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# Key to the Skulls of North Dakota Mammals

## Order Rodentia

1. Infraorbital opening larger than foramen magnum (Fig. 21).....*Erethizontidae, Erethizon dorsatum*  
**Porcupine**  
 Infraorbital opening smaller than foramen magnum.....2
2. Infraorbital opening small, fairly inconspicuous; four lower molariform teeth on each side.....3  
 Infraorbital opening of moderate size, vertically elongate; three lower molariform teeth on each side (Fig. 22).....20
3. Postorbital process prominent (Fig. 25).....*Sciuridae*...5  
 Postorbital process absent.....4
4. Bones thin and translucent or nearly so.....*Heteromyidae*...17  
 Skull not as above.....15
5. Infraorbital opening a foramen piercing the zygomatic plate (Fig. 23).....6  
 Infraorbital opening a canal passing between the zygomatic plate and the rostrum.....7
6. One upper premolar.....*Tamias striatus*  
**Eastern Chipmunk**  
 Two upper premolars.....*Eutamias minimus*  
**Least Chipmunk**
7. Postorbital process very broad, projecting at nearly right angles to long axis of skull at about the middle of the orbit (Fig. 24).....*Marmota monax*  
**Woodchuck**  
 Postorbital process projecting posteriorly and ventrally (Fig. 25).....8
8. Zygomatic arches nearly parallel, not twisted (Fig. 26).....9  
 Zygomatic arches converging anteriorly; ventro-medial portion twisted toward a horizontal plane (Fig. 27).....12
9. Five upper molariform teeth, the first reduced in size.....10  
 Four upper molariform teeth, all about the same size.....11
10. Greatest length of skull less than 50mm; interorbital region narrow, deeply notched (Fig. 28).....*Glaucomys sabrinus*  
**Northern Flying Squirrel**  
 Greatest length of skull more than 50mm; interorbital region relatively broad, not deeply notched (Fig. 29).....*Sciurus carolinensis*

Gray Squirrel

- 11. Zygomatic breadth usually less than 30mm; antero-ventral border of orbit opposite first upper molariform tooth (Fig. 30).....*Tamiasciurus hudsonicus*  
 Red Squirrel  
 Zygomatic breadth usually more than 30mm; antero-ventral border of orbit opposite second upper molariform tooth (Fig. 31).....*Sciurus niger*  
 Fox Squirrel
- 12. Upper molar rows strongly converging posteriorly.....*Cynomys ludovicianus*  
 Black-tailed Prairie Dog  
 Upper molar rows nearly parallel.....13
- 13. Greatest length of skull more than 50mm.....*Spermophilus franklinii*  
 Franklin's Ground Squirrel  
 Greatest length of skull less than 50mm.....14
- 14. Zygomatic breadth less than 25mm.....*Spermophilus tridecemlineatus*  
 Thirteen-lined Ground Squirrel  
 Zygomatic breadth more than 25mm.....*Spermophilus richardsonii*  
 Richardson's Ground Squirrel
- 15. Basioccipital concave (cup-like) with lateral edges projecting ventrally.....*Castoridae, Castor canadensis*  
 Beaver  
 Basioccipital with elevated median ridge, or not as above.....*Geomyidae*...16
- 16. Upper incisors with prominent grooves in front (Fig. 32).....*Geomys bursarius*  
 Plains Pocket Gopher  
 Upper incisors not grooved, or only faintly so (Fig. 33).....*Thomomys talpoides*  
 Northern Pocket Gopher
- 17. Mastoid area greatly expanded; interparietal width less than 1/4 of greatest skull width (Fig. 34).....*Dipodomys ordii*  
 Ord's Kangaroo Rat  
 Mastoid area moderately or slightly expanded; interparietal width more than 1/4 of greatest skull width (Fig. 35).....18
- 18. Breadth of interparietal equal to or greater than interorbital breadth; auditory bullae separated by almost entire width of basisphenoid (Fig. 36).....*Perognathus hispidus*  
 Hispid Pocket Mouse  
 Breadth of interparietal less than interorbital breadth; auditory bullae meeting or nearly so anteriorly (Fig. 37).....19
- 19. Auditory bullae meeting anteromedially (Fig. 38).....*Perognathus flavescens*  
 Plains Pocket Mouse  
 Auditory bullae not meeting (Fig. 37).....*Perognathus fasciatus*  
 Olive-backed Pocket Mouse
- 20. Three upper molars and one small upper premolar; infraorbital canal oval.....*Zapodidae*...21  
 Three upper molars and zero upper premolars; infraorbital canal "v" shaped.....22
- 21. Palatal breadth at third upper molar less than 4.2mm; incisive foramen less than 4.6mm (Fig. 39).....*Zapus hudsonius*

	<b>Meadow Jumping Mouse</b>	
Palatal breadth at third upper molar more than 4.4mm; incisive foramen more than 4.6mm.....	<i>Zapus princeps</i>	
	<b>Western Jumping Mouse</b>	
22. Upper molars with three longitudinal rows of cusps.....	Muridae...23	
Upper molars with two longitudinal rows of cusps (or without cusps).....	Cricetidae...24	
23. Greatest length of skull more than 25mm; zygomatic breadth more than 15mm.....	<i>Rattus norvegicus</i> <b>Norway Rat</b>	
Greatest length of skull less than 25mm; zygomatic breadth less than 25mm.....	<i>Mus musculus</i> <b>House Mouse</b>	
24. Basal length of skull more than 35mm (Fig. 40).....	25	
Basal length of skull less than 35mm.....	26	
25. Basal length of skull more than 50mm.....	<i>Ondatra zebethicus</i> <b>Muskrat</b>	
Basal length of skull less than 50mm.....	<i>Neotoma cinerea</i> <b>Bushy-tailed Woodrat</b>	
26. Occlusal surface of cheekteeth lacking cusps, but with dentine lakes.....	27	
Occlusal surface of cheekteeth with cusps.....	30	
27. Auditory bullae and mastoids much enlarged, reaching plane of occipital condyles (Fig. 41).....	<i>Lagurus curtatus</i> <b>Sagebrush Vole</b>	
Auditory bullae and mastoids not greatly enlarged.....	28	
28. Palate ending in straight shelf (Fig. 39).....	<i>Clethrionomys gapperi</i> <b>Southern Red-backed Vole</b>	
Palate not ending in straight shelf.....	29	
29. Second upper molar with four closed angular sections and a rounded posterior loop; third upper molar with five dentine lakes (Fig. 42).....	<i>Microtus pennsylvanicus</i> <b>Meadow Vole</b>	
Second upper molar with four angular sections and no posterior loop; third upper molar with four dentine lakes (Fig. 43).....	<i>Microtus ochrogaster</i> <b>Prairie Vole</b>	
30. Coronoid process of lower jaw elongated, well developed (Fig. 44).....	<i>Onychomys leucogaster</i> <b>Northern Grasshopper Mouse</b>	
Coronoid process of lower jaw short, reduced (Fig. 45).....	31	
31. Upper incisors with a prominent groove.....	32	
Upper incisors without groove.....	33	
32. Breadth of braincase 9.5mm or more; small accessory cusp between first and second larger cusps evident on outer surface of first lower molar (Fig. 46).....	<i>Reithrodontomys megalotis</i> <b>Western Harvest Mouse</b>	
Breadth of braincase not more than 9.6mm; no accessory cusp evident.....	<i>Reithrodontomys montanus</i> <b>Plains Harvest Mouse</b>	

33. *Peromyscus leucopus* and *Peromyscus maniculatus* (see Note on *Peromyscus*  
at end of key).....

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# Key to the Skulls of North Dakota Mammals

## Order Carnivora

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1. Three molars on each side of lower jaw.....2  
    One or two molars on each side of lower jaw.....7
  2. Broad rostrum; upper molar rows parallel.....Ursidae, *Ursus americanus*  
    **Black Bear**  
    Long narrow rostrum; upper tooth rows not parallel.....Canidae...3
  3. Condylbasal length more than 155mm (Fig. 11).....4  
    Condylbasal length less than 155mm.....5
  4. Condylbasal length usually more than 200mm; greatest length  
    of skull usually more than 250mm.....*Canis lupus*  
    **Grey Wolf**  
    Condylbasal length usually less than 200mm; greatest length  
    of skull usually less than 250mm.....*Canis latrans*  
    **Coyote**
  5. Sagittal crest distinctly "U" shaped; ventral margin of lower jaw  
    with a very distinct step (Fig. 47).....*Urocyon cinereoargenteus*  
    **Grey Fox**  
    Sagittal crest with "V" shaped or not as above; ventral margin of lower  
    jaw without distinct step (Fig. 48).....6
  6. Condylbasal length more than 125mm.....*Vulpes vulpes*  
    **Red Fox**  
    Condylbasal length less than 125mm.....*Vulpes velox*  
    **Swift Fox**
  7. Six upper and six lower molariform teeth.....Procyonidae, *Procyon lotor*  
    **Raccoon**  
    Not as above.....8
  8. Three or four upper and three lower molariform teeth.....Felidae...9  
    Four or five upper and more than three lower molariform  
    teeth.....Mustelidae...11
  9. Three upper and two lower premolars.....*Felis concolor*  
    **Mountain Lion**  
    Two upper and two lower premolars.....10
  10. Hypoglossal foramen separate from foramen lacerum posterius  
    (may be difficult to separate from Bobcat) (Fig. 49).....*Felis lynx*  
    **Lynx**

Hypoglossal foramen confluent with foramen lacerum posterior (Fig. 50).....	<i>Felis rufus</i> <b>Bobcat</b>
11. Total teeth, 38.....	<i>Martes pennanti</i> <b>Fisher</b>
Total teeth less than 38.....	12
12. Total teeth, 36.....	<i>Lutra canadensis</i> <b>River Otter</b>
Total teeth, 34.....	13
13. Palate not extending much beyond posterior edge of last upper molars.....	14
Palate extending appreciably beyond posterior edge of last upper molars.....	15
14. Condylbasal length less than 60mm.....	<i>Spilogale putorius</i> <b>Eastern Spotted Skunk</b>
Condylbasal length more than 60mm.....	<i>Mephitis mephitis</i> <b>Striped Skunk</b>
15. Greatest length of skull more than 90mm; last molar triangular shaped.....	<i>Taxidea taxus</i> <b>Badger</b>
Greatest length of skull less than 90mm; last molar dumbbell shaped ( <i>Mustela</i> - these species may be hard to separate).....	16
16. Condylbasal length less than 55mm.....	17
Condylbasal length more than 55mm.....	18
17. Condylbasal length more than 37mm.....	<i>Mustela frenata</i> <b>Long-tailed Weasel</b>
Condylbasal length less than 37mm.....	19
18. Postorbital process well developed, robust; zygomatic breadth more than 40mm.....	<i>Mustela nigripes</i> <b>Black-footed Ferret</b>
Postorbital process poorly developed, not robust; zygomatic breadth less than 40mm.....	<i>Mustela vison</i> <b>Mink</b>
19. Basilar length of skull less than 31mm (Fig. 51).....	<i>Mustela nivalis</i> <b>Least Weasel</b>
Basilar length of skull 31mm or longer.....	<i>Mustela erminea</i> <b>Ermine</b>

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