

# 2021 SCIENCE DIVISION WRAP-UP

Advancing Science at the Denver Museum of Nature & Science

## COLLECTIONS ACTIVITY

- 103 accessions
- 4 deaccessions
- 83 outgoing loans (5,066 objects)
- 19 incoming loans (862 objects)
- 163 on-site researchers hosted
- 310 virtual research requests fulfilled

## GRANTS

- \$3,582,820 submitted
- \$1,043,215 awarded\*
- \$464,602 pending

\*includes 2020 grant submissions awarded in 2021

## OUTREACH

- 302 virtual presentations, serving 61,872 people
  - 119 internal presentations, serving 29,615
  - 183 external presentations, serving 32,257
- 152 other experiences reached 4,226 people (e.g., classes, in-person talks, tours, open houses, event tables, trainings, fieldtrips. etc.)
- In addition, the revamped [Science](#) section of the DMNS website received lots of attention, with over 110,293 unique views!

## PUBLICATIONS

The Science Division published 38 peer-reviewed journal articles, edited volumes, books, and book chapters in 2021, listed on the following pages.

## COLORADO SPRINGS RESEARCH PROJECT

The CSP team spent 40 days in the field, published three peer-reviewed scientific papers, submitted three additional scientific papers, participated in a French documentary that will air Spring of 2022, provided a field experience for 10 interns, and collected hundreds of new fossils. Click [here](#) for the full project update.

# 2021 SCIENCE DIVISION PUBLICATIONS

Advancing Science at the Denver Museum of Nature & Science

- Ahrens, D., Ahyong, S.T., Ballerio, A., Barclay, M.V.L., Eberle, J., Espeland, E., Huber, B.A., Mengual, X., Pacheco, T.L., Peters, R.S., Rulik, B., Vaz-de-Mello, F., Wesener, T. & **Krell, F.-T.** 2021. Is it time to describe new species without diagnoses? - A comment on Sharkey et al. *Zootaxa*, 5027(2): 151-159. <https://doi.org/10.11646/zootaxa.5027.2.1>
- Blais, B. R., Smith, B. E., Placyk Jr., J. S., Casper, G. S. & **Spellman, G. M.** 2021. Phylogeography of the smooth greensnake, *Ophiodrys vernalis* (Squamata: Colubridae): divergent lineages and variable demographics in a widely distributed yet enigmatic species. *Biological Journal of the Linnean Society* 134(4): 940-957. <https://doi.org/10.1093/biolinnean/blab124>
- Carpenter, A. M., Graham, B. A., **Spellman, G. M.**, Klicka, J. & Burg, T. M. 2021. Genetic, bioacoustics and morphological analyses reveal cryptic speciation in the warbling vireo complex (*Vireo gilvus*: Vireonidae: Passeriformes). *Zoological Journal of the Linnean Society*: zlab036. <https://doi.org/10.1093/zoolinnean/zlab036>
- Fabbri, M., Navalón, G., Mongiardino Koch, N., Hanson, M., **Petermann, H.** & Bhullar, B.-A. 2021. A shift in ontogenetic timing produced the unique sauropod skull. *Evolution* 75: 819-831. <https://doi.org/10.1111/evo.14190>
- Gates, T. A., Evans, D. C., **Sertich, J. J. W.** 2021. Description and rediagnosis of the crested hadrosaurid (Ornithopoda) dinosaur *Parasaurolophus cyrtocristatus* on the basis of new cranial remains. *PeerJ* 9: e10669. <https://doi.org/10.7717/peerj.10669>
- Gent, V. A., Longman, M. W., Bottjer, R. J. & **Hagadorn, J. W.** 2021. Stratigraphic distribution of the Codell Sandstone in the Denver Basin using wireline logs and core. *The Mountain Geologist* 58(3): 305-330. <https://doi.org/10.31582/rmag.mg.58.3.305>
- Graham, M. R., **Garcia, E. L.**, Hendrixson, B. E. & **Cushing, P.E.** 2021. Pliocene origins, Pleistocene refugia, and postglacial range expansions in southern devil scorpions (Vaejovidae: *Vaejovis carolinianus*). *Organisms Diversity & Evolution* 21: 575-590. <https://doi.org/10.1007/s13127-021-00505-z>
- Hagadorn, J. W.**, Longman, M. W., Bottjer, R. J., Gent, V. A., Holm-Denoma, C. S. & Sumrall, J. B. 2021. The type section of the Codell Sandstone. *The Mountain Geologist* 58(3): 211-248. <https://doi.org/10.31582/rmag.mg.58.3.211>
- Hinojosa, L., Riedy, R., Polman, J., Swanson, R., **Nuessle, T.** & Garneau, N. 2021. Expanding Public Participation in Science Practices Beyond Data Collection. *Citizen Science: Theory and Practice* 6(1): 11. <https://doi.org/10.5334/cstp.292>

- Hodgin, E. B., Nelson, L. L., Wall, C. J., Barron-Diaz, A. J., Webb, L. C., Schmitz, M. D., Fike, D. A., **Hagadorn, J. W.** & Smith, E. F. 2021. A link between rift-related volcanism and end-Ediacaran extinction? Integrated chemostratigraphy, biostratigraphy, and U-Pb geochronology from Sonora, Mexico. *Geology* 49: 115-119. <https://doi.org/10.1130/G47972.1>
- Jones, R. R. & Cushing, P. E.** 2021. An assessment of function, intraspecific variation, and taxonomic reliability of eremobatid ctenidia (Arachnida: Solifugae). *Zoologischer Anzeiger* 295: 43-54. <https://doi.org/10.1016/j.jcz.2021.09.002>
- Joyce, W. G., Anquetin, J., Cadena, E.-A., Claude, J., Danilov, I. G., Evers, S. W., Ferrera, G. S., Gentry, A. D., Georgalis, G. L., **Lyson, T. R.**, Perez-Garcia, A., Rabi, M., Sterli, J., Vitek, N. S. & Parham, J. F. 2021. A nomenclature for fossil and living turtles using phylogenetically defined clade names. *Swiss Journal of Palaeontology* 140: 1-45. <https://doi.org/10.1186/s13358-020-00211-x>
- Joyce, W. G., Rollot, Y., Evers, S. W., **Lyson, T. R.**, Rahantarisoa, L. J. & **Krause, D. W.** 2021. A new pelomedusoid turtle, *Sahonachelys mailakavava*, from the Late Cretaceous of Madagascar provides evidence for convergent evolution of specialized suction feeding among pleurodires. *Royal Society Open Science* 8: 210098. <http://doi.org/10.1098/rsos.210098>
- Koons, M.** & Arbuckle MacLeod, C., eds. 2021. *The Egyptian Mummies and Coffins of the Denver Museum of Nature & Science*. Louisville, CO: *University Press of Colorado*. 218 pp.
- Koons, M. L., Mitchell, M. D.**, Hernandez-Bravo, M., **Hitte, T., Moss Logan, J. & Baxter, E.** 2021. The Magic Mountain community archaeology project. *Journal of Community Archaeology & Heritage*. <https://doi.org/10.1080/20518196.2021.1972560>
- Krause, D. W.**, Hoffmann, S., **Lyson T. R., Dougan, L. G., Petermann, H.**, Tezca, A., Chester, S. G. B. & **Miller, I. M.** 2021. New skull material of *Taeniolabis taoensis* (Multituberculata, Taeniolabidae) from the early Paleocene (Danian) of the Denver Basin, Colorado. *Journal of Mammalian Evolution* 28: 1083-1143. <https://doi.org/10.1007/s10914-021-09584-3>
- Krell, F.-T.** 2021. Suppressing works of contemporary authors using the Code's publication requirements is neither easy nor advisable. *Bulletin of Zoological Nomenclature* 78: 61–67. <https://doi.org/10.21805/bzn.v78.a021>
- Krell, F.-T.** 2021. Taxonomy and distribution of *Orubesa* in the Arabian Peninsula and surrounding areas (Coleoptera: Scarabaeoidea). *Zoology in the Middle East* 67(4): 332-343. <https://doi.org/10.1080/09397140.2021.1957209>
- Krell, F.-T.** & Vitali, F. 2021. Attenborough's Beauty: exceptional pattern preservation in a frog-legged leaf beetle from the Eocene Green River Formation, Colorado (Coleoptera: Chrysomelidae: Sagrinae). *Papers in Palaeontology* 7: 2101-2112. <https://doi.org/10.1002/spp2.1398>

- Longman, M. W., **Hagadorn, J. W.** & Gent, V. A. 2021. Sedimentology, petrography and deposition of the Upper Cretaceous Codell Sandstone in the Denver Basin. *The Mountain Geologist* 58: 249-304. <https://doi.org/10.31582/rmag.mg.58.3.249>
- Lyson, T. R., Petermann, H. & Miller, I. M.** 2021. A new plastomenid trionychid turtle, *Plastomenus joycei*, sp. nov. from the earliest Paleocene (Danian) Denver Formation of south-central Colorado, U.S.A. *Journal of Vertebrate Paleontology* 41:1. <https://doi.org/10.1080/02724634.2021.1913600>
- Lyson, T. R., Petermann, H., Toth, N., Bastien, S., & Miller, I. M.** 2021. A new baenid turtle, *Palatobaena knellerorum*, sp. nov. from the lower Paleocene (Danian) Denver Formation of south-central Colorado, U.S.A. *Journal of Vertebrate Paleontology* 41:2. <https://doi.org/10.1080/02724634.2021.1925558>
- Manthey, J. D., Klicka, J., **Spellman, G. M.** 2021. The Genomic Signature of Allopatric Speciation in a Songbird Is Shaped by Genome Architecture (Aves: *Certhia americana*). *Genome Biology and Evolution* 13(8):evab120. <https://doi-org.aurarialibrary.idm.oclc.org/10.1093/gbe/evab120>
- Maccracken, S. A., Sohn, J-C., **Miller, I. M.** & Labandeira, C. C. 2021. A new Late Cretaceous leaf mine *Leucopterospa spirala* gen. et sp. nov. (Lepidoptera: Lyonetiidae) represents the first confirmed fossil evidence of the Cemiostominae. *Journal of Systematic Palaeontology* 19(2): 131-144. <https://doi.org/10.1080/14772019.2021.1881177>
- Nash, S. E.**, Towner, R. H. & Dean J. S. 2021. The Curious Douglas-Fir (*Pseudotsuga Menziesii*) Trees in Schulman Grove, Mesa Verde National Park, Southwestern Colorado, U.S.A. *American Antiquity* 86(3): 549-568. <https://doi.org/10.1017/aaq.2021.4>
- Oser, S. E., Chin, K., **Sertich, J. J. W.**, Varricchio, D. J., Choi, S. & Rifkin, J. 2021. Tiny, ornamented eggs and eggshell from the Upper Cretaceous of Utah represent a new ootaxon with theropod affinities. *Scientific Reports* 11:10021. <https://doi.org/10.1038/s41598-021-89472-1>
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- Robison, H. W., Tumlison, C. R., **Cushing, P. E.** & Dorris, P. R. 2021. An updated checklist of the spiders (Arachnida: Araneae) of Arkansas. *Journal of the Arkansas Academy of Science* 75(5). <https://doi.org/10.54119/jaas.2021.7516>
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- Salem, B. S., O'Connor, P. M., Gorscak, E., El-Sayed, S., **Sertich, J. J. W.**, Seiffert, E. & Sallam, H. M. 2021. Dinosaur remains from the Upper Cretaceous (Campanian) of the Western Desert, Egypt. *Cretaceous Research* 123: 104783. <https://doi.org/10.1016/j.cretres.2021.104783>

- Santibáñez-López, C. E., **Cushing, P. E.**, Powell, A. M. & Graham, M. R. 2021. Diversification and post-glacial range expansion of giant North American camel spiders in genus *Eremocosta* (Solifugae: Eremobatidae). *Scientific Reports* 11: 22093. <https://doi.org/10.1038/s41598-021-01555-1>
- Santibáñez-López, C. E., Farleigh, K., **Cushing, P. E.** & Graham, M. R. 2021. Restriction enzyme optimization for RADseq with camel spiders (Arachnida: Solifugae). *Journal of Arachnology* 48(3): 346-350. <https://doi.org/10.1636/JoA-S-20-040>
- Sarver, B. A. J., Herrera, N. D., Sneddon, D., Hunter, S. S., Settles, M. L., Kronenberg, Z., **Demboski, J. R.**, Good, J. M. & Sullivan, J. 2021. Diversification, Introgression, and Rampant Cytonuclear Discordance in Rocky Mountains Chipmunks (Sciuridae: *Tamias*). *Systematic Biology* 70(5): 908-921. <https://doi.org/10.1093/sysbio/syaa085>
- Schultze, H.-P., Bullecks, J., Soar, L. K. & **Hagadorn, J. W.** 2021. Devonian fish from Colorado's Dyer Formation and the appearance of Carboniferous faunas in the Famennian. Pp. 247-256 in Pradel, A., Denton, J. S. S., and Janvier, P., eds., *Ancient Fishes and their living relatives: A tribute to John G Maisey*. Munich: *Verlag Dr. Friedrich Pfeil*.
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- Titus, A. L., Knoll, K., **Sertich, J. J. W.**, Yamamura, D., Suarez, C. A., Glasspool, I. J., Ginouves, J. E., Lukacic, A. K., Roberts, E. M. 2021. Geology and taphonomy of a unique tyrannosaurid bonebed from the upper Campanian Kaiparowits Formation of southern Utah: implications for tyrannosaurid gregariousness. *PeerJ* 9:e11013. <https://doi.org/10.7717/peerj.11013>
- Woodruff, D. C., Goodwin, M. B., **Lyson, T. R.** & Evans, D. C. 2021. Ontogeny and variation of the pachycephalosaurine dinosaur *Sphaerotholus buchholtzae*, and its systematics within the genus. *Zoological Journal of the Linnean Society*: zlaa179. <https://doi.org/10.1093/zoolinnean/zlaa179>
- Ziani, S., Bezděk, A., **Krell, F.-T.** & Sommer, D. 2021. Authorship and date of publication of the name *Scarabaeus stercorosus* (currently *Anoplotrupes stercorosus*) (Coleoptera: Scarabaeoidea: Geotrupidae). *Zootaxa* 5067(4): 593–599. <https://doi.org/10.11646/zootaxa.5067.4>