Supplementary Reference List

Intestinal ion transport and the pathophysiology of diarrhea

Michael Field

S1. Thwaites, D.T., et al. 2002. H/dipeptide absorption across the human intestinal epithelium is controlled indirectly via a functional Na/H exchanger. *Gastroenterology*. **122**:1322–1233.

S2. Hyun, C.S., Ahn, J., Minhas, B.S., Cragoe, E.J., Jr, and Field, M. 1994. Ion transport in rabbit proximal colon: effects of sodium, amiloride, cAMP, and epinephrine. *Am. J. Physiol*. **266**:G1071–G1082.

S3. Gawenis, L.R., et al. 2001. Intestinal NaCl transport in NHE2 and NHE3 knockout mice. *Am. J. Physiol*. **282**:G776–G784.

S4. Schultheis, P.J., et al. 1998. Targeted disruption of the murine Na+/H+ exchanger isoform 2 gene causes reduced viability of gastric parietal cells and loss of net acid secretion. *J. Clin. Invest*. **101**:1243–1253.

S5. Sangan, P., Rajendran, V.M., Geibel, J.P., and Binder, H.J. 2002. Cloning and expression of a chloride-dependent Na+-H+ exchanger. *J. Biol. Chem*. **277**:9668–9675.

S6. Wang, Z., Petrovic, S., Mann, E., and Soleimani, M. 2002. Identification of an apical Cl(-)/HCO3(-) exchanger in the small intestine. *Am. J. Physiol*. **282**:G573–G579.

S7. Identification of a colon mucosa gene that is down-regulated in colon adenomas and adenocarcinomas. *Proc. Natl. Acad. Sci. U. S. A*. **90**:4166–4170.

S8. Jacob, P., et al. 2002. Down-regulated in adenoma mediates apical C1/HCO3 exchange in rabbit, rat, and human duodenum. *Gastroenterology*. **122**:709–724.

S9. Tidball, C.S. 1961. Active chloride transport during intestinal secretion. *Am. J. Physiol*. **200**:309–312.

S10. Gregory, R.A. 1965. Secretory mechanisms of the digestive tract. *Ann. Rev. Physiol*. **27**:395–414.

S11. Hendrix, T.R., and Bayless, T.M. 1970. Digestion: intestinal

secretion. *Ann. Rev. Physiol.* **32**:139–164.

S12. Field, M., Plotkin, G.R., and Silen, W. 1968. Effects of vasopressin, theophylline and cyclic adenosine monophosphate on short-circuit current across isolated rabbit ileal mucosa. *Nature.* **217**:469–471.

S13. Ameen, N.A., et al. 1999. CFTR channel insertion to the apical surface in rat duodenal villus epithelial cells is upregulated by VIP in vivo. *J. Cell Sci.* **112**:887–894.

S14. Ameen, N.A., et al. 2000. Subcellular distribution of CFTR in rat intestine supports a physiologic role for CFTR regulation by vesicle traffic. *Histochem. Cell Biol.* **114**:219–228.

S15. Warth, R., et al. 1996. The cAMP-regulated and 293B-inhibited K+ conductance of rat colonic crypt base cells. *Pflugers Arch.* **432**:81–88.

S16. Turnheim, K., Plass, H., and Wyskovsky, W. 2002. Basolateral K+ channels of rabbit colon epithelium: role in sodium absorption and Chloride secretion. *Biochim. Biophys. Acta.* **1560**:51–66.

S17. Haas, M., and Forbush, B. 2000. The Na-K-Cl cotransporter of secretory epithelia. *Annu. Rev. Physiol.* **62**:515–534.

S18. Matthews, J.B., et al. 1994. Na-K-2Cl cotransport in intestinal epithelial cells. Influence of chloride efflux and F-actin on regulation of cotransporter activity and bumetanide binding. *J. Biol. Chem.* **269**:15703–15709.

S19. Lamprecht, G., et al. 2002. The down regulated in adenoma (dra) gene product binds to the second PDZ domain of the NHE3 kinase A regulatory protein (E3KARP), potentially linking intestinal Cl-/HCO3- exchange to Na+/H+ exchange. *Biochemistry.* **41**:12336–21342.

S20. Kim, J.H., et al. 2002. Ca(2+)-dependent inhibition of Na+/H+ exchanger 3 (NHE3) requires an NHE3-E3KARP-alpha-actinin-4 complex for oligomerization and endocytosis. *J. Biol. Chem.* **277**:23714–23724.

S21. Bagorda, A., et al. 2002. Reciprocal protein kinase A regulatory interactions between cystic fibrosis transmembrane conductance regulator and Na+/H+ exchanger isoform 3 in a renal polarized epithelial cell model. *J. Biol. Chem.* **277**:21480–21488.

S22. Travis, S.P., Crotty, B., and Jewell, D.P. 1995. Site of action of platelet-activating factor within the mucosa of rabbit distal colon. *Clin. Sci. (Lond.)* **88**:51–57.

S23. Berger, H.A., Travis, S.M., and Welsh, M.J. 1993. Regulation of the cystic fibrosis transmembrane conductance regulator Cl-channel by specific protein kinases and protein phosphatases. *J. Biol. Chem.* **268**:2037–2047.

S24. Jia, Y., Mathews, C.J., and Hanrahan, J.W. 1997. Phosphorylation by protein kinase C is required for acute activation of cystic fibrosis transmembrane conductance regulator by protein kinase A. *J. Biol. Chem.* **272**:4978–4984.

S25. Middleton, L.M., Harvey, R.D. 1998. PKC regulation of cardiac CFTR Cl- channel function in guinea pig ventricular myocytes. *Am. J. Physiol.* **275**:C293–C302.

S26. Kurjak, M., Schusdziarra, V., Allescher, H.D. 1996. Presynaptic modulation by VIP, secretin and isoproterenol of somatostatin release from enriched enteric synaptosomes: role of cAMP. *Eur. J. Pharmacol.* **314**:165–173.

S27. Wegmann, M., Kampen, A., Weber, S., Seyberth, H.W., and Kockerling, A. 2000. Effect of hydroxyeicosatetraenoic acids on furosemide-sensitive chloride secretion in rat distal colon. *J. Pharmacol. Exp. Ther.* **295**:133–138.

S28. Musch, M.W., Miller, R.J., Field, M., and Siegel, M.I. 1982. Stimulation of colonic secretion by lipoxygenase metabolites of arachidonic acid. *Science*. **217**:1255–1256.

S29. Hogenauer, C., Aichbichler, B., Santa Ana, C., Porter, J., and Fordtran, J. 2002. Effect of octreotide on fluid absorption and secretion by the normal human jejunum and ileum in vivo. *Aliment Pharmacol. Ther.* **16:**769–777.

S30. Biagi, B., Wang, Y.Z., and Cooke, H.J. 1990. Effects of tetrodotoxin on chloride secretion in rabbit distal colon: tissue and cellular studies. *Am. J. Physiol.* **258**:G223–G223.

S31. Yu, L.C., and Perdue, M.H. 2001. Role of mast cells in intestinal mucosal function: studies in models of hypersensitivity. *Immunological Reviews*. **179**:61–73.

S32. Wang, Y.F., et al. 1997. The distribution of NPY-containing

nerves and the catecholamine contents of canine enteric nerve plexuses. *Peptides*. **18**:221–234.

S33. Wood, J.D. 1999. Neurotransmission at the interface of sympathetic and enteric divisions of the autonomic nervous system. *Chin. J. Physiol*. **42**:201–210.

S34. Marcial, M.A., Carlson, S.L., and Madara, J.L. 1984. Partitioning of paracellular conductance along the ileal crypt-villus axis: a hypothesis based on structural analysis with detailed consideration of tight junction structure-function relationships. *J. Membr. Biol*. **80**:59–70.

S35. Tarlow, M.J., and Thom, H. 1974. A comparison of stool fluid and stool dialysate obtained in vivo. *Gut*. **15**:608–613.

S36. Alvarez, D.L.R., Canessa, C.M., Fyfe, G.K., and Zhang, P. 2000. Structure and regulation of amiloride-sensitive sodium channels. *Annu. Rev. Physiol*. **62**:573–59.

S37. Jacob, P., et al. 2000. Role of Na+HCO3- cotransporter NBC1, Na+/H+ exchanger NHE1, ansd carbonic anhydrase in rabbit duodenal bicarbonate secretion. *Gastroenterology*. **119**:406–419.

S38. MacLeod, R.J., Redican, F., Lembessis, P., Hamilton, J.R., and Field, M. 1996. Sodium-bicarbonate cotransport in guinea pig ileal crypt cells. *Am. J. Physiol*. **270**:C786–C793.

S39. Seidler, U., et al. 2001. Na+/HCO3- cotransport in normal and cystic fibrosis intestine. *JOP*. **2**(Suppl.):247–256.

S40. Palmer, L.G. 1999. Potassium secretion and the regulation of distal nephron K channels. *Am. J. Physiol*. **277**:F821–F825.

S41. Sandle, G.I., and Butterfield, I. 1999. Potassium secretion in rat distal colon during dietary potassium loading: role of pH regulated apical potassium channels. *Gut*. **44**:40–46.

S42. Welsh, M.J., Smith, P.L., Fromm, M., and Frizzell, R.A. 1982. Crypts are the site of intestinal fluid and electrolyte secretion. *Science*. **218**:1219–1221.

S43. Horvath, P.J., Ferriola, P.C., Weiser, M.M., and Duffey, M.E. 1986. Localization of chloride secretion in rabbit colon: inhibition by anthracene-9-

carboxylic acid. *Am. J. Physiol.* **250**:G185–G190.

S44. Bookstein, C., et al. 1994. Na^+/H^+ exchangers, NHE-1 and NHE-3, of rat intestine. Expression and localization. *J. Clin. Invest.* **93**:106–113.

S45. Kockerling, A., and Fromm, M. 1993. Origin of cAMP-dependent Cl- secretion from both crypts and surface epithelia of rat intestine. *Am. J. Physiol.* **264**:C1294–C1301.

S46. O'Loughlin, E.V., et al. 1996. X-ray microanalysis of cell elements in normal and cystic fibrosis jejunum: evidence for chloride secretion in villi. *Gastroenterology*. **110**:411–418.

S47. Kockerling, A., Sorgenfrei, D., and Fromm, M. 1993. Electrogenic Na+ absorption of rat distal colon is confined to surface epithelium: a voltage-scanning study. *Am. J. Physiol.* **264**:C1285–C1293.

S48. Devuyst, O., and Guggino, W.B. 2002. Chloride channels in the kidney: lessons learned from knockout animals. *Am. J. Physiol.* **283**:F1176–F1191.

S49. Mohammad-Panah, R., et al. 2002. The chloride channel ClC-4 co-localizes with cystic fibrosis transmembrane conductance regulator and may mediate chloride flux across the apical membrane of intestinal epithelia. *J. Biol. Chem.* **277**:566–574.

S50. Welsh, M.J., Denning, G.M., Ostedgaard, L.S., and Anderson, M.P. 1993. Dysfunction of CFTR bearing the delta F508 mutation. *J. Cell Sci. Suppl.* **17**:235–239.

S51. Eherer, A.J., and Fordtran, J.S. 1992. Fecal osmotic gap and pH in experimental diarrhea of various causes. *Gastroenterology*. **103**:545–551.

S52. Rao, M.C., Guandalini, S., Laird, W.J., and Field, M. 1979. Effects of heat-stable enterotoxin of Yersinia enterocolitica on ion transport and cyclic guanosine 3′,5′-monophosphate metabolism in rabbit ileum. Infect. Immun. **26**:875–878.

S53. Prasad, R., Chopra, A.K., Peterson, J.W., Pericas, R., and Houston, C.W. 1990. Biological and immunological characterization of a cloned cholera toxin-like enterotoxin from Salmonella typhimurium. *Microb. Pathog.* **9**:315–329.

S54. Lan, R., and Reeves, P.R. 2002. Pandemic spread of cholera: genetic diversity and relationships within the seventh pandemic clone of *Vibrio cholerae*

determined by amplified fragment length polymorphism. *J. Clin. Microbiol.* **40**:172–181.

S55. Steinberg, E.B., et al. 2001. Cholera in the United States, 1995–2000: trends at the end of the twentieth century. *J. Infect. Dis.* **184**:799–802.

S56. Sandvig, K., and van Deurs, B. 2002. Transport of ptotein toxins into cells: pathways used by ricin, cholera toxin and Shiga toxin. *FEBS Lett.* **529**:49–53.

S57. Fasano, A., et al. 1995. Zonula occludens toxin modulates tight junctions through protein kinase C-dependent actin reorganization, in vitro. *J. Clin. Invest.* **96**:710–720.

S58. Spangler, B.D. 1992. Structure and function of cholera toxin and the related *Escherichia coli* enterotoxin. *Microbiol. Rev.* **56**:622–647.

S59. Chan, S.K., and Gianella, R.A. 1981. Amino acid sequence of heat-stable enterotoxin produced by *Escherichia coli* pathogenic for man. *J. Biol. Chem.* **256**:7744–7746.

S60. Cohen, M.B., Witte, D.P., Hawkins, J.A., and Currie, M.G. 1995. Immunohistochemical localization of guanylin in the rat small intestine and colon. *Biochem. Biophys. Res. Commun.* **209**:803–808.

S61. Kita, T., Kitamura, K., Sakata, J., and Eto, T. 1999. Marked increase of guanylin secretion in response to salt loading in the rat small intestine. *Am. J. Physiol.* **277**:G960–G966.

S62. Forte, L.R., London, R.M., Krause, W.J., and Freeman, R.H. 2000. Mechanisms of guanylin action via cyclic GMP in the kidney. *Annu. Rev. Physiol.* **62**:673–695.

S63. Spitzer, M.D. 2002. Viral causes of diarrhea. *Pediatr. Rev.* **23**:257–258.

S64. Grady, D. 2002. Sick at sea/an outbreak and a mystery; virus rattles cruise industry and health officials. *New York Times*. 6 December 2002, sec. A, p. 1.

S65. Sandvig, K. 2001. Shiga toxins. *Toxicon.* **39**:1629–1635.

S66. Aktories, K., Schmidt, G., and Just, I. 2000. Rho GTPases as targets of bacterial protein toxins. *Biol. Chem.* **381**:421–426.

S67. Pothoulakis, C., and Lamont, J.T. 2001. Microbes and microbial

toxins: paradigms for microbial-mucosal interactions II. The integrated response of the intestine to *Clostridium difficile* toxins. *Am. J. Physiol.* **280**:G178–G183.

S68. Barth, H., Blocker, D., and Aktories, K. 2002. The uptake machinery of clostridial actin ADP-ribosylating toxins - a cell delivery system for fusion proteins and polypeptide drugs. *Naunyn Schmiedebergs Arch. Pharmacol.* **366**:501–512.

S69. Eisenberg, J.N., Seto, E.Y., Colford, J.M., Jr., Olivieri, A., and Spear, R.C. 1998. An analysis of the Milwaukee cryptosporidiosis outbreak based on a dynamic model of the infection process. *Epidemiology*. **9**:264–270.

S70. Pearson, G.R., and Logan, E.F. 1983. Scanning and transmission electron microscopic observations on the host-parasite relationship in intestinal cryptosporidiosis of neonatal calves. *Res. Vet. Sci.* **34**:149–154.

S71. Adams, R.B., Guerrant, R.L., Zu, S., Fang, G., and Roche, J.K. 1994. *Cryptosporidium parvum* infection of intestinal epithelium: morphologic and functional studies in an in vitro model. *J. Infect. Dis.* **169**:170–177.

S72. Scott, K.G., Logan, M.R., Klammer, G.M., Teoh, D.A., and Buret, A.G. 2000. Jejunal brush border microvillous alterations in *Giardia muris*-infected mice: role of T lymphocytes and interleukin-6. *Infect. Immun.* **68**:3412–3418.

S73. Musch, M.W., et al. 2002. T cell activation causes diarrhea by increasing intestinal permeability and inhibiting epithelial Na^+/K^+-ATPase. *J. Clin. Invest.* **110**:1739–1747.

S74. Muller, T., et al. 2000. Congenital sodium diarrhea is an autosomal recessive disorder of sodium/proton exchange but unrelated to known candidate genes. *Gastroenterology*. **119**:1506–1513.

S75. Field, M., and Semrad, C.E. 1993. Toxgenic diarrheas, congenital diarrheas, and cystic fibrosis: disorders of intestinal ion transport. *Annu. Rev. Physiol.* **55**:631–655.

S76. Wong, M.H., Oelkers, P., Craddock, A.L., and Dawson, P.A. 1994. Expression cloning and characterization of the hamster ileal sodium-dependent bile acid transporter. *J. Biol. Chem.* **269**:1340–1347.

S77. Craddock, A.L., et al. 1998. Expression and transport properties of the human ileal and renal sodium-dependent bile acid transporter. *Am. J. Physiol.*

274:G157–G169.

S78. Devor, D.C., Sekar, M.C., Frizzell, R.A., and Duffey, M.E. 1993. Taurodeoxycholate activates potassium and chloride conductances via an IP3-mediated release of calcium from intracellular stores in a colonic cell line (T84). *J. Clin. Invest.* **92**:2173–2181.

S79. Mauricio, A.C., et al. 2000. Deoxycholic acid (DOC) affects the transport properties of distal colon. *Pflugers Arch.* **439**:532–540.

S80. Gelbmann, C.M., Schteingart, C.D., Thompson, S.M., Hofmann, A.F., and Barrett, K.E. 1995. Mast cells and histamine contribute to bile acid-stimulated secretion in the mouse colon. *J. Clin. Invest.* **95**:2831–2839.

S81. Yoo, D., et al. 2000. Interferon-gamma downregulates ion transport in murine small intestine cultured in vitro. *Am. J. Physiol.* **279**:G1323–G1332.

S82. Rocha, F., et al. 2001. IFN-gamma down-regulates expression of Na(+)/H(+) exchangers NHE2 and NHE3 in rat intestine and human Caco-2/bbe cells. *Am. J. Physiol.* **280**:C1224–C1232.

S83. Sugi, K., Musch, M.W., Field, M., and Chang, E.B. 2001. Inhibition of Na+,K+-ATPase by interferon gamma down-regulates intestinal epithelial transport and barrier function. *Gastroenterology.* **120**:1393–1403.

S84. Chang, E.B., Fedorak, R.N., and Field, M. 1986. Experimental diabetic diarrhea in rats. Intestinal mucosal denervation hypersensitivity and treatment with clonidine. *Gastroenterology.* **91**:564–569.

S85. Fedorak, R.N., Field, M., and Chang EB. 1985. Treatment of diabetic diarrhea with clonidine. *Ann. Intern. Med.* **102**:197–199.

S86. Mourad, F.H., Gorard, D., Thillainayagam, A.V., Colin-Jones, D., and Farthing, M.J. 1992. Effective treatment of diabetic diarrhoea with somatostatin analogue, octreotide. *Gut.* **33**:1578–1580.

S87. Fontaine, O., Gore, S.M., and Pierce, N.F. 2000. Rice-based oral rehydration solution for treating diarrhoea. *Cochrane Database Syst. Rev.* CD001264.

S88. Schwartz, J.C. 2000. Racecadotril: a new approach to the treatment of diarrhoea. *Int. J. Antimicrob. Agents.* **14**:75–79.

S89. Salazar-Lindo, E., Santesteban-Ponce, J., Chea-Woo, E., and

Gutierrez, M. 2000. Racecadotril in the treatment of acute watery diarrhea in children. *N. Engl. J. Med.* **343**:463–467.

S90. Roberts, W.G., Fedorak, R.N., and Chang, E.B. 1988. In vitro effects of the long-acting analogue SMS 201-995 on electrolyte transport by the rabbit ileum. *Gastroenterology*. **94**:1343–1350.

S91. Schwartz, C.J., Kimberg, D.V., Sheerin, H.E., Field, M. and Said, S.I. 1974. Vasoactive intestinal peptide stimulation of adenylate cyclase and active electrolyte secretion in intestinal mucosa. *J. Clin. Invest.* **54**:536–544.

S92. Tapper, E.J., Powell, D.W., Morris, S.M. 1978. Cholinergic-adrenergic interactions on intestinal ion transport. *Am. J. Physiol.* **235**:E402–E409.

S93. Strabel, D., and Diener, M. 1995. Evidence against direct activation of chloride secretion by carbachol in the rat distal colon. *Eur. J. Pharmacol.* **274**:181–191.

S94. Kachur, J.F., Miller, R.J., Field, M., and Rivier, J. 1982. Neurohumeral control of ileal electrolyte transport II. Neurotensin and substance P. *J. Pharmacol. Exp. Ther.* **220**:456–463.

S95. Riegler, M., Castagliuolo, I., Wlk, M., and Pothoulakis, C. 1999. Substance P causes a chloride-dependent short-circuit current response in rabbit colonic mucosa in vitro. *Scand. J. Gastroenterol.* **34**:1203–1211.

S96. Hosoda, Y., Karaki, S., Shimoda, Y., and Kuwahara, A. 2002. Substance P-evoked Cl(-) secretion in guinea pig distal colonic epithelia: interaction with PGE(2). *Am. J. Physiol.* **283**:G347–G356.

S97. Köttgen, M., et al. 2003. P2Y1 and P2Y6 receptors mediate colonic NaCl secretion: differential activation of camp-mediated transport via P2Y6 receptors. *J. Clin. Invest.* **111**:371–379.

S98. Cooke, H.J., Wang, Y.Z., Frieling, T., and Wood, J.D. 1991. Neural 5-hydroxytryptamine receptors regulate chloride secretion in guinea pig distal colon. *Am. J. Physiol.* **261**:G833–G840

S99. Cooke, H.J., Sidhu, M., and Wang, Y.Z. 1997. Activation of 5-HT1P receptors on submucosal afferents subsequently triggers VIP neurons and chloride secretion in the guinea-pig colon. *J. Auton. Nerv. Syst.* **66**:105–110.

S100. Regulated chloride permeabilities in primary cultures of rabbit colonocytes. *J. Cell Physiol.* **168**:276–283.

S101. Field, M., Musch, M.W., Miller, R.L., and Goetzl, E.J. 1984. Regulation of epithelial electrolyte transport by metabolites of arachidonic acid. *J. Allergy Clin. Immunol.* **74**:382–385.

S102. Frieling, T., et al. 1997. Leukotriene-evoked cyclic chloride secretion is mediated by enteric neuronal modulation in guinea pig colon. *Naunyn Schmiedebergs Arch. Pharmacol.* **355**:625–630

S103. Guerrant, R.L., Fang, G.D., Thielman, N.M., and Fonteles, M.C. 1994. Role of platelet activating factor in the intestinal epithelial secretory and Chinese hamster ovary cell cytoskeletal responses to cholera toxin. *Proc. Natl. Acad. Sci. U. S. A.* **91**:9655–9658.

S104. Cooke, H.J., Wang, Y.Z., Reddix, R., and Javed, N. 1995. Cholinergic and VIP-ergic pathways mediate histamine H2 receptor-induced cyclical secretion in the guinea pig colon. *Am. J. Physiol.* **268**:G465–G470.

S105. Homaidan, F.R., Tripodi, J., Zhao, L., and Burakoff, R. 1997. Regulation of ion transport by histamine in mouse cecum. *Eur. J. Pharmacol.* **331**:199–204.

S106. Musch, M.W., Kachur, J.F., Miller, R.J., Field, M., and Stoff, J.S. 1983. Bradykinin stimulated electrolyte secretion in rabbit and guinea pig intestine: involvement of arachidonic acid metabolites. *J. Clin. Invest.* **71**:1073–1083.

S107. White, T.E., Dickenson, J.M., Alexander, S.P., and Hill, S.J. 1992. Adenosine A1-receptor stimulation of inositol phospholipid hydrolysis and calcium mobilisation in DDT1 MF-2 cells. *Br. J. Pharmacol.* **106**:215–221.

S108. Lohrmann, E., and Greger, R. 1995. The effect of secretagogues on ion conductances of in vitro perfused, isolated rabbit colonic crypts. *Pflugers Arch.* **429**:494–502.

S109. Sitaraman, S.V., et al. 2001. Neutrophil-epithelial crosstalk at the intestinal lumenal surface mediated by reciprocal secretion of adenosine and IL-6. *J. Clin. Invest.* **107**:861-869.

S110. Di Sole, F. et al. 2002. Molecular aspects of acute inhibition of Na(+)-H(+) exchanger NHE3 by A(2)-adenosine receptor agonists. *J. Physiol.* **541**:529–543.

S111. Pouliot, M., Fiset, M.E., Masse, M., Naccache, P.H., and Borgeat, P. 2002. Adenosine up-regulates cyclooxygenase-2 in human granulocytes: impact on the balance of eicosanoid generation. *J. Immunol.* **169**:5279–5286.

S112. Roden M, Plass H, Vierhapper H, Turnheim K. 1992. Endothelin-1 stimulates chloride and potassium secretion in rabbit descending colon. *Pflugers Arch.* **421**:163-167.

S113. Field, M., and McColl, I. 1973. Ion transport in rabbit ileal mucosa. III. Effects of catecholamines. *Am. J. Physiol.* **225**:858–861.

S114. Hubel, K.A., and Renquist, K.S. 1986. Effect of neuropeptide Y on ion transport by the rabbit ileum. J. *Pharmacol. Exp. Ther.* **238**:167–169.

S115. Anthone, G.J., Orandle, M.S., Wang, B.H., and Yeo, C.J. 1991. Neuropeptide Y-induced intestinal absorption: mediation by alpha 2-adrenergic receptors. *Surgery.* **110**:1132–1138.

S116. Strabel, D., and Diener, M. 1995. The effect of neuropeptide Y on sodium, chloride and potassium transport across the rat distal colon. *Br. J. Pharmacol.* **115**:1071–1079.

S117. Jackerott, M., and Larsson, L.I. 1997. Immunocytochemical localization of the NPY/PYY Y1 receptor in enteric neurons, endothelial cells, and endocrine-like cells of the rat intestinal tract. *J. Histochem. Cytochem.* **45**:1643–1650.

S118. Guandalini, S., Kachur, J.F., Smith, P.L., Miller, R.J., and Field, M. 1980. In vitro effects of somatostatin on ion transport in rabbit intestine. *Am. J. Physiol.* **238**:G67–G74.

S119. Sandle, G.I., Warhurst, G., Butterfield, I., Higgs, N.B., and Lomax, R.B. 1999. Somatostatin peptides inhibit basolateral potassium channels in human colonic crypts. *Am. J. Physiol.* **277**:G967–G975.

S120. Kachur, J.F., Miller, R.J., and Field, M. 1980. Control of guinea pig intestinal electrolyte secretion by a delta-opiate receptor. *Proc. Natl. Acad. Sci. U. S. A.* **77**:2753-2756.

S121. Lang, M.E., Davison, J.S., Bates, S.L., and Meddings, J.B. 1996. Opioid receptors on guinea-pig intestinal crypt epithelial cells. *J. Physiol.* **497**:161–174.

S122. Turnheim, K., Plass, H., and Wyskovsky, W. 2002. Basolateral

potassium channels of rabbit colon epithelium: role in sodium absorption and chloride secretion. *Biochim. Biophys. Acta.* **1560**:51–66.

S123. Klaerke, D.A. 1997. Regulation of Ca(2+)-activated K+ channels from rabbit distal colon. *Comp. Biochem. Physiol. A. Physiol.* **118**:215–217.

S124. Huang, Y., Ko, W.H., Chung, Y.W., and Wong, P.Y. 1999. Identification of calcium-activated potassium channels in cultured equine sweat gland epithelial cells. *Exp. Physiol.* **84**:881–895.

S125. Hirano, J., Nakamura, K., and Kubokawa, M. 2001. Properties of a Ca(2+)-activated large conductance K(+) channel with ATP sensitivity in human renal proximal tubule cells. *Jpn. J. Physiol.* **51**:481–489.

S126. Catalan, M., et al. 2002. ClC-2 in guinea pig colon: mRNA, immunolabeling, and functional evidence for surface epithelium localization. *Am. J. Physiol.* **283**:G1004-1013.

S127. Lipecka, J., et al. 2002. Distribution of ClC-2 chloride channel in rat and human epithelial tissues. *Am. J. Physiol.* **282**:C805-816.

S128. Sandle, G.I., Warhurst, G., Butterfield, I., Higgs, N.B., and Lomax, R.B. 1999. Somatostatin peptides inhibit basolateral potassium channels in human colonic crypts. *Am. J. Physiol.* **277**:G967–G975.

S129. Lourdel, S., et al. 2002. An inward rectifier K(+) channel at the basolateral membrane of the mouse distal convoluted tubule: similarities with Kir4-Kir5.1 heteromeric channels. *J. Physiol.* **538**:391–404.