

Polynucleotide adenylyltransferase

In enzymology, a **polynucleotide adenylyltransferase** (**EC 2.7.7.19** (<https://enzyme.expasy.org/EC/2.7.7.19>)) is an enzyme that catalyzes the chemical reaction



Thus, the two substrates of this enzyme are ATP and RNA, whereas its two products are pyrophosphate and RNA with an extra adenosine nucleotide at its 3' end.

Human genes with this activity include TUT1, MTPAP, PAPOLA, PAPOLB, PAPOLG, TENT2, TENT4A, TENT4B, TENT5C, TENT5D.

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Naming

This enzyme belongs to the family of transferases, specifically those transferring phosphorus-containing nucleotide groups (nucleotidyltransferases). The systematic name of this enzyme class is **ATP:polynucleotide adenylyltransferase**.

Other names in common use include:

- NTP polymerase
- RNA adenylyating enzyme
- AMP polynucleotidylexotransferase
- ATP-polynucleotide adenylyltransferase
- ATP:polynucleotidylexotransferase
- Poly(A) polymerase
- Poly(A) synthetase
- Polyadenylate nucleotidyltransferase
- Polyadenylate polymerase
- Polyadenylate synthetase
- Polyadenylic acid polymerase
- Polyadenylic polymerase
- Terminal riboadenylate transferase
- Poly(A) hydrolase

polynucleotide adenylyltransferase	
Identifiers	
EC no.	2.7.7.19 (https://www.qmul.ac.uk/sbcs/iubmb/enzyme/EC2/7/7/19.html)
CAS no.	9026-30-6 (http://www.commonchemistry.org/ChemicalDetail.aspx?ref=9026-30-6&title=)
Databases	
IntEnz	IntEnz view (https://www.ebi.ac.uk/intenz/query?cmd=SearchEC&ec=2.7.7.19)
BRENDA	BRENDA entry (http://www.brenda-enzymes.org/enzyme.php?ecno=2.7.7.19)
ExPASy	NiceZyme view (https://enzyme.expasy.org/EC/2.7.7.19)
KEGG	KEGG entry (https://www.genome.jp/dbget-bin/www_bget?enzyme+2.7.7.19)
MetaCyc	metabolic pathway (https://biocyc.org/META/substring-search?type=NIL&object=2.7.7.19)
PRIAM	profile (http://priam.prabi.fr/cgi-bin/PRIAM_profiles_CurrentRelease.pl?EC=2.7.7.19)
PDB structures	RCSB PDB (https://www.rcsb.org/search?q=rscb_polymer_entity.rcsb_ec_lineage.id:2.7.7.19) PDBe (https://www.ebi.ac.uk/pdbe/entry/search/index?ec_number:2.7.7.19) PDBsum (https://www.eb

- RNA formation factors
- PF1
- Adenosine triphosphate:ribonucleic acid adenylyltransferase

Function

This enzyme is responsible for the addition of the **3' polyadenine tail** to a newly synthesized pre-messenger RNA (pre-mRNA) molecule during the process of **gene transcription**. The protein is the final addition to a large **protein complex** that also contains smaller assemblies known as the **cleavage and polyadenylation specificity factor (CPSF)** and **cleavage stimulatory factor (CtSF)** and its binding is a necessary prerequisite to the cleavage of the 3' end of the pre-mRNA. After cleavage of the 3' signaling region that directs the assembly of the complex, polyadenylate polymerase (PAP) adds the polyadenine tail to the new 3' end.

The rate at which PAP adds **adenine nucleotides** is dependent on the presence of another regulatory protein, PABPII (polyadenine binding protein II). The first few nucleotides added by PAP are added very slowly, but the short polyadenine tail is then bound by PABPII, which accelerates the rate of adenine addition by PAP. The final tail is about **200-250 adenine nucleotides** long.

PAP is phosphorylated by **mitosis-promoting factor**, a key regulator of the **cell cycle**. High phosphorylation levels decrease PAP activity.

Structural studies

As of late 2007, **27 structures** have been solved for this class of enzymes, with **PDB accession codes** **1AV6** (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=1AV6>), **1B42** (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=1B42>), **1BKY** (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=1BKY>), **1EAM** (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=1EAM>), **1EQA** (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=1EQA>), **1F5A** (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=1F5A>), **1FAO** (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=1FAO>), **1JSZ** (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=1JSZ>), **1JTE** (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=1JTE>), **1JTF** (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=1JTF>), **1P39** (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=1P39>), **1Q78** (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=1Q78>), **1Q79** (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=1Q79>), **1V39** (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=1V39>), **1VFG** (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=1VFG>), **1VP3** (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=1VP3>), **1VP9** (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=1VP9>), **1VPT** (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=1VPT>), **2GA9** (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=2GA9>), **2GAF** (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=2GAF>)

	i.ac.uk/thornton-srv/databases/cgi-bin/enzymes/GetPage.pl?ec_number=2.7.7.19)
Gene Ontology	AmiGO (http://amigo.geneontology.org/amigo/term/GO:0004652) / QuickGO (https://www.ebi.ac.uk/QuickGO/term/GO:0004652)
Search	
PMC	articles (https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&term=2.7.7.19%5BEBC/RN%20Number%5D%20AND%20pubmed%20pmc%20local%5Bsb%5D)
PubMed	articles (https://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&term=2.7.7.19%5BEBC/RN%20Number%5D)
NCBI	proteins (https://www.ncbi.nlm.nih.gov/protein?term=2.7.7.19%5BEBC/RN%20Number%5D)

2GAF), 2HHP (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=2HHP>), 2O1P (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=2O1P>), 2Q66 (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=2Q66>), 2VP3 (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=2VP3>), 3MAG (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=3MAG>), 3MCT (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=3MCT>), and 4DCG (<https://www.ebi.ac.uk/thornton-srv/databases/cgi-bin/pdbsum/GetPage.pl?pdbcode=4DCG>).

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