Virus Name: Nairobi sheep disease	Abbreviation: NSDV

Status
Arbovirus

Select Agent
No

SALS Level

SALS Basis

Other Information
USDA Permit Required, USDA Restricted

Antigenic Group
Nairobi Sheep Disease

SECTION I - Full Virus Name and Prototype Number

Prototype Strain Number / Designation

Accession Number

Original Date Submitted
2/14/1985

Family
Bunyaviridae

Genus
Nairovirus

Information From
M.P. Weinbren

Address
Puerto Rico Nuclear Center, Caparra Heights Station, San Juan, PR

Information Footnote
Reviewed by editor

Section II - Original Source

Isolated By (name)
Montgomery

Isolated at Institute
Nairobi, Kenya, East Africa

Host Genus
Sheep (Persian fat-tail)

Species

Host Age/Stage
Not stated

Sex
Not Answered

Isolated From

Isolation Details

Signs and Symptoms of Illness
Acute gastroenteritis

Arthropod

Time Held Alive before Inoculation

Collection Method
Venepuncture

Collection Date
11/28/1910

Place Collected (Minimum of City, State, Country)
Nairobi, Kenya

Latitude
1° 17' S

Longitude
36° 50' E

Macrohabitat
Open grassland, 5,500 ft altitude

Microhabitat
Outdoors, short-cropped pasture, ground level; daylight

Method of Storage until Inoculated
Citrated blood, temperature not stated

Footnotes

Section III - Method of Isolation

Inoculation Date
11/28/2010

Animal (Details will be in Section 6)
Sheep

Route Inoculated
sc and iv

Reisolation

Other Reasons
Numerous isolations of serologically identical agents causing same disease

Homologous Antibody Formation by Source Animal

Test(s) Used

Footnotes

Section IV - Virus Properties

Physicochemical

Pieces (number of genome segments)	Infectivity	Sedimentation Coefficients (s) (S)
Percentage wt, of Virion Protein	Lipid	Carbohydrate
Virion Polypeptides: Number	Details **Withstands lyophilization well**	
Non-virion Polypeptides: Number	Details	
Virion Density	Sedimentation Coefficients(s) (S)	
Nucleocapsid Density	Sedimentation Coefficients(s) (S)	

Stability of Infectivity (effects)

pH (infective range)

Lipid Solvent (ether - % used to test) **1:1**	After Treatment Titer **3.0 dex**	Control Titer **7.0 dex**
Lipid Solvent (chloroform)	After Treatment Titer	Control Titer
Lipid Solvent (deoxycholate)	After Treatment Titer	Control Titer

Other (formalin, radiation)

Virion Morphology

Shape	Dimensions	
Mean nm	Range nm	
Measurement Method	Surface Projections/Envelope	Nucleocapsid Dimensions,

Symmetry

Morphogenesis

Site of Constituent Formation in Cell	Site of Virion Assembly	Site of Virion Accumulation
Inclusion Bodies	Other	

Hemagglutination

Hemaggiutination	Antigen Source	Erythrocytes (species used)
No	**Sheep serum; SMB ext. by borate-saline; acetone-ether; sucrose- acetone; fluorocarbon**	**Goose**
pH Range **5.8-7.2**	pH Optimum	
Temperature Range **0dC, 20dC, 37dC**	Temperature Optimum	

Remarks

Serologic Methods Recommended

Footnotes

Section V - Antigenic Relationship and Lack of Relationship to Other Viruses

Tested by NT and CF against the agents listed below with no evidence of antigenic relationship (cross tests done in all cases): chikungunya, Semliki Forest, Sindbis, dengue 1, dengue 2, Zika, Uganda S, West Nile, yellow fever, Wesselsbron, Spondweni, Kyasanur forest disease, Oriboca, Apeu, Bunyamwera, Simbu, Pongola, Bwamba fever, Rift Valley fever, Lunyo, encephalomyocarditis (Mengo).
In all instances in which an haemagglutinating antigen was available, NSD antiserum was tested against it but in no case has any relationship been found.
An hyperimmune antiserum to lymphocytic choriomeningitis failed to react with NSD by either NT or CF.

A low-titered relationship by CF, IFA and indirect HA demonstrated between CON and NSD viruses [9] , [10] . SIRACA has decided that these relations are no greater than those used to establish BUN Supergroup. The CON and NSD antigenic groups should be kept as two distinct serogroups.
Following these observations, intergroup antigenic relationships were demonstrated for viruses of the following serogroups: CHF-CON, NSD, DGK, QYB, HUG, and SAK(11). Genus status (Nairovirus genus) within the family Bunyaviridae then was assigned to this group of viruses [11] , [12] ;.

Editor's Note:	It has recently been found that a close relationship exists between Nairobi sheep disease and Ganjam viruses as demonstrated by the CF test. Further studies are in progress to clarify this serological relationship (F.G. Davies and J. Casals, Personal communication).

Section VI - Biologic Characteristics

Virus Source (all VERTEBRATE isolates)
CNS (LV), salivary gland (LV), brown fat (LV), saliva (LV)

Lab Methods of Virus Recovery (ALL ISOLATIONS)
Newborn mice

Cell system (a)	Virus passage history (b)	Evidence of Infection							
		CPE			PLAQUES			Growth Without CPE	
		Day (c)	Extent (d)	Titer TCD50/ml (e)	Day (c)	Size (f)	Titer PFU/ml (e)	+/- (g)	

Grows in wide variety of cells with production of large inclusions.

Section VII - Natural Host Range (Additional text can be added below table)

Vertebrate (species and organ) and arthropod	No. isolations/No. tested	No. with antibody/No. tested Test used	Country and region
Man	1	60/321 NT	Entebbe, Uganda *
Man	1		
Sheep		Numerous	Kenya; Uganda *
Sheep	Numerous		Kenya; Uganda; Congo **
Goat	Numerous		
Goat		Numerous	Kenya; Uganda *
Rhipicephalus appendiculatus	Numerous		
Culicoides terorensis	1		Kenya (14)

* Limited antibody surveys show an extension southward from the below-named belt, on the west into Bechuanaland and the Kalahari Desert on the east down the Mocambique Coastal plain into northern Zululand (South Africa). Elsewhere in southern Africa there is no evidence of its existence.

** Throughout a belt extending from Nairobi, Kenya in the east to Kisenyi in the Congo in the west, and covering the area approximately 50 miles south and 75 miles north of the Equator.

Section VIII - Susceptibility to Experimental Infection (include viremia)

Experimental host and age	Passage history and strain	Inoculation Route-Dose	Evidence of infection	AST (days)	Titer log10/ml
Mice (nb)	P 1-8	ic 0.01	Death	5	7.0
Mice (nb)		ip 0.01	Death	5-10	3.0
Mice (nb)		sc			
Mice (wn)		ic 0.03	Death	5	6.0
Mice (wn)		ip 0.1	Antibody formation		
Mice (nb)	P 110+	all 0.01	Death	2.0	10.0
Mice (ad)	vaccine in mice	ic 0.03	Death	2.5	9.5
Mice		ip 0.03	Death	2.5	9.5
sheep (ad)	Wild	ip 0.5)	Almost invariably		7.0
		sc 0.5)	fatal gastroenteritis	4-7	7.0
		iv 0.5)	Same		
(ad)	Vaccine	all 0.5)	Mild thermal reaction;	4-7	7.0
(lamb)		all 0.5	viremia, antibody formation		
embryonated egg	Both	all	Only an occasional embryo		
(7+12 day)		conventional	infected and then virus growth minimal		
Arvicanthis niloticus (ad)	Both	ip 0.1	Viremia		5.0

Section IX - Experimental Arthropod Infection and Transmission

Arthropod species & virus source(a)	Method of Infection log10/ml (b)		Incubation period (c)		Transmision by bite (d)		Assay of arthropod, log10/ml (e)		
	Feeding	Injected	Days	°C	Host	Ratio	Whole	Organ	System
	Transmission by Rhipicephalus appendiculatus but not by Aedes aegypti (see remarks). Exp. transovarial transmission demonstrated in Rhipicephalus appendiculatus and R. pulchellus (2,13).								

Section X - Histopathology

Character of lesions (specify host)
In mice: produces usual arbovirus type encephalitis, esp. in hippo- campus, with formation of tiny eosinophilic intranuclear inclusions and small densely basophillic cyto- plasmic inclusions. In sheep: ecchymosis in intestine, hyperplasia mesenteric nodes and tubular nephritis.

Inclusion Bodies
Lower Vertabrates

Intranuclear
Lower Vertabrates

Organs/Tissues Affected
Brain (LV), liver (LV), spleen (LV), kidney (M), heart (LV), blood vessels (LV)

Category of tropism
Sheep: viscerotropic; mice: neurotropic

Section XI - Human Disease

In Nature
Reported

Residual

Death

Subclinical
Reported

Overt Disease
Reported

Clinical Manifestations
Fever (R), arthralgia (R)

Number of Cases
1 case (1); in 3 cases, serological conversion with no overt illness

Category (i.e. febrile illness, etc.)

Section XII - Geographic Distribution

Known (Virus detected)
Throughout a belt extending from Nairobi, Kenya in the east to Kisenyi in the Congo on the west and covering the area approx. 50 miles south and 75 miles north of the equator.

Suspected (Antibody only detected)
Southward from the above named area into Bechuanaland and the Kalahari Desert on the west and on the east through the Mozambique coastal plain into northern Zululand (S. Africa); elswhere in southern Africa ther

Section XIII - References

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Remarks

The disease is one with a high morbidity and often a catastrophically high mortality in sheep, more than 75% of a flock being lost. A modified strain of the agent has been produced by Weinbren and Gourlay which induces only a mild thermal reaction when introduced into a susceptible sheep but which confers lasting and solid immunity as demonstrated by challenge with large doses of autochthonous virus. R. appendiculatus is the usual vector. Daubney and Hudson claim occasional transmission with A. variegatum but Hoogstraal doubts accuracy of identification. Weinbren and Gourlay have made many unsuccessful transmission attempts with Ae aegypti. Lewis achieved transmission with R. appendiculatus 871 days after infection.