Virus Name: Puumala	Abbreviation: PUUV

Status
Probably not Arbovirus

Select Agent
No

SALS Level

SALS Basis

Other Information
USDA Permit Required, DOC Permit Required

Antigenic Group
Hantaan

SECTION I - Full Virus Name and Prototype Number

Prototype Strain Number / Designation
Sotkamo strain

Accession Number

Original Date Submitted
4/1/1985

Family
Bunyaviridae

Genus
Hantavirus

Information From
M. Brummer-Korvenkontio, A. Vaheri, C.H. vonBonsdorff

Address
Department of Virology, University of Helsinki, Helsinki, Finland and J. Dalrymple, USAMRID, Frederick, MD, USA

Information Footnote

Section II - Original Source

Isolated By (name)
M. Brummer-Korvenkontio, et al.(1)

Isolated at Institute
Helsinki, Finland

Host Genus
Clethrionomys glareolus (bank vole)

Species

Host Age/Stage

Sex
Not Answered

Isolated From	Isolation Details
Organs/Tissues	**Lungs**

Signs and Symptoms of Illness
None (fluorescent antigen in lungs by IFA when passed in voles)

Arthropod

Time Held Alive before Inoculation

Collection Method
Trapped

Collection Date
11/26/1981

Place Collected (Minimum of City, State, Country)
Sotkamo, Finland

Latitude
64° N

Longitude
29° E

Macrohabitat
Forest

Microhabitat
Meadow

Method of Storage until Inoculated
Kept alive until processed

Footnotes

Section III - Method of Isolation

Inoculation Date
12/23/1981

Animal (Details will be in Section 6)
animal

Route Inoculated
ip, intrapulmonary

Reisolation
Yes

Other Reasons

Homologous Antibody Formation by Source Animal
Yes

Test(s) Used
Indirect IFA

Footnotes

Section IV - Virus Properties

Physicochemical
RNA, Single Strand

Pieces (number of genome segments) **3**	Infectivity	Sedimentation Coefficients(s) **L=2.7x106 MW; M=1.2x106 MW; S=0.6x106 MW**(S)
Percentage wt, of Virion Protein	Lipid	Carbohydrate
Virion Polypeptides: Number **4**	Details **Nucleocapsid protein=52,000 MW; envelope glycoprotiens: G1=64,000 MW, G2=58,000 MW; L protein=approx. 200,000 MW**	
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	Control Titer
Lipid Solvent (chloroform)	After Treatment Titer	Control Titer
Lipid Solvent (deoxycholate)	After Treatment Titer	Control Titer

Other (formalin, radiation)
Cobalt irradiation (1.3 x 107 rads) inactivates infectivity

Virion Morphology

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

Measurement Method | Surface Projections/Envelope | Nucleocapsid Dimensions, Symmetry

Morphogenesis

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

Hemagglutination

Hemaggiutination	Antigen Source	Erythrocytes (species used)
Yes	**Purified cell culture propagated virions**	**Gander**
pH Range	pH Optimum	
5.8-6.8	**5.8-6.2**	
Temperature Range	Temperature Optimum	
	37dC	

Remarks

Serologic Methods Recommended
PRNT, IFA, HI, ELISA

Footnotes

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

Antigenic relations of HFRS-related viruses: PRNT were performed on Vero E6 cell monolayers with rat antisera and cell culture-adapted viruses. Approximately 100 PFU of virus were incubated with twofold dilutions of sera for 1 hour at room temperature before inoculation of 25-cm2 flasks. Inoculated cells were further incubated for 1 hour at 37/C before addition of overlay containing 0.6% agarose (Seakem ME) and 10% heated fetal bovine serum (FBS) in the nutrient mixture. Following incubation for 7 to 14 days after infection, a second overlay identical to the first except for a reduced FBS concentration (2%) and inclusion of neutral red (final concentration 0.167 mg/ml) was applied. Plaques were counted as they became visible 1 to 5 days after addition of the second overlay. Titers were expressed as the reciprocal of the highest dilution of antibody, resulting in greater than 80% reduction of approximately 100 plaques.

Serum pools	Virus							
	HTN	LEE	UR	TCH	GP	SR-11	PH	PUU
HTN	4000	4000	0	160	80	40	0	0
LEE	4000	2000	20	160	160	200	0	0
UR	2000	80	4000	16000	16000	8000	160	0
TCH	2000	200	4000	32000	8000	8000	200	0
GP	200	80	2000	8000	8000	8000	200	0
SR-11	2000	20	2000	2000	2000	2000	200	0
PH	0	0	0	0	20	20	4000	0
PUU	0	0	0	0	0	0	0	1280

Tchoupitoulas, Girard Point, and Sapporo rat viruses are unregistered.

HTN = Hantaan virus (76-118)

LEE = Human isolate from Korea

UR = Seoul virus

TCH = Tchoupitoulas

GP = Girard Point

SR-11 = Sapporo rat

PH = Prospect Hill

PUU = Puumala

Section VI - Biologic Characteristics

Virus Source (all VERTEBRATE isolates)
Lungs (LV)

Lab Methods of Virus Recovery (ALL ISOLATIONS)
Passage in Vero E6 cell cultures and examination by IFA

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)	
E6 cells (CL)	Cleth. glar. P 0-3		No CPE	2-3* after passes				+	
E6 cells (CL)	E6, P5		No CPE		12-18	1-2 mm	6-7*		
A549 (CL)	Cleth. glar. P 0-3		No CPE	1-2 after passes				+	

* 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
Clethrionomys glareolus	3/48 *	155/549 IFA	"Lake Finland", Finland; 1977, 1979, 1981 (1-3)
Clethrionomys glareolus	1/25 **		West of Umea, Sweden;1981 (5, 6)
Clethrionomys rufocanus	1/19	1/19 IFA	Sweden (7)
Clethrionomys glareolus	Several		European USSR (9, 10)
Clethrionomys glareolus(lungs)	1		Turnkout, Antwerp Prov., Belgium (11)

* Strains Puumala (2,3), Hankasalmi (1), Sotkamo (1)

** Strain Hallnas

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)		ic			
Mice (nb)		ip			
Mice (nb)		sc			
Mice (wn)		ic			
Mice (wn)		ip			
Cl. glareolus	Sotkamo P2	ip,sc intrapulmonary	Develop subclinical infection (FA antigen in lungs and liver tissue). Animals sacrificed day 30.		5
Meriones unguiculatus (nb) (Mongolian gerbils)	Hallnas;P-2	ic,ip, in,sc	Develop subclinical persistent infection. (Virus in brain, lungs, spleen, liver, pancreas, parotid, distal small intestine(8)		
Wistar female Rattus norvegicus			12-16 wks. old, infected by inhalation (12).		

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

Section X - Histopathology

Character of lesions (specify host)

Inclusion Bodies — Intranuclear

Organs/Tissues Affected

Category of tropism

Section XI - Human Disease

In Nature
Significant

Residual

Death
Reported

Subclinical
Reported

Overt Disease
Significant

Clinical Manifestations
Fever, backache, headache, proteinuria, microscopical hematuria, oliguria to polyuria, hepatitis, sometimes encephalitis

Number of Cases
About 300 clinical and 4,000 subclinical or mild per year in Finland

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

Section XII - Geographic Distribution

Known (Virus detected)
Finland, Sweden, European USSR, Belgium (11)

Suspected (Antibody only detected)

Section XIII - References

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12. Nuzum, E.O., et al. 1988. Am. J. Trop. Med. Hyg. 38:636-640.

Remarks