

Paul Bennett Savage

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Department of Chemistry and Biochemistry

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Education

University of Wisconsin

Madison, Wisconsin

Doctor of Philosophy, Organic Chemistry, Biotechnology Minor, *1993*

Brigham Young University

Provo, Utah

Bachelor of Science, Chemistry, *1988*

Experience

University of Wisconsin

Madison, Wisconsin

Research Assistant, *1988 - 1993*

Advisor - Dr. Samuel H. Gellman

The Ohio State University

Columbus, Ohio

NIH Postdoctoral Fellow, *1993 - 1995*

Advisor - Dr. Leo A. Paquette

Brigham Young University

Provo, Utah

Assistant Professor, *1995 - 2000*

Associate Professor, *2000 - 2004*

Professor, *2004 - 2005*

Associate Chair, *2004 - 2010*

Reed M. Izatt Professor of Chemistry and Biochemistry, *2005 - present*

University Professor, *2020 - present*

Research Emphases: Development of non-peptide mimics of antimicrobial peptides and carbohydrate-based vaccines adjuvanted with a natural killer T cell antigen for generation of high-affinity antibodies targeting bacterial glycans.

Awards

- Karl G. Maeser Distinguished Faculty Lecturer, *2021*
- Reed M. Izatt and James J. Christensen Faculty Excellence in Research Award, *2010*
- Brigham Young University Sponsored Research Award, *2008*
- Brigham Young University Karl G. Maeser Research and Creative Arts Award, *2006*
- Stoel Rives Utah Innovation Award, Biotechnology, *2006*
- Brigham Young University Technology Transfer Award, *2005*
- Brigham Young University Karl G. Maeser Excellence in Teaching Award, *2004*
- Brigham Young University Creative Works Award, *2001*
- Brigham Young University Young Scholar Award, *2000*
- College of Physical and Mathematical Sciences Award for Excellence in Teaching, *1999*
- National Science Foundation CAREER Award, *1998 - 2002*
- Student Award for Excellence in Teaching-Department of Chemistry, *1997, 1998*
- National Institutes of Health Postdoctoral Fellowship, *1994 - 1995*
- National Research Service Award (Biotechnology Trainee), *1990 - 1993*

Publications (Authored and Coauthored)

262. Meng, T.; James, B.; Haymore, J.; Wang, R.; Gubler, S.; Taylor, S. A.; Finn, M. G.; Teyton, L.; Deng, S.; Savage, P. B. *Tetrahedron* **2024**, *165*, 134186. Synthesis of propargyl glycosides of *Streptococcus pneumoniae* serotypes 6A and 6B for glycoconjugate vaccines.
261. Karasinski, M.; Wnorowska, U.; Daniluk, T.; Deptula, P.; Luckiewicz, M.; Paprocka, P.; Durnas, B.; Sklodowski, K.; Sawczuk, B.; Savage, P. B.; Piktel, E.; Bucki, R. *Internat. J. Mol. Sci.* **2024**, *25*, 7036. Investigating the effectiveness of ceragenins against *Acinetobacter baumannii* to develop new antimicrobial and anti-adhesive strategies.
260. Constanzo, A.; Clarke, D.; Holt, M.; Sharma, S.; Nagy, K.; Tan, Z.; Kain, L.; Abe, B.; Luce, S.; Boitard, C.; Wyseure, T.; Mosnier, L. O.; Su, A. I.; Grimes, C.; Finn, M. G.; Savage, P. B.; Gottschalk, M.; Pettus, J.; Teyton, L. *J. Immunol.* **2024**, *212*, 1-11. Repositioning the early pathology of type 1 diabetes to the extraislet vasculature.
259. Wnorowska, U.; Lysik, D.; Piktel, E.; Zakrzewska, M.; Okla, S.; Lesiak, A.; Spalek, J.; Mystkowska, J.; Savage, P. B.; Janmey, P.; Fiedoruk, K.; Bucki, R. *PLOS One* **2024**, *19*, e0298112. Ceragenin-mediated disruption of *Pseudomonas aeruginosa* biofilms.
258. Czarnowski, M.; Slowinska, M.; Sawieljew, M.; Wnorowska, U.; Kaniluk, T.; Krol, G.; Karasinski, M.; Okla, S.; Savage, P. B.; Piktel, E.; Bucki, R. *Pharmaceuticals* **2024**, *17*, 204. Efficacy of ceragenins in controlling the growth of oral micro-organisms: implications for oral hygiene management.
257. Hacıoglu, M.; Yilmaz, F. N.; Oyardi, O.; Bozkurt-Guzel, Inan, N.; Savage, P. B.; Sibel, D. *Pharmaceuticals* **2023**, *16*, 1643. Antimicrobial activity of ceragenins against vancomycin-susceptible and -resistant *Enterococcus* spp.
256. Farnsworth, A. J.; Holland, K. M.; Zaugg, A. L.; Pauga, F.; Drake, S. M.; Savage, P. B.; Patterson, J. E. *SN Appl. Sci.* **2023**, *5*, 373. Enhanced shear strength of a medical adhesive due to an antimicrobial additive.
255. Slodowski, K.; Suprewicz, L.; Chmielewska-Deptula, S. J.; Kaliniak, S.; Okla, S.; Zakrzewska, M.; Minarows, L.; Mroz, R.; Daniluk, T.; Savage, P. B.; Fiedoruk, K.; Bucki, R. *Front. Microbiol.* **2023**, *14*, 1290952. Ceragenins exhibit bactericidal properties that are independent of the ionic strength in the environment mimicking cystic fibrosis sputum.
254. Zaugg, A.; Sherren, E.; Yi, R.; Larsen, T.; Dyck, B.; Stump, S.; Pauga, F.; Linder, A.; Takara, M.; Gardner, E.; Shin, S.; Pulsipher, J.; Savage, P. B. *Internat. J. Mol. Sci.* **2023**, *24*, 14923. Incorporating ceragenins into coatings protects peripherally inserted central catheter lines against pathogen colonization for multiple weeks.
253. Oyardi, O.; Demir, E. S.; Alkan, B.; Komec, S.; Genc, G. E.; Aygun, G.; Teke, L.; Turan, D.; Eturan, Z.; Savage, P. B.; Bozkurt-Güzel, C. *J. Fungi* **2023**, *9*, 9101026. Investigation of virulence factors, susceptibility to ceragenins, and the impact of biofilm formation on drug efficacy in *Candida auris* isolates from Türkiye.
252. Yilmaz, F. N.; Öksüz, L.; Demir, E. F.; Dösler, S.; Savage, P. B.; Bozkurt-Güzel, C. *Curr. Microbiol.* **2023**, *80*, 327. Efficacy of ceragenins alone and in combination with antibiotics against multidrug-resistant Gram-negative pathogens from bloodstream infections.
251. Suprewicz, L.; Szczepanski, A.; Lenart, M.; Piktel, E.; Fiedoruk, K.; Barreto-Duran, E.; Kula-Pacurar, A.; Savage, P. B.; Milewska, A.; Bucki, R.; Pryc, K. *Antiviral Res.* **2023**, *217*, 105676. Ceragenins exhibit antiviral activity against SARS-CoV-2 by increasing the expression and release of type I interferons upon activation of the host's immune response.
250. Prasad, S. V.; Fiedoruk, K.; Zakrzewska, M.; Savage, P. B.; Bucki, R. *Microbiol. Spectrum* **2023**, *11*, e01215-23. Glyoxylate shunt and pyruvate-to-acetoin shift are specific stress responses induced by colistin and ceragenin CSA-13 in *Enterobacter hormaechei* ST89.
249. Oyardi, O.; Eltimur, T.; Demir, E. S.; Alkan, B.; Savage, P. B.; Akcali, A.; Bozkurt-Guzel, C. *Curr. Microbiol.* **2023**, *80*, 210. Antibacterial and antibiofilm activities of ceragenins alone and in combination with levofloxacin against multidrug resistant *Myroides* spp. clinical isolates from patients with urinary tract infections.

248. Hodak, C. R.; Bescucci, D. M.; Shamash, K.; Kelly, L. C.; Montana, T.; Savage, P. B.; Inglis, G. D. *Animals* **2023**, *6*, 997. Antimicrobial growth promoters altered the function but not the structure of enteric bacterial communities in broiler chicks +/- microbiota transplantation.
247. Wnorowska, U.; Piktel, E.; Duptula, P.; Wollny, T.; Krol, G.; Gluszek, K.; Durnas, B.; Pogoda, K.; Savage, P. B.; Bucki, R. *Sci. Reports* **2022**, *12*, 19164. Ceragenin CSA-13 displays high antibacterial efficiency in a mouse model of urinary tract infection.
246. Dao, A.; McDonald, M. M.; Savage, P. B.; Little, D. G.; Schindeler, A. *J. Bone Oncol.* **2022**, *37*, 100460. Preventing osteolytic lesions and osteomyelitis in multiple myeloma.
245. Oyardi, O.; Savage, P. B.; Guzel, C. B. *Pathogens* **2022**, *11*, 1044. Effects of ceragenins and antimicrobial peptides on the A549 cell line and *in vitro* co-culture model of A549 cells and *Pseudomonas aeruginosa*.
244. Paprocka, P.; Mankowska, A.; Sklodowski, K.; Krol, G.; Wollny, T.; Lesaik, A.; Gluszek, K.; Savage, P. B.; Durnas, B.; Bucki, R. *Pathogens* **2022**, *11*, 621. Bactericidal activity of ceragenin in combination with ceftazidime, levofloxacin, co-trimoxazole, and colistin against the opportunistic pathogen *Stenotrophomonas maltophilia*.
243. Tokujuk, J.; Deptula, P.; Chmielewska, S. J.; Sklodowski, K.; Mierzejewska, Z. A.; Gradzka-Dahlke, M.; Tolstoj, A.; Daniluk, T.; Paprocka, P.; Savage, P. B.; Bucki, R. *Pathogens* **2022**, *11*, 491. Ceragenin CSA-44 as a means to control the formation of the biofilm on the surface of tooth and composite fillings.
242. Demir, E. S.; Oyardi, O.; Savage, P. B.; Altay, H. O.; Bozkurt-Guzel, C. *J. Antibiot.* **2022**, *75*, 403-409. In vitro activity of ceragenins against *Burkholderia cepacia* complex
241. Mitchell, G.; Silvis, M. R.; Talkington, K. C.; Budzik, J. M.; Dodd, C. E.; Paluba, J. M.; Oki, E. A.; Trotta, K. L.; Licht, D. J.; Jimenez-Morales, D.; Chou, S.; Savage, P. B.; Gross, C. A.; Marletta, M. A.; Cox, J. S. *mBio* **2022**, *13*, e02726. Ceragenins and antimicrobial peptides kill bacteria through distinct mechanisms.
240. Paprocka, P.; Durnas, B.; Mankowska, A.; Sklodowski, K.; Krol, G.; Zakrzewska, M.; Czarnowski, M.; Kot, P.; Fortunka, K.; Gozdz, S.; Savage, P. B.; Bucki, R. *Infect. Drug Resist.* **2021**, *14*, 5681-5698. New β -lactam antibiotics and ceragenins - A study to assess their potential in treatment of infections caused by multidrug-resistant strains of *Pseudomonas aeruginosa*.
239. Prasad, S. V.; Piktel, E.; Depcuich, J.; Maximenko, A.; Suprewicz, L.; Daniluk, T.; Spalek, J.; Wnorowska, U.; Zielinski, P. M.; Parlinska-Wojtan, M.; Savage, P. B.; Olka, S.; Fiedoruk, K.; Bucki, R. *Nanomedicine* **2021**, *16*, 2657-2678. Targeting bacteria causing otitis media using nanosystems containing nonspherical gold nanoparticles and ceragenins.
238. Skłodowski, K.; Chmielewska, S. J.; Depcuich, J.; Deptuła, P.; Piktel, E.; Daniluk, T.; Zakrzewska, M.; Czarnowski, M.; Cieśluk, M.; Durnaś, B.; Parlinska-Wojtan, M.; Savage, P. B.; Bucki, R. *Pharmaceutics* **2021**, *13*, 1940. Ceragenin-coated non-spherical gold nanoparticles as novel candidacidal agents.
237. Piktel, E.; Ościłowska, I.; Łukasz Suprewicz, Ł.; Depcuich, J.; Marcińczyk, N.; Chabielska, E.; Wolak, P.; Głuszek, K.; Klimek, J.; Zieliński, P. M.; Marzec, M. T.; Savage, P. B.; Parlińska-Wojtan, M.; Bucki, R. *Cancers*, **2021**, *13*, 5424. Peanut-shaped gold nanoparticles with shell of ceragenin CSA-131 display ability to inhibit ovarian cancer growth in vitro and in a tumor xenograft model.
236. Spalek, J.; Daniluk, T.; Godlewski, A.; Deptuła, P.; Wnorowska, U.; Ziembicka, D.; Cieśluk, M.; Fiedoruk, K.; Ciborowski, M.; Krętowski, A.; Góźdź, S.; Durnaś, B.; Savage, P. B.; Okła, S.; Bucki, R. *Pathogens* **2021**, *10*, 1371. Assessment of ceragenins in prevention of damage to voice prostheses caused by *Candida* biofilm formation.
235. Kamble, S.; Valtchev, P.; Dao, A.; Pelras, T.; Rogers, M. J.; Savage, P. B.; Dehghani, F.; Schindeler, A. *Molecules* **2021**, *26*, 1541. Synthesis and characterization of bone binding antibiotic-1 (BBA-1), a novel antimicrobial for orthopedic applications.
234. Chmielewska, S. J.; Sklodowski, K.; Depcuich, J.; Deptula, P.; Piktel, E.; Fiedoruk, K.; Kot, P.; Paprocka, P.; Fortunka, K.; Wollny, T.; Wolak, P.; Parlinska-Wojtan, M.; Savage, P. B.; Bucki, R. *Pharmaceutics* **2021**, *13*, 425. Bactericidal properties of rod-, peanut-, and star-shaped gold nanoparticles coated with ceragenin CSA-131 against multidrug-resistant bacterial strains.
233. Haynie, T.; Gubler, S.; Drees, C.; Heaton, T.; Mitton, T.; Gleave, Q.; Bendelac, A.; Deng, S.; Savage, P. B. *RCS Advances* **2021**, *11*, 14357-14361. Synthesis of the pentasaccharide repeating unit from *Ruminococcus gnavus* and measurement of its inflammatory properties.

232. Kirshbaum, C.; Greis, K.; Mucha, E.; Kain, S.; Deng, S.; Zappe, A.; Gewinner, S.; Schöllkopf W.; von Helden, G.; Meijer, G.; Savage, P. B.; Marianski, M.; Teyton, L.; Pagel, K. *Nat. Comm.* **2021**, *12*, 1201. Unravelling the structural complexity of glycolipids with cryogenic infrared spectroscopy.
231. Latorre, M. C.; Pérez-Granda, M. J.; Savage, P. G.; Alonso, B.; Martín-Rabadán, P.; Samaniego, R.; Bauzo, E.; Muñoz, P.; Guembe, M. *J. Antimicrob. Chemother.* **2021**, *76*, 1168-1173. Endotracheal tubes coated with a broad-spectrum antibacterial ceragenin reduce bacterial biofilm in an in vitro bench top model.
230. Oyardi, Ö, Savage, P. B.; Erturan, Z.; Bozkurt-Guzel, C. *J. Antimicrob. Chemother.* **2021**, *76*, 443-450. *In vitro* assessment of CSA-131 and CSA-131 poloxamer form for the treatment of *Stenotrophomonas maltophilia* infections in cystic fibrosis.
229. Choi, J.; Mele, T. S.; Porcelli, S. A.; Savage, P. B.; Haeryfar, S. M. M. *J. Immunol.* **2021**, *206*, 386-397. Harnessing the versatility of iNKT cells in a step-wise approach to sepsis immunotherapy.
228. Chmielewska, S. J.; Sklodowski, D.; Piktel, E.; Suprewicz, L.; Fiedoruk, K.; Daniluk, T.; Wolak, P.; Savage, P. B.; Bucki, R. *Infect. Drug Resist.* **2020**, *13*, 3277-3294. NDM-1 carbapenemase-producing *Enterobacteriaceae* are highly susceptible to ceragenins CSA-13, CSA-44, and CSA-131.
227. Damar-Celik, D.; Mataraci-Kara, E.; Savage, P. B.; Ozbek-Celik, B. *J. Chemother.* **2020**, doi.org/10.1080/1120009X.2020.1819702. Antibacterial and antibiofilm activities of ceragenins against *Achromobacter* species isolated from cystic fibrosis patients.
226. Iweala, O. I.; Choudhary, S. K.; Addison, C. T.; Batty, C. J.; Kapita, C. M.; Amelio, C.; Schuyler, A.; Deng, S.; Bachelder, E. M.; Ainslie, K. M.; Savage, P. B.; Brennan, P. J.; Commins, S. P. *J. Allergy Clin Immunol.* **2020**, *146*, 450-452. Glycolipid-mediated basophil activation in alpha-gal allergy.
225. Piktel, E.; Markiewicz, K. H.; Wilczewska, A. Z.; Daniluk, T.; Chmielewska, S.; Niemorowicz-Laskowska, K.; Mystkowska, J.; Paprocka, P.; Savage, P. B.; Bucki R. *Int. J. Nanomed.* **2020**, *15*, 4573-4589. Quantification of synergistic effects of ceragenin CSA-131 combined with iron oxide magnetic nanoparticles against cancer cells.
224. Bozkurt Guzel, C.; Avci, N. M.; Savage, P. B. *Turkish J. Pharma. Sci.* **2020**, *17*, 63-67. *In vitro* activities of the cationic steroid antibiotics CSA-13, CSA-131, CSA-138, CSA-142, and CSA-192 against carbapenem-resistant *Pseudomonas aeruginosa*.
223. Alehashem, M. S.; Bin Ariffin, A.; Savage, P. B.; Dabdawb, W. A. Y.; Thomas, N. F. *RSC Adv.* **2020**, *10*, 10989-11012. Treasures old and new: what we can learn regarding the macrocyclic problem from past and present efforts in natural product total synthesis.
222. Bozkurt-Guzel, C.; Inci, G.; Oyardi, O.; Savage, P. B. *Curr. Microbiol.* **2020**, *77*, 1419-1428. Synergistic activity of ceragenins against carbapenem-resistant *Acinetobacter baumannii* strains in both checkerboard and dynamic time-kill assays.
221. Hacıoglu, M.; Oyardi, O.; Bozkurt-Guzel, C.; Savage, P. B. *J. Antibiotics* **2020**, *73*, 455-462. Antibiofilm activities of ceragenins and antimicrobial peptides against fungal-bacterial mono and multispecies biofilms.
220. Mills, R. J.; Boyling, A.; Cheng, T. L.; Peacock, L.; Savage, P. B.; Tagin, M.; Little, D. G.; Schindeler, A. *J. Orthopaedic Res.* **2020**, *38*, 2065-2073. CSA-90 reduces periprosthetic joint infection in a novel rat model challenged with local and systemic *Staphylococcus aureus*.
219. Dao, A.; Mills, R. J.; Kamble, S.; Savage, P. B.; Little, D. G.; Schindeler, A. *J. Orthopaedic Res.* **2020**, *38*, 1883-1894. The application of ceragenins to orthopedic surgery and medicine.
218. Iweala, O. I.; Choudhary, S. K.; Addison, C. T.; Batty, C. J.; Kapita, C. M.; Amelio, C. I.; Schuyler, A. J.; Deng, S.; Bachelder, E. M.; Ainslie, K. M.; Savage, P. B.; Brennan, P. J.; Commins, S. P. *J. Allergy Clin Immunol.* **2020**, *146*, 450-452. Glycolipid-mediated basophil activation in alpha-gal allergy.
217. Wnorowska, U.; Fiedoruk, K.; Piktel, E.; Prasad, S. V.; Sulik, M.; Janion, M.; Daniluk, T.; Savage, P. B.; Bucki, R. *J. Nanobiotech.* **2020**, *18*, 3. Nanoantibiotics containing membrane-active human cathelicidin LL-37 or synthetic ceragenins attached to the surface of magnetic nanoparticles as novel and innovative therapeutic tools: current status and potential future applications.
216. Bozkurt-Guzel, C.; Hacıoglu, M.; Inci, G.; Savage, P. B. *Turkish J. Pharma. Sci.* **2019**, *16*, 444-449. Antibacterial and antibiofilm activities of ceragenins against *Pseudomonas aeruginosa* clinical isolates.

215. Ozbek-Celik, B.; Damar-Celik, D.; Mataraci-Kara, E.; Bozkurt-Guzel, C.; Savage, P. B. *Antibiotics* **2019**, *8*, 130. Comparative *in vitro* activities of first and second-generation ceragenins alone and in combination with antibiotics against multidrug-resistant *Klebsiella pneumoniae* strains.
214. Hacıoglu, M.; Hacıosmanoglu, E.; Birteksoz-Tan, A. S.; Bozkurt-Guzel, C.; Savage, P. B. *Diag. Microbiol. Infect. Dis.* **2019**, *93*, 114863. Effects of ceragenins and conventional antimicrobials on *Candida albicans* and *Staphylococcus aureus* mono and multispecies biofilms.
213. Pereira, C.; Pérez-Cabezas, B.; Ribeiro, H.; Maia, L.; Cardoso, T.; Dias, A. F.; Azevedo, O.; Ferreira, F.; Garcia, P.; Rodrigues, E.; Chaves, P.; Martins, P.; Pineda, M.; Amraoui, Y.; Fecarotta, S.; Leão-Teles, E.; Deng, S.; Savage, P. B.; Macedo, F. *Front. Immunol.* **2019**, *10*, 1264. Lipid antigen presentation by CD1b and CD1d in lysosomal storage disease patients.
212. Ghosh, S.; Gabrielle, J.; Korza, G.; He, L.; Yuan, J.-H.; Dong, W.; Setlow, B.; Li, Y.-Q. Savage, P. B.; Setlow, P. *J. Appl. Microbiol.* **2019**, *127*, 109-120. Effects of the microbicide ceragenin CSA-13 on and properties of *Bacillus subtilis* spores prepared on two very different media.
211. Bandara, N.; Li, Y.; Diebolder, P.; Mpoy, C.; Gu, X.; Khanal, P.; Deng, S.; Rogers, B. E., Savage, P. B. *RCS Advances* **2019**, *9*, 14472-14476. Translation of ceragenin affinity for bacteria to an imaging reagent for infection.
210. Wnorowska, U.; Piktel, E.; Durnas, B.; Fiedoruk, K.; Savage, P. B.; Bucki, R. *BMC Infectious Diseases* **2019**, *19*, UNSP 369. Use of ceragenins as a potential treatment for urinary tract infections.
209. Birteksoz-Tan, A. S.; Zuhail, Z.; Hacıoglu, M.; Savage, P. B.; Bozkurt-Guzel, C. *J. Antibiotics* **2019**, *72*, 291-297. *In vitro* activities of antimicrobial peptides and ceragenins against *Legionella pneumophila*.
208. Durnás, B.; Fiedoruk, K.; Ciesluk, M.; Deptula, P.; Król, G.; Piktel, E.; Savage, P. B.; Bucki, R. *Med. Studies* **2019**, *35*, 1-9. Lysozyme increases bactericidal activity of ceragenin CSA-13 against *Bacillus subtilis*.
207. Teyton, L.; Finn M. G.; Savage, P. B.; Polonskaya, Z. *Curr. Opin. Immunol.* **2019**, *59*, 65-71. High-affinity anti-glycan antibodies: challenges and strategies.
206. Hashemi, M. M.; Holden, B. S.; Coburn, J.; Taylor, M. F.; Weber, S.; Hilton, B.; Zaugg, A. L.; McEwan, C.; Carson, R.; Anderson, J. L.; Price, J. C.; Deng, S.; Savage, P. B. *Frontiers Microbiol.* **2019**, *10*, 210. Proteomic analysis of resistance of Gram-negative bacteria to chlorhexidine and impacts on susceptibility to colistin, antimicrobial peptides and ceragenins.
205. Chuang, Y.-T.; Leung, K.; Chang, Y.-J.; DeKruyff, R. H.; Savage, P. B.; Cruse, R.; Benoit, C.; Elewaut, D.; Baumbarth, N.; Umetsu, D. T. *J. Allergy Clin. Immunol.* **2019**, *143*, 565-576. A natural killer T-cell subset that protects against airway hyperreactivity.
204. Hacıoglu, M.; Bozkurt-Guzel, C. B.; Savage, P. B.; Tan, A. S. B. *Med. Mycol.* **2019**, *57*, 291-299. Antifungal susceptibilities, *in vitro* production of virulence factors and activities of ceragenins against *Candida* spp. isolated from vulvovaginal candidiasis.
203. Bozkurt-Gozel, C.; Oyardi, O.; Savage, P. B. *J. Chemother.* **2018**, *30*, 332-227. Comparative *in vitro* antimicrobial activities of CSA-142 and CSA-192, second-generation ceragenins, with CSA-13 against various microorganisms.
202. Piktel, E.; Prokop, I.; Wnorowska, U.; Krol, G.; Ciesluk, M.; Niemirowicz, K.; Savage, P. B.; Bucki R. *Oncotarget* **2018**, *9*, 21904-21920. Ceragenin CSA-13 as free molecules and attached to magnetic nanoparticle surfaces induce caspase-dependent apoptosis in human breast cancer cells via disruption of cell oxidative balance.
201. Hashemi, M. M.; Mmuoegbulam, A. O.; Holden, B. S.; Coburn, J.; Wilson, J.; Taylor, M. F.; Reiley, J.; Baradaran, D.; Stenquist, T.; Deng, S.; Savage, P. B. *Internat. J. Environ. Res. Public Health* **2018**, *15*, 2758. Susceptibility of multidrug-resistant bacteria, isolated from water and plants in Nigeria, to ceragenins.
200. Schmid, H.; Schneidawind, C.; Jahnke, S.; Kettermann, F.; Secker K.-A.; Duerr-Stoerzer, S.; Keppeler, H.; Kanz, L.; Savage, P. B.; Scheidawind, D. *Frontiers Immunol.* **2018**, *9*, 1817. Culture-expanded human invariant natural killer T cells suppress T-cell alloreactivity and eradicate leukemia.
199. Bozkurt-Gozel, C.; Hacıoclu, M.; Savage, P. B. *Diag. Microbiol. Infect. Dis.* **2018**, *91*, 324-330. Investigation of the *in vitro* antifungal and antibiofilm activities of ceragenins CSA-8, CSA-13, CSA-44, CSA-131 and CSA-138 against *Candida* species.

198. Mills, R.; Cheng, T. L.; Mikulec, K.; Peacock, L.; Isaacs, D.; Genberg, C.; Savage, P. B.; Little, D. G.; Schindeler, A. *Clin. Orthoped. Rel. Res.* **2018**, *476*, 1311-1323. CSA-90 promotes bone formation and mitigates methicillin-resistant *Staphylococcus aureus* infection in a rat open fracture model.
197. Hashemi, M. M.; Holden, B. S.; Taylor, M. F.; Wilson, J.; Coburn, J.; Hilton, B.; Nance, T.; Gubler, S.; Genberg, C.; Deng, S.; Savage, P. B. *Molecules* **2018**, *23*, 596. Antibacterial and antifungal activities of poloxamer micelles containing ceragenin CSA-131 on ciliated tissues.
196. Bucki, R.; Durnás, B.; Watek, M.; Piktel, W.; Cruz, K.; Wolak, P.; Savage, P. B.; Janmey, P. A. *Infect. Drug Resist.* **2018**, *11*, 77-86. Targeting polyelectrolyte networks in purulent body fluids to modulate bactericidal properties of some antibiotics.
195. Hashemi, M. M.; Rovig, J.; Bateman, J.; Holden, B. S.; Modzelewski, T.; Gueorguieva, I.; von Dyck, M.; Bracken, R.; Genberg, C.; Deng, S.; Savage, P. B. *J. Antimicrob. Chemother.* **2018**, *73*, 143-150. Preclinical testing of a broad-spectrum antimicrobial endotracheal tube coated with an innate immune synthetic mimic.
194. Hashemi, M. M.; Rovig, J.; Holden, B. S.; Taylor, M. F.; Weber, S.; Wilson, J.; Hilton, B.; Zaugg, A. L.; Ellis, S. W.; Yost, C. D.; Finnegan, P. M.; Kistler, C. K.; Berkow, E. L.; Deng, S.; Lockhart, S. R.; Peterson, M.; Savage, P. B. *J. Antimicrob. Chemother.* **2018**, *73*, 1537-1545. Ceragenins are active against drug-resistant *Candida auris* clinical isolates in planktonic and biofilm forms.
193. Piktel, E.; Pogoda, K.; Savage, P. B.; Bucki, R. *Future Microbiol.* **2017**, *12*, 735-737. The search for new sporicidal agents for medical use: where are we?
192. Niemirowicz, K.; Durnás, B.; Tokajuk, G.; Piktel, E.; Michalak, G.; Gu, X.; Kulakowska, A.; Savage, P. B.; Bucki, R. *Sci. Reports* **2017**, *7*, 4610. Formulation and candidacidal activity of magnetic nanoparticles coated with cathelicidin LL-37 and ceragenin CSA-13.
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