

# Morphbank: An Avenue to Document and Disseminate Anatomical Data. I: Phylogenetic Test Case

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## WHAT IS MORPHBANK?

Morphbank (<http://www.morphbank.net>) is an open web repository for digital images utilized in specimen-based biological research. Established in 1998 by a consortium of systematic entomologists, Morphbank serves as a permanent archive to store and distribute images from any of the anatomical sciences. Here, we show its application to phylogenetic studies.

## HOW CAN MORPHBANK BE USED TO DISCOVER, ORGANIZE, AND DOCUMENT MORPHOLOGICAL PHYLOGENTIC CHARACTERS?

Matrices of character codings can be created or generated from a nexus file imported to Morphbank. Each collection of images illustrates a character. Alternatively, collections of images can be used to conduct direct anatomical comparisons among specimens in order to assess or discover new characters. Authors can link matrices published in journals to matrices or collections in Morphbank, supplementing the amount of images or data attached to it.



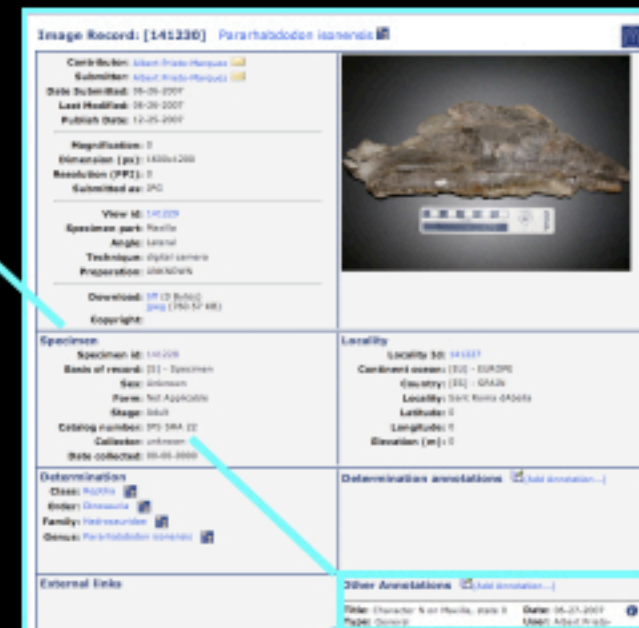
A matrix of characters from a phylogeny is utilized, in this case that for hadrosauriform dinosaurs. Character 16 is the focus of this example

	Characters									
	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-47
<i>I. bernisartensis</i>	00000	00000	00000	00000	00000	00000	00120	00020	00000	00
<i>P. byrdi</i>	1???	???	10100	000??	???	00???	00000	???	???	??
<i>B. canadensis</i>	21110	21121	02111	10010	10011	10011	00220	11011	01010	11
<i>E. annectens</i>	31110	21131	02113	11011	10000	00021	00110	11121	01010	10
<i>Gryposaurus</i> sp.	21110	21111	01112	11010	10010	10001	00120	11121	01010	10
<i>H. stebingeri</i>	21111	11101	11110	001??	01100	01121	11011	21101	11111	10
<i>M. peeblesorum</i>	21110	21111	02111	10000	10011	20021	00220	11011	01010	11
<i>P. blackfeetensis</i>	21110	21121	01112	11011	10012	10001	00111	11101	01010	10
<i>S. osborni</i>	31110	21111	02112	01001	10012	10001	00111	21121	01000	1?
<i>T. transsylvanicus</i>	01011	11001	02000	00000	00000	00021	00200	00???	0???	??

Character 16 is the position of the jugal joint in the maxilla of hadrosauroid dinosaurs

### Character 16, State 0

Jugal rostral process elevated relative to lateral margin of ectopterygoid shelf.



Each cell of the character matrix is linked to a collection of objects stored in Morphbank. (Objects in Morphbank can be images, publications, annotations, specimens, locations, etc.).



Each image is documented with information regarding the specimen (in the case of vertebrate fossils this will include osteological and geological data).

### Character 16, State 1

Ventral margin of jugal rostral process articulates flush with lateral margin of ectopterygoid shelf.



Annotations, such as arrows and explanations of characters, can be added to the images to explain one's interpretation of the morphological character states.

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