

The Species Problem and Polar Bear Evolution

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Abstract

It has been more than 70 years since the Modern Evolutionary Synthesis (hereafter, the Modern Synthesis) updated Darwin's evolutionary principles with the addition of population genetics. The Modern Synthesis has faced numerous criticisms since then but one of the most serious and long-standing has been the "Species Problem": the fact that it still cannot explain the mechanism by which new species arise. Speciation is fundamental to evolution and one of the things we have learned in the last few decades is that developmental change in its various permutations are often pivotal to this process. However, it has also become apparent that the details of how developmental changes operate—especially the interplay between hormones, genes, and environmental cues—may be impossible to incorporate into population genetic models. It is not enough for biologists to acknowledge in theory that developmental changes are critical to evolution if in practice the mathematical models that underpin population genetics cannot assimilate the complex hormonal factors that drive them. Here I present a radically new paradigm, updated since its inception, that incorporates developmental effects into an explicit non-mathematical model of how speciation is initiated that assumes a pivotal role for thyroid hormone and its analogues, using the speciation event that produced the polar bear, *Ursus maritimus*, as an example. This theory and its testable hypotheses provide a solution to the Species Problem and have the potential to truly revolutionize evolutionary biology.

KEY WORDS

heterochrony; population genetics; embryology; speciation; thyroid hormone; origin of species; Extended Evolutionary Synthesis; paradigm; macroevolution

Species Problem The

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Table of Contents Species Problem The

1. Understanding the eBook Species Problem The
 - The Rise of Digital Reading Species Problem The
 - Advantages of eBooks Over Traditional Books
2. Identifying Species Problem The
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Species Problem The
 - User-Friendly Interface
4. Exploring eBook Recommendations from Species Problem The
 - Personalized Recommendations
 - Species Problem The User Reviews and Ratings
 - Species Problem The and Bestseller Lists

5. Accessing Species Problem The Free and Paid eBooks
 - Species Problem The Public Domain eBooks
 - Species Problem The eBook Subscription Services
 - Species Problem The Budget-Friendly Options
6. Navigating Species Problem The eBook Formats
 - ePub, PDF, MOBI, and More
 - Species Problem The Compatibility with Devices
 - Species Problem The Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Species Problem The
 - Highlighting and Note-Taking Species Problem The
 - Interactive Elements Species Problem The
8. Staying Engaged with Species Problem The
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Species Problem The
9. Balancing eBooks and Physical Books Species Problem The
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Species Problem The
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Species Problem The
 - Setting Reading Goals Species Problem The
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Species Problem The
 - Fact-Checking eBook Content of Species Problem The
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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