Virus Name: Hughes		Abbreviation: HUGV
Status **Probable Arbovirus**	Select Agent **No**	SALS Level **2**

SALS Basis
Results of SALS surveys and information from the Catalogue.

Other Information

Antigenic Group
Hughes

SECTION I - Full Virus Name and Prototype Number

Prototype Strain Number / Designation	Accession Number	Original Date Submitted
		2/12/1985

Family	Genus
Bunyaviridae	**Nairovirus**

Information From	Address
Dr. C.M. Clifford	**Rocky Mountain Lab., Hanilton, Montana**

Information Footnote
Reviewed by editor

Section II - Original Source

Isolated By (name)	Isolated at Institute	
L.E. Hughes (1,9)		
Host Genus	Species	Host Age/Stage
Ornithodoros capensis group (2), pool of 12 ticks		**Adults**

Sex
Not Answered

Isolated From	Isolation Details
Signs and Symptoms of Illness	Arthropod
Time Held Alive before Inoculation	
Collection Method **Beating limbs of dead bay cedar and white mangrove**	Collection Date **1/1/1962**

Place Collected (Minimum of City, State, Country)
Bush Key, Dry Tortugas Island, Florida, USA

Latitude	Longitude
24° 40' N	**82° 90' W**

Macrohabitat	Microhabitat	Method of Storage until Inoculated
Coral reef, with subclimax type of plant communities	**Dead limbs of bay cedar; white mangrove, abandoned nests and litter**	**Humidity jars, room temp. 75-80% RH**

Footnotes

Section III - Method of Isolation

Inoculation Date
2/3/1962

Animal (Details will be in Section 6)
wn mice

Route Inoculated
Intracerebral

Reisolation

Other Reasons
Reisolated from ticks collected at same time

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	
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)	After Treatment Titer **0 dex**	Control Titer **5.0 dex**
Lipid Solvent (chloroform)	After Treatment Titer	Control Titer
Lipid Solvent (deoxycholate)	After Treatment Titer **0 dex**	Control Titer **5.0 dex**

Other (formalin, radiation)

Virion Morphology

Shape	Dimensions **About 100 nm**	
Mean nm	Range nm	
Measurement Method **Virus passed 150 nm gradacol membrane, not 100**	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 **No**	Antigen Source **SMB; serum ext. by sucrose- acetone; acetone-ether**	Erythrocytes (species used)
pH Range	pH Optimum	
Temperature Range	Temperature Optimum	

Remarks

Serologic Methods Recommended
CF, NT

Footnotes

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

Hemagglutination-inhibition. Acetone-ether and sucrose-acetone extracted mouse brain and serum antigens were prepared and tested for hemagglutination properties according to the method of Clarke and Casals, with negative results.
Complement-fixation. The acetone-ether extracted brain was used as a complement-fixing antigen in a screen test (1:8 dilution of antigen tested against 1:4 dilution of serum in the presence of 2 exact units of complement) against about 70 hyperimmune mouse serum. No positive reactions were found except with homologous systems [1] .
Neutralization. None of about 70 specific immune sera available at the RML (see [1]) gave any demonstrable protection, whereas, the homologous sera neutralized at least 3 dex of virus.
In CF tests by Jordi Casals at the Rockefeller Foundation Laboratories, negative results were obtained in tests with Hughes antigen against immune sera of 15 strains representing 10 different tick agents, including Ganjam, Bhanja, Wanowrie, and Silverwater [1] .
Later studies at YARU have shown a relationship by CF test of Hughes virus with Soldado and with other viruses including CalAr 913, Farallon, Zirqa and Punta Salinas [4] .
Puffin Island virus, presently unregistered, is antigenically related to but distinct from Hughes virus and other members of HUG serogroup [10] .

Section VI - Biologic Characteristics

Virus Source (all VERTEBRATE isolates)
Blood (LV)

Lab Methods of Virus Recovery (ALL ISOLATIONS)
Newborn and weanling 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)	
Vero (CL)	P-17				6	1 mm	7.5* (7)		
LLC-MK2 (CL)					6	2 mm	>7.7 (7)		
XTC-2 (CL)						Plaques (10)			

* Expressed in dex

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
O. denmarki ticks	3		Dry Tortugas, Florida, USA; 1962
Ornithodoros sp.	1		Farallon Islands, CA; FL, USA and Mexico(3)
Ornithodoros denmarki	1		Raza Island, Gulf of California, Mexico(5)
O. capensis group	7		Soldado Rock, Trinidad (6)
Sterna fuscata (sooty tern; blood)	8/33		

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-2	ic .02	Paralysis and death	5-7	
Mice (nb)	P-4	ip 0.1	Paralysis and death	5-7	4.25
Mice (nb)		sc			
Mice (wn)		ic .03	Tremors convulsions	8-10	3.75
Mice (wn)		ip	Antibody		
Mice (nb)	P-24	ic .02	Paralysis and death	6	5.15
Mice (nb)	P-41	ic .02	Death	5-6	6.15
house mice(10 day)	P-4	ic and ip .02	Paralysis and death	9-10	
house mice (ad)		ic .03	Paralysis and death	11	4.75
hamsters (9 day)	P-3	ic .05	Paralysis and death	9	
hamsters (ad)		ip .25	Antibody		
Peromyscus sp.(ad) P-9		ic .03	None	9	
guinea pigs (yg)	P-1, P-3	ic 0.25	Tremors, temp. and convulsions		
rhesus monkey (ad)	P-4	ic	6 days fever after 14 day incubation period		
embryonated eggs (6 day)		ys 0.25	Death	5-6	
chicks (1-2 day)		ic .02	Paralysis and death	5-8	
chicks (1-2 day		ip 0.1	None, no antibody prod.		
sooty terns (juv.) (caught wild)	P-5	sc 0.1	Viremia (8)		<3.40
noddy terns (juv.) (caught wild)		sc 0.1	Viermia (8)		<3.40

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
Ornithodoros denmarki: Nymphs fed virus; virus recovered up to 840 days after feeding (8).									

Section X - Histopathology

Character of lesions (specify host)
See paper by Hughes, et al. 1964 (1). Lesions in mice and hamsters inoculated ic limited to CNS

Inclusion Bodies — Intranuclear

Organs/Tissues Affected
Brain (LV), spinal cord (LV)

Category of tropism

Section XI - Human Disease

In Nature	Residual	Death
Subclinical	Overt Disease	
Clinical Manifestations		
Number of Cases	Category (i.e. febrile illness, etc.)	

Section XII - Geographic Distribution

Known (Virus detected)
Trinidad; Dry Tortugas Island, Florida; California, USA; Raza Island, Gulf of California, Mexico

Suspected (Antibody only detected)

Section XIII - References

1. Hughes, L.E., et al. 1964. Am. J. Trop. Med. Hyg. 13:118-122.
2. Denmark, H.A. and Clifford, C.M. 1962. The Florida Entomologist 45:139-142.
3. Radovsky, F.J., et al. 1967. J. Parasitol. 53:890-892.
4. Director, Yale Arbovirus Research Unit. Personal communication.
5. Clifford, C.M., et al. 1968. Am. J. Trop. Med. Hyg. 17:881-885.
6. Aitken, T.H.G., et al. 1968. J. Med. Ent. 5:501-503.
7. Stim, T.B. 1969. J. Gen. Virol. 5:329-338.
8. Clifford, C.M. and Yunker, C.E. Unpublished observations.
9. Philip, C.B. 1965. J. Parasitol. 51:252.
10. Gould, E.A., et al. 1983. J. Gen. Virol. 64:739-742.

Remarks