

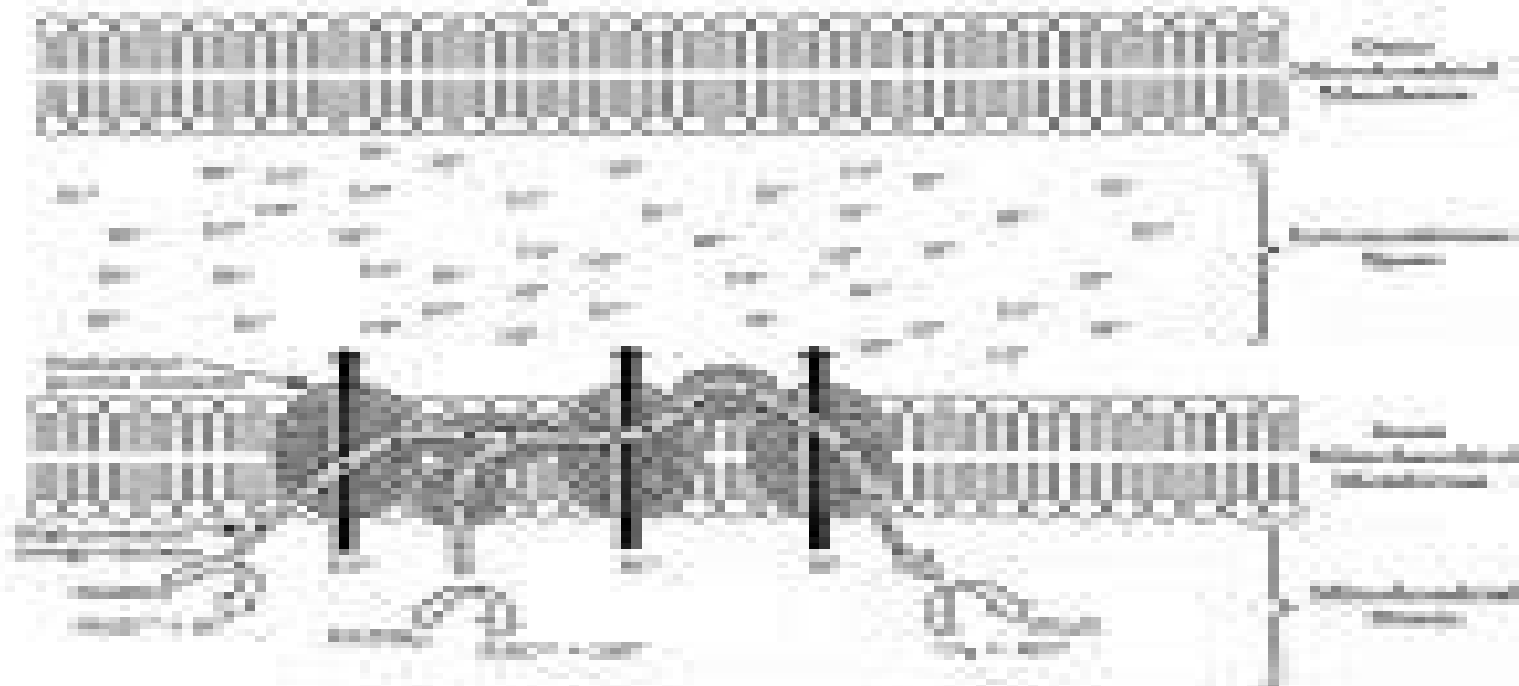
## Oxidative Phosphorylation

How does the membrane potential ( $\Delta\psi$ ) and the  $\text{H}^+$  gradient make ATP during cellular respiration?

### What?

The synthesis of cellular respiration is oxidative phosphorylation. Both the electron transport chain and chemiosmosis make up oxidative phosphorylation. During this phase of cellular respiration, about 34  $\text{NADH}$  and 14  $\text{FADH}_2$  are sent produced to three phases of cellular respiration: glycolysis, the Krebs cycle, and chemiosmosis are used to make ATP. The proton motive force provides energy embedded in the inner mitochondrial membrane.

### Model 1 – Electron Transport Chain



1. Consider the chemiosmosis diagramming model. Clearly illustrate of the chemiosmosis before when this might be found.



# Oxidative Phosphorylation Pogil Answers

**Paul Reilly**



## **Oxidative Phosphorylation Pogil Answers:**

**Oxidative Phosphorylation in Health and Disease** Jan A.M. Smeitink, 2007-03-06 Mitochondrial diseases are often hard to diagnose. From the time they were first researched without animal models, patients of mitochondrial diseases were of equal interest to both clinical and basic scientists. With the new research done, this book includes updates on the normal structure, function, and molecular biology of the mitochondrial respiratory chain, information on traditional diagnostic methodologies, and an overview of the diagnostic promise of new technologies. The hypermetabolism of Luft disease, although only seen twice, is also studied. There are critical reviews of symptoms and signs associated with syndromes, as well as updates on the genetic defects of either the mitochondrial or the nuclear genome responsible for many disorders. *Studies on Oxidative Phosphorylation in Mitochondrial Systems* Lenola Harlene Wellman, 1952

**The Mitochondrial Electron Transport and Oxidative Phosphorylation System** Youssef Hatefi, 1985

**Biological Energy Conservation** Colin William Jones, 2012-12-06 The student of biological science in his final years as an undergraduate and his first years as a graduate is expected to gain some familiarity with current research at the frontiers of his discipline. New research work is published in a perplexing diversity of publications and is inevitably concerned with the minutiae of the subject. The sheer number of research journals and papers also causes confusion and difficulties of assimilation. Review articles usually presuppose a background knowledge of the field and are inevitably rather restricted in scope. There is thus a need for short but authoritative introductions to those areas of modern biological research which are either not dealt with in standard introductory textbooks or are not dealt with in sufficient detail to enable the student to go on from them to read scholarly reviews with profit. This series of books is designed to satisfy this need. The authors have been asked to produce a brief outline of their subject assuming that their readers will have read and remembered much of a standard introductory textbook on biology. This outline then sets out to provide, by building on this basis, the conceptual framework within which modern research work is progressing and aims to give the reader an indication of the problems, both conceptual and practical, which must be overcome if progress is to be maintained. *Oxidative Phosphorylation in Health and Disease* Jan A. M. Smeitink, 2004

**Electron Transport and Oxidative Phosphorylation in *Paracoccus Denitrificans*** Emmo Marinus Meijer, 1979

**Oxidative Phosphorylation** Paul Reilly, 1998-09

*Oxidative Phosphorylation and Related Reactions in Particulate Fractions from Insects* Wilbert Francis Steele, 1966 Oxidative phosphorylation and related reactions, particularly as affected by 2,4-dinitrophenol (DNP), were studied with mitochondria and submitochondrial particles isolated from the flight muscle of the blowfly *Phormia regina* and housefly *Musca domestica*. In the presence of a phosphate acceptor, the mitochondria oxidized pyruvate rapidly, and this was tightly coupled to phosphorylation. Added succinate and other citric acid cycle intermediates were not readily oxidized by the intact mitochondria. However, submitochondrial particles coupled succinate or NADH oxidation to phosphorylation but did not utilize pyruvate. The substrate specificity of intact mitochondria

appears to be related to a membrane permeability barrier Pyruvate oxidation was stimulated by DNP but only in the presence of ATP or ADP and Pi DNP inhibited the ATP Pi exchange reaction and promoted ATP hydrolysis with no substrate present However with sufficient ATP and Pi Pi32 added little or no net ATP hydrolysis occurred when pyruvate oxidation was stimulated by DNP and ATP32 continued to be formed The ATP or ADP and Pi requirements are due to their need in substrate level phosphorylation because DNP still promoted respiration in the presence of ATP ADP and Pi after coupled phosphorylation and DNP ATPase were completely inhibited by oligomycin In the presence of oligomycin DNP stimulated respiration with ATP and Pi added only when sufficient MgC12 2 mM was present to provide ADP for substrate level phosphorylation MgC12 however did not promote respiration in the presence of oligomycin and in the absence of DNP and MgC12 was not essential when ADP was present These findings show that ATP or ADP and Pi are not obligatory in the basic mechanism by which DNP promotes electron transport in insect mitochondria they also show that DNP can release respiration at all three sites of coupled phosphorylation in the presence of oligomycin However at 0.1 to 0.15 mM DNP maximal respiratory stimulation was obtained only in the absence of oligomycin when DNP could promote ATP hydrolysis and uncouple phosphorylation ATP32 formation from oxidative phosphorylation was demonstrated in experiments in which respiration was stimulated nearly maximally by 0.1 mM DNP in the presence of ATP and Pi Pi32 Other experiments which utilized ADP or ATP and hexokinase as a phosphate acceptor indicated that the equivalent of two phosphorylation sites were not completely uncoupled by 0.1 mM DNP since P/O ratios significantly greater than 1 were obtained with short incubation periods even when the phosphate acceptor was not added until 10 minutes after the DNP These results suggest that DNP does not release respiration equally at each of the three sites of coupled phosphorylation In contrast to mitochondria sonic or digitonin particles did not show ATP Pi exchange or DNP ATPase activity Sonic particles coupled succinate or NADH oxidation to phosphorylation with P/O ratios between 0.2 and 0.8 the phosphorylation was inhibited by oligomycin and uncoupled by DNP Therefore DNP can uncouple respiration in one or more reactions that do not necessarily lead to ATP hydrolysis Mg ATPase was observed with both mitochondria and particle preparations At 0.4 mM DNP caused complete inhibition of pyruvate oxidation and coupled phosphorylation with mitochondria but did not inhibit succinate or NADH oxidation with sonic particles although it did uncouple phosphorylation completely

Oxidative Phosphorylation, Proton Translocation and Energy Coupling in Escherichia Coli Elliot Leslie Hertzberg, 1975  
Detection of a Phosphorylated Intermediate in Mitochondrial Oxidative Phosphorylation Richard Lester Cross, 1970  
Mitochondrial Oxidative Phosphorylation Henri Woelders, 1989  
**A Study of Oxidative Phosphorylation Using Isotopes of Oxygen and Phosphorous** Wayne Wesley Luchsinger, 1956  
**Biogenesis of the oxidative phosphorylation machinery in plants. From gene expression to complex assembly** Daniel H. Gonzalez, 2014-09-10 Mitochondrial biogenesis is an extremely complex process A hint of this complexity is clearly indicated by the many steps and factors required to assemble the

respiratory complexes involved in oxidative phosphorylation These steps include the expression of genes present in both the nucleus and the organelle intricate post transcriptional RNA processing events the coordinated synthesis transport and assembly of the different subunits the synthesis and assembly of co factors and finally the formation of supercomplexes or respirasomes It can be envisaged and current knowledge supports this view that plants have evolved specific mechanisms for the biogenesis of respiratory complexes For example expression of the mitochondrial genome in plants has special features not present in other groups of eukaryotes Moreover plant mitochondrial biogenesis and function should be considered in the context of the presence of the chloroplast a second organelle involved in energetic and redox metabolism It implies the necessity to discriminate between proteins destined for each organelle and requires the establishment of functional interconnections between photosynthesis and respiration In recent years our knowledge of the mechanisms involved in these different processes in plants has considerably increased As a result the many events and factors necessary for the correct expression of proteins encoded in the mitochondrial genome the cis acting elements and factors responsible for the expression of nuclear genes encoding respiratory chain components the signals and mechanisms involved in the import of proteins synthesized in the cytosol and the many factors required for the synthesis and assembly of the different redox co factors heme groups iron sulfur clusters copper centers are beginning to be recognized at the molecular level However detailed knowledge of these processes is still not complete and especially little is known about how these processes are interconnected Questions such as how the proteins once synthesized in the mitochondrial matrix are inserted into the membrane and assembled with other components including those imported from the cytosol how the expression of both genomes is coordinated and responds to changes in mitochondrial function cellular requirements or environmental cues or which factors and conditions influence the assembly of complexes and supercomplexes are still open and will receive much attention in the near future This Research Topic is aimed at establishing a collection of articles that focus on the different processes involved in the biogenesis of respiratory complexes in plants as a means to highlight recent advances In this way it intends to help to construct a picture of the whole process and not less important to expose the existing gaps that need to be addressed to fully understand how plant cells build and modulate the complex structures involved in respiration

### **Oxidative Phosphorylation and Electron Transport in *Proteus Mirabilis*** Elbertus Gerrit Van der Beek,1976\*

*Evidence for a Soluble Intermediate of Oxidative Phosphorylation Isolated from Cabbage Mitochondria* Morris Alfred Johnson,1966 An intermediate of oxidative phosphorylation was apparently solubilized from cabbage mitochondria The method of solubilization used primarily was extraction of a mitochondrial acetone powder with 0.1 M glycylglycine pH 7.4 at 4°C The intermediate betrayed its presence by causing the transfer of  $\text{P}_{32}$  to ADP with the resultant formation of  $\text{ATP}_{32}$  or G 6 P $_{32}$  when the hexokinase trap was used The formation of  $\text{ATP}_{32}$  or G 6 P $_{32}$  was determined as N E P $_{32}$  non extractable P $_{32}$  by the isobutanol benzene extraction procedure The transfer reaction used for assay took place in a completely soluble

system and both ADP and extract were required. The historical development of an isolation procedure and of a suitable assay system were described. Initial attempts to detect an intermediate were directed at introducing the radioactive label of  $\text{P}_i^{32}$  while the mitochondria were still intact or during the extraction of the acetone powder. At these stages of the work the assay was also conducted during the extraction of the acetone powder by inclusion of the acceptor system ADP, hexokinase and glucose and Mg in the extraction medium. Most of the significant facts were obtained through the use of a clarified extract which had not been exposed to  $\text{P}_i^{32}$  previously. Although it was possible to centrifuge the crude extract at  $105\,000 \times g$  for 90 min without sedimenting the component necessary for the transfer reaction, this high speed centrifugation was not employed on a routine basis. The alleged intermediate was apparently proteinaceous as indicated by its response to heat, aging, dialysis inhibitors and trichloroacetic acid (TCA). The transfer activity of the extract was lost upon incubation at  $50^\circ\text{C}$  for five min, upon aging at  $4^\circ\text{C}$  upon the addition of TCA and in the presence of  $2 \times 10^{-5} \text{ M}$  p-chloromercuribenzoic acid (PCMB). Although non-dialyzable, the extract was inactivated by dialysis, probably due to the loss of an essential small molecule such as NAD or NADP. Both NAD and NADP stimulated the transfer activity in crude extracts and in extracts which had undergone the centrifugation at  $105\,000 \times g$ . The action of these coenzymes was attributed to their possible role in promoting the labeling of the intermediate from  $\text{P}_i^{32}$ . In addition to these two activators, the rate of the transfer reaction was markedly dependent upon the  $\text{P}_i$  concentration up to  $1 \times 10^{-3} \text{ M}$   $\text{P}_i$ . The yield of intermediate from slightly less than two kilo grams of cabbage was usually 50–100 millimicromoles under favorable assay conditions. The probability that this represents less than the maximum yield was considered. The transfer activity was rather severely inhibited by  $1 \times 10^{-3} \text{ M}$  arsenate and partially inhibited by  $1 \times 10^{-4} \text{ M}$  dinitrophenol (DNP). It was not sensitive to oligomycin. ATP, AMP and GDP did not substitute for ADP nor did NADH substitute for NAD. The intermediate appeared to be labile when kept in an aqueous system in the presence of Mg. Problems posed by such items as the impurity of the  $\text{P}_i^{32}$  and by side reactions were discussed. The extract also contained succinic thiokinase exchange activity. Most of the available evidence, including a preliminary ammonium sulfate fractionation, would indicate that this exchange was due to a separate protein. On the basis of experimental evidence obtained in this study, a sequence for the operation of the transfer reaction in the assay system was proposed. It was suggested that both the non-phosphorylated AH and the phosphorylated XH forms of an intermediate of oxidative phosphorylation were present in the extract. It was further speculated that NAD and/or NADP functioned as the A of AH and were active in promoting the labeling of the XH form with  $\text{P}_i^{32}$ . In view of no ready alternate explanation for the transfer activity of the extract, it was suggested that this activity merits consideration as the expression of an intermediate of oxidative phosphorylation.

*Some Factors Influencing the Efficiency of Oxidative Phosphorylation* Anne Cathrine Thaulow Riiber, 1958

**Effect of Fluorescamine and Its Derivatives on Mitochondrial Oxidative Phosphorylation** David Da-Wei Shiuan, 1981

Control of Oxidative Phosphorylation in Mitochondria from Type I and Type II Skeletal Muscle Brian Glancy, 2009

Oxidative Phosphorylation in

Plant Mitochondria Harold Christopher Passam, King's College London. Department of Plant Science, 1971      *Oxidative*  
*Phosphorylation in Mitochondria During Embryonic Development* Anna Miriam Henson, 1967

Oxidative Phosphorylation Pogil Answers: Bestsellers in 2023 The year 2023 has witnessed a remarkable surge in literary brilliance, with numerous engrossing novels captivating the hearts of readers worldwide. Lets delve into the realm of popular books, exploring the captivating narratives that have captivated audiences this year. Oxidative Phosphorylation Pogil Answers : Colleen Hoover's "It Ends with Us" This touching tale of love, loss, and resilience has captivated readers with its raw and emotional exploration of domestic abuse. Hoover masterfully weaves a story of hope and healing, reminding us that even in the darkest of times, the human spirit can prevail. Oxidative Phosphorylation Pogil Answers : Taylor Jenkins Reid's "The Seven Husbands of Evelyn Hugo" This captivating historical fiction novel unravels the life of Evelyn Hugo, a Hollywood icon who defies expectations and societal norms to pursue her dreams. Reid's absorbing storytelling and compelling characters transport readers to a bygone era, immersing them in a world of glamour, ambition, and self-discovery. Discover the Magic : Delia Owens' "Where the Crawdads Sing" This evocative coming-of-age story follows Kya Clark, a young woman who grows up alone in the marshes of North Carolina. Owens crafts a tale of resilience, survival, and the transformative power of nature, captivating readers with its evocative prose and mesmerizing setting. These popular novels represent just a fraction of the literary treasures that have emerged in 2023. Whether you seek tales of romance, adventure, or personal growth, the world of literature offers an abundance of engaging stories waiting to be discovered. The novel begins with Richard Papan, a bright but troubled young man, arriving at Hampden College. Richard is immediately drawn to the group of students who call themselves the Classics Club. The club is led by Henry Winter, a brilliant and charismatic young man. Henry is obsessed with Greek mythology and philosophy, and he quickly draws Richard into his world. The other members of the Classics Club are equally as fascinating. Bunny Corcoran is a wealthy and spoiled young man who is always looking for a good time. Charles Tavis is a quiet and reserved young man who is deeply in love with Henry. Camilla Macaulay is a beautiful and intelligent young woman who is drawn to the power and danger of the Classics Club. The students are all deeply in love with Morrow, and they are willing to do anything to please him. Morrow is a complex and mysterious figure, and he seems to be manipulating the students for his own purposes. As the students become more involved with Morrow, they begin to commit increasingly dangerous acts. The Secret History is an exceptional and suspenseful novel that will keep you speculating until the very end. The novel is a cautionary tale about the dangers of obsession and the power of evil.

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