**Article**

**Bibliometric Analysis of Literature in Snake Venom-Related Research Worldwide (1933–2022)**

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**Simple Summary:** Around the world, snake envenomation poses a serious health risk. Proteins with pharmacological effects are present in snake venom. Recent studies elaborate snake venom and its potential application, including as a cancer drug and antibacterial substances. Our study aimed to analyze the global profile of the literature in snake venom research from documents indexed in the Scopus database between 1933 and 2022. In total, 2999 documents were published with Brazil showing the highest productivity. Antivenom, proteomics, and transcriptomics are emerging as hot topics on a global scale. The present study offers a distinctive overview of snake venom research conducted worldwide.

**Abstract:** Snake envenomation is a severe economic and health concern affecting countries worldwide. Snake venom carries a wide variety of small peptides and proteins with various immunological and pharmacological properties. A few key research areas related to snake venom, including its applications in treating cancer and eradicating antibiotic-resistant bacteria, have been gaining significant attention in recent years. The goal of the current study was to analyze the global profile of literature in snake venom research. This study presents a bibliometric review of snake venom-related research documents indexed in the Scopus database between 1933 and 2022. The overall number of documents published on a global scale was 2999, with an average annual production of 34 documents. Brazil produced the highest number of documents (n = 729), followed by the United States (n = 548), Australia (n = 240), and Costa Rica (n = 235). Since 1963, the number of publications has been steadily increasing globally. At a worldwide level, antivenom, proteomics, and transcriptomics are growing hot issues for research in this field. The current research provides a unique overview of snake venom research at global level from 1933 through 2022, and it may be beneficial in guiding future research.

**Keywords:** snake venom; bibliometry; VOSviewer

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**1. Introduction**

Venom glands are considered a unique morphological and physiological adaptation developed by animals during evolution to increase the efficacy of capturing prey and as part of a defense system against predators [1–5]. A growing body of research attempting to dissect the composition and possible application of animal venoms has been accumulating for decades [6–9]. In particular, snake venoms, consisting of various types of proteins and small peptide cocktails, have been gaining significant attention as novel sources of drug discovery in recent years [10–12]. The main reason for understanding the compositions of snake venom is that snake bites are considered serious health and economic problems...
worldwide [13–16]. Annually, it is reported that more than 2 million snake envenomations occur globally, leading to a high mortality rate in Asia, Africa, and America [17–19]. Therefore, snake envenomation was officially classified as a priority neglected tropical disease by the World Health Organization (WHO) in 2017 [20].

Snake venom comprises a vast range of proteins and peptide isoforms, causing a diverse array of immunological and clinical effects when injected [21–23]. The secreted phospholipases A2 (PLA2s), snake venom serine proteases (SVSP), three-finger peptides (3FTX), and snake venom metalloproteinases (SVMP) are commonly found enzymes in snake venom. These enzymes alone or in combination have been reported to cause respiratory arrest, inflammation responses, paralysis, necrosis in local tissue, coagulopathy, and hemorrhage upon administration [21,24–31]. Intravenous delivery of antivenom in conjunction with analgesic drugs, hydration treatment, hemodialysis, or supplementation of antibiotics are commonly used to treat snake envenomation [17]. However, the recovery process from snake envenomation has been hampered by the high prevalence of musculoskeletal disabilities and even mortality [32–34].

Multiple studies reported various perspectives on snake venom and its applications in the field of medicine and health [11,12,35,36]. Concerns over the swift rise in microbial drug resistance have prompted researchers to explore the promising role of snake venom and its components in eradicating superbugs (Table S1) [37–45]. In parallel, numerous studies have also been conducted to isolate and characterize peptides found in snake venoms as potential cancer drugs (Table S2) [46–87]. Additionally, in recent years, conjugation of snake venom with monoclonal antibodies has been implemented as a favorable method for designing clinically effective anticancer agents [88]. Recent developments in drug discovery techniques also enable the combination of peptides extracted from snake venom with nanoparticles, allowing customized delivery to the target specific cells or tissues [89,90].

The WHO promotes a periodic review of current development in neglected tropical diseases, including snake bite, to support national and global research capacity [91,92]. Notably, bibliometric analysis has been extensively used to analyze the global research output of various neglected tropical diseases [93–95]. However, previous studies in snake venom-related research focused primarily on the clinical application of snake venom, with little attention paid to the progress, current state, and future direction of research in this field. To the best of our knowledge, there are currently no bibliometric studies that qualitatively and quantitatively evaluate the output of snake venom-related research. Therefore, assessing the global research profile of literature on snake venom is critical. This study focused on providing a comprehensive profile of snake venom-related literature for the last eight decades by mapping international collaboration, evaluating the performance of prominent institutions, examining the productivity of prestigious journals, dissecting the characteristics of highly cited articles, and highlighting the emerging research topics. The findings of the current study may provide a visual overview of research progress in this field, as well as assist researchers and practitioners in evaluating the research impacts.

2. Materials and Methods

The Scopus database was used to retrieve all snake venom-related documents, excluding erratum, published between 1933 and 2022. Scopus was regarded as the primary source of bibliometric analysis in various disciplines [96–99]. Using the key terms “snake” AND “venom” in the ‘title’ and ‘abstract’ fields, a bibliometric filter to capture snake venom-related publications from the Scopus database was established and performed in May 2022. Type of document, year of publication, institutions, countries, journal titles, citations, and key terms were extracted. The extracted data were analyzed using VOSviewer [100].

3. Results

Between 1933 and 2022, 2999 documents were published globally, resulting in an average annual production of 34 documents related to snake venom. Research articles (n = 2629; 87.66%) account for the highest number, followed by reviews (n = 268; 8.93%),
book chapters ($n = 46; 1.53\%$), and conference papers ($n = 37; 1.23\%$). The majority of the documents ($n = 2869; 95.66\%$) were written in English, followed by Chinese ($n = 52; 1.73\%$), Spanish ($n = 34; 1.13\%$), and Russian ($n = 20; 0.66\%$). Since 1963, the number of snake venom-related documents has gradually increased, with the maximum productivity observed in 2020 ($n = 128; 4.26\%$) (Figure 1).

**Figure 1.** Publication profile of snake venom-related research during the years 1933–2022. A total of 2999 documents were retrieved from the Scopus database. The productivity in snake venom-related research has gradually increased since the 1960s, with the highest number of documents published in 2020.

Between 1933–2022, 138 countries contributed to the literature on snake venom. The top 10 most productive countries listed a publication share ranging from 24.3% for Brazil to 3.33% for Germany. Table 1 illustrates the top ten countries in terms of their proportionate contribution to the total number of documents on a worldwide scale. Brazil produced the most documents with 729 (24.3%) documents, followed by the United States ($n = 548; 18.2\%$), Australia ($n = 240; 8\%$), Costa Rica ($n = 235; 7.83\%$), and the United Kingdom ($n = 208; 6.93\%$). The United States ($n = 24$) listed the highest number of international collaborations, followed by Australia, Germany, and the United Kingdom ($n = 21$) (Table 1; Figure 2).

| SCR a | Country       | No. of Documents (%) | No. of Collaborating Countries b |
|-------|---------------|----------------------|----------------------------------|
| 1     | Brazil        | 729 (24.3)           | 18                               |
| 2     | United States | 548 (18.2)           | 24                               |
| 3     | Australia     | 240 (8.00)           | 21                               |
| 4     | Costa Rica    | 235 (7.83)           | 18                               |
| 5     | United Kingdom| 208 (6.93)           | 21                               |
| 6     | Japan         | 202 (6.73)           | 11                               |
Table 1. Cont.

| SCR a  | Country           | No. of Documents (%) | No. of Collaborating Countries b |
|--------|-------------------|----------------------|---------------------------------|
| 7      | China             | 182 (6.06)           | 15                              |
| 8      | India             | 180 (6.00)           | 13                              |
| 9      | Taiwan, China     | 103 (3.43)           | 6                               |
| 10     | Germany           | 100 (3.33)           | 21                              |

a SCR: standard competition ranking. b Number of collaborating countries with a minimum threshold of 30 documents.

Figure 2. Mapping of country collaboration. Out of 138 countries, 25 published a minimum of 30 documents. The size of the circle is proportional to the number of collaborations with other countries.

Table 2 shows the top ten journals with the highest number of documents worldwide, totaling 1082 (36.07%) documents. *Toxicon* (n = 682; IF = 2.74), *Toxins* (n = 115; IF = 4.086), and *Journal of Venomous Animals and Toxins including Tropical Diseases* (n = 47; IF = 2.71) were the most prolific journals on the subject of snake venom. Research articles with the highest number of citations in Table 3 highlight the landmark studies in snake venom-related research and can be used as references in determining the current trends and future directions.

Table 2. The top ten journals in the field of snake venom-related research.

| SCR a  | Journal Title                                      | No. of Documents (%) | Impact Factor b |
|--------|----------------------------------------------------|----------------------|-----------------|
| 1      | *Toxicon*                                          | 682 (22.74)          | 2.74            |
| 2      | *Toxins*                                           | 115 (3.83)           | 4.086           |
| 3      | *Journal of Venomous Animals and Toxins Including Tropical Diseases* | 47 (1.56)           | 2.71            |
| 4      | *Journal of Proteomics*                            | 40 (1.33)            | 4.044           |
| 5      | *Biochimie*                                        | 36 (1.20)            | 4.079           |
| 6      | *Journal of Biological Chemistry*                  | 35 (1.16)            | 5.157           |

a SCR: Standard competition ranking. b Clarivate Analytics' Journal Citation Reports (JCR) 2021 were used to calculate impact factors (IF).
Table 2. Cont.

| SCR   | Journal Title                          | No. of Documents (%) | Impact Factor b |
|-------|----------------------------------------|----------------------|-----------------|
| 7     | International Journal of Biological Macromolecules | 34 (1.13)            | 6.953           |
| 8     | Archives of Biochemistry and Biophysics | 33 (1.10)            | 4.013           |
| 8     | Biochemical and Biophysical Research Communications | 33 (1.10)            | 3.575           |
| 10    | Biochemistry                          | 27 (0.90)            | 3.162           |

a SCR: Standard competition ranking. If two journals share the same ranking number, a gap is left out in the rankings. b Clarivate Analytics’ Journal Citation Reports (JCR) 2021 were used to calculate impact factors (IF).

Table 3. The highest cited articles on snake venom-related research.

| SCR   | Authors                      | Title                                                                 | Article Type      | Year | Journal Title                  | No. of Citations |
|-------|------------------------------|-----------------------------------------------------------------------|-------------------|------|-------------------------------|-----------------|
| 1     | Bode et al. [101]            | Astacins, serralysins, snake venom and matrix metalloproteinases exhibit identical zinc-binding environments (HEXXHXXXGXXH and Met-turn) and topologies and should be grouped into a common family, the ‘metzincins’ | Article           | 1993 | FEBS Letters                   | 630             |
| 2     | Markland [102]               | Snake venoms and the hemostatic system                                | Review            | 1998 | Toxicon                        | 546             |
| 3     | Bjarnason and Fox [103]      | Hemorrhagic metalloproteinases from snake venoms                      | Review            | 1994 | Pharmacology and Therapeutics | 483             |
| 4     | Theakston and Reid [104]     | Development of simple standard assay procedures for the characterization of snake venoms | Article           | 1983 | Bulletin of the World Health Organization | 482             |
| 5     | Daltry et al. [105]          | Diet and snake venom evolution                                       | Article           | 1996 | Nature                         | 477             |
| 6     | Fry et al. [106]             | Early evolution of the venom system in lizards and snakes            | Article           | 2006 | Nature                         | 423             |
| 7     | Gutiérrez and Lomonte [107]  | Phospholipase A2 myotoxins from Bothrops snake venoms                | Review            | 1995 | Toxicon                        | 422             |
| 8     | Gutiérrez and Rucavado [27]  | Snake venom metalloproteinases: Their role in the pathogenesis of local tissue damage | Review            | 2000 | Biochimie                      | 416             |
| 9     | Fox and Serrano [108]        | Structural considerations of the snake venom metalloproteinases, key members of the M12 reprolysin family of metalloproteinases | Article           | 2005 | Toxicon                        | 406             |
| 10    | Matsui et al. [109]          | Snake venom proteases affecting hemostasis and thrombosis            | Review            | 2000 | Biochimica et Biophysica Acta | 359             |

a SCR: Standard competition ranking.

Table 4 shows the global performance of the top 10 productive institutions in the field of snake venom from 1933 to 2022, with a total of 1192 (39.74%) documents. The Universidad de Costa Rica in Costa Rica is the most prolific contributor with 240 (8%) snake venom-related documents. The Instituto Butantan in Brazil (n = 228; 7.60%), the Universidade de São Paulo in Brazil (n = 213; 7.10%), the Universidade Estadual de Campinas in Brazil (n = 95; 3.16%), and the National University of Singapore in Singapore (n = 77; 2.56%) were listed second through fifth.
Table 4. The most productive institutions in publications related to snake venom.

| SCR | Institution                                | Country        | No. of Documents (%) |
|-----|--------------------------------------------|----------------|----------------------|
| 1   | Universidad de Costa Rica                  | Costa Rica     | 240 (8.00)           |
| 2   | Instituto Butantan                         | Brazil         | 228 (7.60)           |
| 3   | Universidade de São Paulo                  | Brazil         | 213 (7.10)           |
| 4   | Universidade Estadual de Campinas          | Brazil         | 95 (3.16)            |
| 5   | National University of Singapore           | Singapore      | 77 (2.56)            |
| 6   | Universidade Estadual Paulista Júlio de Mesquita Filho | Brazil     | 76 (2.53)            |
| 7   | Liverpool School of Tropical Medicine      | United Kingdom | 73 (2.43)            |
| 8   | Fundação Oswaldo Cruz                     | Brazil         | 72 (2.40)            |
| 9   | National Taiwan University                 | Taiwan, China  | 59 (1.96)            |
| 9   | Universidade Federal de Uberlândia         | Brazil         | 59 (1.96)            |

* SCR: Standard competition ranking. If two institutes share the same ranking number, a gap is left out in the rankings.

Figure 3 maps the occurrence of terms retrieved from 2999 documents related to snake venom indexed by Scopus. Among the 15,498 extracted terms, 255 were detected to be present in more than 50 occurrences, resulting in 5 distinguished clusters: red, blue, green, yellow, and purple (Figure 3a). Cluster 1 (red color) includes terms such as amino acid sequence, metalloproteinase, blood clotting; cluster 2 (green color): envenomation, animal model, mice; cluster 3 (blue color): vipersidae, mass spectrometry, proteomics; cluster 4 (yellow color): drug effect, human cell, metabolism; cluster 5 (purple color): crotalid venoms, bothrops. In Figure 3b, VOSviewer categorizes the extracted terms into a color gradient from blue to yellow, representing old to new publication years. The early years of snake venom-related studies elaborated on several key terms such as drug effect, venom, disintegrin, phospholipase A2, cytotoxicity, and amino acid sequence. Meanwhile, the emerging topics in recent years includes antivenom, proteomics, and transcriptome.

Figure 3. VOSviewer mapping of occurrence terms extracted from titles and abstracts in snake venom-related research articles. (a) network visualization; (b) overlay visualization. The size of the circles is proportional to the frequency of appearances. The length of the link indicates the degree of relationship. With a minimum of 50 occurrences, 255 out of 15,498 terms match the criteria.

4. Discussion

The current study thoroughly examined global research output on the topic of snake venom. According to our findings, snake venom has garnered much interest from scientists all around the world in the last 89 years. The gradual increase in snake venom-related documents since the 1960s could be associated with the funding of the International Society
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on Toxinology (IST) in 1962 [110,111]. Toxicon, the official journal of IST, was listed as the most prolific journal with the highest number of documents related to snake venom in this study. The earliest document from Toxicon retrieved in this study was published in 1962 titled “Hemolytic action of indirect lytic snake venom in vivo” by De Vries et al. from Israel [112]. In total, Toxicon journal contributed 22.74% (n = 682) of the total documents extracted from the Scopus database, indicating the significant impact of Toxicon in the development of snake venom-related studies. Interestingly, despite the fact that the oldest article related to snake venom in Toxins journal was published in 2009 [113], Toxins, by Multidisciplinary Digital Publishing Institute (MDPI), was recognized as the journal with the second highest number of published documents (n = 115; 3.83%). The designation of snake bites as a priority neglected tropical disease by WHO in 2017 also affects the growth of documents related to snake venom research [20]. In the period 2017–2021, with an average of 119 documents per year, a total of 596 (19.87%) documents were published, indicating a high research productivity in the field of snake venom in recent years.

Our results showing that Brazil is the most prolific country in terms of snake venom research could be explained by the fact that Brazil is the home to a highly diverse species of snakes [114,115]. Additionally, the high prevalence of snake envenomation in Brazil promotes extensive efforts for prevention and management of snake bites, as well as elaborating the potential application of snake venom in medicine in this country [116–121]. Consistent with the result showing that Brazil is the most productive country, Brazil is home to 6 of the 10 institutions with the highest number of documents in snake venom-related research. Other developing countries, such as Costa Rica and India, were among the most productive countries in the field of snake venom research, which could be linked to multiple reports of the snake biting cases in these countries [122–128]. Our results also demonstrate that developing countries published a relatively high percentage of research articles, indicating that snake venom-related research is not limited to developed countries. Taken together, these findings suggest that the study of snake venom is currently emerging as a global effort.

The number of citations obtained by research articles might be used to determine the central topics in a certain field [129–131]. The “Astacins, serralysins, snake venom and matrix metalloproteinases exhibit identical zinc-binding environments (HEXXHXXGXXH and Met-turn) and topologies and should be grouped into a common family, the ‘metzincins’” article by Bode et al., from Germany, published in FEBS Letters, was the most frequently cited article [101]. Importantly, our bibliometric analysis also revealed that snake venom-related articles and reviews were published in reputable journals such as Nature and Science [105,106,132–134].

Up to 2010, researchers reported various studies related to disintegrin, venom, amino acid sequence, phospholipase A2, cytotoxicity, and drug effect. Recent focus on snake venom-related research has been gradually shifting to antivenom, proteomics, and transcriptome, providing hints to the emerging subjects in snake venom-related research in the future. In the last few years, there has been an increase in the publication of snake venom proteomes, especially from the families of Elapidae and Viperidae (Table S3) [135–213]. To estimate the protein diversity and abundance, characterization of snake venom proteomes involves two main steps: identification of the proteins and peptides followed by quantification [214]. In general, to improve the efficiency of the protein identification step, de-complexing procedures were highly recommended before performing mass spectrometry [215–217]. The established protocols generally involve the following workflows: Reverse-Phase High-Performance Liquid Chromatography (RP-HPLC), 1D SDS-PAGE, and in-gel trypsin digestion followed by mass spectrometry (MS) [218–220]. The coverage of proteome identification might be improved by incorporating various approaches, including the utilization of venom gland transcriptome libraries and a top-down/bottom-up combination of mass spectrometry [216,221].

In the field of transcriptomics, cloning technology served as the foundation for the early studies of venom gland transcriptome [170,222]. High-throughput RNA sequencing
obtained from venom glands is now possible due to the development of next generation sequencing (NGS) technologies [223]. A growing number of venom gland transcriptomes of numerous species of snakes have been constructed (Table S4) [5,136,143,147,148,170,182,189,193,222,224–228,228–252]. The possibilities of examining various genes are one of the most powerful applications of transcriptomics from the snake venom gland. Through comprehensive profiling, identification of novel protein or peptides in snake venom and interspecies comparison is possible [143,236,237,250,253,254]. Additional transcriptomics studies can also be employed to analyze genetic varieties within snake families [234,247]. Notably, a comprehensive analysis of venom gland transcriptome libraries might help in accelerating the discovery of novel antivenoms.

In general, the widely available antivenoms are produced by continuously exposing animals to sub lethal doses of the snake venom [255,256]. However, the animal-derived antivenoms possess several drawbacks, including contamination of irrelevant antibodies, inadvertent allergic reactions, inefficient production methods, and varied outputs [257,258]. Promising antivenom molecules are listed in Table S5 [259–277]. Generating monoclonal antibodies against specific enzymes in snake venom has been considered as an alternative strategy for developing antivenoms [259–265]. Additionally, fragments of recombinant antibodies and nanoparticle have shown effectiveness in inactivating snake venom [272–277]. Identifying the inhibitors of venom enzymes is also established as an alternative strategy to design novel antivenoms [266–271]. Taken together, the future of antivenom development appears promising with monoclonal antibodies, recombinant fragments, and enzyme inhibitors being proven to be effective in neutralizing snake venoms.

Lastly, the limitation of the current study, similar to previous bibliometric analysis [278,279], is that it excluded documents published in journals not indexed by Scopus.

5. Conclusions

The current study presents a comprehensive review of snake venom-related research, spanning nearly eight decades of global literature output. According to our findings, Brazil produced the highest number of documents, followed by the United States, Australia, Costa Rica, and the United Kingdom. Studies in the areas of antivenom, proteomics, and transcriptome are expected to gather a considerable amount of interest in the near future. To summarize, the data offered in this study paints a clear picture of the progress made in the field of snake venom research from 1933 to 2022, and it may be helpful in providing insights for future research.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/ani12162058/s1. Table S1. Snake venom components as novel drug candidates to eliminate drug resistant bacteria. Table S2. Anticancer properties of snake venom and its components. Table S3. Elapidae and Viperidae families as representatives of the well-characterized proteomics of snake venoms. Table S4. List of snake species for which transcriptomics libraries are available. Table S5. List of promising antivenom molecules.

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References

1. Lüddecke, T.; Herzig, V.; Reumont, B.M.; Vilcinskas, A. The Biology and Evolution of Spider Venoms. Biol. Rev. 2022, 97, 163–178. [CrossRef] [PubMed]

2. Schendel, V.; Rash, L.D.; Jenner, R.A.; Undheim, E.A. The Diversity of Venom: The Importance of Behavior and Venom System Morphology in Understanding Its Ecology and Evolution. Toxins 2019, 11, 666. [CrossRef] [PubMed]

3. Suranee, V.; Srikanthan, A.; Sunagar, K. Animal Venoms: Origin, Diversity and Evolution. In eLS; John Wiley & Sons, Ltd., Ed.; Wiley: Hoboken, NJ, USA, 2018; pp. 1–20. ISBN 978-0-470-01617-6.

4. Walker, A.A. The Evolutionary Dynamics of Venom Toxins Made by Insects and Other Animals. Biochem. Soc. Trans. 2020, 48, 1353–1365. [CrossRef]

5. Fry, B.G.; Scheib, H.; van der Weerd, L.; Young, B.; McNaughtan, J.; Ramjan, S.F.R.; Vidal, N.; Poelmann, R.E.; Norman, J.A. Evolution of an Arsenal: Structural and Functional Diversification of the Venom System in the Advanced Snakes (Caenophidia). Mol. Cell. Proteom. 2008, 7, 215–246. [CrossRef]

6. Bordon, K.d.C.F.; Cologna, C.T.; Fornari-Baldo, E.C.; Pinheiro-Jr, E.L.; Cerni, F.A.; Amorim, F.G.; Anjolette, F.A.P.; Cordeiro, F.A.; Wiezela, G.A.; Cardoso, I.A.; et al. From Animal Poisons and Venoms to Medicines: Achievements, Challenges and Perspectives in Drug Discovery. Front. Pharm. 2020, 11, 1132. [CrossRef]

7. Coulter-Parkhill, A.; McClean, S.; Gault, V.A.; Irwin, N. Therapeutic Potential of Peptides Derived from Animal Venoms: Current Views and Emerging Drugs for Diabetes. Clin. Med. Insights Endocrinol Diabetes 2021, 14, 117955142110060. [CrossRef]

8. Sung, S.-H.; Kim, J.-W.; Han, J.-E.; Shin, B.-C.; Park, J.-K.; Lee, G. Animal Venom for Medical Usage in Pharmacopuncture in Korean Medicine: Current Status and Clinical Implication. Toxins 2021, 13, 105. [CrossRef]

9. Utkin, Y.N. Animal Venom Studies: Current Benefits and Future Developments. WJBC 2015, 6, 28. [CrossRef]

10. Chen, Y.S.; Cheung, R.C.F.; Xia, L.; Young, B.; McNaughtan, J.; Ramjan, S.F.R.; Vidal, N.; Poelmann, R.E.; Norman, J.A. Snake Venom Toxins: Toxicity and Medicinal Applications. Biochem. Soc. Trans. 2020, 48, 1353–1365. [CrossRef]

11. Ferraz, C.R.; Arrahman, A.; Xie, C.; Casewell, N.R.; Lewis, R.J.; Kool, J.; Cardoso, F.C. Multifunctional Toxins in Snake Venoms and Therapeutic Implications: From Pain to Hemorrhage and Necrosis. Front. Ecol. Evol. 2019, 7, 218. [CrossRef]

12. Mohamed Abd El-Aziz, T.; Soares, A.G.; Stockand, J.D. Snake Venoms in Drug Discovery: Valuable Therapeutic Tools for Life Saving. Toxins 2019, 11, 564. [CrossRef]

13. Ahmed, S.; Koudou, G.B.; Bagot, M.; Drabo, F.; Bougma, W.R.; Pulford, C.; Bockarie, M.; Harrison, R.A. Health and Economic Burden of Snakebite Management on Health Facilities in Three Regions of Southern Burkina Faso. PLoS Negl. Trop. Dis. 2021, 15, e0009464. [CrossRef]

14. Martins, S.B.; Bolon, I.; Alcobas, G.; Ochoa, C.; Torgerson, P.; Sharma, S.K.; Ray, N.; Chappuis, F.; Ruiz de Castañeda, R. Assessment of the Effect of Snakebite on Health and Socioeconomic Factors Using a One Health Perspective in the Terai Region of Nepal: A Cross-Sectional Study. Lancet Glob. Health 2022, 10, e409–e415. [CrossRef]

15. Kasturiratne, A.; Laloo, D.G.; Janaka de Silva, H. Chronic Health Effects and Cost of Snakebite. Toxicol X 2021, 9, 10–100. [CrossRef]

16. Patikorn, C.; Leelavanich, D.; Ismail, A.K.; Othman, I.; Taychakhoonavudh, S.; Chaiyakunapruk, N. Global Systematic Review of Cost of Illness and Economic Evaluation Studies Associated with Snakebite. J. Glob. Health 2020, 10, 020415. [CrossRef]

17. Gutiérrez, J.M.; Calvete, J.J.; Habib, A.G.; Harrison, R.A.; Williams, D.J.; Warrell, D.A. Snakebite Envenoming. Nat. Rev. Dis. Primers 2017, 3, 17063. [CrossRef]

18. Harrison, R.A.; Casewell, N.R.; Ainsworth, S.A.; Laloo, D.G. The Time Is Now: A Call for Action to Translate Recent Momentum on Tackling Tropical Snakebite into Sustained Benefit for Victims. Trans. R. Soc. Trop. Med. Hyg. 2019, 113, 835–838. [CrossRef]

19. Kasturiratne, A.; Wickremasinghe, A.R.; de Silva, N.; Gunawardena, N.K.; Pathmeswaran, A.; Premaratna, R.; Savioli, L.; Laloo, D.G.; de Silva, H.J. The Global Burden of Snakebite: A Literature Analysis and Modelling Based on Regional Estimates of Envenoming and Deaths. PLoS Med. 2008, 5, e218. [CrossRef]

20. The Lancet Snake-Bite Envenoming: A Priority Neglected Tropical Disease. Lancet 2017, 390, 2. [CrossRef]

21. Slagboom, J.; Kool, J.; Harrison, R.A.; Casewell, N.R. Haemotoxic Snake Venoms: Their Functional Activity, Impact on Snakebite Victims and Pharmaceutical Promise. Br. J. Haematol. 2017, 177, 947–959. [CrossRef]

22. Tasoulis, T.; Ibister, G.K. A Review and Database of Snake Venom Proteomes. Toxins 2017, 9, 290. [CrossRef]

23. Vonk, F.J.; Jackson, K.; Doley, R.; Madaras, F.; Mirtschin, P.J.; Vidal, N. Snake Venom: From Fieldwork to the Clinic: Recent Insights into Snake Biology, Together with New Technology Allowing High-Throughput Screening of Venom, Bring New Hope for Drug Discovery. Bioessays 2011, 33, 269–279. [CrossRef]

24. Casewell, N.R.; Wüster, W.; Vonk, F.J.; Harrison, R.A.; Fry, B.G. Complex Cocktails: The Evolutionary Novelty of Venoms. Trends Ecol. Evol. 2013, 28, 219–229. [CrossRef]

25. Fry, B.G.; Wüster, W.; Kini, R.M.; Brusic, V.; Khan, A.; Venkataraman, D.; Rooney, A.P. Molecular Evolution and Phylogeny of Elapid Snake Venom Three-Finger Toxins. J. Mol. Evol. 2003, 57, 110–129. [CrossRef]
26. Gutiérrez, J.M.; Rucavado, A.; Escalante, T.; Díaz, C. Hemorrhage Induced by Snake Venom Metalloproteinases: Biochemical and Biophysical Mechanisms Involved in Microvessel Damage. Toxicon 2005, 45, 997–1011. [CrossRef]

27. Gutiérrez, J.; Rucavado, A. Snake Venom Metalloproteinases: Their Role in the Pathogenesis of Local Tissue Damage. Biochimie 2000, 82, 841–850. [CrossRef]

28. Harris, J.; Scott-Davey, T. Secreted Phospholipases A2 of Snake Venoms: Effects on the Peripheral Neuromuscular System with Comments on the Role of Phospholipases A2 in Disorders of the CNS and Their Uses in Industry. Toxins 2013, 5, 2533–2571. [CrossRef]

29. Lynch, V.J. Inventing an Arsenal: Adaptive Evolution and Neofunctionalization of Snake Venom Phospholipase A2 Genes. BMC Evol. Biol. 2007, 7, 2. [CrossRef]

30. Tettelin, V.I. Three-Finger Snake Neurotoxins and Ly6 Proteins Targeting Nicotinic Acetylcholine Receptors: Pharmacological Tools and Endogenous Modulators. Trends Pharmacol. Sci. 2015, 36, 109–123. [CrossRef]

31. Samy, R.P.; Stiles, B.G.; Chinnathambi, A.; Zayed, M.E.; Alharbi, S.A.; Franco, O.L.; Rowan, E.G.; Kumar, A.P.; Lim, L.H.K.; Sethi, A.P. Pathogenesis of Dermonecrosis Induced by Venom of the Spitting Cobra, Naja Nigriscollis: An Experimental Study in Mice. Toxicon 2016, 119, 171–179. [CrossRef]

32. Tan, C.H. Snake Venomics: Fundamentals, Recent Updates, and a Look to the Next Decade. Toxins 2019, 11, 20. [CrossRef]

33. Kleggetveit, I.P.; Skulberg, P.K.; Jørum, E. Complex Regional Pain Syndrome Following Viper-Bite. Scand. J. Pain 2016, 10, 15–18. [CrossRef] [PubMed]

34. Jayawardana, S.; Gunanathan, A.; Arambepola, C.; Chang, T. Chronic Musculoskeletal Disabilities Following Snake Envenoming in Sri Lanka: A Population-Based Study. PLoS Negl. Trop. Dis. 2016, 10, e0005103. [CrossRef] [PubMed]

35. Pérez-Peinado, C.; Defaús, S.; Andreu, D. Hitchhiking with Nature: Snake Venom Peptides to Fight Cancer and Superbugs. Toxins 2020, 12, 255. [CrossRef] [PubMed]

36. Samy, R.P.; Gopalakrishnakone, P.; Chow, V.T.K.; Bow, H.; Weng, J.T. In Vitro Antimicrobial Activity of Natural Toxins and Animal Venoms Tested against Burkholderia Pseudomallei. BMC Infect Dis. 2006, 6, 100. [CrossRef]

37. Li, S.-A.; Lee, W.-H.; Zhang, Y. Efficacy of OH-CATH30 and Its Analogs against Drug-Resistant Bacteria In Vitro and in Mouse Models. Antimicrob. Agents Chemother. 2012, 56, 3309–3317. [CrossRef]

38. Cai, S.; Qiao, X.; Feng, L.; Shi, N.; Wang, H.; Yang, H.; Guo, Z.; Wang, M.; Chen, Y.; Wang, Y.; et al. Python Cathelicidin CATHPb1 Protects against Multidrug-Resistant Staphylococcal Infections by Antimicrobial-Immunomodulatory Duality. J. Med. Chem. 2018, 61, 2075–2086. [CrossRef]

39. Zhao, F.; Lan, X.-Q.; Du, Y.; Chen, P.-Y.; Zhao, J.; Zhao, F.; Lee, W.-H.; Zhang, Y. King Cobra Peptide OH-CATH30 as a Potential Candidate Drug through Clinic Drug-Resistant Isolates. Zool. Res. 2018, 39, 87–96. [CrossRef]

40. Tajbakhsh, M.; Karimi, A.; Tohidpour, A.; Abbasi, N.; Fallah, F.; Akhavan, M.M. The Antimicrobial Potential of a New Derivative of Cathelicidin from Bungarus Fasciatus against Methicillin-Resistant Staphylococcus Aureus. J. Microbiol. 2018, 56, 128–137. [CrossRef]

41. Almeida, J.R.; Mendes, B.; Lancellotti, M.; Marangoni, S.; Vale, N.; Leonardi, A.; Petan, T.; Žlajpah, M.; Krizaj, I. Disintegrins from the Venom of Vipera Ammodytes Ammodytes Efficiently Inhibit Migration of Breast Cancer Cells. ACS Chem. Biol. 2017, 12, 555–559. [CrossRef]
52. Naumann, G.B.; Silva, L.F.; Silva, L.; Faria, G.; Richardson, M.; Evangelista, K.; Kohlhoff, M.; Gontijo, C.M.F.; Navdaev, A.; de Rezende, F.F.; et al. Cytotoxicity and Inhibition of Platelet Aggregation Caused by an L-Amino Acid Oxidase from Bothrops Leucurus Venom. Biochim. Biophys Acta Gen. Subj. 2011, 1810, 683–694. [CrossRef] [PubMed]

53. Xiong, Y.; He, Q.; Yu, X.; Li, B.; Song, Z. The Anti-Ovarian Carcinoma Activity of L-Amino Acid Oxidase from Crotalus Adamanteus Venom in Vivo and in Vitro. Med. Oncol. 2022, 39, 112. [CrossRef] [PubMed]

54. Daghestani, M.; Hakami, H.H.; Hassan, Z.K.; Badr, G.; Amin, M.H.; Amin, M.H.; Shafi Bhat, R. The Anti-Cancer Effect of Echis Coloratus and Wallerintmissis Aegyptia Venoms on Colon Cancer Cells. Toxins Rev. 2021, 40, 257–266. [CrossRef]

55. Alves, R.M.; Antonucci, G.A.; Paiva, H.H.; Cintra, A.C.O.; Franco, J.J.; Mendonça-Franqueto, E.P.; Dorta, D.J.; Giglio, J.R.; Rosa, J.C.; Fuly, A.L.; et al. Evidence of Caspase-Mediated Apoptosis Induced by L-Amino Acid Oxidase Isolated from Bothrops Atrox Snake Venom. Comp. Biochem. Physiol. Part. A Mol. Integr. Physiol. 2008, 151, 542–550. [CrossRef] [PubMed]

56. Son, D.J.; Park, M.H.; Chae, S.J.; Moon, S.O.; Lee, J.W.; Song, H.S.; Moon, D.C.; Kang, S.S.; Kwon, Y.E.; Hong, J.T. Inhibitory Effect of Snake Venom Toxin from Vipera Lebetina Turanica on Hormone-Refractory Human Prostate Cancer Cell Growth: Induction of Apoptosis through Inactivation of Nuclear Factor KB. Mol. Cancer Ther. 2007, 6, 675–683. [CrossRef]

57. Mukherjee, A.K.; Saviola, A.J.; Burns, P.D.; Mackessy, S.P. Apoptosis Induction in Human Breast Cancer (MCF-7) Cells by a Novel Venom L-Amino Acid Oxidase (Rusvinoxidase) Is Independent of Its Enzymatic Activity and Is Accompanied by Caspase-7 Activation and Reactive Oxygen Species Production. Apoptosis 2015, 20, 1358–1372. [CrossRef]

58. Park, M.H.; Jo, M.; Won, D.; Song, H.S.; Han, S.B.; Song, M.J.; Hong, J.T. Snake Venom Toxin from Vipera Lebetina Turanica Induces Apoptosis of Colon Cancer Cells via Uregulation of ROS- and JNK-Mediated Death Receptor Expression. BMC Cancer 2012, 12, 228. [CrossRef]

59. Park, J.K.; Jo, M.R.; Park, M.H.; Song, H.S.; An, B.J.; Song, M.J.; Han, S.B.; Hong, J.T. Cell Growth Induction and Inhibition of Apoptosis by Snake Venom Toxin in Ovarian Cancer Cell via Inactivation of Nuclear Factor KB and Signal Transducer and Activator of Transcription 3. Arch. Pharm. Res. 2012, 35, 867–876. [CrossRef]

60. Park, M.H.; Son, D.J.; Kwak, D.H.; Song, H.S.; Oh, K.-W.; Yoo, H.-S.; Lee, Y.M.; Song, M.J.; Hong, J.T. Snake Venom Toxin Inhibits Cell Growth through Induction of Apoptosis in Neuroblastoma Cells. Arch. Pharm. Res. 2009, 32, 1545–1554. [CrossRef]

61. Zhang, L.; Cui, L. A Cytotoxin Isolated from Agkistrodon halys acutus Snake Venom Induces Apoptosis via Fas Pathway in A549 Cells. Toxicol. In Vitro 2007, 21, 1095–1103. [CrossRef]

62. Zakraoui, O.; Marcinkiewicz, C.; Aloui, Z.; Othman, H.; Grépin, R.; Haoues, M.; Essafi, M.; Srairi-Abid, N.; Gasmi, A.; Karoui, H.; et al. Lebein, a Snake Venom Disintegrin, Suppresses Human Colon Cancer Cells Proliferation and Tumor-Induced Angiogenesis through Cell Cycle Arrest, Apoptosis Induction and Inhibition of VEGF Expression: Mechanisms and Targets for Lebein in Colorectal Cancer. Mol. Carcinog. 2017, 56, 18–35. [CrossRef]

63. Costa, T.R.; Menaldo, D.L.; Zoccal, K.F.; Burin, S.M.; Aissa, A.F.; Castro, F.A.d.; Faccioli, L.H.; Greggi Antunes, L.M.; Sampaio, S.V. CR-LA0O, an L-Amino Acid Oxidase from Calloselasma Rhodostoma Venom, as a Potential Tool for Developing Novel Immunotherapeutic Strategies against Cancer. Sci. Rep. 2017, 7, 42673. [CrossRef]

64. Prinholato da Silva, C.; Costa, T.R.; Paiva, R.M.A.; Cintra, A.C.O.; Menaldo, D.L.; Antunes, L.M.G.; Sampaio, S.V. Antitumor Potential of the Myotoxin BthTX-I from Bothrops Jararacussu Snake Venom: Evaluation of Cell Cycle Alterations and Death Mechanisms Induced in Tumor Cell Lines. J. Venom. Anim. Toxins Incl. Trop. Dis. 2015, 21, 44. [CrossRef]

65. Ebrahimi, K.; Vatanpour, H.; Zare, A.; Shirazi, F.H.; Nakjhavani, M. Anticancer Activity of a Caspian Cobra (Naja naja oxiana) Snake Venom in Human Cancer Cell Lines Via Induction of Apoptosis. J. Immunother. 2015, 21, 105–112. [CrossRef]

66. Al-Amsari, A.; Anvarbatches, R.; Al-Shahrani, M.; Islam, M. Snake Venom Causes Apoptosis by Increasing the Reactive Oxygen Species in Colorectal and Breast Cancer Cell Lines. OTT 2016, 9, 6485–6498. [CrossRef]

67. Lee, H.L.; Park, M.H.; Hong, J.E.; Kim, D.H.; Kim, J.Y.; Seo, H.O.; Han, S.-B.; Yoon, J.H.; Lee, W.H.; Song, H.S.; et al. Inhibitory Effect of Snake Venom Toxin on NF-KB Activity Prevents Human Cervical Cancer Cell Growth via Increase of Death Receptor 3 and 5 Expression. Arch. Toxicol. 2016, 90, 463–477. [CrossRef]

68. Bernardes-Oliveira, E.; Gomes, D.L.; Martelli Palomino, G.; Juvenal Silva Farias, K.; da Silva, W.D.; Rocha, H.A.O.; Gonçalves, A.K.; Fernandes-Pedrosa, M.de.F.; Crispim, J.C.d.O. Bothsrops Jararaca and Bothrops Erythromelas Snake Venoms Promote Cell Cycle Arrest and Induce Apoptosis via the Mitochondrial Depolarization of Cervical Cancer Cells. Evid. Based Complementary Altern. Med. 2016, 2016, 1574971. [CrossRef]

69. Tran, T.V.; Siniavina, A.E.; Hoang, A.N.; Le, M.; Pham, C.D.; Phung, T.V.; Nguyen, K.C.; Ziganshin, R.H.; Tsetlin, V.I.; Weng, C.F.; et al. Phospholipase A2 from Krait Bungarus fasciatus Venom Induces Human Cancer Cell Death In Vitro. PeerJ 2019, 7, 22. [CrossRef]

70. Jiménez–Charris, E.; Lopes, D.S.; Gimenes, S.N.C.; Teixeira, S.C.; Montealegre–Sánchez, L.; Solano–Redondo, L.; Fierro–Pérez, L.; Rodrigues–Avila, V. de M. Antitumor Potential of Pllns–II, an Acidic Asp49–PLA2 from Porthidium Lansbergii Lansbergii Snake Venom on Human Cervical Carcinoma HEla Cells. Int. J. Biol. Macromol. 2019, 122, 1053–1061. [CrossRef]

71. Hammouda, M.; Montenegro, M.; Sánchez–del–Campo, L.; Zakraoui, O.; Aloui, Z.; Riahi–Chebbi, I.; Karoui, H.; Rodriguez–López, J.; Essafi–Benkhadir, K. Lebein, a Snake Venom Disintegrin, Induces Apoptosis in Human Melanoma Cells. Toxins 2016, 8, 206. [CrossRef]

72. Bezerra, P.H.A.; Ferreira, I.M.; Franceschi, B.T.; Bianchini, F.; Ambroso, L.; Cintra, A.C.O.; Sampaio, S.V.; Castro, F.A.d.; Torqueti, M.R. BthTX-I from Bothrops Jararacussu Induces Apoptosis in Human Breast Cancer Cell Lines and Decreases Cancer Stem Cell Subpopulation. J. Venom. Anim. Toxins Incl. Trop. Dis. 2019, 25, e20190010. [CrossRef] [PubMed]
Animals 2022, 12, 2058

73. Ri, S. Cerastes Cerastes and Vipera Lebetina Snake Venoms Apoptotic—Stimulating Activity to Human Breast Cancer Cells and Related Gene Modulation. JCS 2012, 4, 317–323. [CrossRef]

74. Nikodijević, D.D.; Jovančić, J.V.; Cvetković, D.M.; Andelković, M.Z.; Nikezić, A.G.; Milutinović, M.G. L-Amino Acid Oxidase from Snake Venom: Biotransformation and Induction of Apoptosis in Human Colon Cancer Cells. Eur. J. Pharm. 2021, 910, 174466. [CrossRef][PubMed]

75. Bazaaz, A.; Luis, J.; Srairi-Abid, N.; Kallech-Ziri, O.; Kessentini-Zouari, R.; Defilles, C.; Lissitzky, J.-C.; El Ayeb, M.; Marrakchi, N. MVL-PLA2, a Phospholipase A2 from Macrovipera Lebetina Transmediterranea Venom, Inhibits Tumor Cells Adhesion and Migration. Matrix Biol. 2009, 28, 188–193. [CrossRef]

76. Sánchez, E.E.; Rodríguez-Acosta, A.; Palomar, R.; Lucena, S.E.; Bashir, S.; Soto, J.G.; Pérez, J.C. Colombistatin: A Disintegrin Isolated from the Venom of the South American Snake (Bothrops colombiensis) That Effectively Inhibits Platelet Aggregation and SK-Mel-28 Cell Adhesion. Arch. Toxicol. 2009, 83, 271–279. [CrossRef]

77. Saviola, A.; Burns, P.D.; Mukherjee, A.K.; Mackessy, S.P. The Disintegrin Tzabcabin Inhibits Adhesion and Migration in Melanoma and Lung Cancer Cells. Int. J. Biol. Macromol. 2016, 88, 457–464. [CrossRef]

78. Teixeira, T.L.; Oliveira Silva, V.A.; da Cunha, D.B.; Polettini, F.L.; Thomaz, C.D.; Pianca, A.A.; Zambom, F.L.; da Silva Leitao, D.P.; Reis, R.M.; Mazzi, M.V. Isolation and Characterization of the in vitro Cytotoxic Activity of a Novel L-Amino Acid Oxidase (LAAOcdt) from Crotalus Durissus Terrificus Venom on Human Cancer Cell Lines. Toxicon 2016, 119, 203–217. [CrossRef]

79. Kim, D.S.; Jang, Y.-J.; Jeon, O.-H.; Kim, D.-S. Saxatilin Inhibits TNF-α-Induced Proliferation by Suppressing AP-1-Dependent IL-8 Expression in the Ovarian Cancer Cell Line MDAH 2774. Mol. Immunol. 2007, 44, 1409–1416. [CrossRef]

80. Karthikeya, R.; Karghayan, S.; Sri Balasubashini, M.; Somasundaram, S.T.; Balasubramanian, T. Inhibition of Hep2 and HeLa Cell Proliferation in Vitro and EAC Tumor Growth in Vivo by Lapemis Curtus (Shaw 1802) Venom. Toxicon 2008, 51, 157–161. [CrossRef]

81. Chernyshenko, V.; Luis, J.; Srairi-Abid, N.; Kallech-Ziri, O.; Kessentini-Zouari, R.; Defilles, C.; Lissitzky, J.-C.; El Ayeb, M.; Marrakchi, N. L-Amino Acid Oxidase. Basic Clin. Pharm. Toxicol. 2014, 114, 336–343. [CrossRef]

82. Saviola, A.J.; Burns, P.D.; Mukherjee, A.K.; Mackessy, S.P. The Disintegrin Tzabcabin Inhibits Adhesion and Migration in Melanoma and Lung Cancer Cells. Int. J. Biol. Macromol. 2016, 88, 457–464. [CrossRef]

83. Momic, T.; Cohen, G.; Reich, R.; Arlinghaus, F.T.; Eble, J.A.; Marcinkiewicz, C.; Lazarovic, P. Vixapatin (VP12), a C-Type Lectin-Protein from Vipera Xantina Palestinae Venom: Characterization as a Novel Anti-Angiogenic Compound. BMB Rep. 2007, 40, 439–443. [CrossRef]

84. Bazaa, A.; Luis, J.; Srairi-Abid, N.; Kallech-Ziri, O.; Kessentini-Zouari, R.; Defilles, C.; Lissitzky, J.-C.; El Ayeb, M.; Marrakchi, N. MVL-PLA2, a Phospholipase A2 from Macrovipera Lebetina Transmediterranea Venom, Inhibits Tumor Cells Adhesion and Migration. Matrix Biol. 2009, 28, 188–193. [CrossRef]

85. Sánchez, E.E.; Rodríguez-Acosta, A.; Palomar, R.; Lucena, S.E.; Bashir, S.; Soto, J.G.; Pérez, J.C. Colombistatin: A Disintegrin Isolated from the Venom of the South American Snake (Bothrops colombiensis) That Effectively Inhibits Platelet Aggregation and SK-Mel-28 Cell Adhesion. Arch. Toxicol. 2009, 83, 271–279. [CrossRef]

86. Al-Sadoon, M.K.; Abdel-Maksoud, M.A.; Rabah, D.M.; Badr, G. Induction of Apoptosis and Growth Arrest in Human Breast Cancer Cells. Eur. J. Pharm. 2021, 910, 174466. [CrossRef][PubMed]

87. Zhao, Y.S.; Yang, H.L.; Liu, C.Z. Inhibitory Effects of Immunotargeting of Chinese Cobra Cytotoxin and Iodine-131 against Nasopharyngeal Carcinoma Cells in Vitro. J. South. Med. Univ. 2007, 30, 1235–1236. [CrossRef]

88. Zhao, Y.S.; Yang, H.L.; Liu, C.Z. Inhibitory Effects of Immunotargeting of Chinese Cobra Cytotoxin and Iodine-131 against Nasopharyngeal Carcinoma Cells in Vitro. J. South. Med. Univ. 2008, 28, 1235–1236. [CrossRef]

89. Al-Sadoon, M.K.; Abdel-Maksoud, M.A.; Rabah, D.M.; Badr, G. Induction of Apoptosis and Growth Arrest in Human Breast Cancer Cells by a Snake (Walterinnesia Aegyptia) Venom Combined with Silica Nanoparticles: Crosstalk Between Bcl2 and Caspase 3. Cell. Physiol Biochem. 2012, 30, 653–665. [CrossRef]

90. Al-Sadoon, M.K.; Rabah, D.M.; Badr, G. Enhanced Anticancer Efficacy of Snake Venom Combined with Silica Nanoparticles in a Murine Model of Human Multiple Myeloma: Molecular Targets for Cell Cycle Arrest and Apoptosis Induction. Cell. Immunol. 2013, 284, 129–138. [CrossRef]

91. Chippaux, J.-P. Snakebite Envenomation Turns Again into a Neglected Tropical Disease! J. Venom. Anim. Toxins Incl. Trop. Dis. 2017, 23, 38. [CrossRef]

92. Hanney, S.R.; Gonzalez-Block, M.A. Organising Health Research Systems as a Key to Improving Health: The World Health Report 2013 and How to Make Further Progress. Health Res. Policy Syst. 2013, 11, 47. [CrossRef]

93. Bai, J.; Li, W.; Huang, Y.-M.; Guo, Y. Bibliometric Study of Research and Development for Neglected Diseases in the BRICS. Infect. Dis. Poverty 2016, 5, 89. [CrossRef]

94. Fontecha, G.; Sánchez, A.; Ortiz, B. Publication Trends in Neglected Tropical Diseases of Latin America and the Caribbean: A Bibliometric Analysis. Pathogens 2021, 10, 356. [CrossRef]

95. Sweileh, W.M. Contribution of Researchers in Arab Countries to Scientific Publications on Neglected Tropical Diseases (1971–2020). Trop. Dis. Travel Med. Vaccines 2022, 8, 14. [CrossRef]

96. Burnham, J.F. Scopus Database: A Review. Biomed. Digit. Libr. 2006, 3, 1. [CrossRef]
126. Salve, P.S.; Vatavati, S.; Hallad, J. Clustering the Envenoming of Snakebite in India: The District Level Analysis Using Health Management Information System Data. Clin. Epidemiol. Glob. Health 2020, 8, 733–738. [CrossRef]
127. Sasa, M.; Segura Cano, S.E. New Insights into Snakebite Epidemiology in Costa Rica: A Retrospective Evaluation of Medical Records. Toxicon X 2020, 7, 100035. [CrossRef]
128. Surawee, W.; Warrell, D.; Whitaker, R.; Menon, G.; Rodrigues, R.; Fu, S.H.; Begum, R.; Sati, P.; Piyasena, K.; Bhatia, M.; et al. Trends in Snakebite Deaths in India from 2000 to 2019 in a Nationally Representative Mortality Study. eLife 2020, 9, e54076. [CrossRef]
129. Aksnes, D.W.; Langfeldt, L.; Wouters, P. Citations, Citation Indicators, and Research Quality: An Overview of Basic Concepts and Theories. SAGE Open 2019, 9, 21582441982957. [CrossRef]
130. Mammoła, S.; Fontaneto, D.; Martínez, A.; Chichorro, F. Impact of the Reference List Features on the Number of Citations. Scientometrics 2021, 126, 785–799. [CrossRef]
131. Tahamtan, I.; Safipour Afshar, A.; Ahadmzadeh, K. Factors Affecting Number of Citations: A Comprehensive Review of the Literature. Scientometrics 2016, 107, 1195–1225. [CrossRef]
132. Lentz, T.L.; Wilson, F.T.; Hawrot, E.; Speicher, D.W. Amino Acid Sequence Similarity Between Rabies Virus Glycoprotein and Snake Venom Curaremimetic Neurotoxins. Science 1984, 226, 847–848. [CrossRef] [PubMed]
133. Metz, M.; Piliponsky, A.M.; Chen, C.-C.; Lammel, V.; Åbrink, M.; Pejler, G.; Tsai, M.; Galli, S.J. Mast Cells Can Enhance Resistance to Snake and Honeybee Venoms. Science 2006, 313, 526–530. [CrossRef] [PubMed]
134. Tsernoglou, D.; Petsko, G.A.; McQueen, J.E.; Hermans, J. Molecular Graphics: Application to the Structure Determination of a Snake Venom Neurotoxin. Science 1977, 197, 1378–1381. [CrossRef] [PubMed]
135. Laustsen, A.H.; Gutiérrez, J.M.; Rasmussen, A.R.; Engmark, M.; Gravlund, P.; Sanders, K.L.; Lobse, B.; Lomonte, B. Danger in the Reef: Proteosome, Toxicity, and Neutralization of the Venom of the Olive Sea Snake, Aipysurus Laevis. Toxicon 2015, 107, 187–196. [CrossRef] [PubMed]
136. Doley, R.; Tran, N.N.B.; Reza, M.A.; Kini, R.M. Unusual Accelerated Rate of Deletions and Insertions in Toxin Genes in the Venom Glands of the Pygmy Copperhead (Austrelaps labialis) from Kangaroo Island. BMC Evol. Biol. 2008, 8, 70. [CrossRef] [PubMed]
137. Oh, A.M.F.; Tan, K.Y.; Lim, S.E.; Tan, N.H. Venomics of Bungarus caeruleus (Indian krait): Comparable Venom Profiles, Variable Immunoactivities among Specimens from Sri Lanka, India and Pakistan. J. Proteom. 2017, 164, 1–18. [CrossRef] [PubMed]
138. Rasmussen, A.R.; Yee, T.T.; Mustafa, M.R.; Hodgson, W.C.; Othman, I. Proteomic Characterization and Comparison of Malaysian Bungarus Candidus and Bungurus Fasciatus Venoms. J. Proteom. 2014, 110, 129–144. [CrossRef]
139. Ziganshin, R.H.; Kovalchuk, S.I.; Arapidi, G.P.; Starkov, V.G.; Hoang, A.N.; Thi Nguyen, T.T.; Nguyen, K.C.; Shoibonov, B.B.; Tsetlin, V.I.; Utkin, Y.N. Quantitative Proteomic Analysis of Vietnamese Krait Venoms: Neurotoxins Are The Major Components in Bungurus Multicinctus and Phospholipases A2 in Bungarus Fasciatus. Toxicon 2015, 107, 197–209. [CrossRef]
140. Shanshan, X.; Gao, J.-F.; Zhang, X.-Y.; Shen, S.-S.; He, Y.; Wang, J.; Ma, X.-M.; Ji, X. Proteomic Characterization and Comparison of Venom from Two Elapid Snakes (Bungurus multicinctus and Naja atra) from China. J. Proteom. 2016, 138, 83–94. [CrossRef]
141. Lauridsen, L.P.; Laustsen, A.H.; Lomonte, B.; Gutiérrez, J.M. Toxicovenomics and Antivenom Profiling of the Eastern Green Mamba Snake (Dendroaspis angusticeps). J. Proteom. 2017, 136, 248–261. [CrossRef]
142. Laustsen, A.H.; Lomonte, B.; Lobse, B.; Fernández, J.; Gutiérrez, J.M. Unveiling the Nature of Black Mamba (Dendroaspis polylepis) Venom through Venomics and Antivenins: Identification of Key Toxin Targets for Antivenom Development. J. Proteom. 2015, 119, 126–142. [CrossRef]
143. Chatrath, S.T.; Chapeaurouge, A.; Lin, Q.; Lim, T.K.; Dunstan, N.; Mirtschin, P.; Kumar, P.P.; Kini, R.M. Identification of Novel Proteins from the Venom of a Cryptic Snake Drysdalia Coronoides by a Combined Transcriptomics and Proteomics Approach. J. Proteome Res. 2011, 10, 739–750. [CrossRef]
144. Calvete, J.J.; Ghezziello, P.; Paiva, O.; Maitainaho, T.; Ghassempour, A.; Goudarzi, H.; Kraus, F.; Sanz, L.; Williams, D.J. Snake Venomics of Two Poorly Known Hydrophidina: Comparative Proteomics of the Venoms of Terrestrial Toxicocalamus Longissimus and Marine Hydrophis Cyanocincus. J. Proteom. 2012, 75, 4091–4101. [CrossRef]
145. Tan, C.H.; Tan, K.Y.; Lim, S.E.; Tan, N.H. Venomics of the Beaked Sea Snake, Hydrophis Schistosus: A Minimalist Toxin Arsenal and Its Cross-Neutralization by Heterologous Antivenoms. J. Proteom. 2015, 126, 121–130. [CrossRef]
146. Fernández, J.; Vargas-Vargas, N.; Pla, D.; Sasa, M.; Rey-Suárez, P.; Sanz, L.; Gutiérrez, J.M.; Calvete, J.J.; Lomonte, B. Snake Venomics of Micrurus Alleni and Micrurus Mosquitensis from the Caribbean Region of Costa Rica Reveals Two Divergent Compositional Patterns in New World Elapids. Toxicon 2015, 107, 217–233. [CrossRef]
147. Corrêa-Netto, C.; Junqueira-da-Azevedo, I.d.L.M.; Silva, D.A.; Ho, P.L.; Leitão-de-Araújo, M.; Alves, M.L.M.; Sanz, L.; Foguel, D.; Zingali, R.B.; Calvete, J.J. Snake Venomics and Venom Gland Transcriptomic Analysis of Brazilian Coral Snakes, Micrurus Altirostris and M. Corallinus. J. Proteom. 2011, 74, 1795–1809. [CrossRef]
148. Margres, M.J.; Aronow, K.; Löyacano, J.; Rokyta, D.R. The Venom-Gland Transcriptome of the Eastern Coral Snake (Micrurus fulvius) Reveals High Venom Complexity in the Intrageneric Evolution of Venoms. BMC Genom. 2013, 14, 531. [CrossRef]
149. Rey-Suárez, P.; Nuñez, V.; Gutiérrez, J.M.; Lomonte, B. Proteomic and Biological Characterization of the Venom of the Redtail Coral Snake, Micrurus Mipartitus (Elapidae), from Colombia and Costa Rica. J. Proteom. 2011, 75, 655–667. [CrossRef]
150. Fernández, J.; Alape-Girón, A.; Angulo, Y.; Sanz, L.; Gutiérrez, J.M.; Calvete, J.J.; Lomonte, B. Venomic and Antivenomic Analyses of the Central American Coral Snake, Micrurus Nigrocinctus (Elapidae). J. Proteome Res. 2011, 10, 1816–1827. [CrossRef]
Animals 2022, 12, 2058

151. Sanz, L.; Pla, D.; Pérez, A.; Rodríguez, Y.; Zavaleta, A.; Salas, M.; Lomonte, B.; Calvet, J. Venomic Analysis of the Poorly Studied Desert Coral Snake, Micrurus Tschudii Tschudii, Supports the 3FTx/PLA2 Dichotomy across Micrurus Venoms. Toxins 2016, 8, 178. [CrossRef]

152. Huang, H.-W.; Liu, B.-S.; Chien, K.-Y.; Chiang, L.-C.; Huang, S.-Y.; Sung, W.-C.; Wu, W.-G. Cobra Venom Proteome and Glycome Determined from Individual Snakes of Naja Atra Reveal Medically Important Dynamic Range and Systematic Geographic Variation. J. Proteom. 2015, 128, 92–104. [CrossRef]

153. Malih, I.; Ahmad rusmili, M.R.; Tee, T.Y.; Saile, R.; Ghalim, N.; Othman, I. Proteomic Analysis of Moroccan Cobra Naja Haje Legionsis Venom Using Tandem Mass Spectrometry. J. Proteom. 2014, 96, 240–252. [CrossRef]

154. Tan, K.Y.; Tan, C.H.; Fung, S.Y.; Tan, N.H. Venomics, Lethality and Neutralization of Naja Kaouthia (Monocled cobra) Venoms from Three Different Geographical Regions of Southeast Asia. J. Proteom. 2015, 120, 105–125. [CrossRef]

155. Xu, N.; Zhao, H.-Y.; Yin, Y.; Shen, H.; Shan, L.-L.; Chen, C.-X.; Zhang, Y.-X.; Gao, J.-F.; Ji, X. Combined Venomics, Antivenomics and Venom Gland Transcriptome Analysis of the Monocoled Cobra (Naja kaouthia) from China. J. Proteom. 2017, 159, 19–31. [CrossRef]

156. Dutta, S.; Chanda, A.; Kalita, B.; Islam, T.; Patra, A.; Mukherjee, A.K. Proteomic Analysis to Unravel the Complex Venom Proteome of Bothrops Atrox: Paedomorphism along Its Transamazonian Dispersal and Implications of Geographic Venom Variability on Snakebite Management. J. Proteom. 2011, 80, 708–719. [CrossRef]

157. Lauridsen, L.P.; Laustsen, A.H.; Lomonte, B.; Gutiérrez, J.M. Exploring the Venom of the Forest Cobra Snake: Toxico- and Antivenom Profiling of Naja Melanoleuca. J. Proteom. 2017, 150, 98–108. [CrossRef]

158. Bocian, A.; Urbanik, M.; Huis, K.; Eyskowski, A.; Petriella, V.; Andrejšákova, Z.; Petrillová, M.; Legáth, J. Proteomic Analyses of Agkistrondon Contortrix Contortrix Venom Using 2D Electrophoresis and MS Techniques. Toxins 2016, 8, 372. [CrossRef]

159. Calvet, J.J.; Chalkidis, H.M.; Mourão, G.; Angulo, Y.; Gutiérrez, J.M.; Warrell, D.A.; Theakston, R.D.G.; et al. Snake Venomics of African Spitting Cobras: Toxin Composition and Assessment of Congeneric Cross-Reactivity of the Pan-African EchiTab-Plus-ICP Antivenom by Antivenomics and Neutralization Approaches. J. Proteom. Res. 2011, 10, 1266–1280. [CrossRef]

160. Bojanov, J.; Chalkidis, H.M.; Mourão, G.; Angulo, Y.; Gutiérrez, J.M.; Warrell, D.A.; Theakston, R.D.G.; et al. Comparative Proteomic Analysis of the Venom of the Taipan Snake, Oxyuranus Scutellatus, from Papua New Guinea and Australia: Role of Neurotoxic and Procoagulant Effects in Venom Toxicity. J. Proteom. 2012, 75, 2128–2140. [CrossRef] [PubMed]

161. Calvete, J.J.; Chalkidis, H.M.; Mourão, G.; Angulo, Y.; Gutiérrez, J.M.; Warrell, D.A.; Theakston, R.D.G.; et al. Comparative Proteomic Analysis of the Venom of Bothrops Atrox: Paedomorphism along Its Transamazonian Dispersal and Implications of Geographic Venom Variability on Snakebite Management. J. Proteom. 2011, 80, 708–719. [CrossRef]
172. Kohlhoff, M.; Borges, M.H.; Yarleque, A.; Cabezas, C.; Richardson, M.; Sanchez, E.F. Exploring the Proteomes of the Venoms of the Peruvian Pit Vipers Bothrops Atrox, B. Barnetti and B. Pictus. J. Proteom. 2012, 75, 2181–2195. [CrossRef]

173. Núñez, V.; Cid, P.; Sanz, L.; De La Torre, P.; Angulo, Y.; Lomonte, B.; Gutiérrez, J.M.; Calvete, J.J. Snake Venomics and Antivenomics of Bothrops Atrox Venoms from Colombia and the Amazon Regions of Brazil, Perú and Ecuador Suggest the Occurrence of Geographic Variation of Venom Phenotype by a Trend towards Paedomorphism. J. Proteom. 2009, 73, 57–78. [CrossRef]

174. Sousa, L.F.; Nicolau, C.A.; Peixoto, P.S.; Bernardoni, J.L.; Oliveira, S.S.; Portes-Junior, J.A.; Mourão, R.H.V.; Lima-dos-Santos, I.; Sano-Martins, I.S.; Chalkidis, H.M.; et al. Comparison of Phylogeny, Venom Composition and Neutralization by Antivenom in Diverse Species of Bothrops Complex. PLoS Negl. Trop. Dis. 2013, 7, e2442. [CrossRef]

175. Sousa, L.F.; Portes-Junior, J.A.; Nicolau, C.A.; Bernardoni, J.L.; Nishiyama, M.Y., Jr.; Amazonas, D.R.; Freitas-de-Sousa, L.A.; Mourão, R.H.; Chalkidis, H.M.; Valente, R.H.; et al. Functional Proteomic Analyses of Bothrops Atrox Venom Reveals Phenotypes Associated with Habitat Variation in the Amazon. J. Proteom. 2017, 159, 32–46. [CrossRef]

176. Mora-Obando, D.; Guerrero-Vargas, J.A.; Prieto-Sánchez, R.; Beltrán, J.; Rucavado, A.; Sasa, M.; Gutiérrez, J.M.; Ayerbe, S.; Lomonte, B. Proteomic and Functional Profiling of the Venom of Bothrops Ayerebi from Cauca, Colombia, Reveals Striking Interspecific Variation with Bothrops Asper Venom. J. Proteom. 2014, 96, 159–172. [CrossRef]

177. Gutiérrez, J.M.; Sanz, L.; Escolano, J.; Fernández, J.; Lomonte, B.; Angulo, Y.; Rucavado, A.; Warrell, D.R.; Calvete, J.J. Snake Venomics of the Lesser Antillean Pit Vipers Bothrops Caribaeus and Bothrops Lanceolatus: Correlation with Toxicological Activities and Immunoreactivity of a Heterologous Antivenom. J. Proteome Res. 2008, 7, 4396–4408. [CrossRef]

178. Calvete, J.J.; Borges, A.; Segura, A.; Flores-Díaz, M.; Alape-Girón, A.; Gutiérrez, J.M.; Diez, N.; De Sousa, L.; Kiriakos, D.; Sánchez, E.; et al. Snake Venomics and Antivenomics of Bothrops Colombiensis, a Medically Important Pitviper of the Bothrops Asper-Asper Complex Endemic to Venezuela: Contributing to Its Taxonomy and Snakebite Management. J. Proteom. 2009, 72, 227–240. [CrossRef]

179. Tashima, A.K.; Sanz, L.; Camargo, A.C.M.; Serrano, S.M.T.; Calvete, J.J. Snake Venomics of the Brazilian Pitvipers Bothrops Cotiara and Bothrops Fonsecaii. Identification of Taxonomy Markers. J. Proteom. 2008, 71, 473–485. [CrossRef]

180. Gay, C.; Sanz, L.; Calvete, J.J.; Pla, D. Snake Venomics and Antivenomics of Bothrops Diporus, a Medically Important Pitviper in Northeastern Argentina. Toxins 2015, 8, 9. [CrossRef]

181. Jorge, R.J.B.; Monteiro, H.S.A.; Gonçalves-Machado, L.; Guarnieri, M.C.; Ximenes, R.M.; Borges-Nojosa, D.M.; Luna, K.P.d.O.; Zingali, R.B.; Corrêa-Neto, C.; et al. Combined Venomics and Immunoreactivity of a Heterologous Antivenom. J. Proteome Res. 2008, 7, 4396–4408. [CrossRef]

182. Valente, R.H.; Guimarães, P.R.; Junqueira, M.; Neves-Ferreira, A.G.C.; Soares, M.R.; Chapeaurouge, A.; Trugilho, M.R.O.; León, I.R.; Rocha, S.L.G.; Oliveira-Carvalho, A.L.; et al. Bothrops Insularis Venomics: A Proteomic Analysis Supported by Transcriptomic-Generated Sequence Data. J. Proteom. 2009, 72, 241–255. [CrossRef] [PubMed]

183. Gonçalves-Machado, L.; Pla, D.; Sanz, L.; Jorge, R.J.B.; Leitão-De-Araújo, M.; Alves, M.L.M.; Alvesa, D.J.; De Miranda, J.; Nowatzki, J.; de Morais-Zani, K.; et al. Combined Venomics, Venom Gland Transcriptomics, Bioactivities, and Antivenomics of Two Bothrops Jararaca Populations from Geographic Isolated Regions within the Brazilian Atlantic Rainforest. J. Proteom. 2016, 135, 73–89. [CrossRef] [PubMed]

184. Bernardes, C.P.; Menaldo, D.L.; Camacho, E.; Rosa, J.C.; Escalante, T.; Rucavado, A.; Lomonte, B.; Gutiérrez, J.M.; Sampaio, S.V. Proteomic Analysis of Bothrops Pirajai Snake Venom and Characterization of BpirMP, a New P-I Metalloproteinase. J. Proteom. 2013, 80, 250–267. [CrossRef] [PubMed]

185. Fernández Culma, M.; Andrés Pereiráz, J.; Núñez Rangel, V.; Lomonte, B. Snake Venomics of Bothrops Punctatus, a Semiarboreal Pitviper Species from Antioquia, Colombia. PeerJ 2014, 2, e246. [CrossRef]

186. Tang, E.L.H.; Tan, C.H.; Fung, S.Y.; Tan, N.H. Venomics of Calloselasma Rhodostoma, the Malayan Pit Viper: A Complex Toxin Arsenal Unraveled. J. Proteom. 2016, 148, 44–56. [CrossRef]

187. Fahni, L.; Makran, B.; Pla, D.; Sanz, L.; Oukkache, N.; Lkhider, M.; Harrison, R.A.; Ghalim, N.; Calvete, J.J. Venomics and Antivenomics Profiles of North African Cerastes Cerastes and C. Vipera Populations Reveals a Potentially Important Therapeutic Weakness. J. Proteom. 2012, 75, 2442–2453. [CrossRef]

188. Lomonte, B.; Rey-Suárez, P.; Tsai, W.-C.; Angulo, Y.; Sasa, M.; Gutiérrez, J.M.; Calvete, J.J. Snake Venomics of the Pit Vipers Porthidium Nasutum, Porthidium Ophryomegas, and Cerrophidion Godmani from Costa Rica: Taxological and Taxonomical Insights. J. Proteom. 2012, 75, 1675–1699. [CrossRef]

189. Rokyta, D.R.; Wray, K.P.; Lemmon, A.R.; Lemmon, E.M.; Caudle, S.B. A High-Throughput Venom-Gland Transcriptome for the Eastern Diamondback Rattlesnake (Crotalus adamanteus) and Evidence for Perservative Positive Selection across Toxin Classes. Toxicon 2011, 57, 657–671. [CrossRef]

190. Segura, A.; Herrera, M.; Reta-Mares, F.; Jaime, C.; Sánchez, A.; Vargas, M.; Villalta, M.; Gómez, A.; Gutiérrez, J.M.; León, G. Proteomic, Toxological and Immunogenic Characterization of Mexican West-Coast Rattlesnake (Crotalus basiliscus) Venom and Its Immunological Relatedness with the Venom of Central American Rattlesnake (Crotalus simus). J. Proteom. 2017, 158, 62–72. [CrossRef]

191. Boldrini-França, J.; Corrêa-Netto, C.; Silva, M.M.S.; Rodrigues, R.S.; De La Torre, P.; Pérez, A.; Soares, A.M.; Zingali, R.B.; Nogueira, R.A.; Rodrigues, V.M.; et al. Snake Venomics and Antivenomics of Crotalus Durissus Subspecies from Brazil: Assessment of Geographic Variation and Its Implication on Snakebite Management. J. Proteom. 2010, 73, 1758–1776. [CrossRef]
Animals 2022, 12, 2058

192. Georgieva, D.; Öhler, M.; Seifert, J.; von Bergen, M.; Arni, R.K.; Genov, N.; Betzel, C. Snake Venomic of Crotalus Durissus Terrificus —Correlation with Pharmacological Activities. *J. Proteome Res.* 2010, 9, 2302–2316. [CrossRef]

193. Roktya, D.R.; Wray, K.P.; Marges, M.J. The Genesis of an Exceptionally Lethal Venom in the Timber Rattlesnake (*Crotalus horridus*) Revealed through Comparative Venom-Gland Transcriptomics. *BMC Genom.* 2013, 14, 394. [CrossRef]

194. Castro, E.N.; Lomonte, B.; del Carmen Gutierrez, M.; Alogon, A.; Gutierrez, J.M. Intraspecies Variation in the Venom of the Rattlesnake *Crotalus simus* from Mexico: Different Expression of Crototoxin Results in Highly Variable Toxicity in the Venoms of Three Subspecies. *J. Proteom.* 2013, 87, 103–121. [CrossRef]

195. Saviola, A.J.; Pla, D.; Sanz, L.; Casto, T.A.; Calvete, J.J.; Mackessy, S.P. Comparative Venomics of the Prairie Rattlesnake (*Crotalus viridis viridis*) from Colorado: Identification of a Novel Pattern of Ontogenetic Changes in Venom Composition and Assessment of the Immunoreactivity of the Commercial Antivenom CroFab®. *J. Proteom.* 2015, 121, 28–43. [CrossRef]

196. Kalita, B.; Patra, A.; Mukherjee, A.K. Unraveling the Proteome Composition and Immuno-Profiling of Western India Russell’s Viper Venom for In-Depth Understanding of Its Pharmacological Properties, Clinical Manifestations, and Effective Antivenin Treatment. *J. Proteome Res.* 2017, 16, 583–598. [CrossRef]

197. Mukherjee, A.K.; Kalita, B.; Mackessy, S.P. A Proteomic Analysis of Pakistan Daboia russelii Russelii Venom and Assessment of Potency of Indian Polyclonal and Monovalent Antivenom. *J. Proteom.* 2016, 144, 73–86. [CrossRef]

198. Tan, N.H.; Fung, S.Y.; Tan, K.Y.; Yap, M.K.K.; Gnanathan, C.A.; Tan, C.H. Functional Venomics of the Sri Lankan Russell’s Viper (*Daboia russelii*) and Its Toxinological Correlations. *J. Proteom.* 2015, 128, 403–423. [CrossRef]

199. Gao, J.-F.; Wang, J.; He, Y.; Qu, Y.-F.; Lin, L.-H.; Ma, X.-M.; Ji, X. Proteomic and Biochemical Analyses of Short-Tailed Pit Viper (*Gloydius brevicaudus*) Venom: Age-Related Variation and Composition–Activity Correlation. *J. Proteom.* 2014, 105, 307–322. [CrossRef]

200. Yang, Z.-M.; Yang, Y.-E.; Chen, Y.; Cao, J.; Zhang, C.; Liu, L.-L.; Wang, Z.-Z.; Wang, X.-M.; Tsai, I.-H. Transcriptome and Proteome of the Highly Neurotoxic Venom of *Gloydus Intermedius*. *Toxicon* 2015, 107, 175–186. [CrossRef]

201. Madrigal, M.; Sanz, L.; Flores-Diaz, M.; Sasa, M.; Nunez, V.; Alape-Girón, A.; Calvete, J.J. Snake Venomics across Genus Lachesis. Ontogenetic Changes in the Venom Composition of Lachesis Stenophrys and Comparative Proteomics of the Venoms of Adult Lachesis Melanocephala and Lachesis Acrochorda. *J. Proteom.* 2012, 77, 280–297. [CrossRef]

202. Makran, B.; Fahmi, L.; Pla, D.; Sanz, L.; Oukkache, N.; Lkhider, M.; Ghalim, N.; Calvete, J.J. Snake Venomics of Macrovipers Mauritianica from Morocco, and Assessment of the Para-Specific Venom: A Comparison of an Experimental Monospecific and a Commercial Antivenoms. *J. Proteom.* 2012, 75, 2431–2441. [CrossRef]

203. Aird, S.D.; Watanabe, Y.; Villar-Briones, A.; Roy, M.C.; Terada, K.; Mikheyev, A.S. Quantitative High-Throughput Profiling of Snake Venom Gland Transcriptomes and Proteomes (*Ovophis okinavensis* and *Protobothrops flavoviridis*). *BMC Genom.* 2013, 14, 790. [CrossRef]

204. Jiménez-Charris, E.; Montalegre-Sanchez, L.; Solano-Redondo, L.; Mora-Obando, D.; Camacho, E.; Castro-Herrera, F.; Fierro-Pérez, L.; Lomonte, B. Proteomic and Functional Analyses of the Venom of *Porthidium lansbergi lansbergi* (Lansberg’s Hognose Viper) from the Atlantic Department of Colombia. *J. Proteom.* 2015, 114, 287–299. [CrossRef]

205. Villalta, M.; Pla, D.; Yang, S.L.; Sanz, L.; Segura, A.; Vargas, M.; Chen, P.Y.; Herrera, M.; Estrada, R.; Cheng, Y.F.; et al. Snake Venomics and Antivenomics of Protobothrops Macrossquamatus and Viridovipera Stejnegeri from Taiwan: Keys to Understand the Variable Immune Response in Horses. *J. Proteom.* 2012, 75, 5628–5645. [CrossRef]

206. Zainal Abidin, S.; Rajadurai, P.; Chowdhury, M.; Ahmad Rusmili, M.; Othman, I.; Naidu, R. Proteomic Characterization and Comparison of Malaysian Tropidolaemus Wagleri and Cryptelytrops Purpureomaculatus Venom Using Shotgun-Proteomics. *Toxins* 2016, 8, 299. [CrossRef]

207. Kovalchuk, S.; Ziganshin, R.; Starkov, V.; Tsetlin, V.; Utkin, Y. Quantitative Proteomic Analysis of Venoms from Russian Vipers of Pelias Group: Phospholipases A2 Are the Main Venom Components. *Toxins* 2016, 8, 105. [CrossRef]

208. Gökçen, B.; Heiss, P.; Petras, D.; Nalbantsoy, A.; Süßmuth, R.D. Mass Spectrometry Guided Venom Profiling and Bioactivity Screening of the Anatolian Meadow Viper, *Vipera Anatolica*. *Toxicin* 2015, 107, 163–174. [CrossRef]

209. Calvete, J.J.; Fasoli, E.; Sanz, L.; Boschetti, E.; Righetti, P.G. Exploring the Venom Proteome of the Western Diamondback Rattlesnake, *Crotalus Atrox*, via Snake Venomics and Combinatorial Peptide Ligand Library Approaches. *J. Proteome Res.* 2009, 8, 3035–3067. [CrossRef]

210. Calvete, J.J.; Pérez, A.; Lomonte, B.; Sánchez, E.E.; Sanz, L. Snake Venomics of *Crotalus Tigris*: The Minimalist Toxin Arsenal of the Deadliest Nearctic Rattlesnake Venom. Evolutionary Clues for Generating a Pan-Specific Antivenin against Crotalid Type II Venoms. *J. Proteome Res.* 2012, 11, 1382–1390. [CrossRef]

211. Pla, D.; Sanz, L.; Molina-Sánchez, P.; Zorita, V.; Madrigal, M.; Flores-Diaz, M.; Alape-Girón, A.; Núñez, V.; Andrés, V.; Gutiérrez, J.M.; et al. Snake Venomics of Lachesis Muta Rhombeata and Genus-Wide Antivenomics Assessment of the Paraspecific Immunoreactivity of Two Venoms Evidence the High Compositional and Immunological Conservation across Lachesis. *J. Proteom.* 2013, 89, 112–123. [CrossRef]

212. Sanz, L.; Ayvazyan, N.; Calvete, J.J. Snake Venomics of the Armenian Mountain Vipers Macrovipera Lebetina Obtusa and Vipera Raddei. *J. Proteom.* 2008, 71, 198–209. [CrossRef] [PubMed]

213. Sanz, L.; Gibbs, H.L.; Mackessy, S.P.; Calvete, J.J. Venom Proteomes of Closely Related *Sistrurus* Rattlesnakes with Divergent Diets. *J. Proteome Res.* 2006, 5, 2098–2112. [CrossRef] [PubMed]
237. Franciscetti, I.M.B.; My-Pham, V.; Harrison, J.; Garfield, M.K.; Ribeiro, J.M.C. Bitis Gabonica (Gaboon viper) Snake Venom Gland: Toward a Catalog for the Full-Length Transcripts (CDNA) and Proteins. *Gene* **2004**, *337*, 55–69. [CrossRef]

238. Cardoso, K.C.; Da Silva, M.J.; Costa, G.G.; Torres, T.T.; Del Bem, L.E.V.; Vidal, R.O.; Menossi, M.; Hyslop, S. A Transcriptomic Analysis of Gene Expression in the Venom Gland of the Snake Bothrops Alternatus (Urutu). *BMC Genom.* **2010**, *11*, 605. [CrossRef]

239. Neiva, M.; Arraes, F.B.M.; de Souza, J.V.; Radis-Baptista, G.; Prieto da Silva, A.R.B.; Walter, M.E.M.T.; Brigido, M.d.M.; Yamane, T.; López-Lozano, J.L.; Astolfi-Filho, S. Transcriptome Analysis of the Amazonian Viper Bothrops Atrox Venom Gland Using Expressed Sequence Tags (ESTs). *Toxicon* **2009**, *53*, 427–436. [CrossRef]

240. Cidade, D.A.P.; Simão, T.A.; Dávila, A.M.R.; Wagner, G.; de L.M. Junqueira-de-Azevedo, I.; Lee Ho, P.; Bon, C.; Zingali, R.B.; Albano, R.M. Bothrops Jararaca Venom Gland Transcriptome: Analysis of the Gene Expression Pattern. *Toxicon* **2006**, *48*, 437–461. [CrossRef]

241. Zelanis, A.; Andrade-Silva, D.; Rocha, M.M.; Furtado, M.F.; Serrano, S.M.T.; Junqueira-de-Azevedo, I.L.M.; Ho, P.L. A Transcriptomic View of the Proteome Variability of Newborn and Adult Bothrops Jararaca Snake Venoms. *PLoS Negl. Trop. Dis.* **2012**, *6*, e1554. [CrossRef]

242. Rokyta, D.R.; Lemmon, A.R.; Margres, M.J.; Aronow, K. The Venom-Gland Transcriptome of the Eastern Diamondback Rattlesnake (*Crotalus adamanteus*). *BMC Genom.* **2012**, *13*, 312. [CrossRef] [PubMed]

243. Boldrini-França, J.; Rodrigues, R.S.; Fonseca, F.P.P.; Menaldo, D.L.; Ferreira, F.B.; Henrique-Silva, F.; Soares, A.M.; Hamaguchi, A.; Rodrigues, V.M.; Otaviano, A.R.; et al. *Crotalus Durissus Collilineatus* Venom Gland Transcriptome: Analysis of Gene Expression Profile. *Biochimie* **2009**, *91*, 856–895. [CrossRef] [PubMed]

244. Wiezel, G.A.; Shibao, T.Y.T.; Cologna, C.T.; Morandi Filho, R.; Ueira-Vieira, C.; De Pauw, E.; Quinton, L.; Arantes, E.C. In-Depth Venom of the Brazilian Rattlesnake *Crotalus Durissus Terrificus*: An Integrative Approach Combining Its Venom Gland Transcriptome and Venom Proteome. *J. Proteome Res.* **2018**, *17*, 3941–3958. [CrossRef] [PubMed]

245. Durban, J.; Pérez, A.; Sanz, L.; Gómez, A.; Bonilla, F.; Rodríguez, S.; Chacón, D.; Sasa, M.; Angulo, Y.; Gutiérrez, J.M.; et al. Integrated “Omics” Profiling Indicates That MiRNAs Are Modulators of the Ontogenetic Venom Composition Shift in the Central American Rattlesnake, *Crotalus Simus Simus*. *BMC Genom.* **2013**, *14*, 234. [CrossRef]

246. Zhang, B.; Liu, Q.; Yin, W.; Zhang, X.; Huang, Y.; Luo, Y.; Qiou, P.; Xu, Y.; Yu, J.; Hu, S.; et al. Transcriptome Analysis of Deinagkistrodon Acutus Venomous Gland Focusing on Cellular Structure and Functional Aspects Using Expressed Sequence Tags. *BMC Genom.* **2006**, *7*, 152. [CrossRef]

247. Casewell, N.R.; Harrison, R.A.; Wüster, W.; Wagstaff, S.C. Comparative Venom Gland Transcriptome Surveys of the Saw-Scaled Vipers (Viperidae: Echis) Reveal Substantial Intra-Family Gene Diversity and Novel Venom Transcripts. *BMC Genom.* **2006**, *7*, 14. [CrossRef]

248. Wagstaff, S.C.; Sanz, L.; Juárez, P.; Harrison, R.A.; Calvete, J.J. Combined Snake Venomics and Venom Gland Transcriptomic Analysis of the Ocellated Carpet Viper, *Echis Ocellatus*. *J. Proteom.* **2009**, *71*, 609–623. [CrossRef]

249. Wagstaff, S.C.; Harrison, R.A. Venom Gland EST Analysis of the Saw-Scaled Viper, *Echis Ocellatus*, Reveals Novel A981 Integrin-Binding Motifs in Venom Metalloproteinases and a New Group of Putative Toxins, Renin-like Aspartic Proteases. *Gene* **2006**, *377*, 21–32. [CrossRef]

250. Junqueira-de-Azevedo, I.L.M.; Ching, A.T.C.; Carvalho, E.; Faria, F.; Nishiyama, M.Y.; Ho, P.L.; Diniz, M.R.V. *Lachesis Muta* (Viperidae) CDNAs Reveal Diverging Pit Viper Molecules and Scaffolds Typical of Cobra (Elapidae) Venoms: Implications for Snake Toxin Repertoire Evolution. *Genetics* **2006**, *173*, 877–889. [CrossRef]

251. Pahari, S.; Mackessy, S.P.; Kini, R.M. The Venom Gland Transcriptome of the Desert Massasauga Rattlesnake (*Sistrurus catenatus edwardsii*): Towards an Understanding of Venom Composition among Advanced Snakes (Superfamily Colubroidea). *BMC Mol. Biol.* **2007**, *8*, 115. [CrossRef]

252. Leonardi, A.; Sajevic, T.; Pungerčar, J.; Križaj, I. Comprehensive Study of the Proteome and Transcriptome of the Venom of the Most Venomous European Viper: Discovery of a New Subclass of Ancestral Snake Venom Metalloproteinase Precursor-Derived Proteins. *J. Proteome Res.* **2019**, *18*, 2287–2309. [CrossRef]

253. Kashima, S.; Roberto, P.G.; Soares, A.M.; Astolfi-Filho, S.; Pereira, J.O.; Giuliani, S.; Faria, M., Jr.; Xavier, M.A.S.; Fontes, M.R.M.; Giglio, J.R.; et al. Analysis of Bothrops Jararacussu Venomous Gland Transcriptome Focusing on Structural and Functional Aspects: I—Gene Expression Profile of Highly Expressed Phospholipases A2. *Biochimie* **2004**, *86*, 211–219. [CrossRef]

254. Rajagopalan, N.; Pung, Y.F.; Zhu, Y.Z.; Wong, P.T.H.; Kumar, P.P.; Kini, R.M. B-Cardiotoxin: A New Three-finger Toxin from *Ophiophagus Hannah* (King Cobra) Venom with Beta-blocker Activity. *FASEB J.* **2007**, *21*, 3685–3695. [CrossRef]

255. Calvete, J.J. Antivenomics and Venom Phenotyping: A Marriage of Convenience to Address the Performance and Range of Clinical Use of Antivenoms. *Toxicon* **2010**, *56*, 1284–1291. [CrossRef]

256. Gutiérrez, J.M.; León, G.; Burnouf, T. Antivenoms for the Treatment of Snakebite Envenomings: The Road Ahead. *Biologicals* **2011**, *39*, 129–142. [CrossRef]

257. Kini, R.; Sidhu, S.; Laustsen, A. Biosynthetic Oligoclonal Antivenom (BOA) for Snakebite and Next-Generation Treatments for Snakebite Victims. *Toxins* **2018**, *10*, 534. [CrossRef]

258. Laustsen, A.H.; Engmark, M.; Milbo, C.; Johannesen, J.; Lomonte, B.; Gutiérrez, J.M.; Lohse, B. From Fangs to Pharmacology: The Future of Snakebite Envenoming Therapy. *Curr. Pharm. Des.* **2016**, *22*, 5270–5293. [CrossRef]
259. Boulain, J.-C.; Mdnez, A.; Couderc, J.; Faure, G.; Liacopoulos, P.; Fromageot, P. Neutralizing Monoclonal Antibody Specific for Naja Nigricollis Toxin Alpha: Preparation, Characterization, and Localization of the Antigenic Binding Site. *Biochemistry* 1982, 21, 2910–2915. [CrossRef]

260. Morine, N.; Matsuda, S.; Terada, K.; Eto, A.; Ishida, I.; Oku, H. Neutralization of Hemorrhagic Snake Venom Metalloproteinase HR1α from Bothroboths Flavoviridis by Human Monoclonal Antibody. *Toxicon* 2008, 51, 345–352. [CrossRef]

261. Laustsen, A.H.; Karatt-Vellatt, A.; Masters, E.W.; Arias, A.S.; Pus, U.; Knudsen, C.; Oscoz, S.; Slavny, P.; Griffiths, D.T.; Luther, A.M.; et al. In Vivo Neutralization of Dendrotoxin-Mediated Neurotoxicity of Black Mamba Venom by Oligoclonal Human IgG Antibodies. *Nat. Commun.* 2018, 9, 3928. [CrossRef]

262. Lafaye, P.; Choumeli, V.; Demangel, C.; Bon, C.; Maziot, J.-C. Biologically Active Human Anti-Crototoxin ScFv Isolated from a Semi-Synthetic Phage Library. *Immunotechnology* 1997, 3, 117–125. [CrossRef]

263. Tamarozzi, M.B.; Soares, S.G.; Marcussi, S.; Giglio, J.R.; Barbosa, J.E. Expression of Recombinant Human Antibody Fragments Capable of Inhibiting the Phospholipase and Myotoxic Activities of Bothrops Jararacussu Venom. *Biochim. Biophys. Acta Gen. Subj.* 2006, 1760, 1450–1457. [CrossRef]

264. Kulkeaw, K.; Sakolvaree, Y.; Srimanote, P.; Tongtawe, P.; Maneewatch, S.; Sookrung, N.; Tungtrongchitr, A.; Tapchaisri, P.; Kurazono, H.; Chaiumpa, W. Human Monoclonal ScFv Neutralize Lethal Thai Cobra, Naja Kaoutia, Neurotoxin. *J. Proteom.* 2009, 72, 270–282. [CrossRef]

265. Silva, L.C.; Pucca, M.B.; Pessenda, G.; Campos, L.B.; Martinez, E.Z.; Cerni, F.A.; Barbosa, J.E. Discovery of Human ScFvs That Cross-Neutralize the Toxic Effects of B. Jararacussu and C. d. Terrificus Venoms. *Acta Trop.* 2018, 177, 66–73. [CrossRef]

266. Lewin, M.; Samuel, S.; Merkel, J.; Bickler, P. Varespladib (LY315920) Appears to Be a Potent, Broad-Spectrum, Inhibitor of Snake Venom Phospholipase A2 and a Possible Pre-Referral Treatment for Envenomation. *Toxins* 2016, 8, 248. [CrossRef]

267. Lewin, M.; Gutiérrez, J.; Samuel, S.; Herrera, M.; Bryant-Quitós, W.; Lomonte, B.; Bickler, P.; Bullfone, T.; Williams, D. Delayed Oral LY333013 Rescues Mice from Highly Neurotoxic, Lethal Doses of Papuan Taipan (Oxyuranus scutellatus) Venom. *Toxins* 2018, 10, 380. [CrossRef] [PubMed]

268. Arias, A.S.; Rucavado, A.; Gutiérrez, J.M. Peptidomimetic Hydroxamate Metalloproteinase Inhibitors Abrogate Local and Systemic Toxicity Induced by Echis Ocellatus (Saw-Scaled) Snake Venom. *Toxicon* 2017, 132, 40–49. [CrossRef] [PubMed]

269. Wang, Y.; Zhang, J.; Zhang, D.; Xiao, H.; Xiong, S.; Huang, C. Exploration of the Inhibitory Potential of Varespladib for Snakebite Envenomation. *Molecules* 2018, 23, 391. [CrossRef] [PubMed]

270. Escalante, T.; Franceschi, A.; Rucavado, A.; Gutiérrez, J.M. Effectiveness of Batimastat, a Synthetic Inhibitor of Matrix Metalloproteinases, in Neutralizing Local Tissue Damage Induced by BaP1, a Hemorrhagic Metalloproteinase from the Venom of the Snake Bothrops Asper. *Biochem. Pharm.* 2000, 60, 269–274. [CrossRef]

271. Ferreira, F.B.; Pereira, T.M.; Souza, D.L.N.; Lopes, D.S.; Freitas, V. Structure-Based Discovery of Thiosemicarbazone Metalloproteinase Inhibitors for Hemorrhage Treatment in Snakebites. *ACS Med. Chem. Lett.* 2017, 8, 1136–1141. [CrossRef]

272. Karain, B.D.; Lee, M.K.H.; Hayes, W.K. C60 Fullerences as a Novel Treatment for Poisoning and Envenomation: A Proof-of-Concept Study for Snakebite. *J. Nanosci. Nanotechnol.* 2016, 16, 7764–7771. [CrossRef]

273. Richard, G.; Meyers, A.J.; McLean, M.D.; Arabi-Gharroudhi, M.; MacKenzie, R.; Hall, J.C. In Vivo Neutralization of α-Cobratoxin with High-Affinity Llama Single-Domain Antibodies (VHHS) and a VH1-Hc Antibody. *PloS ONE* 2013, 8, e69495. [CrossRef] [PubMed]

274. Chavanayam, C.; Thanongsaksrikul, J.; Thueng-in, K.; Bangphoomi, K.; Sookrun, N.; Chaiumpa, W. Humanized-Single Domain Antibodies (VH/VH1) That Bound Specifically to Naja Kaoutia Phospholipase A2 and Neutralized the enzymatic Activity. *Toxins* 2012, 4, 554–567. [CrossRef]

275. Luiz, M.; Pereira, S.; Prado, N.; Gonçalves, N.; Kayano, A.; Moreira-Dill, L.; Sobrinho, J.; Zanchi, F.; Fuly, A.; Fernandes, C.; et al. Camelid Single-Domain Antibodies (VHHS) against Crototoxin: A Basis for Developing Modular Building Blocks for the Enhancement of Treatment or Diagnosis of Crotalid Envenoming. *Toxins* 2018, 10, 142. [CrossRef]

276. Castro, J.M.A.; Oliveira, T.S.; Silveira, C.R.F.; Caporinno, M.C.; Rodriguez, D.; Moura-da-Silva, A.M.; Ramos, O.H.P.; Rucavado, A.; Gutiérrez, J.M.; Magalhães, G.S.; et al. A Neutralizing Recombinant Single Chain Antibody, ScFv, against BaP1, A P-I Hemorrhagic Metalloproteinase from Bothrops Asper Snake Venom. *Toxicon* 2014, 87, 81–91. [CrossRef]

277. Zhang, L.; Cao, Y.; Liu, M.; Chen, X.; Xiang, Q.; Tian, J. Functional Recombinant Single-chain Variable Fragment Antibody against Agkistrodon Acutus Venom. *Exp. Med.* 2019, 17, 3768–3774. [CrossRef]

278. Al-Jabi, S.W. Arab World’s Growing Contribution to Global Leishmaniasis Research (1998–2017): A Bibliometric Study. *BMC Public Health* 2019, 19, 625. [CrossRef]

279. Sweileh, W.M.; Al-Jabi, S.W.; Sawalha, A.F.; AbuTaha, A.S.; Zouyd, S.H. Bibliometric Analysis of Worldwide Publications on Antimalarial Drug Resistance (2006–2015). *Malar. Res. Treat.* 2017, 2017, 1–13. [CrossRef]