



David C. Catling

# ASTROBIOLOGY

A Very Short Introduction

OXFORD

## Astrobiology: A Very Short Introduction

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OXFORD  
UNIVERSITY PRESS



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UNIVERSITY PRESS

Great Clarendon Street, Oxford, OX2 6DP,  
United Kingdom

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First Edition published in 2013

Impression: 4

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Published in the United States of America by Oxford University Press  
198 Madison Avenue, New York, NY 10016, United States of America

British Library Cataloguing in Publication Data  
Data available

Library of Congress Control Number: 2013940856

ISBN 978-0-19-958645-5

Printed in Great Britain by  
Ashford Colour Press Ltd, Gosport, Hampshire

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# Acknowledgements

I thank Professor John Armstrong, Dr Rory Barnes, Professor John Baross, Dr Billy Brazelton, Professor Roger Buick, Dr Rachel Horak, Imelda Kirby, and Professor Woody Sullivan for reading parts of the manuscript and offering various corrections and suggestions. Thanks also to Latha Menon and Mimi Southwood, who read the entire manuscript, the latter offering the perspective of a non-scientist. Numerous students who attended my astrobiology classes at the University of Washington over the years also helped me mentally prepare for writing this book. At Oxford University Press, I thank Emma Ma and Latha Menon for their encouragement and assistance.

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# Chapter 1

## What is astrobiology?

### Behind the name

‘What the hell is *astrobiology*?’ an American Secret Service agent cried into his walkie-talkie. He had just been checking the identity of an academic visitor to NASA’s Ames Research Center, near San Francisco. The visitor had said that he was attending NASA’s first astrobiology science conference. Ames has an airstrip that provides a secure landing site for Air Force One, and, in April 2000, President Bill Clinton had just flown in to visit the San Francisco Bay area, bringing along his Secret Service entourage.

The agent’s question was a fair one. It was only in the late 1990s that a scientific consensus emerged about the meaning of *astrobiology*. Few laymen or Secret Service agents would have heard of the term. Back then, NASA began to promote a research programme in astrobiology led by Ames, where I was working as a space scientist. At first, some of my colleagues disliked the literal Greek meaning of the ‘biology of stars’. One noted with a scoff how life couldn’t exist inside the infernos of stars. A less curmudgeonly interpretation is that the ‘astro’ in astrobiology concerns life *around* stars, including the Sun, or simply life in space. In fact, many astrobiologists are as much concerned with the history of life on Earth as with life elsewhere. Astrobiologists agree that we should have a firm understanding of how life evolved on Earth in



order to ponder the existence of life in outer space. Yet one of the astonishing aspects of modern science is that it has so far failed to answer questions about biology that even a child might ask. How did life on Earth get started? We have some ideas but the details are unknown. Which special properties of the Earth and the Solar System make our planet habitable? Again, some thoughts but there is still much to learn. And what caused life to evolve into complex organisms instead of remaining simple? Again, we're uncertain.

To fill these holes in human knowledge, astrobiology has emerged as *a branch of science concerned with the study of the origin and evolution of life on Earth and the possible variety of life elsewhere*. This is my own preferred definition. NASA has defined astrobiology as *the study of the origins, evolution, distribution, and future of life in the universe*. Other common definitions are *the study of life in the universe* or *the study of life in a cosmic context*. Within this purview, astrobiologists pursue the question 'What's the history and future of terrestrial life?' as well as 'Is there life elsewhere?'

Four developments coincided with the emergence of astrobiology as a discipline in the late 1990s. In 1996, controversial signs of ancient life were described within a Martian meteorite—a 1.9 kilogram piece of rock that had been blasted off the surface of Mars by an asteroid impact and had eventually landed in Antarctica. Whether the interpretation of fossilized microscopic life was correct or not (see Chapter 6), it set people thinking. Furthermore, over the preceding two decades, biologists had established that some microbes not only tolerated a much larger range of environments than had previously been thought but actually *thrived* in extremes of temperature, acid, pressure, or salinity. So it became plausible to contemplate extraterrestrial microbes existing in seemingly hostile places. A third finding came in 1996 from pictures taken by NASA's *Galileo* spacecraft of the ice-covered surface of Jupiter's moon, Europa, which revealed