

<b>Virus Name: Main Drain</b>		<b>Abbreviation: MDV</b>
Status <b>Arbovirus</b>	Select Agent <b>No</b>	SALS Level <b>2</b>
SALS Basis <b>Results of SALS surveys and information from the Catalogue.</b>		
Other Information		
Antigenic Group <b>Bunyamwera</b>		

**SECTION I - Full Virus Name and Prototype Number**

Prototype Strain Number / Designation <b>BFS 5015</b>	Accession Number	Original Date Submitted <b>7/24/1984</b>
Family <b>Bunyaviridae</b>	Genus <b>Bunyavirus</b>	
Information From <b>Robert P. Scrivani</b>	Address <b>School of Public Health, University of California, Berkeley, California, USA</b>	
Information Footnote <b>Revised</b>		

**Section II - Original Source**

Isolated By (name) <b>Robert P. Scrivani</b>	Isolated at Institute <b>School of Public Health, Berkeley</b>	
Host Genus <b>Culicoides variipennis (pool of 100)</b>	Species	Host Age/Stage <b>Adult</b>
Sex <b>Female</b>		
<u>Isolated From</u>	<u>Isolation Details</u>	
Signs and Symptoms of Illness	Arthropod	
Time Held Alive before Inoculation		
Collection Method <b>Dry ice baited trap</b>	Collection Date <b>5/27/1964</b>	
Place Collected (Minimum of City, State, Country) <b>Kern County, California, USA</b>		
Latitude <b>35° 30' N</b>	Longitude <b>119° 0' W</b>	
Macrohabitat <b>Semi-desert, saltbush vegetation bordering agricultural land</b>	Microhabitat <b>Outdoors, ground level</b>	Method of Storage until Inoculated <b>Sealed glass tube at -65dC</b>
Footnotes		

**Section III - Method of Isolation**

Inoculation Date  
**3/10/1965**

Animal (Details will be in Section 6)  
**nb mice (Tissue Culture)**

Route Inoculated <b>Intracerebral</b>	Reisolation <b>Yes</b>
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Other Reasons  
**No similar virus in laboratory**

Homologous Antibody Formation by Source Animal

Test(s) Used

Footnotes

**Section IV - Virus Properties**

Physicochemical  
**RNA, Single Strand**

Pieces (number of genome segments) <b>3</b>	Infectivity	Sedimentation Coefficients(s) (S)
Percentage wt, of Virion Protein	Lipid	Carbohydrate
Virion Polypeptides: Number <b>3 (2)</b>	Details <b>Determined by polyacrylamide gel electrophoresis (2)</b>	
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) <b>1:1000</b>	After Treatment Titer <b>&lt;2.0 dex</b>	Control Titer <b>5.5 dex</b>
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

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**Hemagglutination**

Hemagglutination                      Antigen Source                      Erythrocytes (species used)  
**Yes**                      **SMB ext. by sucrose-acetone**                      **Goose**

pH Range                      pH Optimum  
**6.1-6.4**                      **6.2**

Temperature Range                      Temperature Optimum  
**4dC, 22dC, 37dC**                      **37dC**

Remarks  
**Low titer HA (from 20-40) enhanced by sonication to 160-320**

Serologic Methods Recommended  
**HI, NT, CF**

Footnotes  
**Low titer HA (from 20-40) enhanced by sonication to 160-320**

See Reference [6].

Type of Immune Fluid	Main Drain Antigen				Main Drain antiserum		
	Immune Fluid or Antigen	CF <sup>1</sup>	HI <sup>1</sup>	NT <sup>2</sup>	CF <sup>1</sup>	HI <sup>1</sup>	NT <sup>2</sup>
		Ht/Ho <sup>3</sup>	Ht/Ho	Ht/Ho			
Hyperimmune mouse serum or ascitic fluid <sup>4</sup>	Main Drain	128	1280	2.1	128	1280	2.1
Cache Valley	16/64	0/80		64	0		
Lokern	256/512	0/640	0.0/3.7	64	0	0.3	
Maguari	32/64	0/320		64	0		
Tensaw	256/512	0/1280		64	0		
Tlacotalpan	512/512	10/320		64	10		
Immune hamster serum	Main Drain		80	2.5		80	2.5
Cache Valley		0/80	0.1/2.1		0	0.0	
Lokern		0/160	0.0/3.8		0	0.0	
Maguari		0/160	0.2/1.8		0	0.1	
Tensaw		10/640	1.2/2.0		0	0.0	

<sup>1</sup> CF and HI titers are expressed as the reciprocal of the serum or ascitic fluid dilution.

<sup>2</sup> NT results are expressed as LNI given in dex. Tests with hyperimmune sera or ascitic fluids were performed in SM inoculated ic, whereas tests with immune hamster serum were done by plaque reduction in Vero cells.

<sup>3</sup> Heterologous titer/homologous titer

<sup>4</sup> Reagents and facilities of the Yale Arbovirus Research Unit, New Haven, Connecticut, were made available through the courtesy of Dr. W.G. Downs and Dr. R.E. Shope for conducting HI tests. CF tests were done by Dr. R.E. Shope.

**Section VI - Biologic Characteristics**

Virus Source (all VERTEBRATE isolates)  
Blood (LV), CNS (M)

Lab Methods of Virus Recovery (ALL ISOLATIONS)  
Newborn mice

Cell system (a)	Virus passage history (b)	Evidence of Infection						
		CPE			PLAQUES			Growth Without CPE +/- (g)
		Day (c)	Extent (d)	Titer TCD50/ml (e)	Day (c)	Size (f)	Titer PFU/ml (e)	
Hamster kidney (PC)	SM 2	3	4+	8.6*				
Duck embryo (PC)	SM 5				3	Plaques		
Vero (CL)	SM 2	3-4	3-4+		3	Plaques	8.5*	
Ae dorsalis (CL)			No CPE					+ (3)
Culex tarsalis (CL)			No CPE					+ (4)

\* 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
Man		0/269* HI	California, USA
Equine (brain)	1		Sacramento County, California, USA (7)
Lepus californicus	10/1,066	270/769 HI	Kern Co., CA, USA
Sylvagus auduboni	0/601	2/57 HI	
Ammospermophilus nelsoni	0/1,308	1/193 HI	
Citellus beecheyi	0/230	3/120 HI	
Sciurus griseus		1/35 HI	California, USA

Neotoma sp.		5/103 HI	
Other rodentia, chiroptera, carnivora	0/4,489	0/182 HI	
Wild birds		0/492 HI	Kern County, CA, USA
Amphibians/ reptiles	0/470	0/790 HI	
Equine		292/735 HI	California, USA
Bovine		11/519 HI	
Ovine		122/670 HI	
Porcine		1/84 HI	
Culicoides variipennis	29/122,089		Kern Co., CA, USA
Culex tarsalis	0/158,446		Butte, Glenn and Kern Co., CA, USA
Culicoides variipennis	2		Western Utah USA (8)
Psorophora signipennis	20		
Aedes dorsalis	9		
Ae. nigromaculis	3		
Culiseta inornata	1		
Other mosquitoes	0/58,974		Butte, Glenn and Kern Co., CA, USA
Other Culicoides spp., Leptoconops, Phlebotomus, Simulium, spp	0/11,689		California, USA

Paired sera from patients with undiagnosed febrile disease 1967-1969, supplied through the courtesy of Dr. E. Lennette, and Dr. R. Emmons, California State Department of Public Health.

Experimental host and age	Passage history and strain	Inoculation Route-Dose	Evidence of infection	AST (days)	Titer log <sub>10</sub> /ml
Mice (nb)	SM 2	ic 0.01	Death	3	9.6
Mice (nb)		ip			
Mice (nb)		sc			
Mice (wn)		ic 0.03	Death	4	
Mice (wn)	SM 3	ip 0.10	Antibody		
L. californicus(ad)	100 PFU, SM 2	sc 0.20	Antibody and/or viremia		2.0-6.3
S. auduboni (ad)		sc 0.20	Antibody and/or viremia		2.1-5.1
A. nelsoni (ad)		sc 0.20	Antibody and/or viremia		2.7
D. nitratoides (ad)		sc 0.20	Antibody and/or viremia		2.4-6.3
Wild birds(finches, sparrows) chickens(3 wk)	750 PFU, SM 2	sc 0.20	No HI antibody		

**Section IX - Experimental Arthropod Infection and Transmission**

Arthropod species & virus source(a)	Method of Infection log10/ml (b)		Incubation period (c)		Transmission by bite (d)		Assay of arthropod, log10/ml (e)		
	Feeding	Injected	Days	°C	Host	Ratio	Whole	Organ	System

Culiseta inornata, Culex tarsalis, Anopheles freeborni, Ae melanimon, Ae nigromaculis, and Culicoides variipennis became infected after feeding on virus-soaked pledgets. Viremic S. auduboni served to infect Culiseta inornata, Anopheles freeborni and Culicoides variipennis but not Cx tarsalis, Dermacentor parumapertus or Ornithodoros parkeri. Infected Culicoides variipennis transmitted to S. auduboni, but infected Anopheles freeborni did not. Culicoides nubeculosus infected after intrathoracic inoculation and after ingestion. Transmission to mouse blood contained in chick skin membrane demonstrated after 16 days incubation at 26C (5).

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**Section X - Histopathology**

Character of lesions (specify host)

Inclusion Bodies

Intranuclear

Organs/Tissues Affected

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)  
**California; Utah, USA (8)**

Suspected (Antibody only detected)

### Section XIII - References

1. Porterfield, J.S., et al. 1975/76. Intervirology. 6:13-24.
2. Gentsch, J., et al. 1977. J. Gen. Virol. 34:257-268.
3. Cahoon, B.E., et al. 1979. J. Med. Ent. 16:104-111.
4. Main, O.M., et al. 1977. J. Med. Ent. 14:107-112.
5. Mellor, P.S., et al. 1974. Arch ges. Virusforsch. 46:105-110.
6. Hunt, A.R. and Calisher, C.H. 1979. Am. J. Trop. Med. Hyg. 28:740-749.
7. Emmons, R.W., et al. 1983. J. Am. Vet. Med. Assoc. 183:555-558.
8. Crane, G.T., et al. 1983. J. Med. Ent. 20:294-300.

### Remarks

**Diagnostic HI antibody rise shown in paired sera from five cases of equine encephalomyelitis that had onsets in 1967, 1968 and 1969. Diagnostic rises were shown in three of the five cases by CF.**