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BLACK RHINOCEROS VETERINARY RESEARCH UPDATE 1991

R. Eric Miller, DVM
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Black Rhinoceros (Diceros bicornis) SSP Committee
Rhinoceros Taxon Advisory Group

Under the auspices of the SSP, animal health research in the black rhinoceros is an ongoing effort. This report will serve as an update to the 1990 veterinary report to the Black Rhinoceros SSP. Obtaining tissue and sera from all species of captive and wild rhinoceroses remains a priority. Central storage facilities exist for formalinized rhinoceros tissues (Dr. Richard Montali, National Zoological Park) and for frozen serum and tissue (Dr. Eric Miller, St. Louis Zoological Park). These banks have provided readily available sources of materials for comparative and retrospective studies. "Normal" values from wild black rhinoceroses (80+ animals) in Zimbabwe has been published by Dr. Michael Kock, Raoul du Toit, et. al. (1).

Four diseases in black rhinoceroses continue to be notable for their unusual nature and relatively high frequency of occurrence. Although hemolytic anemia has been the leading cause of death among captive animals (43 episodes of hemolysis noted in 34 rhinoceroses; 23 rhinoceroses died from their anemia), no deaths from "primary" hemolysis (not associated with other systemic disease) have been noted since 1986. It is too soon to determine the full significance of this, but it may be a hopeful sign that leptospirosis vaccination and dietary improvements have had some effect. Additionally, no new cases of encephalomalacia have been identified since 1988.

Fungal pneumonias (Aspergillus and less commonly phycomycetes) continue to be noted; at least 6 cases have been identified in black rhinoceroses in North America. Four occurred in black rhinoceroses receiving immunosuppressive therapy for other conditions and 2 cases were "spontaneous." The occurrence of these infections suggests an altered immunological response and has led to research on the immune status of black rhinoceroses (see Dr. Slavin's project below, Dr. Herron's project on the 1990 report). Last, but not least, is the occurrence of oral/skin ulcers. Twenty-six cases have been noted, ranging from mild skin ulcers to severe ulcerative lesions of the skin, mucosal junctions and gastrointestinal tract. Death may result from secondary complications. Dr.

Linda Munson is reviewing tissues from these cases (see description of her project below).

Prior to the 1991 International Rhinoceros Conference at the San Diego Zoo, Dr. David Jessup (International Wildlife Veterinary Services) organized a meeting of veterinarians active in rhinoceros medicine and research. Attendees represented zoo and wildlife veterinarians from the US, Great Britain, Zimbabwe and Namibia. The meeting presented an excellent opportunity for wildlife and zoo veterinarians to share clinical and research experiences and to identify areas of common interest and cooperation. A statement that resulted from this meeting and the Veterinary Session of the Rhinoceros Conference is attached. Two areas were identified that warrant further research: 1) immunological function (for reasons noted above) and 2) additional nutritional studies.

Following is an updated list of animal health projects that have either been initiated or active in the past year:

1. Project: T-Lymphocyte Stimulation Testing and Immunological Evaluation for Fungal Infections
Researchers: Dr. Raymond Slavin and Dr. Allan P. Knutsen, St. Louis University School of Medicine, St. Louis, MO 63104, and R. Eric Miller, DVM, St. Louis Zoological Park, St. Louis, MO 63110, USA.

   Currently being designed, this project will employ various immunological tests to identify black rhinoceroses infected with Aspergillus sp. (primarily pneumonia as noted above) and to evaluate their response to fungal organisms. A more general immunological study will evaluate the response of black rhinoceros lymphocytes to in mitogen stimulation studies.

2. Project: Nutritional studies

   Researchers: Dr. Craig Thatcher, Virginia-Maryland Regional College of Veterinary Medicine, Blacksburg, VA 24601, USA, R. Eric Miller, DVM, St. Louis Zoological Park, St. Louis, MO 63110, USA.

   See Nutritional Report to the Black Rhinoceros SSP Committee.

3. Project: Evaluation of oral and skin ulcers

   Researcher: Dr. Linda Munson, College of Veterinary Medicine, University of Tennessee, Knoxville, TN 37901-1076, USA.

   Due to the occurrence of oral and/or skin ulcers in captive black rhinoceroses (3), biopsy and postmortem tissues from all cases are being reviewed by Dr. Munson. Twenty-six captive black rhinoceroses in the US have had mucosal and/or cutaneous

ulcers; 3 cases have been noted in the past year. Most of the rhinoceroses have had recurrent ulcers. Microscopically, the oral and skin lesions appear as chronic ulcers, though, as of yet no single histologic pattern has emerged. In these captive rhinoceroses there has been no evidence of the dirofilarid parasite Stephanofilaria dinniki. The etiology remains unknown. Dr. Munson is preparing a paper describing the ulcerative "syndrome."

4. Project: Leptospirosis evaluation by microagglutination titers and fluorescent antibody testing.

Researcher: Dr. Carol Bolin, National Veterinary Services Laboratory, Ames, IA 50010, USA

On the basis of fluorescent antibody (FA) tests, infection with Leptospirosis interrogans has noted in 3 of 4 cases of fatal hemolytic anemia in black rhinoceroses (2). Additionally, in the past year, another FA+ case was noted in a female that died in 1990 at the Cincinnati Zoo with severe skin ulcers and anemia. The relationship of L. interrogans infection with disease in this animal is unclear. Currently titer data from captive and wild (Zimbabwe samples supplied by Drs. Michael and Nancy Kock and David Jessup and Raoul du Toit, Namibian samples supplied by Dr. Peter Morkel and Louis Geldenhuys) are being submitted for publication. Of interest is evidence of exposure to varying serovars (strains) of L. interrogans in different areas of Zimbabwe and Namibia (no evidence of exposure in 3 rhinoceroses from the latter's arid habitat). The presence of infection with L. interrogans in some of the hemolytic cases and the titer data continue to support the previous recommendation that all black rhinoceroses be vaccinated biannually with a bacterin that contains at least 5 serovars of L. interrogans including icterohaemorrhagiae and grippotyphosa. Leptoferm-5 (Norden Laboratories, Lincoln, NE 80809, USA) is recommended. Opportunistic postvaccinal sampling of black rhinoceros continues to demonstrate responses in microagglutination titers that would be considered appropriate and protective in domestic species.

Note: Though leptospiral infection may be indicated in 50%-75% of the fatal cases of hemolytic anemia, it is important to note that it has not been identified in all cases. Ongoing studies are attempting to identify other factors that may contribute to red blood cell instability.

5. Project: Further evaluation of red blood cell metabolism.

Researcher: Dr. Donald Paglia, University of California - Los Angeles, Los Angeles, CA 90024, USA

ATP levels in the black rhinoceros RBC are approximately 5% - 20% of those in most other mammalian species. The impact of this finding is uncertain, but it raises the possibility that the black rhinoceros RBC may use alternative energy pathways (4). Further analysis of rhinoceros RBC metabolism and substrate usage is ongoing at UCLA as heparinized blood samples become available. Funding sources need to be identified to maintain and continue this project.

6. Project: Aspergillus sp. pneumonia in black rhinoceroses.

Researcher: Dr. Scott Citino, Metro Miami Zoo, Miami, FL 33176, USA and Dr. Eric Miller, St. Louis Zoological Park, St. Louis, MO 63110, USA.

Fungal pneumonia caused by Aspergillus sp. has been noted in at least 6 captive black rhinoceroses. At least 4 of the 6 affected animals were on immunosuppressive therapy for ulcers (see Dr. Munson's project above). However, 2 of the cases were apparently spontaneous. The occurrence of fungal pneumonia in captive black rhinoceroses warrants further studies regarding their immunocompetence (see Dr. Slavin's project).

7. Project: Cross matching of black rhinoceros sera and red blood cells

Researcher: Dr. Ann Bowling, School of Veterinary Medicine, University of California, Davis, CA 95616

Red blood cells (citrated samples) from 9 black rhinoceroses have been cross-matched with sera from 18 black rhinoceroses. In agglutination testing, weak to moderate reactions have been observed in 13 of the 18 sera samples. One sera sample has produced weak lytic reactions against 7 of the 8 animals tested. Interpreted in light of experience in domestic animals, no evidence has been found that would suggest a clinically obvious problem being defined by these tests. However, it is tempting to speculate that a pattern is emerging from these reactions which may define one or more naturally occurring anti-red cell antibodies. Hopefully, further samples will help in interpreting these observations.

8. Project: Complete blood counts and serum chemistries.

Researcher: Dr. Steven Stockham, College of Veterinary Medicine, University of Missouri, Columbia, MO 65211

Because of variability between laboratory methods, a request was made that complete blood counts and serum chemistries from all rhinoceroses be submitted to a central laboratory. To date, 35 samples have been received from 15 black and 6 white rhinoceroses. Data are currently being reviewed.

9. Project: Serum iron levels and iron binding proteins

Researcher: Dr. Joseph Smith, College of Veterinary Medicine, Kansas State University, Manhattan, KS 66506

Due to the elevated tissue levels of iron noted at necropsy in many black rhinoceroses, additional tissue iron levels from necropsies and serum levels of iron and iron transporting proteins in living animals are being assayed. Thirty-seven sera samples (29 black, 7 white, and 1 Indian), and 17 liver and/or splenic samples (14 black, 3 white) samples have been evaluated. When the data from black rhinoceroses are compared to the white rhinoceroses included in the study, they do not appear to differ significantly. Further analysis is underway to determine if initial impressions that black rhinoceroses accumulate iron in the liver and spleen as they age, and if the serum iron and TIBC of adult black rhinoceroses are higher than that of younger animals or white rhinoceroses.

10. Project: Evaluation for hepadnovirus.

Researcher: Dr. Mike Worley, Zoological Society of San Diego, San Diego, CA 92103, USA.

This study continues to evaluate rhinoceros serum samples for antibodies to hepatitis B-like virus. Additional testing is in progress in an attempt to more definitively identify viral isolates.

-next page-

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July 3, 1991

Dr. Ulysses Seal
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Dear Ulie:

Please find enclosed the data regarding the occurrence of hemolytic anemia in black rhinoceroses that you requested at the at the Bronx Zoo meeting. You had specifically suggested that we could have the mortality data analyzed for significance of the apparent decrease in deaths since 1986 (in New York, I forgot to mention a death that occurred in 1990 - #367 - an animal that developed hemolytic anemia after a severe caudal nasal cavity infection and I'm still not sure if to count this as a "primary" case or not, see ** on chart below).

Additionally, I could not remember if I had already sent you a copy, so I've also enclosed a draft of the paper I submitted for the upcoming version of Fowler's zoo medicine book. The numbers do not agree between the papers as I have added additional cases to the data below. I have also included copies of my data "scratch sheets" if you wish to identify individuals.

I've identified 43 episodes of presumed hemolysis (hemoglobinuria, in a few cases red discoloration to the urine associated with severe anemia), in 34 black rhinoceroses in North America, Europe and Japan. I am currently having a Japanese article translated that I believe will add additional cases due to leptospirosis, and Tom Beggs of Howletts Park reported on additional cases in Great Britain, not all of which I have been able to identify. Twenty-three deaths occurred during hemolytic events (counting #367 mentioned above as a hemolytic death).

I have listed the data as to when the hemolytic events occurred and whether or not the animals **died** (numbers listed in bold type) or survived (listed in regular type) their

BLACK RHINOCEROS DEATHS IN NORTH AMERICA

1991

STDBK # NAME	SEX	DOB	DOD	CAUSE OF DEATH
239 Nanyuki SD-WAP	F	15OCT76	13JUN91	Ruptured liver, trauma
2066 No Name Bentsen	M	20JUL91	20JUL91	Weak, possibly premature

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Respectfully submitted,

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September 1, 1991

episodes. By year, the occurrence of hemolytic anemia was as follows:

YEAR*	TOTAL	BREAKDOWN (DIED/SURVIVED)
1962	2	(1/1)
1963	1	(1/0)
1969	1	(0/1)
1971	2	(2/0)
1973	1	(1/0)
1975	1	(1/0)
1976	1	(0/1)
1977	3	(3/0)
1978	1	(0/1)
1979	6	(3/3)
1980	5	(3/2)
1981	2	(1/1)
1982	1	(1/0)
1984	2	(1/1)
1985	2	(1/1)
1986	4	(3/1)
1987	2	(0/2)
1990	3	(1/2)**

* Years known on 40 of the 43 episodes, not known from 2 rhinoceroses at the Nagoya Zoo (#237 and 238) and the first episode in "Katharina" at the Frankfurt Zoo.

** A male (#296) at the Mexico City Zoo accounted for the 2 episodes in which a rhinoceros survived - in both spirochetemia was noted and he presumably had leptospirosis, he was not vaccinated. The fatal case (#367) developed hemolytic anemia after a prolonged illness with a caudal sinus cavity infection. Difficult to call a "primary" hemolytic anemia - why I forgot to mention it in New York as a recent death from hemolysis. The animal had not been vaccinated for leptospirosis since OCT88. I am currently submitting liver tissue to Dr. Bolin for FA (not submitted by the Caldwell Zoo and I am checking if we have stored tissue).

The British had commented that their cases tended to occur in the winter. In past compilations, seasonality was not present, but I recalculated with the present data. Months are known for 35 of the 43 hemolytic events, they are as follows:

JAN - 2
FEB - 4
MAR - 1
APR - 5
MAY - 4
JUN - 3
JUL - 3

AUG - 2
SEP - 2
OCT - 1
NOV - 4
DEC - 4.

I've also presented these data in an attached bar graph. These data do not seem to present strong evidence of seasonality. Would you agree and can this also be statistically analyzed?

Hemolysis in 10 of the rhinoceroses above was either suspicious of or definitively diagnosed (FA+) as occurring concurrently with leptospiral infection. Liver tissue was submitted from 4 black rhinoceroses dying during hemolysis and 3 were positive (#187, Cheyenne Mountain Zoo was -). The leptospirosis cases/ suspects are:

ANIMAL	INSTITUTION	DATE	DIED OR SURVIVED	DIAGNOSTIC METHOD
#293	Granby	DEC86	D	FA+(titers were-)
#155	Tampa	JAN85	D	FA+
#186	St. Louis	MAY81	D	FA+
#179	Memphis	JUN79	S	^ titers (greater than 1:8000 to L. int. ictero-hemorrhagiae
#199	Memphis	JUN79	D	died in association with #179 above
#126	Memphis	JUN79	D	died in association with #179 above
#218	Dvur Kralove	NOV79 FEB80 MAR81	S S S	^ titers (1:12800 L. int. grippo-typhosa, died of "complications of anemia"
#170	Dvur Kralove	?78 NOV79	S D	^titers (1:6800 L. int. grippo-typhosa
#209	Osaka	?84	D	silver-stained spirochetes in tissues

#296	Mexico City	FEB90	S	spirochetemia on exam, sera to be sent to US for FA testing.
		MAY90	S	

Please contact me if I can supply any further data or answer any questions about it. You and Tom also requested neonatal mortality data and I will start work on that in the coming week and forward it to you both when I get it compiled. I will also work on drafting a letter that will serve as a "leptospirosis vaccination reminder" to be distributed to the Black Rhinoceros SSP institutions. Thank you again for your interest and your support in New York.

Sincerely,

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BLACK RHINOCEROS VETERINARY RESEARCH UPDATE 1992

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and Rhinoceros Taxon Advisory Group

Under the auspices of the Rhinoceros Taxon Advisory Group (TAG) and the Black Rhinoceros SSP, veterinary research to address the many medical issues affecting this species remains an active and ongoing effort. Unfortunately, deaths from a number of diseases that are still not completely understood, most notably hemolytic anemia and oral/skin ulcers, continue to limit the growth of the captive black rhinoceros population.

Perhaps the most significant problem in the past year has been the deaths of 3 of 10 black rhinoceroses imported from Zimbabwe in April 1992. At necropsy, the animals marked biliary stasis in their livers was noted. Diagnostic tests and final diagnosis in these cases are still pending.

Additional cases of note include hemolytic anemia in a 27 year old female (studbook #121) at the Oklahoma City Zoo that survived a bout of acute hemolysis (PCV=18%) after antibiotic therapy and extensive IV phosphorous supple-mentation. A 4 month old calf at the Denver Zoo has apparently developed encephalomalacia as previously reported.[6] If confirmed, this would be the fifth case of encephalomalacia and again emphasizes the importance of collecting brain tissue from all rhinoceros necropsies.

On a more encouraging note, the interest spurred by these events has resulted in the initiation of several new research projects, most notably by Drs. Evan Blumer (nutritional studies in cooperation with Purina Mills and fecal steroid analyses) and Janet Stover (potential electron microscopic studies of liver and a bile acid study described below), and the augmentation of several preexisting studies.

Also on a positive note, Dr. Paglia's laboratory at UCLA has reported dramatic new findings in the metabolism of the black rhinoceros red blood cell (RBC) (see below and attachment).[8-10]

Several practical clinical suggestions have resulted, including a renewed emphasis on avoiding compounds known to cause hemolysis in human enzyme deficiencies and more aggressive treatment of acidosis and hypophosphatemia[1] in hemolytic black rhinoceroses.

Funding of rhinoceros research remains an ongoing problem. Until recently, Dr. Paglia's project had been funded by an NIH grant (which was not renewed). At the time of this report, his laboratory has obtained partial funding via a $5000 donation from the Cincinnati Zoo and $10,000 from an AAZPA Conservation Endowment Fund (CEF). A concerted effort from the Rhinoceros TAG is underway to support that project and several others that are currently in need of financial support. Included in this potential funding list are a dietary review of by a team assembled by Dr. Craig Thatcher at the Virginia-Maryland Regional College of Veterinary Medicine, a immunological and fungal studies by Dr. Slavin at St. Louis University, and support for Dr. Linda Munson's work on the ulcerative syndrome.

Lastly, a Rhinoceros Veterinary Bibliography, containing over 385 references, was compiled and distributed to veterinarians at all rhinoceros holding institutions in North America, rhinoceros coordinators worldwide, and researchers who have been active in rhinoceros health matters.[5]

Following is an updated list of animal health projects that have been initiated or active during the past year:

1. Project: Continued studies of red blood cell metabolism in rhinoceroses.

   Researcher: Dr. Donald Paglia, University of California -Los Angeles, CA 90024, USA.

   Dr. Paglia's laboratory continues to document a marked deficiency of energy (ATP) in black rhinoceroses red blood cells (RBCs). Thus the compromised status of the RBCs apparently makes them susceptible to hemolysis "triggered" by a variety of "stresses" (eg, oxidant compounds such as drugs, infections such as leptospirosis).[8-10] Another promising breakthrough is the discovery that the enzyme catalase is nearly absent in black rhinoceros RBCs. In man, acatalasemia is associated with oral ulcers and in black rhinoceroses; this finding may link both that syndrome and hemolytic anemia. Interestingly, although the RBCs from the 2 white rhinoceroses tested to date were also energy deficient, they had catalase levels similar to those in normal human cells. This finding encourages further research to address the role of catalase deficiency in some of the unique disease problems of black rhinoceroses. A summary of these findings was distributed to veterinarians at rhinoceros holding institutions and will be presented at the AAZV meeting (copy enclosed).

2. Project: Comprehensive nutritional review of captive diets.

Researcher: Dr. Craig Thatcher, Virginia-Maryland Regional College of Veterinary Medicine, Blacksburg, VA 24601, USA.

Initiation of this project is awaiting funding ($25,000). Dr. Thatcher has assembled a team of that includes nutritionists, an epidemiologist and an infectious disease specialist to assist in the review of captive rhinoceros diets. It is hoped that this project will provide a basis on which to build additional studies of specific nutritional factors.

3. Project: Evaluation of oral and skin ulcers

Researcher: Dr. Linda Munson, College of Veterinary Medicine, University of Tennessee, Knoxville, TN 37901.

Dr. Munson continues to review tissues from biopsy and necropsy samples from these cases.[7] She has identified 32 cases. Histologically, the lesions have been characterized by ballooning degeneration and intraepithelial vesicle formation. Publication of her findings is pending.

4. Project: Leptospirosis evaluation by microagglutination titers and fluorescent antibody testing.

Researcher: Dr. Carole Bolin, National Veterinary Laboratories, Ames, IA 50010, USA.

Dr. Bolin's laboratory continues to perform micro-agglutination titers on sera and fluorescent antibody (FA) testing on rhinoceros tissue samples. FA tests on the two rhinoceros deaths at Fossil Rim were negative. A paper summarizing the results from both captive and translocated rhinoceroses in Zimbabwe is in press.[2]

Titers from the recent importation of 10 black rhinoceroses from Zimbabwe found evidence of exposure in all animals to the serovar *Leptospirosis interrogans* serovar *bratislava*. Due to these findings, a revised leptospiral vaccination protocol has been recommended that includes this serovar. We are now recommending biannual vaccination with a 6-way serovar (*canicola, grippotyphosa, hardjo, icterohemorrhagiae, pomona,* and *bratislava*). This vaccine is commercially available as Brativac, a swine product from Norden Pharmaceuticals (Lincoln, NE, USA) that comes in 10 or 50 dose units.

5. Project: Evaluation of bile acid levels and their effect on platelet function in black and white rhinoceroses.

Researchers: Dr. Roger Clemens, College of Veterinary Medicine, University of Florida, Gainesville, FL 32610-0103, Dr. Janet Stover, White Oak Plantation, Yulee, FL 32907.

Bile acid levels appear to be elevated in several black rhinoceroses tested. Interference of the test with other compounds in the blood is being evaluated. In the horse, elevated levels of bile acids have been associated with increased red blood cell fragility and altered platelet function. Results from normal and abnormal black and white rhinoceroses are pending.

6. Project: Complete blood counts and serum chemistries.
Researcher: Dr. Steven Stockham, College of Veterinary Medicine, University of Missouri, Columbia, MO 65211.

Testing of blood and sera samples continues. These values will further establish "normal" values in the captive black rhinoceros population, and provide comparative information with data previously published from free-ranging black rhinoceroses.[3]

7. Project: Evaluation of iron levels and metabolism.

Researcher: Dr. Joseph Smith, College of Veterinary Medicine, Kansas State University, Manhattan, KS 66506, USA.

Dr. Smith is continuing to measure iron and iron binding proteins in samples submitted to Kansas State. In general, his quantitative measurements indicate increased levels of hepatic iron in captive black rhinoceroses and that sera iron and TIBC of black rhinoceroses are higher in older than younger animals, and are higher than in white rhinoceroses. A publication summarizing his data is pending. Of related interest is a recent publication that suggests that the accumulation of hepatic iron may be a function of the length of time spent in captivity.[3]

8. Project: Evaluation for hepadnovirus.

Researcher: Dr. Mike Worley, Zoological Society of San Diego, San Diego, CA 92103, USA.

This study continues to evaluate rhinoceros sera samples for antibodies to hepatitis-B like virus. Additional testing is in progress in an attempt to more definitively identify viral isolates.

9. Project: Cross-matching of black rhinoceros sera and red blood cells.

Researcher: Dr. Ann Bowling, School of Veterinary Medicine, University of California, Davis, CA 95616.

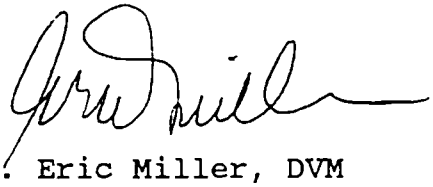
Citrated samples of whole blood from 20+ black rhinoceroses have been cross-matched with sera from 18 other black rhinoceroses. Although the pattern emerging from these reactions may define one or more naturally occurring anti-red blood cell antibodies, no evidence has been found that would suggest a clinically obvious problem with transfusions being defined by these tests.. No obvious patterns or differences in reactivity were noted between the Eastern and Southern subspecies (*D. b. michaeli* and *D. b. minor*).

10. Project: Evaluation of the immune response in rhinoceroses with particular emphasis on aspergillosis infections.

Researchers: Drs. Raymond Slavin and Alan P. Knutsen, St. Louis University School of Medicine, St. Louis, MO 63104, USA.

The general immune response in the rhinoceros will be determined by comparing anti-leptospiral antibodies in rhinoceroses affected with aspergillosis pneumonia and unaffected individuals. Cellular immunity will be measured by *in vitro* lymphocyte response to phytohemagglutinin. The specific response to aspergillus will be determined by detection of precipitating antibodies; measurement of IgG anti-aspergillus antibody in the serum, and *in vitro* lymphocyte proliferative response to aspergillus. This project is awaiting funding ($5000).

Respectfully submitted,



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Black Rhinoceros SSP

-OVER FOR MORTALITIES/REFERENCES-

BLACK RHINOCEROS DEATHS IN NORTH AMERICA 1992

STDBK # LOCATION	SEX	DOB	DOD	CAUSE OF DEATH
74/San Francisco	M	1JAN54	7NOV91	Ruptured hepatic tumor
2064/ Denver	F	10APR90	30JAN92	Euthanized due to encephalomalacia
2078/Fos. Rim	F	Adult	12JUN92	Hepatic bile stasis, dystocia, oral/skin ulcers, anemia, imported from Zimbabwe 22APR92
2077/Fos. Rim	M	Adult	27JUN92	Hepatic bile stasis, oral/skin ulcers, imported from Zimbabwe 22APR92
#188/ Columbus	F	1970	25JUL92	Metritis? Pending histology.
/Wh. Oak	M	Adult	22AUG92	Hepatic bile stasis, oral ulcers, thoracic hemorrhage, imported from Zimbabwe 22APR92

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