

# Nucleotide sequence of a full-length cDNA coding for the mitochondrial precursor protein of the $\beta$ -subunit of $F_1$ -ATPase from *Neurospora crassa*

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Subunits of mitochondrial  $H^+$ -ATPases are investigated under a variety of different aspects: (i) mechanisms of energy coupling (1, 2); (ii) evolution of ATPases (3) and (iii) mechanisms of mitochondrial import and assembly of the nuclear coded subunits (4–7). For the latter reason, we have cloned and expressed a full-length cDNA coding for the nuclear coded  $\beta$ -subunit of the  $F_1$ -ATPase from *Neurospora crassa*. The nucleotide sequence and the deduced amino acid sequence are shown in Figure 1. The protein is synthesized in the cytosol as a precursor of 55,470 Da which is cleaved inside mitochondria to the mature protein. The mature protein shares 70–80% of sequence similarity to known mitochondrial  $\beta$  subunits, for example yeast (8), bovine (9) or human (10).

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## Note added in proof

We have learned that Drs E. and B. Bowman (University of California, Santa Cruz) have cloned the corresponding gene from *N. crassa* (personal communication).

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-30
1 ATGTTCAAGAGCGGCATTTCGCGCTTCGCCGACTGCCCGTCCCTCTTTGCGGGGGG
1 M F K S G I S A F A R T A R P S F A A A
61 TCCCGTCGGCGCTCCGCCCGGTGCCCTCAACTCCGTGCCCTGCCCTCAGCAGATT
21 S R R A V R P A A L N L R A P A L S R F
121 GCCAGCTCCGCGGTGTGGTGATGGCAAGATCTACCAGGTCATTGGTCCCGTTCGAT
41 A S S A G V G D G K I Y Q V I G A V V D
181 GTCAGTTTCGATACCGACAAGCTCCCTCCATTCTCAACGCCCTTGAGACCCAGAACAAT
61 V K F D T D K L P P I L N A L E T Q N N
241 GGCCAGAAGCTCGTCTCGAGGTCTCGCAACATCTCGGCGAGAACGTCGTGAGATGCATT
81 G Q K L V L E V S Q H L G E N V V R C I
301 GCCATGGACGGTACTGAGGGTCTCGTTCGTGGTGCCAAGGCCCTCCGACACTGGTGTCC
101 A M D G T E G L V R G A K A S D T G A P
361 ATCACCATCCCTGTCCGCCCTGCCACCCTTGCCCGTATCATCAAGTCAGTGGTGACCCC
121 I T I P V G P A T L G R I I N V T G D P
421 ATCGAGGCGGGTCCCATCAAGACCACAGTTCGCCCTATCCAGCCGAGGCTCCC
141 I D E R G P I K T D K F R P I H A E A P
481 GAGTTCGTTGAGCAGTCCACCCTGCCAGATCTCGTCACTGGTATCAAGTTCGTGAT
161 E F V E Q S T T A E I L V T G I K V V D
541 CTCCTGCCCGCTACGCTCGTGGTGAAAGATGGTCTCTTCGGTGGTGGTGTGGCC
181 L L A P Y A R G G K I G L F G A G V G
601 AAGCCGCTTCATTCAGGAGCTCATCAACAACATGCCAAGGCTCAGCGTGGTACTCC
201 K T V F I Q E L I N N I A K A H G G Y S
661 GTCTTACCGGTGTCCGTGAGCGTACCCGTGAGGTAACGATCTGTACCACGAAATCGAG
221 V F T G V G E R T R E G N D L Y H E M Q
721 GAGACCTCCGTCACTCAGCTCGATGGTGACTCCAAGTCCGCTTGCTGTCCGTCAGATG
241 E T S V I Q L D G D S K V A L V F G Q M
781 AACGAGCCCCGGAGCTCGTCCCGGTGTCGCCCTTACTGGTCTTACCATTGCCGAGTAC
261 N E P P G A R A R V A L T G L T I A E Y
841 TTCGATGAGGAGGTCAGGATGTGTCTCTCATTGACAACATTTCCGTTTACC
281 F R D E E G Q D V L L F I D N I F R F T
901 CAGCCGGTTCGAGGTGTCGGCTCTTCCGTCGATTCCTCCGTCGGTGGTACCAG
301 Q A G S E V S A L L G R I P S A V G Y Q
961 CCCACTTCGCGCTCGACATGGTTCAGATGCAGGAGCGTATTACCACCACCACAAGGT
321 P T L A V D M G Q M Q E R I T T T T K G
1021 TCCATTACCTCCGTCAGGCCGTCAGTCCCGGTGACGATTTGACTGATCCCTGCC
341 S I T S V Q A V Y V P A D D L T D P A P
1081 GCCACCATTTCGCCCATCTTGACGCCACCCTGTCTGTCCCGTGGTATCTGAGTTG
361 A T T F A H L D A T T V L S R G I S E L
1141 GGTATCTACCCGCTGTGATCCCTTGACTCCAAGTCCGATGCTCGACCCCGTATT
381 G I Y P A V D P L D S K S R M L D P R I
1201 GTCGCCAGGAGACTACGAGACCCGCCCGGTCCAGCAGATCCTCCAGGAGTACAAG
401 V G Q E H Y E T A T R V Q Q I L Q E Y K
1261 TCCCTCCAGGATATCATTGCCATTCTGGTATGGACGAACCTTCCGAGGCCAGGCTC
421 S L Q D I I A I L G M D E L S E A D K L
1321 ACCGTCGAGCGTCCCGTAAGATCCAGGTTTCCTCAGCAGCCTTTCAGTGTCCGTCAG
441 T V E R A R K I Q R F L S Q P F T V A Q
1381 GTCTTCACTGGTATCGAGGTAAGCTCGTGTGACCTAAGACACCATTTGCCCTTCAAG
461 V F T G I E G K L V D L K D T I A S F K
1441 GCTATTCTCGTGGTGAGGGTGATGACCTCCCGAGGGTCCCTTCACTAGTGGTGGCGAC
481 A I L A G E G D D L P E G A F Y M V G D
1501 TTCGCCCTGCTCCGCCAAGGGTGAGAAGATCTTGCTGAGCTTGAGGCCAGGCTTAA
501 F A S A R A K G E K I L A E L E G Q A
1561 GCGATTAATCGGGAGTTCAAATCGGACGGAACGATGGCCCTGTATAGAGTAAGA
1621 AAGGTTTTTCGGGACTTCTCCTATGAGCTGTGTATCAAATGAAGTTCTTTTTTTT
1681 CTCTATATACCT

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Figure 1. Nucleotide sequence of a full-length cDNA insert and the deduced protein sequence for  $F_1\beta$  precursor from *N. crassa*.