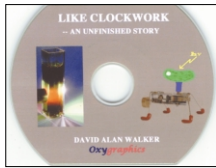


## Photosynthesis for ramblers and browsers

### Like Clockwork – An Unfinished Story

By David Alan Walker.

Oxygraphics (<http://www.oxygraphics.co.uk>), distributed by Packard Publishing, 2000. US\$15.00 or £10.00 (CD-ROM) (129 pages). ISBN 1 870 232 12 7



There are two kinds of textbook. One will give the writers' opinions and interests masquerading under such

adjectives as 'objective', 'concise' and 'complete', claiming to be 'all the modern student needs to know'. This sort of book requires the reader to accept the infallibility of the authors and to memorise all the facts that comprise the subject. 'Controversial issues have been omitted to allow ample room for important, generally accepted physiological mechanisms... We have refrained from citing sources to keep nonessential details to a minimum' [1]. If you are busy, enjoy committing things to memory, want no more than exactly what you need to pass an examination, and never ask questions, then you will probably love, *Principles of Physiology* [1], for example. You will also hate *Like Clockwork*, for it is definitely the other kind of book. The kind that requires you to stop and think.

Take nothing for granted with *Like Clockwork*. It is not even a book. It is a CD with a largish (30-megabyte) Acrobat pdf file, some supplementary files of animations, and an html file 'Getting Started'. 'Getting Started' will open your web browser, provide a link to the free program Acrobat Reader, and then open the pdf file. The pdf file itself, all 129 pages, has many embedded hypertext links, as cross-references, music, animations, and external links to web pages containing – sometimes – relevant, additional information. The links are in blue. But not all blue words are links. In my version of Acrobat Reader (v.5) a link is indicated when the cursor resembles a hand with an extended index figure. If the hand has

a 'w' on it, the link is external, and you might have to consider your telephone bill. Here is a sample of both style and content, from chapter 3.

'Why, you might ask, have I paid so much attention on the previous page to hydrogen ions? The answer is simple enough. Ever since **Croesus** first minted gold and silver coins, in the sixth century BC, **money** has been central to economics. Likewise, for some billions of years living organisms have been able to conserve energy and, in this respect, hydrogen ions have been as important, as electrons, to the energy economy on which we all depend.'

Click on 'Croesus' and a web site somewhere tells you that King Croesus of Lydia reigned from 561–546 BC and was the first person to mint gold and silver coinage '...as modern numismatic scholars concur'. The pictured silver half-stater, a snip at US\$750, is now sold. Click on 'money' and you get a snatch of pop song embedded in the file, part of 'Why don't you do right?' by Sinead O'Conner (I cannot personally vouch for this). Elsewhere in the text, embedded songs include the periodic table sung by Tom Lehrer to the tune of 'The Major-General's Song' from Gilbert and Sullivan's 'The Pirates of Penzance' (click 'elements'); 'Is that all there is' (Peggy Lee); and 'Yellow is the colour of my true love's hair' by Donovan (who, for my hydrogen ions, can be left in the decent obscurity of the 1960s). The literary references are equally eclectic, from the Bible to authors such as Laurence Sterne, Jonathan Swift, Douglas Adams and J.K. Rowling.

What does the book cover? Well, in one sense, photosynthesis. In another, life, the universe, and everything. As regards photosynthesis, the emphasis is on the basic chemistry, electron transport, ATP synthesis, and pathways of carbon assimilation in plants and algae. The last chapter is ostensibly about chlorophyll fluorescence, veers into oxygen electrodes and chirality, and ends with a note on the ever-open library of the Internet. An omission from the whole is molecular structure – surely the major new development of photosynthesis research in recent years. There are many fascinating links and tutorials out there on that, and an excellent new book on photosynthesis by Robert Blankenship [2], which is rich in molecular graphics. Only the ATPase

structure appears, and is given praise and some fuzzy diagrams in *Like Clockwork*. There is a throwaway reference to a recent paper by Dick McCarty, but there is no citation, so it is up to you and your search engine to find it [3]. Let me recommend the movies *From Light to ATP* and *Rotary ATP Synthase*, from Wolfgang Junge's laboratory (<http://www.biologie.uni-osnabrueck.de/Biophysik/Junge/overheads.html>). It is also odd that reaction centres are missing. The two core components of the genius Robin Hill's Z-scheme can now be described at near-atomic resolution [4].

A few years ago, I made a web site (<http://plantcell.lu.se/lrm>) to accompany a review article [5] and to provide interactive molecular graphics and animations impossible on paper, including the ATPase. The publisher's reprints had mauled my manuscript so badly that I made a pdf file, as urtext, in self-defence. A recent and comprehensive guide to almost everything the web has to offer on photosynthesis is available on paper [6] and as hypertext (<http://www.life.uiuc.edu/govindjee/photoweb/>). I am undecided about the pdf format of *Like Clockwork*. It is certainly much friendlier than the CD of Proceedings of the 2001 International Photosynthesis Congress [7], which the publishers seemingly designed for their own convenience, not the reader's. *Like Clockwork* might have been better just in html – in spite of the embedded links, pdf seems best suited to printing. In Acrobat Reader, be sure to turn on 'Bookmarks', otherwise you will never know where you are. I printed out the pdf file on a colour laser writer, making a hefty and literally portable A4 document much more easily readable than the document presented even on a 'needle-sharp' 17-inch TTF-LCD display. But each page has a different running header, so, on paper, you're not quite sure where you are going. A word of warning – the 'business card' CD is not round. Be sure that your computer will take it in safely – and eject it when you have finished.

*Like Clockwork* is not concise, it is discursive. An unkind epithet might be 'rambling'. Of course a Rambler will see, and understand, much more than someone racing through a prescribed itinerary. And what, as David Walker

himself might write, is wrong with that? *Like Clockwork* is thought provoking. It is also fun. And, in spite of David Walker's major and lasting contributions in photosynthesis research, there are still open questions, and a humility that leaves room for the reader to form his own opinions. David Walker is about as far as can be from saying 'because I say so'. Science is not a list of facts, but the way we make the world intelligible. So I know which kind of book I prefer. *Like Clockwork* is unique, and I warmly recommend it. It hints at a revised version of the great book *C<sub>3</sub>, C<sub>4</sub>* of 1983 [8]. That would also be

wonderful, especially given the same treatment. But, perhaps, minus Donovan.

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