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# Serum Antibody Prevalence of Parainfluenza 3 Virus in a Free-ranging Bison (*Bison bison*) Herd from Alaska

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ABSTRACT: Serum antibody prevalence of parainfluenza 3 virus in the free-ranging Delta bison (*Bison bison*) herd which is found near Delta Junction, Alaska (USA), increased from 0% to 100% during the period 1977 to 1984. Domestic cattle are hypothesized as the source for the infection. There has been no clinical disease or decrease in productivity in this bison herd since establishment of the infection.

*Key words:* Bison, *Bison bison*, parainfluenza 3 virus, PI3, serologic survey.

The Delta bison (*Bison bison*) herd numbers from 300 to 400 animals and ranges freely in an 800 km$^2$ area principally south and east of the community of Delta Junction, Alaska (USA, 64°00′N, 145°45′W). This herd was established by a transplant of 23 animals from Montana (USA) in 1928.

During the 1970's and early 1980's major expansion of agricultural industries occurred near Delta Junction (Engelbrecht and Thomas, 1987). Cattle and swine populations in the Delta Junction area increased 2- to 3-fold between the mid-1970's and mid-1980's (Alaska Agricultural Statistics Service, 1988). Cattle, horses and swine all currently number in the hundreds. Sheep and goats are less numerous.

Bison do not routinely come into direct contact with domestic livestock. However, part of the historic bison range has been cleared and developed for agricultural purposes. During August and September bison have been attracted to agricultural areas by maturing grain crops. Direct and indirect interaction with livestock may occur at such times.

Moose (*Alces alces*) are common within the home range of the Delta bison herd. Bison may occasionally come into contact with Dall sheep (*Ovis dalli*) and caribou (*Rangifer tarandus*) at the edges of respective home ranges. There is no contact with other free-ranging bison. A serologic survey was conducted to determine the exposure of wildlife populations, especially bison, to livestock pathogens in the area.

Blood samples from 409 Delta herd bison were collected by hunters from animals which they had shot or by personnel of the Alaska Department of Fish and Game (P.O. Box 605, Delta Junction, Alaska 99737, USA) from tranquilized bison. Samples were collected from 43 Delta herd caribou which range from 63°45′N to 64°15′N and from 146°30′W to 149°00′W. Thirty moose sera were collected from an area extending from 64°15′N to 64°45′N and from 146°00′W to 149°00′W. Specimens were collected from 77 Dall sheep at Sheep Creek (63°20′N, 143°50′W). Blood was allowed to settle for 18 to 48 hr at ambient or refrigerated temperatures and then centrifuged. Sera were collected and frozen.

Hemagglutination inhibition tests (HI) for evidence of exposure to parainfluenza 3 virus (PI3) were performed according to the method of Thorsen and Henderson (1971). Confirmatory PI3 tests on 78 bison sera were conducted at the same facility using the serum neutralization procedure (Thorsen and Henderson, 1971). Bison sera also were periodically tested for evidence of exposure to (1) infectious bovine rhinotracheitis, bovine viral diarrhea, and respiratory syncytial virus by the serum neutralization test (Thorsen and Henderson, 1971); (2) epizootic hemorrhagic disease and bluetongue viruses by the immunodiffusion test (Pearson and Jochim, 1979); (3) *Coxiella burnetti* by the complement fixation test (Erickson et al., 1975); (4) *Bru-*

TABLE 1. Serum hemagglutination inhibition antibody prevalence of parainfluenza 3 virus in the Delta bison herd from Delta Junction, Alaska (USA).

| Year | Sex | | Total (%) |
|---|---|---|---|
| | Male | Female | |
| 1975 | 0/5* | 0/3 | 0/8 (0) |
| 1976 | 0/5 | 0/8 | 0/13 (0) |
| 1977 | 0/14 | 0/12 | 1/26 (4) |
| 1978 | 9/18 | 4/12 | 13/30 (43) |
| 1979 | 4/6 | 4/5 | 8/11 (73) |
| 1980 | 1/3 | 1/2 | 2/5 (40) |
| 1981 | 19/33 | 4/12 | 23/45 (51) |
| 1982 | 9/26 | 8/27 | 17/53 (32) |
| 1983 | 14/14 | 30/31 | 44/45 (98) |
| 1984 | 18/18 | 23/23 | 41/41 (100) |
| 1985 | 10/11 | 18/18 | 28/29 (97) |
| 1986 | 13/13 | 38/38 | 51/51 (100) |
| 1987 | 22/22 | 20/20 | 42/42 (100) |
| 1988 | 7/7 | 3/3 | 10/10 (100) |
| Total (%) | 126/195 (65) | 154/214 (72) | 280/409 (68) |

* Number positive/number tested.

*cella* spp. by the buffered acidified plate antigen test (Angus and Barton, 1984); (5) 12 serovarieties of *Leptospira interrogans* by the microscopic agglutination test (Cole et al., 1973); and (6) *Mycobacterium bovis* by the enzyme-linked immunosorbent assay test (Thoen et al., 1988). Known positive and negative control sera were included with each batch of sera tested. A titer of 8 or greater was considered evidence of past exposure to PI3 for both methods based upon standards established for other wildlife species (Thorsen and Henderson, 1971; Parks and England, 1974; Kingscote and Bohac, 1986). Samples which met or exceeded this titer will be referred to as "positive." All others are referred to as "negative." Differences in antibody prevalence based upon gender of bison were tested for significance by means of the Chi-square test (Johnson, 1980). Virus isolation was attempted from nasal swabs collected by hunters during 1984 ($n$ = 27) and 1988 ($n$ = 16), bison lung tissue during 1985 ($n$ = 17), and lung lavage fluid during 1988 ($n$ = 17).

Results of PI3 HI tests for bison are presented in Table 1. Titers ranged from 8 to 256. Results of neutralization tests confirmed positive results of HI tests in every case. All virus isolation attempts were unsuccessful.

No evidence of exposure to PI3 was found in bison samples collected prior to 1977. By 1983, antibody prevalence had reached nearly 100% and remained high for the remainder of the sampling period. A 1972 serologic survey of 41 bison from the National Bison Range in Montana revealed that "antibodies against parainfluenza-3 virus were present in all serum samples tested" (Heddleston and Wessman, 1973). Apparently PI3 has been enzootic in that herd for many years. By contrast, the dramatic increase in antibody prevalence in the Delta bison herd is typical of the pattern following introduction of a new disease agent into a susceptible population.

Ages were not available for most of the bison collected. Of 12 yearling bison sampled between 1983 and 1986, 11 were serologically positive for PI3. The only calf (6-mo-old) sampled during this time was also positive. The calf's test result may have been due to passive transfer of maternal antibody. However, these data suggest that bison are exposed to PI3 early in life. There was no significant difference in sex-specific

prevalence. This is expected for an agent transmitted primarily by means of respiratory aerosols.

Serum antibody prevalence of PI3 in other wildlife species was 0%. Serum antibody prevalence in bison for infectious bovine rhinotracheitis virus was one of 366, bovine viral diarrhea virus was six of 316, respiratory syncytial virus was 0 of 105, epizootic hemorrhagic disease virus was two of 392, bluetongue virus was 0 of 391, *Coxiella burnetti* was one of 274, *Brucella* spp. was 0 of 309, *Leptospira interrogans* was 14 of 306, and *Mycobacterium bovis* was 0 of 46.

Domestic livestock are believed to have been the source of PI3 which entered the Delta bison herd. Respiratory disease is not uncommon in cattle in this area. Serologic evidence indicates that cattle have been exposed to infectious bovine rhinotracheitis, bovine viral diarrhea, and PI3 (R. A. Dieterich, pers. comm.). Long-term, large-scale serologic survey results for cattle are not available.

To date, there have been no signs of disease nor any decrease in the high productivity in this closely monitored bison herd. Fortunately, by itself PI3 is considered to be a minor pathogen in most wildlife species (Karstad, 1981). Other pathogens which could be transmitted from livestock to bison may not be so innocuous. In a parallel situation, pathogens from domestic sheep have been implicated as being partially responsible for declines of bighorn sheep (*Ovis canadensis*) populations in the contiguous United States (Turner and Payson, 1982).

Wildlife populations in Alaska have been largely free of livestock diseases in the past (Zarnke, 1986). Increased movement of livestock and geographic expansion of agriculture may pose a threat to the health of wildlife populations. The potential of pathogen exchange between domestic and wildlife species should play a role in the decision-making process related to the agriculture industry and management of wildlife.

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## BOOK REVIEW . . .

**Congressional Directory: Environment,** John T. Grupenhoff and Betty Farley. Grupenhoff Publications, Inc. Bethesda, Maryland. 540 pp. $87.50 U.S.

This text is a quick reference guide to members of Congress, congressional committees, and subcommittees involved in environmental decision making. Key word indices allow rapid access to information on appropriate congressional committees and their members involved in legislation concerning specific issues. The directory provides personal profiles of each Representative or Senator. Profiles contain education, occupational history, family status, and awards or honorary recognition. Also included are biographies of congressional staff.

In general, the directory is user-friendly. It is presented in a logical and readable manner. Access to information pertaining to specific members of Congress, to environmental committees or environmental issues is easily conducted through the key word indices. The authors have done a commendable job of presenting the complex and seemingly convoluted pathways of environmental legislation in a very understandable format.

Although this reference is of undeniable utility there are some shortcomings. The biographies of congressional members and staffers are insufficient to derive any meaningful interpretation of their interests, or backgrounds and education in environmental issues. Additionally, it would be helpful if the voting on recent environmental legislation was listed for each of the members of Congress. Furthermore, the directory is limited by the transient nature of the material presented. Political appointments are short term positions. Updates processed every 90 days of members and their aides are reportedly provided. However, it is unclear how informative these updates are and the duration over which they will be supplied without additional expense. The information contained in the directory would be more useful if it were presented as a computer software package that could be continually upgraded as congressional members and committees change.

I recommend this directory as a good source book for anyone concerned with action on environmental legislation. However, it may be prudent to utilize the directory through a library rather than purchasing a personal copy.

For further information regarding the directory contact: Environment Communications % Science and Health Communications Group, Inc., 6410 Rockledge Drive, Suite 203, Bethesda, Maryland 20817.

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