carbonate) copolymer for functional cardiac regeneration. *Acta Biomater.*, **15**, 55-64.