

Foreword

The idea to compile this book was first raised during an Exploratory ESF workshop in Wageningen in 2001. At that meeting, it was thought that it should provide the long-needed update on parthenogenesis and its genetic and ecological consequences, but that it should also look at the paradox of sex from an asexual perspective. Already then, it was decided to only focus on eukaryotes, as this would avoid discussions on whether bacteria have sex or not. . . The book would thus deal with these evolutionary opportunists that had given up or lost sexual reproduction. We also wanted to make sure that both animals and plants were included and to help the zoological and botanical communities in understanding each other. When ESF funded the proposal of PVD and KM for a scientific network on parthenogenesis, (PARTNER) we started hunting for authors and contributions during the four PARTNER workshops in 2003 (Wageningen), 2004 (Valencia and Münster) and 2005 (London). This is why most authors of this book have also been participants of one or several PARTNER workshops, and this book can be seen as an ESF deliverable. However, there are also contributions from authors outside of PARTNER, which have added additional expertise to this book. Their contributions also illustrate that the field of research on parthenogenesis is currently moving very fast.

The book contains five parts. The first one consists of the introduction to the theme (see Chapter 1) to catch the reader's interest and its history by concentrating on four major scientists who have significantly contributed to the field (Chapter 2). The general part also comprises the necessary descriptions of the cytology and the mechanisms related to the different asexual and sexual modes of reproduction in plants (Chapter 3) and animals (Chapter 4). In Chapter 3, great care has been taken to explain the botanical terminology of parthenogenetic reproduction and potential pitfalls are pointed out, which have greatly hampered the discussion between zoologists and botanists on asexual reproduction in the past.

The second part of the book discusses the main hypotheses behind the paradox of sex and how modern science regards them. Although there are more than 25 hypotheses attempting to explain the paradox of sex, we have decided to concentrate on four major ones. Is the accumulation of mutations (Muller's ratchet (Muller 1964) and Kondrashov's hatchet (Kondrashov 1988)) still regarded as one of the major problems of long-term asexuality and if so, under which conditions might it apply to the real biological world (see Chapter 5)? What is the reaction norm of

asexuals? Can the general-purpose genotype and frozen niche hypotheses indeed be found in biological reality (Chapter 6)? Is the Red Queen still in the running as one of the major theories to explain the prevalence of sex (Chapter 7)? And if so, what are the conditions that have to be matched? Chapter 8 deals with the phenomena of geographic parthenogenesis and presents a new theory on how hybridisation could have caused the patterns in both plants and animals.

The third part of the book deals with more philosophical questions, which have nonetheless a practical impact on working with asexuals: how can clones (Chapter 9) and asexual species (Chapter 10) be defined? It is our hope that readers will find workable solutions in both chapters.

The fourth part comprises numerous case studies, illustrating the enormous variety of mechanisms by which asexual plants and animals reproduce in the living world. The first set of case studies includes examples of putative ancient asexual scandals (following the terminology of Judson and Normark 1996) from the animal world, namely darwinulid ostracods (Chapter 11), oribatid mites (Chapter 12) and bdelloid rotifers (Chapter 13). The surprising conclusion seems to be that none of these so-called scandals has followed the same route in avoiding the long-term disadvantages of asexuality, and that each of them might have found a novel way to circumvent the paradox of sex. There appears to be a general consensus that there are no ancient asexual plants (see Chapter 3).

The three scandalous chapters are followed by a number of items on invertebrates with mixed reproduction. These include examples of cyclic parthenogenesis, namely monogont rotifers and cladocerans (Chapters 14 and 15, respectively), which combine the best of both worlds and provide important insights into the factors triggering the switch between sex and asex. Also, stick insects with an amazing variety of reproductive modes (Chapter 16) are described, followed by examples of Hymenoptera, where microbial infections are one of the most common causes of asexuality (Chapter 17). The last invertebrate case study is on hermaphrodite planarians with asexual reproduction, but also with a little bit of sex (Chapter 18). The invertebrates are followed by vertebrate examples of parthenogenesis, covering fish (Chapter 19), waterfrogs (Chapter 20) and reptiles (Chapter 21). All three chapters provide good explanations on the mechanisms of vertebrate parthenogenesis and why it is less common than in invertebrates.

Two case studies on apomictic plants, the common dandelion (Chapter 22) and Böcher's rock cress (Chapter 23) close the section on case studies. Both author teams provide new, unpublished data on the evolutionary age of an apomixis gene (Chapter 22) and the Meselson effect, respectively (Chapter 23).

Last comes a section on applied aspects of parthenogenesis, a novel and important part. The section starts with examples of asexual diseases and why their reproductive mode poses a major threat to humanity (Chapter 24). The next chapter introduces aphids as agricultural pest and links their detrimental effects with their asexual reproduction. Chapter 26 explains why cloning of mammals is still so unsuccessful and how it can be improved. The last Chapter, 27, deals with clonal grape vines and its implication on wine making.

This last chapter provides the perfect excuse to raise the glass to all authors and readers and to wish them a very fruitful and enjoyable reading – may the bouquet be rich, the flavour be crisp and the finish be lasting!

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References

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