

References

- Aguado, C., García-Paredes, B., Sotelo, M. J., Sastre, J., & Díaz-Rubio, E. (2014). Should capecitabine replace 5-fluorouracil in the first-line treatment of metastatic colorectal cancer? *World Journal of Gastroenterology : WJG*, *20*(20), 6092–6101. <https://doi.org/10.3748/wjg.v20.i20.6092>
- Ahmadi, F., Oveisi, Z., Samani, S. M., & Amoozgar, Z. (2015). Chitosan based hydrogels: characteristics and pharmaceutical applications. *Research in Pharmaceutical Sciences*, *10*(1), 1–16. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4578208/#:~:text=Chitosan%20is%20a%20natural%20cationic>
- Al-Thawabeia, R. A., & Hodali, H. A. (2015). Use of Zeolite ZSM-5 for Loading and Release of 5-Fluorouracil. *Journal of Chemistry*, *2015*, 1–9. <https://doi.org/10.1155/2015/403597>
- Allen, L. V., Worthen, D. B., & Mink, B. (2008). *Suppositories*. London: The Pharmaceutical Press.
- Amini-Fazl, M. S., Mohammadi, R., & Kheiri, K. (2019). 5-Fluorouracil loaded chitosan/polyacrylic acid/Fe₃O₄ magnetic nanocomposite hydrogel as a potential anticancer drug delivery system. *International Journal of Biological Macromolecules*, *132*, 506–513. <https://doi.org/10.1016/j.ijbiomac.2019.04.005>
- Anastassopoulou, J., Kyriakidou, M., Malesiou, E., Rallis, M., & Theophanides, T. (2019). Infrared and Raman Spectroscopic Studies of Molecular Disorders in Skin Cancer. *In Vivo*, *33*(2), 567–572. <https://doi.org/10.21873/invivo.11512>
- Aoullay, Z., Slaoui, M., Razine, R., Er-Raki, A., Meddah, B., & Cherrah, Y. (2020). Therapeutic Characteristics, Chemotherapy-Related Toxicities and Survivorship in Colorectal Cancer Patients. *Ethiopian Journal of Health Sciences*, *30*(1). <https://doi.org/10.4314/ejhs.v30i1.9>
- Arévalo-Pérez, R., Maderuelo, C., & Lanao, J. M. (2020). Recent advances in colon drug delivery systems. *Journal of Controlled Release*, *327*, 703–724. <https://doi.org/10.1016/j.jconrel.2020.09.026>
- Arzhavitina, A., & Steckel, H. (2010). Foams for pharmaceutical and cosmetic application. *International Journal of Pharmaceutics*, *394*(1-2), 1–17. <https://doi.org/10.1016/j.ijpharm.2010.04.028>
- Ashford, M., Fell, J., Attwood, D., Sharma, H., & Woodhead, P. (1994). Studies on pectin formulations for colonic drug delivery. *Journal of Controlled Release*, *30*(3), 225–232. [https://doi.org/10.1016/0168-3659\(94\)90028-0](https://doi.org/10.1016/0168-3659(94)90028-0)
- Atuma, C., Strugala, V., Allen, A., & Holm, L. (2001). The adherent gastrointestinal mucus gel layer: thickness and physical state in vivo. *American Journal of Physiology-Gastrointestinal and Liver Physiology*, *280*(5), G922–G929. <https://doi.org/10.1152/ajpgi.2001.280.5.g922>
- Bandzierz, K., Reuvekamp, L., Dryzek, J., Dierkes, W., Blume, A., & Bielinski, D. (2016). Influence of Network Structure on Glass Transition Temperature of Elastomers. *Materials*, *9*(7), 607. <https://doi.org/10.3390/ma9070607>
- Barclay, T. G., Day, C. M., Petrovsky, N., & Garg, S. (2019). Review of polysaccharide particle-based functional drug delivery. *Carbohydrate Polymers*, *221*, 94–112. <https://doi.org/10.1016/j.carbpol.2019.05.067>
- Bauer, S. (2012). Mass Spectrometry for Characterizing Plant Cell Wall Polysaccharides. *Frontiers in Plant Science*, *3*. <https://doi.org/10.3389/fpls.2012.00045>

- Baun, O., & Blümler, P. (2017). Permanent magnet system to guide superparamagnetic particles. *Journal of Magnetism and Magnetic Materials*, 439, 294–304. <https://doi.org/10.1016/j.jmmm.2017.05.001>
- Beaupre, D. M., & Weiss, R. G. (2021). Thiol- and Disulfide-Based Stimulus-Responsive Soft Materials and Self-Assembling Systems. *Molecules*, 26(11), 3332. <https://doi.org/10.3390/molecules26113332>
- Bemiller, J. N. (2018). *Carbohydrate chemistry for food scientists* (pp. 303–312). Cambridge, Ma.: Elsevier.
- Bigucci, F., Luppi, B., Monaco, L., Cerchiara, T., & Zecchi, V. (2009). Pectin-based microspheres for colon-specific delivery of vancomycin. *Journal of Pharmacy and Pharmacology*, 61(1), 41–46. <https://doi.org/10.1211/jpp.61.01.0006>
- Blinder, S. M. (2004). *Introduction to quantum mechanics : in chemistry, materials science, and biology*. Amsterdam: Elsevier.
- Bonner, J. (1936). The chemistry and physiology of the pectins. *The Botanical Review*, 2(10), 475–497. <https://doi.org/10.1007/bf02869919>
- Bray, F., Ferlay, J., Soerjomataram, I., Siegel, R. L., Torre, L. A., & Jemal, A. (2018). Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: A Cancer Journal for Clinicians*, 68(6), 394–424. <https://doi.org/10.3322/caac.21492>
- Brown, J., Haines, S., & Wilding, I. R. (1997). Colonic spread of three rectally administered mesalazine (Pentasa) dosage forms in healthy volunteers as assessed by gamma scintigraphy. *Alimentary Pharmacology and Therapeutics*, 11(4), 685–691. <https://doi.org/10.1046/j.1365-2036.1997.00193.x>
- Bruschi, M. L. (Ed.). (2015). Mathematical models of drug release. In *Strategies to modify the drug release from pharmaceutical systems* (pp. 63–86). Amsterdam Etc.: Elsevier/Woodhead Publishing, , Cop.
- Celus, M., Kyomugasho, C., Van Loey, A. M., Grauwet, T., & Hendrickx, M. E. (2018). Influence of Pectin Structural Properties on Interactions with Divalent Cations and Its Associated Functionalities. *Comprehensive Reviews in Food Science and Food Safety*, 17(6), 1576–1594. <https://doi.org/10.1111/1541-4337.12394>
- Celus, M., Salvia-Trujillo, L., Kyomugasho, C., Maes, I., Van Loey, A. M., Grauwet, T., & Hendrickx, M. E. (2018). Structurally modified pectin for targeted lipid antioxidant capacity in linseed/sunflower oil-in-water emulsions. *Food Chemistry*, 241, 86–96. <https://doi.org/10.1016/j.foodchem.2017.08.056>
- Cervantes, E., Martín, J. J., & Saadaoui, E. (2016). Updated Methods for Seed Shape Analysis. *Scientifica*, 2016, 1–10. <https://doi.org/10.1155/2016/5691825>
- Cheewatanakornkool, K., Niratisai, S., Manchun, S., Dass, C. R., & Sriamornsak, P. (2017). Thiolated pectin–doxorubicin conjugates: Synthesis, characterization and anticancer activity studies. *Carbohydrate Polymers*, 174, 493–506. <https://doi.org/10.1016/j.carbpol.2017.06.115>
- Cheng, H., Zhang, Z., Leng, J., Liu, D., Hao, M., Gao, X., ... Zhou, Y. (2013). The inhibitory effects and mechanisms of rhamnogalacturonan I pectin from potato on HT-29 colon cancer cell proliferation and cell cycle progression. *International Journal of Food Sciences and Nutrition*, 64(1), 36–43. <https://doi.org/10.3109/09637486.2012.694853>
- Cheng, R., & Ma, J. (2015). Angiogenesis in diabetes and obesity. *Reviews in Endocrine and Metabolic Disorders*, 16(1), 67–75. <https://doi.org/10.1007/s11154-015-9310-7>

- Cheung, R. C. F., Ng, T. B., Wong, J. H., & Chan, W. Y. (2015). Chitosan: An Update on Potential Biomedical and Pharmaceutical Applications. *Marine Drugs*, *13*(8), 5156–5186. <https://doi.org/10.3390/md13085156>
- Curtis, R., Austerberry, J., & Holloway, L. (2019). Comprehensive biotechnology. In *Comprehensive biotechnology* (pp. 860–878). Amsterdam, Netherlands ; Oxford, England ; Cambridge, Massachusetts: Pergamon.
- Dhingra, D., Michael, M., Rajput, H., & Patil, R. T. (2011). Dietary fibre in foods: a review. *Journal of Food Science and Technology*, *49*(3), 255–266. <https://doi.org/10.1007/s13197-011-0365-5>
- Dimitrovska, I., Olumceva, T., Markova, E., Kostoska, M., Taneska, L., Petrushevska, M., ... Simonoska Crcarevska, M. (2020). Topical gel with ethyl cellulose based microsponges loaded with clindamycin hydrochloride for acne treatment. *Cellulose*, *27*(12), 7109–7126. <https://doi.org/10.1007/s10570-020-03283-7>
- Dong, Y., Ruan, Y., Wang, H., Zhao, Y., & Bi, D. (2004). Studies on glass transition temperature of chitosan with four techniques. *Journal of Applied Polymer Science*, *93*(4), 1553–1558. <https://doi.org/10.1002/app.20630>
- Dongowski, G., Lorenz, A., & Anger, H. (2000). Degradation of Pectins with Different Degrees of Esterification by Bacteroides thetaiotaomicron Isolated from Human Gut Flora. *Applied and Environmental Microbiology*, *66*(4), 1321–1327. <https://doi.org/10.1128/aem.66.4.1321-1327.2000>
- Drago, R. S. (1992). *Physical methods for chemists* (2nd ed., pp. 120–129). Gainesville, FL: Surfside Scientific Publishers.
- Duggan, S., Cummins, W., O' Donovan, O., Hughes, H., & Owens, E. (2017). Thiolated polymers as mucoadhesive drug delivery systems. *European Journal of Pharmaceutical Sciences*, *100*, 64–78. <https://doi.org/10.1016/j.ejps.2017.01.008>
- Elieh-Ali-Komi, D., & Hamblin, M. R. (2016). Chitin and Chitosan: Production and Application of Versatile Biomedical Nanomaterials. *International Journal of Advanced Research*, *4*(3), 411–427. Retrieved from
- Ember, K. J. I., Hoeve, M. A., McAughtrie, S. L., Bergholt, M. S., Dwyer, B. J., Stevens, M. M., ... Campbell, C. J. (2017). Raman spectroscopy and regenerative medicine: a review. *Npj Regenerative Medicine*, *2*(1). <https://doi.org/10.1038/s41536-017-0014-3>
- Esteves, J. (2015). Understanding the Higgs boson with the Large Hadron Electron Collider. *Journal of Physics: Conference Series*, *645*, 012009. <https://doi.org/10.1088/1742-6596/645/1/012009>
- Fan, L.-F., He, W., Bai, M., Du, Q., Xiang, B., Chang, Y.-Z., & Cao, D.-Y. (2008). Biphasic Drug Release: Permeability and Swelling of Pectin/Ethylcellulose Films, and in Vitro and in Vivo Correlation of Film-Coated Pellets in Dogs. *CHEMICAL & PHARMACEUTICAL BULLETIN*, *56*(8), 1118–1125. <https://doi.org/10.1248/cpb.56.1118>
- Fang, T., Liu, D., Ning, H., Liu, D., Sun, J., Huang, X., ... Huang, R. (2018). Modified citrus pectin inhibited bladder tumor growth through downregulation of galectin-3. *Acta Pharmacologica Sinica*, *39*(12), 1885–1893. <https://doi.org/10.1038/s41401-018-0004-z>
- Freire, M. C., Alexandrino, F., Marcelino, H. R., Picciani, P. H. de S., Silva, K. G. de H. e, Genre, J., ... Egito, E. S. T. do. (2017). Understanding Drug Release Data through Thermodynamic Analysis. *Materials*, *10*(6), 651. <https://doi.org/10.3390/ma10060651>

- Galandiuk, S., Wrightson, W., Marr, L., Myers, S., & LaRocca, R. V. (1996). Suppository delivery of 5-fluorouracil in rectal cancer. *Annals of Surgical Oncology*, *3*(3), 270–276. <https://doi.org/10.1007/bf02306282>
- Gibot, L., Chabaud, S., Bouhout, S., Bolduc, S., Auger, F. A., & Moulin, V. J. (2015). Anticancer properties of chitosan on human melanoma are cell line dependent. *International Journal of Biological Macromolecules*, *72*, 370–379. <https://doi.org/10.1016/j.ijbiomac.2014.08.033>
- Goel, M., Khanna, P., & Kishore, J. (2010). Understanding survival analysis: Kaplan-Meier estimate. *International Journal of Ayurveda Research*, *1*(4), 274. <https://doi.org/10.4103/0974-7788.76794>
- Grenon, N. N., & Chan, J. (2009). Managing Toxicities Associated With Colorectal Cancer Chemotherapy and Targeted Therapy. *Clinical Journal of Oncology Nursing*, *13*(3), 285–296. <https://doi.org/10.1188/09.cjon.285-296>
- Grifantini, R., Taranta, M., Gherardini, L., Naldi, I., Parri, M., Grandi, A., ... Cinti, C. (2018). Magnetically driven drug delivery systems improving targeted immunotherapy for colon-rectal cancer. *Journal of Controlled Release*, *280*, 76–86. <https://doi.org/10.1016/j.jconrel.2018.04.052>
- Guggi, D., Marschütz, M. K., & Bernkop-Schnürch, A. (2004). Matrix tablets based on thiolated poly(acrylic acid): pH-dependent variation in disintegration and mucoadhesion. *International Journal of Pharmaceutics*, *274*(1-2), 97–105. <https://doi.org/10.1016/j.ijpharm.2003.06.001>
- Günter, E. A., & Popeyko, O. V. (2016). Calcium pectinate gel beads obtained from callus cultures pectins as promising systems for colon-targeted drug delivery. *Carbohydrate Polymers*, *147*, 490–499. <https://doi.org/10.1016/j.carbpol.2016.04.026>
- Ha, Y., Ko, S., Kim, I., Huang, Y., Mohanty, K., Huh, C., & Maynard, J. A. (2018). Recent Advances Incorporating Superparamagnetic Nanoparticles into Immunoassays. *ACS Applied Nano Materials*, *1*(2), 512–521. <https://doi.org/10.1021/acsnm.7b00025>
- Haggar, F., & Boushey, R. (2009). Colorectal Cancer Epidemiology: Incidence, Mortality, Survival, and Risk Factors. *Clinics in Colon and Rectal Surgery*, *22*(04), 191–197. <https://doi.org/10.1055/s-0029-1242458>
- Harris, D. C., & Bertolucci, M. D. (1989). *Symmetry and spectroscopy an introduction to vibrational and electronic spectroscopy* (pp. 151–169). New York: Dover.
- Healey, E., Stillfried, G. E., Eckermann, S., Dawber, J. P., Clingan, P. R., & Ranson, M. (2013). Comparative Effectiveness of 5-Fluorouracil with and without Oxaliplatin in the Treatment of Colorectal Cancer in Clinical Practice. *Anticancer Research*, *33*(3), 1053–1060. Retrieved from <https://ar.iiarjournals.org/content/33/3/1053>
- Hillman, L., Peters, S., Fisher, A., & Pomare, E. W. (1983). Differing effects of pectin, cellulose and lignin on stool pH, transit time and weight. *British Journal of Nutrition*, *50*(2), 189–195. <https://doi.org/10.1079/bjn19830088>
- Ho, G. T. T., Zou, Y.-F., Wangenstein, H., & Barsett, H. (2016). RG-I regions from elderflower pectins substituted on GalA are strong immunomodulators. *International Journal of Biological Macromolecules*, *92*, 731–738. <https://doi.org/10.1016/j.ijbiomac.2016.07.090>
- Hua, S. (2019). Physiological and Pharmaceutical Considerations for Rectal Drug Formulations. *Frontiers in Pharmacology*, *10*. <https://doi.org/10.3389/fphar.2019.01196>

- Ibekwe, V. C., Liu, F., Fadda, H. M., Khela, M. K., Evans, D. F., Parsons, G. E., & Basit, A. W. (2006). An Investigation into the In Vivo Performance Variability of pH Responsive Polymers for Ileo-Colonic Drug Delivery Using Gamma Scintigraphy in Humans. *Journal of Pharmaceutical Sciences*, 95(12), 2760–2766. <https://doi.org/10.1002/jps.20742>
- Iijima, M., Nakamura, K., Hatakeyama, T., & Hatakeyama, H. (2000). Phase transition of pectin with sorbed water. *Carbohydrate Polymers*, 41(1), 101–106. [https://doi.org/10.1016/s0144-8617\(99\)00116-2](https://doi.org/10.1016/s0144-8617(99)00116-2)
- Izadi, Z., Divsalar, A., Saboury, A. A., & Sawyer, L. (2016). β -lactoglobulin-pectin Nanoparticle-based Oral Drug Delivery System for Potential Treatment of Colon Cancer. *Chemical Biology & Drug Design*, 88(2), 209–216. <https://doi.org/10.1111/cbdd.12748>
- Jacques, C. H. M., Hopfenberg, H. B., & Stannett, V. (1974). Super Case II Transport of Organic Vapors in Glassy Polymers. In H. B. Hopfenberg (Ed.), *Permeability of Plastic Films and Coatings* (1st ed., pp. 73–86). Boston, MA: Springer US.
- Jahromi, L. P., Ghazali, M., Ashrafi, H., & Azadi, A. (2020). A comparison of models for the analysis of the kinetics of drug release from PLGA-based nanoparticles. *Heliyon*, 6(2), e03451. <https://doi.org/10.1016/j.heliyon.2020.e03451>
- Jäpelt, A., Svendsen, E. N., & Oddershede, J. (1986). Relationship Between Raman Intensities and Derivatives of the Dipole Polarizability. In *Geometrical Derivatives of Energy Surfaces and Molecular Properties* (pp. 279–288). Dordrecht: Springer.
- Jones, D. S., Muldoon, B. C. O., Woolfson, A. David., & Sanderson, F. Dominic. (2007). An Examination of the Rheological and Mucoadhesive Properties of Poly(Acrylic Acid) Organogels Designed as Platforms for Local Drug Delivery to the Oral Cavity. *Journal of Pharmaceutical Sciences*, 96(10), 2632–2646. <https://doi.org/10.1002/jps.20771>
- Khaleghi, M., Ahmadi, E., Khodabandeh Shahraki, M., Aliakbari, F., & Morshedi, D. (2020). Temperature-dependent formulation of a hydrogel based on Hyaluronic acid-polydimethylsiloxane for biomedical applications. *Heliyon*, 6(3), e03494. <https://doi.org/10.1016/j.heliyon.2020.e03494>
- Khotimchenko, M. (2020). Pectin polymers for colon-targeted antitumor drug delivery. *International Journal of Biological Macromolecules*, 158, 1110–1124. <https://doi.org/10.1016/j.ijbiomac.2020.05.002>
- Klijn, A. J., Asselman, M., Vijverberg, M. A. W., Dik, P., & de Jong, T. P. V. M. (2004). The diameter of the rectum on ultrasonography as a diagnostic tool for constipation in children with dysfunctional voiding. *Journal of Urology*, 172(5), 1986–1988. <https://doi.org/10.1097/01.ju.0000142686.09532.46>
- Komninou, D., Ayonote, A., Richie, J. P., & Rigas, B. (2003). Insulin Resistance and Its Contribution to Colon Carcinogenesis. *Experimental Biology and Medicine*, 228(4), 396–405. <https://doi.org/10.1177/153537020322800410>
- Kuipers, E. J., Grady, W. M., Lieberman, D., Seufferlein, T., Sung, J. J., Boelens, P. G., ... Watanabe, T. (2015). Colorectal cancer. *Nature Reviews Disease Primers*, 1(), 15065. <https://doi.org/10.1038/nrdp.2015.65>
- Kumar, P., & Mishra, B. (2008). Colon Targeted Drug Delivery Systems -An Overview. *Current Drug Delivery*, 5(3), 186–198. <https://doi.org/10.2174/156720108784911712>
- Kumari, A., Jain, A., Hurkat, P., Tiwari, A., & Jain, S. K. (2018). Eudragit S100 coated microsponges for Colon targeting of prednisolone. *Drug Development and Industrial Pharmacy*, 44(6), 902–913. <https://doi.org/10.1080/03639045.2017.1420079>

- Kungel, P. T. A. N., Correa, V. G., Corrêa, R. C. G., Peralta, R. A., Soković, M., Calhelha, R. C., ... Peralta, R. M. (2018). Antioxidant and antimicrobial activities of a purified polysaccharide from yerba mate (*Ilex paraguariensis*). *International Journal of Biological Macromolecules*, *114*, 1161–1167. <https://doi.org/10.1016/j.ijbiomac.2018.04.020>
- Lara-Espinoza, C., Carvajal-Millán, E., Balandrán-Quintana, R., López-Franco, Y., & Rascón-Chu, A. (2018). Pectin and Pectin-Based Composite Materials: Beyond Food Texture. *Molecules*, *23*(4), 942. <https://doi.org/10.3390/molecules23040942>
- Lee, Bajracharya, Min, Han, Park, & Han. (2020). Strategic Approaches for Colon Targeted Drug Delivery: An Overview of Recent Advancements. *Pharmaceutics*, *12*(1), 68. <https://doi.org/10.3390/pharmaceutics12010068>
- Lehr, C.-M., Bouwstra, J. A., Tukker, J. J., & Junginger, H. E. (1990). Intestinal transit of bioadhesive microspheres in an in situ loop in the rat—A comparative study with copolymers and blends based on poly(acrylic acid). *Journal of Controlled Release*, *13*(1), 51–62. [https://doi.org/10.1016/0168-3659\(90\)90074-4](https://doi.org/10.1016/0168-3659(90)90074-4)
- Leivas, C. L., Nascimento, L. F., Barros, W. M., Santos, A. R. S., Iacomini, M., & Cordeiro, L. M. C. (2016). Substituted galacturonan from starfruit: Chemical structure and antinociceptive and anti-inflammatory effects. *International Journal of Biological Macromolecules*, *84*, 295–300. <https://doi.org/10.1016/j.ijbiomac.2015.12.034>
- Lin, W.-C., Pan, W.-Y., Liu, C.-K., Huang, W.-X., Song, H.-L., Chang, K.-S., ... Sung, H.-W. (2018). In situ self-spray coating system that can uniformly disperse a poorly water-soluble H₂S donor on the colorectal surface to treat inflammatory bowel diseases. *Biomaterials*, *182*, 289–298. <https://doi.org/10.1016/j.biomaterials.2018.07.044>
- Liu, P. F., Liu, D., Cai, C., Chen, X., Zhou, Y., Wu, L., ... Xie, Y. (2016). Size-dependent cytotoxicity of Fe₃O₄ nanoparticles induced by biphasic regulation of oxidative stress in different human hepatoma cells. *International Journal of Nanomedicine*, *Volume 11*, 3557–3570. <https://doi.org/10.2147/ijn.s105575>
- Lo, Y.-L., Lin, Y., & Lin, H.-R. (2013). Evaluation of Epirubicin in Thermogelling and Bioadhesive Liquid and Solid Suppository Formulations for Rectal Administration. *International Journal of Molecular Sciences*, *15*(1), 342–360. <https://doi.org/10.3390/ijms15010342>
- Longley, D. B., Harkin, D. P., & Johnston, P. G. (2003). 5-fluorouracil: mechanisms of action and clinical strategies. *Nature Reviews. Cancer*, *3*(5), 330–338. <https://doi.org/10.1038/nrc1074>
- Lopez-Moya, F., Colom-Valiente, M. F., Martinez-Peinado, P., Martinez-Lopez, J. E., Puellas, E., Sempere-Ortells, J. M., & Lopez-Llorca, L. V. (2015). Carbon and nitrogen limitation increase chitosan antifungal activity in *Neurospora crassa* and fungal human pathogens. *Fungal Biology*, *119*(2-3), 154–169. <https://doi.org/10.1016/j.funbio.2014.12.003>
- Lucarini, G., Ciuti, G., Mura, M., Rizzo, R., & Menciassi, A. (2015). A New Concept for Magnetic Capsule Colonoscopy Based on an Electromagnetic System. *International Journal of Advanced Robotic Systems*, *12*(3), 25. <https://doi.org/10.5772/60134>
- Mady, O. Y., & Donia, A. A. (2015). A new mathematic method for calculation of peppassahlin model constants and interpret the results in relation to zero order, higuchi, krosmeier-peppas models and microcapsule structure image. *World Journal of Pharmaceutical Research*, *4*(8), 2199–2246.

- Maisel, K., Chattopadhyay, S., Moench, T., Hendrix, C., Cone, R., Ensign, L. M., & Hanes, J. (2015). Enema ion compositions for enhancing colorectal drug delivery. *Journal of Controlled Release*, *209*, 280–287. <https://doi.org/10.1016/j.jconrel.2015.04.040>
- Makhlof, A., Werle, M., & Takeuchi, H. (2008). Mucoadhesive drug carriers and polymers for effective drug delivery. *Journal of Drug Delivery Science and Technology*, *18*(6), 375–386. [https://doi.org/10.1016/s1773-2247\(08\)50075-x](https://doi.org/10.1016/s1773-2247(08)50075-x)
- Mármol, I., Sánchez-de-Diego, C., Pradilla Dieste, A., Cerrada, E., & Rodríguez Yoldi, M. (2017). Colorectal Carcinoma: A General Overview and Future Perspectives in Colorectal Cancer. *International Journal of Molecular Sciences*, *18*(1), 197. <https://doi.org/10.3390/ijms18010197>
- Martinez-Useros, J., & Garcia-Foncillas, J. (2016). Obesity and colorectal cancer: molecular features of adipose tissue. *Journal of Translational Medicine*, *14*(1). <https://doi.org/10.1186/s12967-016-0772-5>
- Martins, A. L. L., de Oliveira, A. C., do Nascimento, C. M. O. L., Silva, L. A. D., Gaeti, M. P. N., Lima, E. M., ... Marreto, R. N. (2017). Mucoadhesive Properties of Thiolated Pectin-Based Pellets Prepared by Extrusion-Spheronization Technique. *Journal of Pharmaceutical Sciences*, *106*(5), 1363–1370. <https://doi.org/10.1016/j.xphs.2017.01.028>
- McConnell, E. L., Murdan, S., & Basit, A. W. (2008). An Investigation into the Digestion of Chitosan (Noncrosslinked and Crosslinked) by Human Colonic Bacteria. *Journal of Pharmaceutical Sciences*, *97*(9), 3820–3829. <https://doi.org/10.1002/jps.21271>
- McFarlane, M. J. (1990). Chapter 97. The Rectal Examination. In H. K. Walker, W. D. Hall, & J. W. Hurst (Eds.), *The History, Physical, and Laboratory Examinations* (3rd ed.). Retrieved from <https://www.ncbi.nlm.nih.gov/books/NBK424/>
- Minzanova, S. T., Mironov, V. F., Arkhipova, D. M., Khabibullina, A. V., Mironova, L. G., Zakirova, Y. M., & Milyukov, V. A. (2018). Biological Activity and Pharmacological Application of Pectic Polysaccharides: A Review. *Polymers*, *10*(12). <https://doi.org/10.3390/polym10121407>
- Mittal, N., & Kaur, G. (2013). In situ gelling ophthalmic drug delivery system: Formulation and evaluation. *Journal of Applied Polymer Science*, *131*(2), n/a-n/a. <https://doi.org/10.1002/app.39788>
- Mohammed, M., Syeda, J., Wasan, K., & Wasan, E. (2017). An Overview of Chitosan Nanoparticles and Its Application in Non-Parenteral Drug Delivery. *Pharmaceutics*, *9*(4), 53. <https://doi.org/10.3390/pharmaceutics9040053>
- Moreno, J., & Peinado, R. (Eds.). (2012). Wine Colloids. In *Enological Chemistry* (pp. 323–354). <https://doi.org/10.1016/b978-0-12-388438-1.00019-4>
- Morris, G. A., Kök, S. M., Harding, S. E., & Adams, G. G. (2010). Polysaccharide drug delivery systems based on pectin and chitosan. *Biotechnology and Genetic Engineering Reviews*, *27*(1), 257–284. <https://doi.org/10.1080/02648725.2010.10648153>
- Mudie, D. M., Murray, K., Hoad, C. L., Pritchard, S. E., Garnett, M. C., Amidon, G. L., ... Marciani, L. (2014). Quantification of Gastrointestinal Liquid Volumes and Distribution Following a 240 mL Dose of Water in the Fasted State. *Molecular Pharmaceutics*, *11*(9), 3039–3047. <https://doi.org/10.1021/mp500210c>
- Mukhopadhyay, R., Gain, S., Verma, S., Singh, B., Vyas, M., Mehta, M., & Haque, A. (2018). Polymers in designing the mucoadhesive films: A comprehensive review. *International Journal of Green Pharmacy*, *12*(2), S330–S344.

- Müller, M. F., Ibrahim, A. E. K., & Arends, M. J. (2016). Molecular pathological classification of colorectal cancer. *Virchows Archiv*, *469*, 125–134. <https://doi.org/10.1007/s00428-016-1956-3>
- Müller, A., & Mohan, N. (1977). Raman intensities, depolarization ratios, and polarizability derivatives: Matrix notation, relation to other molecular constants and simple isotopic rules. *The Journal of Chemical Physics*, *67*(5), 1918–1925. <https://doi.org/10.1063/1.435123>
- Muvva, A., Chacko, I. A., Ghate, V., & Lewis, S. A. (2020). Modified Pectins for Colon-Specific Drug Delivery. *Indian Journal of Pharmaceutical Education and Research*, *54*(2s), s12–s18. <https://doi.org/10.5530/ijper.54.2s.57>
- Naik, J. B., & Waghulde, M. R. (2017). Development of vildagliptin loaded Eudragit® microspheres by screening design: in vitro evaluation. *Journal of Pharmaceutical Investigation*, *48*(6), 627–637. <https://doi.org/10.1007/s40005-017-0355-3>
- National Comprehensive Cancer Network. (2018, October 19). Colon Cancer (Version 4.2018). Retrieved from NCCN Guidelines for Patients website: <https://www.nccn.org/patients/guidelines/content/PDF/colon-patient.pdf>
- Nayak, B. K. (2010). Understanding the relevance of sample size calculation. *Indian Journal of Ophthalmology*, *58*(6), 469. <https://doi.org/10.4103/0301-4738.71673>
- Negarandeh, R., Salehifar, E., Saghafi, F., Jalali, H., Janbabaei, G., Abdhaghghi, M. J., & Nosrati, A. (2020). Evaluation of adverse effects of chemotherapy regimens of 5-fluoropyrimidines derivatives and their association with DPYD polymorphisms in colorectal cancer patients. *BMC Cancer*, *20*(1). <https://doi.org/10.1186/s12885-020-06904-3>
- Nishioka, B., Watanabe, S., Fijita, Y., Kojima, O., Morisawa, K., Yamane, E., ... Majima, S. (1980). Clinical studies of intrarectal administration of 5-FU emulsion as an adjunct to surgical treatment for rectal cancer. *The Japanese Journal of Surgery*, *10*(2), 110–114. <https://doi.org/10.1007/bf02468674>
- Nunes, R., Sarmiento, B., & das Neves, J. (2014). Formulation and delivery of anti-HIV rectal microbicides: Advances and challenges. *Journal of Controlled Release*, *194*, 278–294. <https://doi.org/10.1016/j.jconrel.2014.09.013>
- Oh, J. K., & Park, J. M. (2011). Iron oxide-based superparamagnetic polymeric nanomaterials: Design, preparation, and biomedical application. *Progress in Polymer Science*, *36*(1), 168–189. <https://doi.org/10.1016/j.progpolymsci.2010.08.005>
- Okumura, M., Shimamoto, S., & Hidaka, Y. (2012). A chemical method for investigating disulfide-coupled peptide and protein folding. *FEBS Journal*, *279*(13), 2283–2295. <https://doi.org/10.1111/j.1742-4658.2012.08596.x>
- Ouellette, R. J., & Rawn, J. D. (2019). *Organic chemistry : structure, mechanism, synthesis* (2nd ed., p. 529). London ; San Diego, Ca: Academic Press.
- Paek, S.-H., Xuan, J.-J., Choi, H.-G., Park, B. C., Lee, Y.-S., Jeong, T.-C., ... Kim, J.-A. (2006). Poloxamer 188 and Propylene Glycol-Based Rectal Suppository Enhances Anticancer Effect of 5-Fluorouracil in Mice. *Biological and Pharmaceutical Bulletin*, *29*(5), 1060–1063. <https://doi.org/10.1248/bpb.29.1060>
- Pawar, A., Gadhe, A., Venkatachalam, P., Sher, P., & Mahadik, K. (2008). Effect of core and surface cross-linking on the entrapment of metronidazole in pectin beads. *Acta Pharmaceutica*, *58*(1). <https://doi.org/10.2478/v10007-007-0046-0>
- Pazdur, R., Hoff, P. M., Medgyesy, D., Royce, M., & Brito, R. (1998). The oral fluorouracil prodrugs. *Oncology (Williston Park, N.Y.)*, *12*(10 Suppl 7), 48–51. Retrieved from

- Peng, Q., Xu, Q., Yin, H., Huang, L., & Du, Y. (2014). Characterization of an immunologically active pectin from the fruits of *Lycium ruthenicum*. *International Journal of Biological Macromolecules*, *64*, 69–75. <https://doi.org/10.1016/j.ijbiomac.2013.11.030>
- Peppas, N. A., & Sahlin, J. J. (1989). A simple equation for the description of solute release. III. Coupling of diffusion and relaxation. *International Journal of Pharmaceutics*, *57*(2), 169–172. [https://doi.org/10.1016/0378-5173\(89\)90306-2](https://doi.org/10.1016/0378-5173(89)90306-2)
- Philip, A., & Philip, B. (2010). Colon Targeted Drug Delivery Systems: A Review on Primary and Novel Approaches. *Oman Medical Journal*, *25*(2), 70–78. <https://doi.org/10.5001/omj.2010.24>
- Philippova, O. E., & Korchagina, E. V. (2012). Chitosan and its hydrophobic derivatives: Preparation and aggregation in dilute aqueous solutions. *Polymer Science Series A*, *54*(7), 552–572. <https://doi.org/10.1134/s0965545x12060107>
- Raines, D., Arbour, A., Thompson, H. W., Figueroa-Bodine, J., & Joseph, S. (2014). Variation in small bowel length: Factor in achieving total enteroscopy? *Digestive Endoscopy*, *27*(1), 67–72. <https://doi.org/10.1111/den.12309>
- Ramteke, K. H., & Nath, L. (2014). Formulation, Evaluation and Optimization of Pectin- Bora Rice Beads for Colon Targeted Drug Delivery System. *Advanced Pharmaceutical Bulletin*, *4*(2), 167–177. <https://doi.org/10.5681/apb.2014.025>
- Richter, W., & Schiel, D. (1984). The SH stretching vibrational Raman profile of ethanethiol. *Chemical Physics Letters*, *108*(5), 480–483. [https://doi.org/10.1016/0009-2614\(84\)85184-2](https://doi.org/10.1016/0009-2614(84)85184-2)
- Ritger, P. L., & Peppas, N. A. (1987). A simple equation for description of solute release II. Fickian and anomalous release from swellable devices. *Journal of Controlled Release*, *5*(1), 37–42. [https://doi.org/10.1016/0168-3659\(87\)90035-6](https://doi.org/10.1016/0168-3659(87)90035-6)
- Rutman, R. J., Cantarow, A., & Paschkis, K. E. (1954). Studies in 2-Acetylaminofluorene Carcinogenesis: III. The Utilization of Uracil-2-C14 by Preneoplastic Rat Liver and Rat Hepatoma. *Cancer Research*, *14*(2), 119–123. Retrieved from
- Salunkhe, N. H., Jadhav, N. R., Mali, K. K., Dias, R. J., Ghorpade, V. S., & Yadav, A. V. (2014). Mucoadhesive microsphere based suppository containing granisetron hydrochloride for management of emesis in chemotherapy. *Journal of Pharmaceutical Investigation*, *44*(4), 253–263. <https://doi.org/10.1007/s40005-014-0123-6>
- Sara, J. D., Kaur, J., Khodadadi, R., Rehman, M., Lobo, R., Chakrabarti, S., ... Grothey, A. (2018). 5-fluorouracil and cardiotoxicity: a review. *Therapeutic Advances in Medical Oncology*, *10*, 175883591878014. <https://doi.org/10.1177/1758835918780140>
- Shariatnia, Z. (2019). Pharmaceutical applications of chitosan. *Advances in Colloid and Interface Science*, *263*, 131–194. <https://doi.org/10.1016/j.cis.2018.11.008>
- Sharma, R., & Ahuja, M. (2011). Thiolated pectin: Synthesis, characterization and evaluation as a mucoadhesive polymer. *Carbohydrate Polymers*, *85*(3), 658–663. <https://doi.org/10.1016/j.carbpol.2011.03.034>
- Shundo, C., Zhang, H., Nakanishi, T., & Osaka, T. (2012). Cytotoxicity evaluation of magnetite (Fe₃O₄) nanoparticles in mouse embryonic stem cells. *Colloids and Surfaces B: Biointerfaces*, *97*, 221–225. <https://doi.org/10.1016/j.colsurfb.2012.04.003>
- Si, X.-Y., Merlin, D., & Xiao, B. (2016). Recent advances in orally administered cell-specific nanotherapeutics for inflammatory bowel disease. *World Journal of Gastroenterology*, *22*(34), 7718. <https://doi.org/10.3748/wjg.v22.i34.7718>

- Sinclair, G. W., & Peppas, N. A. (1984). Analysis of non-fickian transport in polymers using simplified exponential expressions. *Journal of Membrane Science*, 17(3), 329–331. [https://doi.org/10.1016/s0376-7388\(00\)83223-8](https://doi.org/10.1016/s0376-7388(00)83223-8)
- Singh, I., & Rana, V. (2013). Enhancement of Mucoadhesive Property of Polymers for Drug Delivery Applications. *Reviews of Adhesion and Adhesives*, 1(2), 271–290. <https://doi.org/10.7569/raa.2013.097307>
- Sogias, I. A., Williams, A. C., & Khutoryanskiy, V. V. (2008). Why is Chitosan Mucoadhesive? *Biomacromolecules*, 9(7), 1837–1842. <https://doi.org/10.1021/bm800276d>
- Sriamornsak, P. (2011). Application of pectin in oral drug delivery. *Expert Opinion on Drug Delivery*, 8(8), 1009–1023. <https://doi.org/10.1517/17425247.2011.584867>
- Stauffer, C. M., & Pfeifer, C. (2021). Colonoscopy. Retrieved from PubMed website: <https://www.ncbi.nlm.nih.gov/books/NBK559274/>
- Stintzing, S. (2014). Management of colorectal cancer. *F1000Prime Reports*, 6. <https://doi.org/10.12703/p6-108>
- Tam, J. P., Dong, X. C., & Wu, C. R. (1999). Solvent assistance in regiospecific disulfide formation in dimethylsulfoxide. *Letters in Peptide Science*, 6(5-6), 265–273. <https://doi.org/10.1007/bf02443421>
- Ternes, D., Karta, J., Tsenkova, M., Wilmes, P., Haan, S., & Letellier, E. (2020). Microbiome in Colorectal Cancer: How to Get from Meta-omics to Mechanism? *Trends in Microbiology*, 28(5), 401–423. <https://doi.org/10.1016/j.tim.2020.01.001>
- Thakur, B. R., Singh, R. K., Handa, A. K., & Rao, M. A. (1997). Chemistry and uses of pectin — A review. *Critical Reviews in Food Science and Nutrition*, 37(1), 47–73. <https://doi.org/10.1080/10408399709527767>
- Tseng, W.-K., Chieh, J.-J., Yang, Y.-F., Chiang, C.-K., Chen, Y.-L., Yang, S. Y., ... Wu, C.-C. (2012). A Noninvasive Method to Determine the Fate of Fe₃O₄ Nanoparticles following Intravenous Injection Using Scanning SQUID Biosusceptometry. *PLoS ONE*, 7(11), e48510. <https://doi.org/10.1371/journal.pone.0048510>
- Unagolla, J. M., & Jayasuriya, A. C. (2018). Drug transport mechanisms and in vitro release kinetics of vancomycin encapsulated chitosan-alginate polyelectrolyte microparticles as a controlled drug delivery system. *European Journal of Pharmaceutical Sciences*, 114, 199–209. <https://doi.org/10.1016/j.ejps.2017.12.012>
- van Hoogdalem, E., de Boer, A. G., & Breimer, D. D. (1991). Pharmacokinetics of rectal drug administration, Part I. General considerations and clinical applications of centrally acting drugs. *Clinical Pharmacokinetics*, 21(1), 11–26. <https://doi.org/10.2165/00003088-199121010-00002>
- Vodenkova, S., Buchler, T., Cervena, K., Veskrnova, V., Vodicka, P., & Vymetalkova, V. (2020). 5-fluorouracil and other fluoropyrimidines in colorectal cancer: Past, present and future. *Pharmacology & Therapeutics*, 206, 107447. <https://doi.org/10.1016/j.pharmthera.2019.107447>
- Ways, T. M. M., Lau, W., & Khutoryanskiy, V. (2018). Chitosan and Its Derivatives for Application in Mucoadhesive Drug Delivery Systems. *Polymers*, 10(3), 267. <https://doi.org/10.3390/polym10030267>
- Wen, Y., & Oh, J. K. (2014). Recent Strategies to Develop Polysaccharide-Based Nanomaterials for Biomedical Applications. *Macromolecular Rapid Communications*, 35(21), 1819–1832. <https://doi.org/10.1002/marc.201400406>

- Winther, J. R., & Thorpe, C. (2014). Quantification of thiols and disulfides. *Biochimica et Biophysica Acta (BBA) - General Subjects*, 1840(2), 838–846. <https://doi.org/10.1016/j.bbagen.2013.03.031>
- Wu, J., Chen, M., Shi, S., Wang, H., Li, N., Su, J., ... Wang, S. (2017). Hypoglycemic effect and mechanism of a pectic polysaccharide with hexenuronic acid from the fruits of *Ficus pumila* L. in C57BL/KsJ db/db mice. *Carbohydrate Polymers*, 178, 209–220. <https://doi.org/10.1016/j.carbpol.2017.09.050>
- Xiao, Y., & Du, J. (2020). Superparamagnetic nanoparticles for biomedical applications. *Journal of Materials Chemistry B*, 8(3), 354–367. <https://doi.org/10.1039/C9TB01955C>
- Xu, C., Tan, R. X., Zhang, J. S., & Mo, Y. (2008). Calcium Pectinate Capsules for Colon-Specific Drug Delivery. *Drug Development and Industrial Pharmacy*, 31(2), 127–134. <https://doi.org/10.1081/ddc-200046990>
- Xu, J., Tam, M., Samaei, S., Lerouge, S., Barralet, J., Stevenson, M. M., & Cerruti, M. (2017). Mucoadhesive chitosan hydrogels as rectal drug delivery vessels to treat ulcerative colitis. *Acta Biomaterialia*, 48, 247–257. <https://doi.org/10.1016/j.actbio.2016.10.026>
- Younes, I., & Rinaudo, M. (2015). Chitin and Chitosan Preparation from Marine Sources. Structure, Properties and Applications. *Marine Drugs*, 13(3), 1133–1174. <https://doi.org/10.3390/md13031133>
- Zaveri, T., Hayes, J., & Ziegler, G. (2014). Release of Tenofovir from Carrageenan-Based Vaginal Suppositories. *Pharmaceutics*, 6(3), 366–377. <https://doi.org/10.3390/pharmaceutics6030366>
- Zhang, W., Xu, P., & Zhang, H. (2015). Pectin in cancer therapy: A review. *Trends in Food Science & Technology*, 44(2), 258–271. <https://doi.org/10.1016/j.tifs.2015.04.001>
- Zhang, Y., Huo, M., Zhou, J., Zou, A., Li, W., Yao, C., & Xie, S. (2010). DDSolver: An Add-In Program for Modeling and Comparison of Drug Dissolution Profiles. *The AAPS Journal*, 12(3), 263–271. <https://doi.org/10.1208/s12248-010-9185-1>
- Zhu, J., Zhong, L., Chen, W., Song, Y., Qian, Z., Cao, X., ... Chen, W. (2019). Preparation and characterization of pectin/chitosan beads containing porous starch embedded with doxorubicin hydrochloride: A novel and simple colon targeted drug delivery system. *Food Hydrocolloids*, 95, 562–570. <https://doi.org/10.1016/j.foodhyd.2018.04.042>