Kartik Sunagar

Associate Professor · Evolutionary Biologist

Centre for Ecological Sciences

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Academic Positions

2017-Present	**Indian Institute of Science**, Bangalore, India	*Associate Professor*
2022-Present	**Institute of Bioinformatics and Applied Biotechnology**, Bangalore, India	*Adjunct Faculty*
2022-Present	**VISHAM: Venom Institute for Snakebite Health and Advanced Medicine**, Bangalore, India	*Director*
2015 - 2017	**The Hebrew University of Jerusalem**, Jerusalem, Israel	*Guest Scientist*

Education

University of Porto — *Porto, Portugal*

PhD, Evolutionary Biology — *December, 2013*

- Distinction
- Equivalent to Summa cum laude

Karnataka University — *Karnataka, India*

Master of Science, Applied Genetics — *August, 2008*

- Distinction, 1st Rank

Karnataka University — *Karnataka, India*

Bachelor of Science, Genetics, Chemistry and Zoology — *August, 2006*

- Distinction, 1st Rank (Genetics)

Awards and Fellowships

2019	**Wellcome Trust DBT India Alliance**, Intermediate Fellowship	*India*
2018	**Ramanujan Fellowship**, Science and Engineering Research Board	*India*
2023	**Professor Har Swarup Memorial Award**, Indian National Science Academy	*India*
2020	**INSA Medal for Young Scientist**, Indian National Science Academy	*India*
2017	**INSPIRE Faculty Award**, Department of Science and Technology	*India*
2021	**Merck Young Scientist Award**, Merck	*India*
2015	**Marie Skłodowska-Curie Individual Fellowship**, European Commission	
2015	**Discovery Early Career Researcher Award**, Australian Research Council	*Australia*
2018	**Gyandeep Award for excellence in scientific research**, Department of Forest for the Maharashtra State	*India*
2016	**Toxins Travel Award**, MDPI	
2014	**PBC Fellowship for Outstanding Postdoctoral Researchers from India**, The Hebrew University of Jerusalem	*Israel*
2014	**Lady Davis postdoctoral fellowship**, The Hebrew University of Jerusalem	*Israel*
2014	**Postdoctoral Fellowship**, The Hebrew University of Jerusalem	*Israel*
2014	**BIOL external Discovery Early Career Researcher Award (DECRA) travel grant**, University of Queensland	*Australia*
2016	**Young investigators registration reimbursement award**, The Society for Molecular Biology and Evolution	
2014	**Postdoctoral fellowship**, Foundation for Science and Technology, PTDC/MAR/115199/2009	*Portugal*
2014	**Postdoctoral fellowship**, Foundation for Science and Technology, PTDC/AAC-AMB/121301/2010	*Portugal*
2010	**Doctoral fellowship**, Foundation for Science and Technology	*Portugal*

Recognition

2021	**Snakebite Envenoming Roster of Experts and Technical Advisory Group**, World Health Organization
2024	**Expert Committee**, National Programme for Prevention and Control of Snakebite Envenoming in India, Ministry of Health and Family Welfare, Government of India.
2023	**Expert Advisory Committee**, National Action Plan for prevention and control of snakebite envenoming (NAP-SE), National Centre for Disease Control, Directorate General of Health Services, Ministry of Health and Family Welfare, Government of India.
2022	**Special Technical Advisory Committee**, Aquaculture and Marine Biotechnology, Department of Biotechnology
2022	**Advisory Committee**, Department of Atomic Energy and Maharashtra Government to develop Haffkine Institute
2022	**Expert Advisory Committee**, ICMR Centre for Advance Research of Excellence on Snakebite
2022	**Expert Advisory Committee**, National Task Force for Research on Snakebite in India, Indian Council of Medical Research (ICMR)
2024-Present	**Key Opinion Leader on snakebite and antivenom.**, George Clinical,
2018	**Technical Advisory Committee**, Indian Pharmacopoeia Commission
2021-2023	**Deputy Editor**, PLoS Neglected Tropical Diseases
2021-Present	**Guest Associate Editor**, Frontiers in Tropical Diseases
2015-2021	**Editorial Board Member**, Toxins MDPI
2021	**Guest Editor**, Frontiers in ecology and evolution.
2021-Present	**Steering Committee**, The Snakebite Research Network
2019-Present	**Executive board member**, Indian Society for Toxinology and Snakebite Mitigation
2018	**Advisory board**, Snakebite healing and education society
2018	**Advisory board**, ToxiVen Biotech Pvt. Ltd
2021-2022	**Deputy Editor**, PLOS Neglected Tropical Diseases.
2021-Present	**Guest Editor**, Journal of Biosciences
2022	**Guest Associate Editor**, Frontiers in ecology and evolution. Chemical Ecology section.
2022	**Review Editor**, Frontiers in Tropical Diseases: Neglected Tropical Diseases
2015-2020	**Editorial board member**, Toxins, Animal Venoms section
	Plenary/keynote talks/Chair, Gordon Research Conference (2023, 2024); World Congress of the International Toxinology Society (2015, 2022, 2024), Annual Meeting of Proteomics Society of India (2023), etc.

Contribution to academia

Review manuscripts for

Science, Nature, Nature Communications, PNAS, Molecular Biology and Evolution, GigaScience, Genome Biology and Evolution, Frontiers in Immunology, PLOS Neglected Tropical Diseases, Scientific Reports, BMC Evolutionary Biology, BMC Genomics, G3: Genes, Genomes, Genetics, Current Medicinal Chemistry, Journal of Proteomics, Toxins, Toxicon, FEBS Letters, Biochemie, Molecules, Theoretical Ecology, Journal of Molecular Evolution, PLoS One, Comparative Biochemistry and

Physiology Part C, MDPI Insects, Current Science, and Herpetological Journal.

Review grant proposals for European Research Council, National Science Foundation (USA), Wellcome Trust, European Research Council (ERC), The Natural Environment Research Council (UK), Wellcome Trust DBT India Alliance, Australian Research Council, The Science Foundation Ireland, Department of Biotechnology, Department of Science and Technology, Rufford Small Grants Foundation

Research Funding

Total: Rs. 39,45,49,187

S.No.	Grant	Funding	Duration	Role
1.	Discovery and expression of recombinant camelid antibodies against 'Big Four' Indian snakes for snakebite diagnosis and treatment. **Indian Council of Medical Research (ICMR)**, India.	₹7,00,00,000	01.11.2025 to 01.11.2029	Principal Investigator
1.	Production of India's first regional antivenom. **Bharat Serums Ltd.**, India.	₹14,96,940	01.08.2022 to 01.08.2023	Principal Investigator
2.	Cross-neutralisation potential of PANF African 14 antivenoms. **Premium Serums**, India.	₹9,07,029	01.12.2021 to 01.12.2022	Principal Investigator
3.	Venomics and antivenomics of medically important African snakes. **VINS Bio Products Ltd.**, India.	₹15,53,420	01.11.2021 to 01.11.2022	Principal Investigator
4.	Detection of biting snake species from clinical samples. **The Hamish Ogston Foundation**, UK.	₹78,00,000	01.02.2022 to 31.01.2023	Principal Investigator
5.	SRPNTS continuation grant. **Wellcome Trust**, UK.	₹1,99,67,674	01.04.2021 to 30.03.2023	Co-Investigator
6.	Capacity development grant. **Foreign, Commonwealth and Development Office**, UK.	₹1,74,60,488 OR £174,150	01.04.2021 to 30.03.2023	Co-Investigator

7.	The Indian Venom Research Unit. **Government of Karnataka**, India.	₹7,00,00,000	01.05.2021 to 01.04.2026	Principal Investigator
8.	Anti-necrosis grant. **Wellcome Trust**, UK.	₹8,93,85,347	01.04.2021 to 31.12.2025	Co-investigator
9.	Antibody Discovery and Development Against Non-Immunogenic Snake Venom Toxins. **Wellcome Trust**, UK.	₹₹1,42,11,219 OR $190,576	01.07.2021 to 31.12.2024	Co-investigator
10.	**Wellcome Trust DBT India Alliance** Intermediate Fellowship, UK-India.	₹3,60,00,000	01.09.2020 to 31.08.2025	Principal Investigator
11.	Establishing quality analyses protocols for Indian and African snake venoms. **VINS Bio Products Ltd.**, India.	₹10,00,000	01.07.2020 to 31.04.2021	Principal Investigator
12.	Fangs in the Ghats. **The Hamish Ogston Foundation and the Global Snakebite Initiative**, UK-Global.	₹467,070	01.03.2020 to 31.12.2021	Principal Investigator
13.	SRPNTS program. **Department for International Development**, UK.	₹4,50,00,000	01.08.2018 to 31.03.2021	Co-Investigator
14.	INSPIRE Faculty Award. **The Department of Science and Technology**, Govt. of India.	₹35,00,000	01.08.2018 to 31.03.2021	Principal Investigator
15.	Formulation and preclinical evaluation of the second-generation Indian antivenom. **Serum Institute of India**, India.	₹20,00,000	01.04.2019 to 31.12.2021	Principal Investigator
16.	Biological Science Interdisciplinary Proposal. **Indian Institute of Science.**	₹3,00,000	01.04.2019	Principal Investigator
17.	Ramanujan Fellowship. **Science and Engineering Research Board**, India.	₹35,00,000	Not taken	Principal Investigator

18.	Madras Crocodile Bank Trust and Centre for Herpetology. **USV Private Ltd.**, India.	₹4,75,000	26.02.2018 to 31.05.2019	Principal Investigator
19.	Marie Skłodowska-Curie Individual Fellowship	₹14,200,000	01.05.2015 to 30.04.2017	Principal Investigator
20.	Discovery Early Career Researcher Award	₹19,300,000	Not taken	Principal Investigator

Publications

Total Citations	h-index	i10-index
5625	38	69

***: Equal contribution** **@: Corresponding author**

92. Seneci L, Suranse V, Mancuso M, Senoner T, Xie B, Koludarov I, **Sunagar K**[@] and Fry BG@. 2025. Deadly innovations: Molecular phylogenetics and evolution of phospholipases A_2 toxins in viperid snake venoms. **Biochemie**.

Impact Factor: 4.2

91. Rudresha GV, Bhatia S, Samanta A, Naik M and **Sunagar K**[@]. 2025. Dissecting *Daboia*: Investigating synergistic effects of Russell's viper venom toxins. **International Journal of Biological Macromolecules**.

Impact Factor: 8.5

90. Gond PG, Javed S, Samanta A, Unawane A, Nayak M, Jaglan A and **Sunagar K**[@]. 2025. Explaining *Echis*: Proteotranscriptomic profiling of *Echis carinatus* venom. **Toxins**.

Impact Factor: 4.0

89. Rudresha G. V., Khochare S, Casewell NR, and **Sunagar K**[@]. 2025. Preclinical evaluation of small molecule inhibitors as early-intervention therapeutics against the pan-Indian Russell's viper (*Daboia russelii*) envenoming. **Communications Biology**.

Impact Factor: 5.2

88. Abraham SV, Mathew D, Sreekumar A, George AV, Chanchal V, Kuzhikkathu KP, Rajeev PC, Valuvil UB, Kumar J, Mohan KB, Thomas J, Ayyan M, Das S, Sirur FM, Madhavan I, Rafi AM, Mukundan

PK, **Sunagar K**, Krishnan SV, and Palatty BU. 2025. Clinical challenges, controversies, and regional strategies in snakebite care in India. 2025. Clinical challenges, controversies, and regional strategies in snakebite care in India. **The Lancet Regional Health - Southeast Asia**.

Impact Factor: 5.0

87. Sarangi N, Senji Laxme R. R. and **Sunagar K**[@]. 2025. Significant Serpents: Predictive Modelling of Bioclimatic Venom Variation in Russell's Viper. **PLoS Neglected Tropical Diseases**.

Impact Factor: 4.41

86. Takjoo R, Schmidt C, Wilson D, Shaikh NY, Sunagar K, Loukas A, Smout M, and Daly N. 2024. Structural analysis of an Asterias rubens peptide indicates the presence of a disulfide directed ß-hairpin. **FEBS Open Bio.**

Impact Factor: 2.8

85. U Rashmi, Bhatia S, Nayak M, Khochare S and **Sunagar K**[@]. 2024. Elusive elapid: Biogeographic venom variation in Indian kraits and its repercussion on snakebite therapy. **Frontiers in Pharmacology**.

Impact Factor: 5.35

84. Senji Laxme RR, Khochare S, Bhatia S, Martin G, and **Sunagar K**[@]. From Birth to Bite: The Evolutionary Ecology of India's Medically Most Important Snake Venoms. **BMC Biology**.

Impact Factor: 5.04

83. Khochare S, Jaglan A, Rashmi U, Dam P, and **Sunagar K**[@]. Harnessing the Cross-Neutralisation Potential of Existing Antivenoms for Mitigating the Outcomes of Snakebite in Sub-Saharan Africa. **International Journal of Molecular Sciences.** 2024; 25(8):4213. https://doi.org/10.3390/ijms25084213.

Impact Factor: 8.5

82. Khalek I, Senji Laxme, Nguyen I, (other authors), **Sunagar K**[@] and Jardine J[@]. Synthetic development of a broadly neutralizing antibody against snake venom long-chain α-neurotoxins. 2024. **Science Translational Medicine**.

Impact Factor: 19.343 **Featured on the journal cover**

81. Jaglan A, Bhatia S, Martin G, and **Sunagar K**[@]. The Royal Armoury: Venomics and antivenomics of king cobra (Ophiophagus hannah) from the Indian Western Ghats. 2023. **International Journal of Biological Macromolecules**. 253(Pt2):126708. https://doi: 10.1016/j.ijbiomac.2023.126708.

Impact Factor: 8.025

80. Khochare S, Laxme S, Jaikumar P and Kaur N, Attarde S, Martin G, and **Sunagar K@**. Fangs in the Ghats: preclinical insights into the medical importance of endemic pit vipers from the Western Ghats. 2023. **International Journal of Molecular Sciences**. 24(11), 9516. https://doi.org/10.3390/ijms241195

Impact Factor: 6.208

79. Shaikh NY and **Sunagar K@**. The deep-rooted origin of disulfide-rich spider venom toxins. 2023. **eLife**. 12:e83761. https://doi.org/10.7554/eLife.83761.

Impact Factor: 8.713

78. Sunagar K@, Khochare S, Jaglan A, Senthil S and Suranse V. Stings on wings: proteotranscriptomic and biochemical profiling of the lesser banded hornet *(Vespa affinis)* venom. 2022. **Frontiers in Molecular Biosciences**. 14(11), 725; doi.org/10.3390/toxins14110725.

Impact Factor: 6.113

77. Cardoso F, Pineda S, Herzig V, **Sunagar K**, Shaikh NY, Jin A, King GF, Alewood P, Lewis R and Dutertre S. The deadly toxin arsenal of the tree-dwelling Australian funnel-web spiders. 2022. **International Journal of Molecular Sciences**. 23(21), 13077. doi.org/10.3390/ijms232113077

Impact Factor: 6.208

76. Senji Laxme RR, Khochare S, Attarde S, Kaur N, Jaikumar P, Shaikh NY, Aharoni R, Primor N, Hawlena D, Moran Y@ and **Sunagar K@**. The Middle Eastern cousin: Comparative venomics of Daboia palaestinae and Daboia russelii. 2022. **Toxins**. 14(11), 725. doi.org/10.3390/toxins14110725

Impact Factor: 5.07

75. Suranse V, Jackson TNW and **Sunagar K@**. Contextual constraints: dynamic evolution of snake venom phospholipase A2. 2022. **Toxins**. 14(6), 420; https://doi.org/10.3390/toxins14060420

Impact Factor: 5.07

74. Attarde S, Iyer A, Khochare S, Shaligram U, Vikharankar M and **Sunagar K@**. The preclinical evaluation of a second-generation antivenom for treating snake envenoming in India. 2022. **Toxins**. 14(3), 168; https://doi.org/10.3390/toxins14030168

Impact Factor: 5.07

73. Attarde SA, Khochare S, Iyer A, Jackson TNW and **Sunagar K@.** To the islands their own: Venomics of the enigmatic Andaman cobra *(N. sagittifera)* and the preclinical failure of Indian antivenoms in Andaman and Nicobar Islands. **Frontiers in Pharmacology**.

Impact Factor: 5.988

72. Suranse V, Iyer A, Jackson TNW and **Sunagar K@**. 2021. Origin and Early Diversification of the Enigmatic Squamate Venom Cocktail. A Contribution to the Origin and Early Evolution of Snakes (D. Gower and H. Zaher Ed.). Systematics Association Special Volume Series. **Cambridge University Press**.

71. Rashmi*, Khochare S*, Attarde S, Senji Laxme RR, Suranse V, Martin G, and **Sunagar K@**. Remarkable intrapopulation venom variability in the monocellate cobra (*Naja kaouthia*) unveils India's snakebite problem. 2021. **Journal of Proteomics**. 242:104256. https://doi.org/10.1016/j.jprot.2021.104256

Impact Factor: 3.855

70. Senji Laxme RR*, Attarde S*, Khochare S*, Suranse V, Martin G, Casewell NRC, Whitaker R, and **Sunagar K@**. 2021. Biogeographic venom variation in Russell's viper (*Daboia russelii*) and the preclinical inefficacy of antivenom therapy in snakebite hotspots. **PLOS Neglected Tropical Diseases**. https://doi.org/10.1371/journal.pntd.0009150

Impact Factor: 4.781

69. Senji Laxme RR*, Attarde S*, Khochare S*, Suranse V, Martin G, Casewell NRC, Whitaker R, and **Sunagar K@**. 2021. Biogeographical venom variation in the Indian spectacled cobra (*Naja naja*) underscores the pressing need for pan-India efficacious snakebite therapy. **PLOS Neglected Tropical Diseases.** https://doi.org/10.1371/journal.pntd.0009150

Impact Factor: 4.781 **Featured on the journal cover**

68. Kaur N, Iyer A, and **Sunagar K@**. 2021. Evolution bites: Timeworn inefficacious snakebite therapy in the era of recombinant vaccines. **Indian Pediatrics.** 58(3):219-223. PMID: 33713055.

Impact Factor: 2.3

67. Sunagar K@ and Abraham SV. The Curious Case of the "Neurotoxic Skink": Scientific Literature Points to the Absence of Venom in Scincidae. **Toxins.** 13, 114. https://doi.org/10.3390/toxins13020114.

Impact Factor: 5.07

66. Sunagar K@*, Khochare S*, Laxme RRS, Attarde S, Dam P, Suranse V, Khaire A, Martin G and Captain A. A wolf in another wolf's clothing: Post-genomic regulation dictates venom profiles of medically-important cryptic kraits in India. **Toxins.** 13(1), 69; https://doi.org/10.3390/toxins13010069

Impact Factor: 5.07

65. White paper on venomous snakebite in India. Indian Council of Medical Research, Department of Health Research. 2021. **Indian Journal of Medical Research**.

Impact Factor: 5.274

64. Herzig V*, **Sunagar K***, Wilson DR*, Pineda SS*, Israel MR, Duterte S, McFarland BS, Undheim EAB, Hodgson WC, Alewood PF, Lewis RJ, Bosmans F, Vetter I, King GF and Fry BG. 2020. Australian funnel-web spiders evolved human-lethal δ-hexatoxins for defense against vertebrate predators. **Proceedings of the National Academy of Sciences, USA.**

Impact Factor: 11.205

63. Casewell NRC*, Jackson TNW*, Lausten AH*, and **Sunagar K***. 2020. Causes and consequences of snake venom variation. **Trends in Pharmacological Sciences**. https://doi.org/10.1016/j.tips.2020.05.006

Impact Factor: 17.638

62. Tournière O, Dolan D, Richards GS, **Sunagar K**, Columbus-Shenkar YY, Moran Y and Rentzsch F. 2020. NvPOU4/Brain3 functions as a terminal selector gene in the nervous system of the cnidarian Nematostella vectensis. **Cell Reports**. 30 (13), 4473-4489.e5. DOI: 10.1016/j.celrep.2020.03.031

Impact Factor: 9.995 **Featured on the journal cover**

61. Editorial. Modica MV, **Sunagar K**, Holford M and Duterte S. 2020. Diversity and Evolution of Animal Venoms: Neglected Targets, Ecological Interactions, Future Perspectives. **Frontiers in Ecology and Evolution.**

Impact Factor: 4.496

60. Senji Laxme RR*, Khochare S*, de Souza HF*, Ahuja B, Suranse V, Martin G, Whitaker R, and **Sunagar K@**. 2019. Beyond the 'big four': Venom profiling of the medically important yet neglected Indian snakes reveals disturbing antivenom deficiencies. **PLoS Neglected Tropical Diseases**. 13(12): e0007899. https://doi.org/ 10.1371/journal.pntd.0007899.

Impact Factor: 4.781 **Featured on the journal cover**

59. Casewell NR*, Petras D, Card DC, Suranse V, Mychajliw AM, Richards D, Koludarov I, Albulescu L-O, Slagboom J, Hempel B-F, Ngum NM, Kennerley RJ, Brocca JL, Whiteley G, Harrison RA, Bolton FMS, Debono J, Vonk FJ, Alföldi J, Johnson J, Karlsson EK, Lindblad-Toh K, Mellor IR, Süssmuth RD, Fry BG, Kuruppu S, Hodgson WC, Kool J, Castoe TA, Barnes I, **Sunagar K**, Undheim EAB and Turvey

ST. 2019. *Solenodon* genome reveals convergent evolution of venom in eulipotyphlan mammals. **Proceedings of the National Academy of Sciences, USA.**

Impact Factor: 11.205

58. Sunagar K[@*], Columbus-Shenkar Y*, Fridrich A, Gutkovich N, Aharoni R, and Moran Y[@]. 2018. Cell type-specific expression profiling unravels the development and evolution of stinging cells in sea anemone. **BMC Biology.** 16:108

Impact Factor: 7.364

57. Baumann K, Dashevsky D, **Sunagar K**, and Fry BG. 2018. Scratching the Surface of an Itch: Molecular Evolution of *Aculeata* Venom Allergens. **Journal of Molecular Evolution**, 86(7):484-500. https://doi.org/10.1007/s00239-018-9860-x.

Impact Factor: 3.973

56. Columbus-Shenkar Y, Sachkova M, Macrander J, Fridrich A, Modepalli V, Reitzel AM, **Sunagar K**, and Moran Y. Dynamics of venom composition across a complex life cycle. 2018. **eLife** 2018;7:e35014.

Impact Factor: 8.713 **Featured on the journal cover**

55. Laxme S.R.R*, Suranse V*, and **Sunagar K[@]**. 2018. Arthropod venoms: Biochemistry, Ecology and Evolution. **Toxicon** (Special edition). 158:84-103.

Impact Factor: 3.033

54. Suranse V, Srikantan A, and **Sunagar K[@]**. 2018. Animal Venoms: origin, diversity, and evolution. In **eLS, John Wiley and Sons**, Ltd (Ed.). doi:10.1002/9780470015902.a0000939.pub2.

53. Sunagar K. Morgenstern, A. Reitzel and Y. Moran. Ecological venomics: how genomics, transcriptomics and proteomics can shed new light on the ecology and evolution of venom. 2016. **Journal of Proteomics**. 1874-3919. http://dx.doi.org/10.1016/j.jprot.2015.09.015

Impact Factor: 3.855

52. Reeks T, Lavergne V, **Sunagar K**, Jones A, Undheim E, Dunstan N, Fry BG and Alewood P. 2015. Deep venomics of the *Pseudonaja* genus reveals inter- and intra-specific variation. **Journal of Proteomics**. 133:20-32

Impact Factor: 3.855

51. Sunagar K[@] and Moran Y@. 2015. The rise and fall of an evolutionary innovation: contrast-

ing strategies of venom evolution in ancient and evolutionarily young animals. **PLoS Genetics** 11:e1005596

Impact Factor: 6.02

50. Ujvari B*, Caswell NR*, **Sunagar K***, Arbuckle K, Wüster W, Lo N, Conigrave AD, Mun H, O'Meally D, Beckmann C, King G, Deplazes E and Madsen T. 2015. Widespread convergence in toxin resistance by predictable molecular evolution. **Proceedings of the National Academy of Sciences, USA**. 112:11911-6

Impact Factor: 11.1 **Featured on the journal cover**

49. Jouiaei M*, **Sunagar K***, Federman Gross A, Scheib H, Alewood PF, Moran Y and Fry BG. 2015. Evolution of an ancient venom: recognition of a novel family of cnidarian toxins and the common evolutionary origin of sodium and potassium neurotoxins in sea anemone. **Molecular biology and evolution**. 32:1598-610.

Impact Factor: 8.8 **5-Year Impact Factor:** 18.670

48. The Origin and Evolution of the Toxicofera Reptile Venom System. B.G. Fry, **K. Sunagar**, N. R. Casewell, E. Kochva, K. Roelants, H. Scheib, W. Wüster, N. Vidal, B. Young, F. Burbrink, R. A. Pyron, F. J. Vonk, and T. N. W. Jackson. In 2015. Venomous reptiles and their toxins: Evolution, pathophysiology and Biodiscovery (ed. B.G. Fry). **Oxford Press**, USA. p. 1-33

47. Signs, Symptoms, and Treatment of Envenomation L. Boyer, A. Alagón, B.G. Fry, T. N. W. Jackson, **K. Sunagar**, and J.-P. Chippaux. 2015. Venomous reptiles and their toxins: Evolution, pathophysiology and Biodiscovery. (B.G. Fry, ed.), **Oxford Press**, USA. p. 32-60

46. Antivenom Research and Development M. Bénard-Valle, E. E. Neri-Castro, B.G. Fry, L. Boyer, C. Cochran, M. Alam, T. N. W. Jackson, D. Paniagua, F. Olvera-Rodríguez, I. Koludarov, **K. Sunagar**, and A. Alagón. 2015. Venomous reptiles and their toxins: Evolution, pathophysiology and Biodiscovery. (B.G. Fry, ed.), **Oxford Press**, USA. p. 61-72

45. Ineffective Traditional and Modern Techniques for the Treatment of Snakebite M. Bénard-Valle, E. E. Neri-Castro, L. Boyer, T. N. W. Jackson, **K. Sunagar**, M. Clarkson, and B.G. Fry. 2015. Venomous reptiles and their toxins: Evolution, pathophysiology and Biodiscovery. (B.G. Fry, ed.), **Oxford Press**, USA. p. 73-88

44. Maintaining Venomous Reptile Collections: Proitemols and Occupational Safety B.G. Fry, I. Hendrikx, P. Rowley, T. N. W. Jackson, H. van der Ploeg, R. Johnson, M. Sasa, N. Dunstan, S. Barve, B. Lock, T. Phillip, M. Zivkovic, L. Boyer, K. Wiley, J. Harrison, R. Carmichael, M. C. Morris, P. Martelli, D.

Brandl, G. Shankar, S. McCarthy, **K. Sunagar**, J. Pittman, and C. Cochran. 2015. Venomous reptiles and their toxins: Evolution, pathophysiology and Biodiscovery. (B.G. Fry, ed.), **Oxford Press**, USA. p. 89-132

43. Veterinary Care of Venomous Reptiles J. Haberfild, P. Martelli, R. Johnson, S. Barten, A. Gillett, B. Lock, R. Jones, S. Simpson, T. N. W. Jackson, C. Cochran, N. Dunstan, **K. Sunagar**, and B.G. Fry. 2015. Venomous reptiles and their toxins: Evolution, pathophysiology and Biodiscovery. (B.G. Fry, ed.), **Oxford Press**, USA. p. 133-152

42. Research Methods B.G. Fry, E. A. B. Undheim, T. N. W. Jackson, K. Roelants, D. Georgieva, I. Vetter, J. J. Calvete, H. Scheib, B. W. Cribb, D. C. Yang, N. L. Daly, M. L. Roy Manchadi, J. M. Gutiérrez, B. Lomonte, G. M. Nicholson, S. Dziemborowicz, V. Lavergne, L. Ragnarsson, L. D. Rash, M. Mobli, W. C. Hodgson, N. R. Casewell, A. Nouwens, S. C. Wagstaff S. A. Ali, D. L. Whitehead, V. Herzig, P. Monagle, N. D. Kurniawan, T. Reeks, and **K. Sunagar**@. 2015. Venomous reptiles and their toxins: Evolution, pathophysiology and Biodiscovery. (B.G. Fry, ed.), **Oxford Press**, USA. p. 153-214

41. Three-Finger Toxins (3FTx) Y. Utkin, **K. Sunagar**, T. N. W. Jackson, T. Reeks, and B.G. Fry. 2015. Venomous reptiles and their toxins: Evolution, pathophysiology and Biodiscovery. (B.G. Fry, ed.), **Oxford Press**, USA. p. 215-227

40. Beta-Defensins A. R. B. Prieto da Silva, B.G. Fry, **K. Sunagar**, H. Scheib, T. N. W. Jackson, G. Rádis-Baptista, A. J. Zaharenko, P. L. de Sá Jr., A. Pereira, N. Oguiura, M. A. F. Hayashi, A. Kerkis, T. Yamane, and I. Kerkis. 2015. Venomous reptiles and their toxins: Evolution, pathophysiology and Biodiscovery. (B.G. Fry, ed.), **Oxford Press**, USA. p. 228-238

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