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Birnavirus RNA polymerase is related to polymerases of positive strand RNA viruses

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Recently the short segment of genomic double-stranded RNA of a birnavirus, infectious bursa disease virus (IBDV), was sequenced and it was claimed that its encoded product, IBDV RNA-dependent RNA polymerase, had no sequence similarity to other RNA polymerases (1). Closer inspection, however, showed that IBDV polymerase contains, properly positioned, all the amino acid residues invariant in (putative) RNA-dependent RNA polymerases of positive strand RNA viruses (2, and A.E.G. et al., in preparation) as well as many residues partially conserved in the latter. This indicates that birnavirus RNA polymerases may be evolutionary related to those of positive strand RNA viruses and, more generally, that birnaviruses, whose characteristic features are a virus-specific protein covalently linked to genomic RNAs and expression by polyprotein processing (3,4), may be related to positive strand RNA viruses.

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             I                    II                   III            IV
           *    *               *   *    *              ***
GA      aTIDLssasds-36-lfstmGNgfTFelEsMI-16-sLgiygDDIivp-31-sCgAhF
EMCV    YdVDyanfDat-46-gGlpSGcAATaMlNtIM-21-KVIsygDDLiva-40-FlkrkF
FMDV    WdVDysafDAN-46-gGmpSGcsATsIiNtIL-21-tMisygDDIvva-41-FlkrhF
WNV     YadDtagwDtr-56-dqrGSGQvvTYalNtFt-45-RMavSgDDcvvK-39-FCSnhF
SNBV    letDIasfDka-47-ammkSGmflTlfvNtVL-17-caafigDDniih-33-FCggfi
TMV     leLDIaKyDka-47-YqrkSGDvtTFIgNtVI-15-KgafcgDDally-31-FCgryv
TRV     veIDMaKfDka-47-YqQkSGDAdTYnaNsdr-15-mVtyggDDalia-31-FCgkfl
CMV     leIDLaKfDka-47-fqrrTGDAfTYfgNtIV-15-RLlfSgDDalaf-29-iCSkfY
CarMV   igfDMaRfDqh-49-gcrmSGDmnTaLgNcLL-13-RLinngDDcvli-37-FCqmAp
IBV     mgwDypKcDra-52-gGtaSGDAtTayaNaVf-59-sLmilaDDgvvc-46-FCSqht
           :::  : :              :::  :   : ::    ::    ::      ::   :
IBDV    YSIDLeKgEAN-56-YGQGSGNAATFInNhLL-32-KIerSiDDIrgK-53-FCSAAY
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Conserved segments (I-IV) of viral polymerases. Viruses: GA=GA bacteriophage, EMCV=encephalomyocarditis, FMDV=foot-and-mouth disease, WNV=West Nile, SNBV=Sindbis, TMV=tobacco mosaic, TRV=tobacco rattle, CMV=cucumber mosaic, CarMV=carnation mottle, IBV=infectious bronchitis. Sequences from refs. 1 (IBDV), 5 (IBV), 2 (other positive strand RNA viruses). *, consensus residues of positive strand RNA viral RNA polymerases (2, and A.E.G. et al., in preparation); capitals: residues identical or homologous to respective residues of IBDV; colons: residues identical or homologous to those of IBDV in at least 1/2 of included positive strand RNA viral polymerases.

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