1965 ANNUAL SUMMARY
JULY 1, 1966

COMMUNICABLE DISEASE CENTER

# ENCEPHALITIS

## SURVEILLANCE

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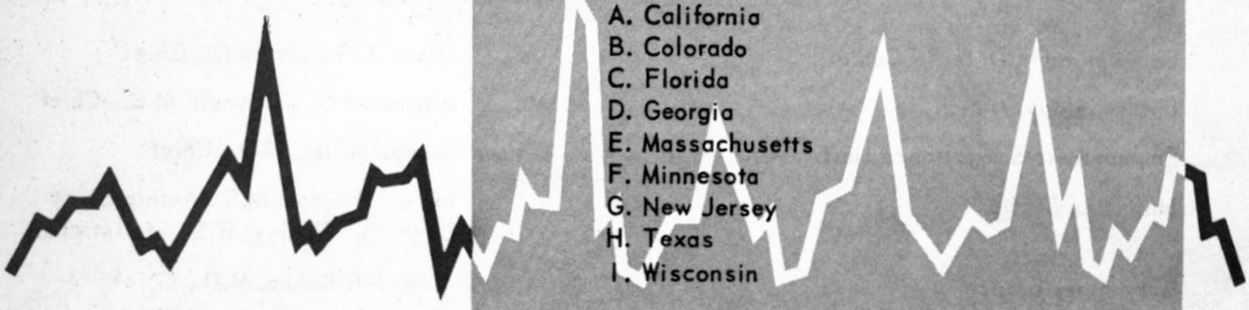



U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE / PUBLIC HEALTH SERVICE

# PREFACE

Summarized in this report is information received from State Health Departments, university investigators, virology laboratories and other pertinent sources, domestic and foreign. Much of the information is preliminary. It is intended primarily for the use of those with responsibility for disease control activities. Anyone desiring to quote this report should contact the original investigator for confirmation and interpretation.

Contributions to the Surveillance Report are most welcome. Please address to:

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## I. SUMMARY

This report is the annual summary of human encephalitis surveillance for the year 1965. More than 2700 cases including over 170 deaths were reported to the Encephalitis Surveillance Unit. Over one-half the cases were encephalitis of unknown etiology; 36 percent of the cases were post-infectious encephalitis; 11 percent of the cases were caused by arthropod-borne viruses.

A large outbreak of WEE occurred in the north central and mountain states. California encephalitis in humans was recognized more frequently than in previous years.

In Section III is collected contributions from the states about special investigations of encephalitis in the past year.

Isolations of arboviruses from mosquitoes, birds, and other animals are summarized in Section IV.

A report from the U. S. Department of Agriculture of clinical encephalitis in horses in 1965 is presented in Section V.

## II. MORBIDITY TRENDS

For the year 1965, a total of 2703 cases of encephalitis including 173 deaths were reported to the Encephalitis Surveillance Unit (ESU). These cases are shown by etiology in Table I.

Table I

Etiology of 2703 Cases of Encephalitis
Reported to the ESU, United States, 1965

| | No. of Cases | | Percent Total | |
|---|---|---|---|---|
| Post-infectious | | 981 | | 36.3 |
| Mumps | 634 | | 23.5 | |
| Measles | 171 | | 6.3 | |
| Varicella | 112 | | 4.1 | |
| Influenza | 17 | | 0.6 | |
| Herpes simplex | 19 | | 0.7 | |
| Post-vaccinal | 9 | | 0.3 | |
| Lymphocytic choriomeningitis | 8 | | 0.3 | |
| Rubella | 7 | | 0.3 | |
| Herpes zoster | 2 | | 0.1 | |
| Adenovirus | 2 | | 0.1 | |
| Arthropod-borne | | 297 | | 11.0 |
| WEE | 172 | | 6.4 | |
| California | 59 | | 2.2 | |
| SLE | 58 | | 2.1 | |
| EEE | 8 | | 0.3 | |
| Etiology Unknown | | 1,425 | | 52.7 |
| TOTAL | | 2,703 | | 100.0 |

Over one-half of the reported encephalitis cases were of unknown etiology. Approximately 36 percent of encephalitis cases were classified as post-infectious; 11 percent were caused by arthropod-borne viruses. Encephalitis cases are tabulated by state in Table II.

## TABLE II

## REPORTED CASES AND DEATHS* OF INFECTIOUS ENCEPHALITIS BY STATE ACCORDING TO ETIOLOGY, 1965

| State | Total Cases | Arthropod-borne | | | | | Post-infectious | | | | | | Etiology Unknown |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Total | WEE | SLE | EEE | CAL. | Total | Mumps | Measles | Varicella | Rubella | Other Specified** | |
| **U. S.** | **2703** *173* | **297** *8* | **172** *4* | **58** | **8** *4* | **59** | **981** *68* | **634** *4* | **171** *21* | **112** *29* | **7** | **57** *14* | 1425 *97* |
| **NE** | **136** *13* | | | | | | **80** *8* | **45** | **25** *5* | **10** *3* | | | **56** *5* |
| Me. | 9 *1* | | | | | | 4 *1* | 1 | 3 *1* | | | | 5 |
| N. H. | 1 | | | | | | 1 | 1 | | | | | |
| Vt. | 3 | | | | | | 2 | | 2 | | | | 1 |
| Mass. | 60 *1* | | | | | | 35 *1* | 19 | 12 *1* | 4 | | | 25 |
| R. I. | 40 | | | | | | 28 | 21 | 5 | 2 | | | 12 |
| Conn. | 23 *11* | | | | | | 10 *6* | 3 | 3 *3* | 4 *3* | | | 13 *5* |
| **MA** | **589** *13* | **4** | | **3** | **1** | | **198** *9* | **121** *1* | **22** | **27** *6* | **3** | **25** *2* | **387** *4* |
| NYC | 228 *3* | | | | | | 82 *3* | 64 | 2 | 9 *3* | | 7 | 146 |
| Up. NY | 102 *6* | | | | | | 47 *5* | 25 *1* | 6 | 9 *3* | 2 | 5 *1* | 55 *1* |
| N. J. | 151 *1* | 3 | | 2 | 1 | | 27 *1* | 12 | 2 | 4 | | 9 *1* | 121 |
| Pa. | 108 *3* | 1 | | 1 | | | 42 | 20 | 12 | 5 | 1 | 4 | 65 *3* |
| **ENC** | **281** *9* | **54** | **2** | **3** | | **49** | **108** *3* | **54** | **29** *1* | **16** | **3** | **6** *2* | **119** *6* |
| Ohio | 143 *2* | 29 | | 1 | | 28 | 26 *2* | 13 | 9 | 2 | | 2 *2* | 88 |
| Ind. | 19 | 8 | 1 | | | 7 | 11 | 4 | 4 | 2 | | 1 | |
| Ill. | 39 | 1 | | 1 | | | 31 | 17 | 3 | 7 | 3 | 1 | 7 |
| Mich. | 61 *5* | 1 | | 1 | | | 37 | 19 | 11 | 5 | | 2 | 23 *5* |
| Wisc. | 19 *2* | 15 | 1 | | | 14 | 3 *1* | 1 | 2 *1* | | | | 1 *1* |
| **WNC** | **254** *31* | **54** *1* | **41** *1* | **6** | | **7** | **59** *8* | **40** | **10** *4* | **4** *2* | | **5** *2* | **141** *22* |
| Minn. | 60 *7* | 3 *1* | 2 *1* | | | 1 | 40 *5* | 31 | 4 *2* | 3 *2* | | 2 *1* | 17 *1* |
| Iowa | 34 | 6 | | | | 6 | 5 | 2 | 3 | | | | 23 |
| Mo. | 23 *6* | 8 | 4 | 4 | | | 6 *1* | 4 | | 1 | | 1 *1* | 9 *5* |
| N. D. | 51 *4* | 21 | 21 | | | | 1 | 1 | | | | | 29 *4* |
| S. D. | 12 | 3 | 3 | | | | | | | | | | 9 |
| Nebr. | 14 *1* | 2 | 1 | 1 | | | 1 *1* | | 1 *1* | | | | 11 |
| Kans. | 60 *13* | 11 | 10 | 1 | | | 6 *1* | 2 | 2 *1* | | | 2 | 43 *12* |
| **SA** | **300** *46* | **10** *4* | | | **7** *4* | **3** | **130** *15* | **90** *1* | **18** *2* | **14** *6* | | **8** *6* | **160** *27* |
| Dela. | 4 | | | | | | 1 | | | 1 | | | 3 |
| Md. | 16 *9* | 1 *1* | | | 1 *1* | | 8 *1* | 1 | 5 | 1 *1* | | 1 | 7 *7* |
| D. C. | 2 *1* | | | | | | 1 *1* | | | | | 1 *1* | 1 |
| Va. | 55 *4* | | | | | | 20 *4* | 11 | 3 *1* | 5 *2* | | 1 *1* | 35 |
| W. Va. | 5 | | | | | | 1 | | 1 | | | | 4 |
| N. C. | 33 *21* | 4 | | | 1 | 3 | 13 *8* | 3 *1* | 3 *1* | 4 *3* | | 3 *3* | 16 *13* |
| S. C. | 5 *1* | | | | | | 1 | 1 | | | | | 4 *1* |
| Ga. | 11 *8* | 2 *2* | | | 2 *2* | | | | | | | | 9 *6* |
| Fla. | 169 *2* | 3 *1* | | | 3 *1* | | 85 *1* | 74 | 6 | 3 | | 2 *1* | 81 |
| **ESC** | **94** *20* | | | | | | **34** *11* | **17** | **11** *5* | **4** *4* | | **2** *2* | **60** *9* |
| Ky. | 14 *3* | | | | | | 4 *1* | 3 | | 1 *1* | | | 10 *2* |
| Tenn. | 28 *13* | | | | | | 11 *6* | 3 | 4 *2* | 3 *3* | | 1 *1* | 17 *7* |
| Ala. | 34 *2* | | | | | | 13 *2* | 10 | 3 *2* | | | | 21 |
| Miss. | 18 *2* | | | | | | 6 *2* | 1 | 4 *1* | | | 1 *1* | 12 |
| **WSC** | **180** *6* | **46** | **20** | **26** | | | **60** *1* | **38** | **12** *1* | **6** | **1** | **3** | **74** *5* |
| Ark. | 20 | | | | | | 8 | 3 | 3 | 1 | 1 | | 12 |
| La. | 30 *6* | | | | | | 14 *1* | 7 | 4 *1* | 2 | | 1 | 16 *5* |
| Okla. | 16 | | | | | | | | | | | | 16 |
| Tex. | 114 | 46 | 20 | 26 | | | 38 | 28 | 5 | 3 | | 2 | 30 |
| **MT** | **396** *14* | **119** *3* | **100** *3* | **19** | | | **36** *1* | **22** | **10** | **3** *1* | | **1** | **241** *10* |
| Mont. | 34 *2* | 16 | 15 | 1 | | | 8 | 5 | 1 | 1 | | 1 | 10 *2* |
| Ida. | 12 | | | | | | | | | | | | 12 |
| Wyo. | 19 *1* | 11 | 11 | | | | 2 *1* | | | 2 *1* | | | 6 |
| Colo. | 269 *3* | 86 *3* | 68 *3* | 18 | | | 11 | 6 | 5 | | | | 172 |
| N. M. | 10 | 6 | 6 | | | | | | | | | | 4 |
| Ariz. | 16 *8* | | | | | | 2 | 2 | | | | | 14 *8* |
| Utah | 34 | | | | | | 13 | 9 | 4 | | | | 21 |
| Nev. | 2 | | | | | | | | | | | | 2 |
| **PAC** | **473** *21* | **10** | **9** | **1** | | | **276** *12* | **207** *2* | **34** *3* | **28** *7* | | **7** | **187** *9* |
| Wash. | 16 *2* | | | | | | 15 *1* | 11 | 3 *1* | 1 | | | 1 *1* |
| Ore. | 36 *6* | | | | | | 21 | 11 | 2 | 2 | | 6 | 15 *6* |
| Cal. | 409 *12* | 10 | 9 | 1 | | | 237 *11* | 185 *22* | 28 *2* | 24 *7* | | | 162 *1* |
| Alaska | 3 | | | | | | 1 | | | | | 1 | 2 |
| Hawaii | 9 *1* | | | | | | 2 | | 1 | 1 | | | 7 *1* |
| **P. Rico** | **6** | | | | | | **3** | | **1** | **2** | | | **3** |

*Deaths in Italics
**Table VI

All encephalitis cases reported for the years 1962-65 are shown by month in Figure 1. The previous characteristic pattern of incidence with a small spring increase and a large late summer increase again occurred during 1965. The numbers of reported cases by etiologic group for each month are shown in Table III and Figure 2.

Table III

Reported Cases of Encephalitis by Month According to Etiology, 1965

| Month | Total Cases Reported | Post-Infectious Encephalitis | Arthropod-borne Encephalitis | Unknown Etiology |
|---|---|---|---|---|
| January | 182 | 91 | 0 | 91 |
| February | 174 | 88 | 0 | 86 |
| March | 212 | 114 | 0 | 98 |
| April | 216 | 119 | 0 | 97 |
| May | 223 | 127 | 0 | 96 |
| June | 199 | 109 | 4 | 86 |
| July | 254 | 83 | 30 | 141 |
| August | 467 | 58 | 165 | 244 |
| September | 308 | 48 | 79 | 181 |
| October | 179 | 37 | 11 | 131 |
| November | 118 | 36 | 1 | 81 |
| December | 152 | 62 | 0 | 90 |
| Unknown | 19 | 9 | 7 | 3 |
| TOTAL | 2703 | 981 | 297 | 1425 |

The highest incidence of cases of post-infectious encephalitis occurred during the spring, whereas the cases due to the arthropod-borne viruses peaked during August. An increase in cases of encephalitis with no known etiology was also noted in August and September. Such a pattern was observed in 1964, as well (ESU Report 1964).

A - Post-infectious Encephalitis

As in previous years, the most frequent etiologic cause of post-infectious encephalitis was mumps, followed by measles and varicella. The incidence of commonly reported post-infectious encephalitis is compared for the years 1960 to 1965 in Table IV.

Table IV

Cases of Commonly Reported Post-Infectious Encephalitis by Etiology, 1960-1965

| | Etiology | | | | | |
|---|---|---|---|---|---|---|
| Year | Mumps | Measles | Varicella | Rubella | Influenza | Post-Vaccinal |
| 1960 | 700 | 299 | 95 | -- | 24 | -- |
| 1961 | 402 | 276 | 75 | -- | 8 | 8 |
| 1962 | 358 | 337 | 76 | -- | 40 | 7 |
| 1963 | 671 | 239 | 84 | -- | 30 | 3 |
| 1964 | 932 | 300 | 106 | 59 | 14 | 8 |
| 1965 | 634 | 171 | 112 | 7 | 17 | 9 |

*Figure 1.*

REPORTED CASES OF ENCEPHALITIS BY MONTH
UNITED STATES, 1962-1965

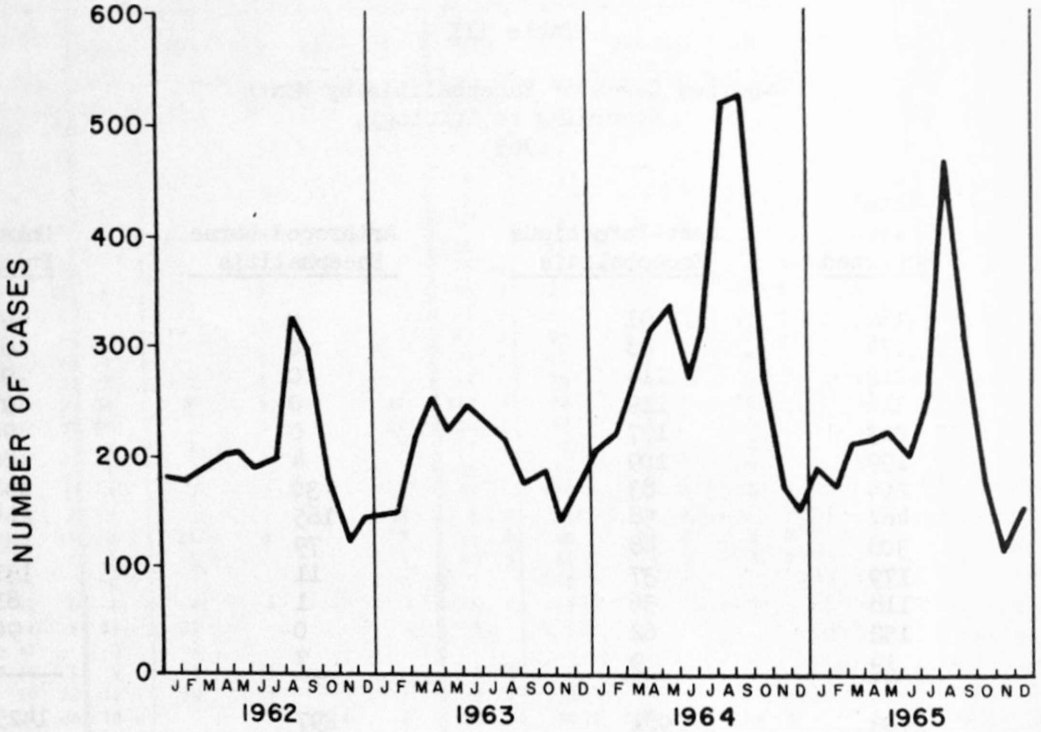
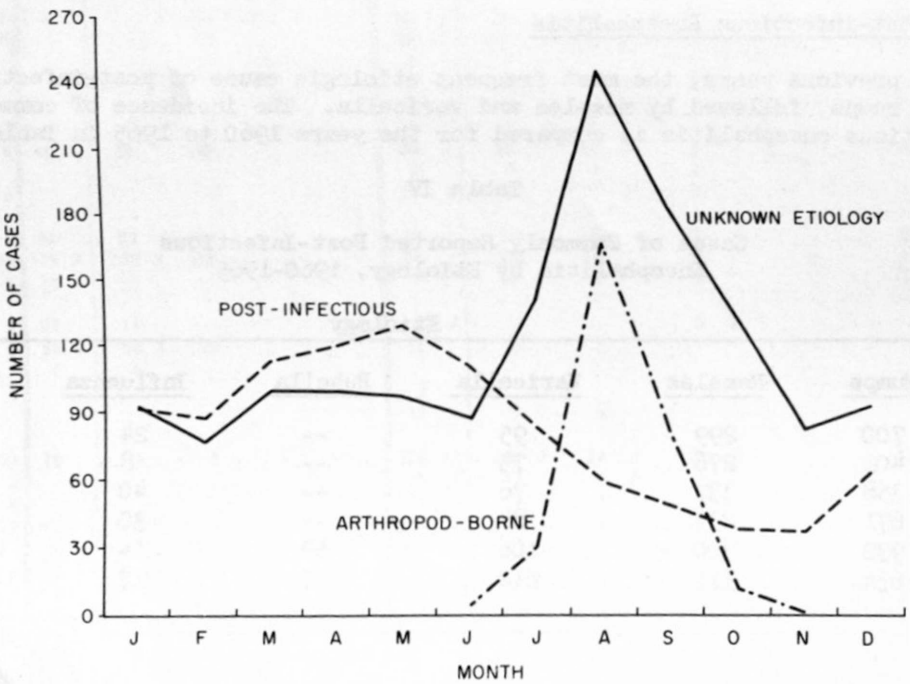



*Figure 2.*

REPORTED CASES OF ENCEPHALITIS BY ETIOLOGIC GROUP
AND MONTH OF ONSET, 1965



The decline of measles encephalitis cases in 1965 was a reflection of the decline in the total number of reported measles cases. The ratio of encephalitis cases to 100,000 measles cases remained essentially the same as during the previous five years (Table V).

Table V

Reported Cases of Measles and Post-measles Encephalitis in the U.S. - 1960-1965

| Year | Measles | Measles Encephalitis | |
|---|---|---|---|
| | | No. of Cases | Rate per 100,000 measles cases |
| 1960 | 441,703 | 299 | 67.7 |
| 1961 | 423,919 | 276 | 65.1 |
| 1962 | 481,530 | 337 | 70.0 |
| 1963 | 385,156 | 239 | 62.1 |
| 1964 | 490,591 | 300 | 61.2 |
| 1965 | 265,501* | 171 | 64.4 |

* provisional

Figure 3 shows that encephalitis associated with mumps, measles, and varicella all have their period of greatest incidence in the Spring.

Table VI lists reported cases and deaths of post-infectious encephalitis of low frequency. There were 19 cases of herpes simplex encephalitis reported from 9 states. In 9 of the 11 reported fatal cases, herpes simplex virus was isolated from the central nervous system. All of the 9 cases from New Jersey were documented by a rise in complement fixation titer. The cases of herpes encephalitis from New Jersey were all adults older than 30 years of age.

Eight cases of encephalitis following smallpox vaccine were reported in 1965, but there were no fatalities. North Carolina reported one fatal case of encephalitis in a 3-year old girl who had received yellow fever vaccine. The 17-D strain of yellow fever virus was isolated from the brain by the Laboratory Branch, CDC.

Influenza accounted for 17 cases of encephalitis; lymphocytic choriomeningitis 8; herpes zoster 2; and adenovirus 2.

B - Arthropod-borne Encephalitis

Cases of arthropod-borne encephalitis have been classified into confirmed and presumptive categories. Both confirmed and presumptive cases are included in the final case count of arthropod-borne encephalitis. Confirmed cases fulfill any one of the following criteria: 1) isolation of virus; 2) a fourfold rise in hemagglutination-inhibition (HI) antibody titer or complement fixation (CF) titer between acute and convalescent specimens; 3) a fourfold fall in HI or CF titer between acute and convalescent specimens; 4) a rise in neutralization index of 1.7 logs or greater. The category of presumptive cases was based on significant antibody in a single serum specimen; HI equal to or greater than 320, CF equal to or greater than 8, or neutralization index equal to or greater than 2.0 logs.

A total of 297 confirmed or presumptive cases of arthropod-borne encephalitis with onsets of illness in 1965 has been reported. By comparison with the previous 10 years (see Table VII) this was a year of intermediate arbovirus activity; however, the 172 cases of Western encephalitis represent the largest total of WEE cases reported since encephalitis surveillance began in 1955. California encephalitis was recognized more frequently in 1965 than previously.

*Figure 3.*

POST-INFECTIOUS ENCEPHALITIS
ASSOCIATED WITH MEASLES, MUMPS, VARICELLA AND RUBELLA
BY MONTH OF ONSET, UNITED STATES, 1965

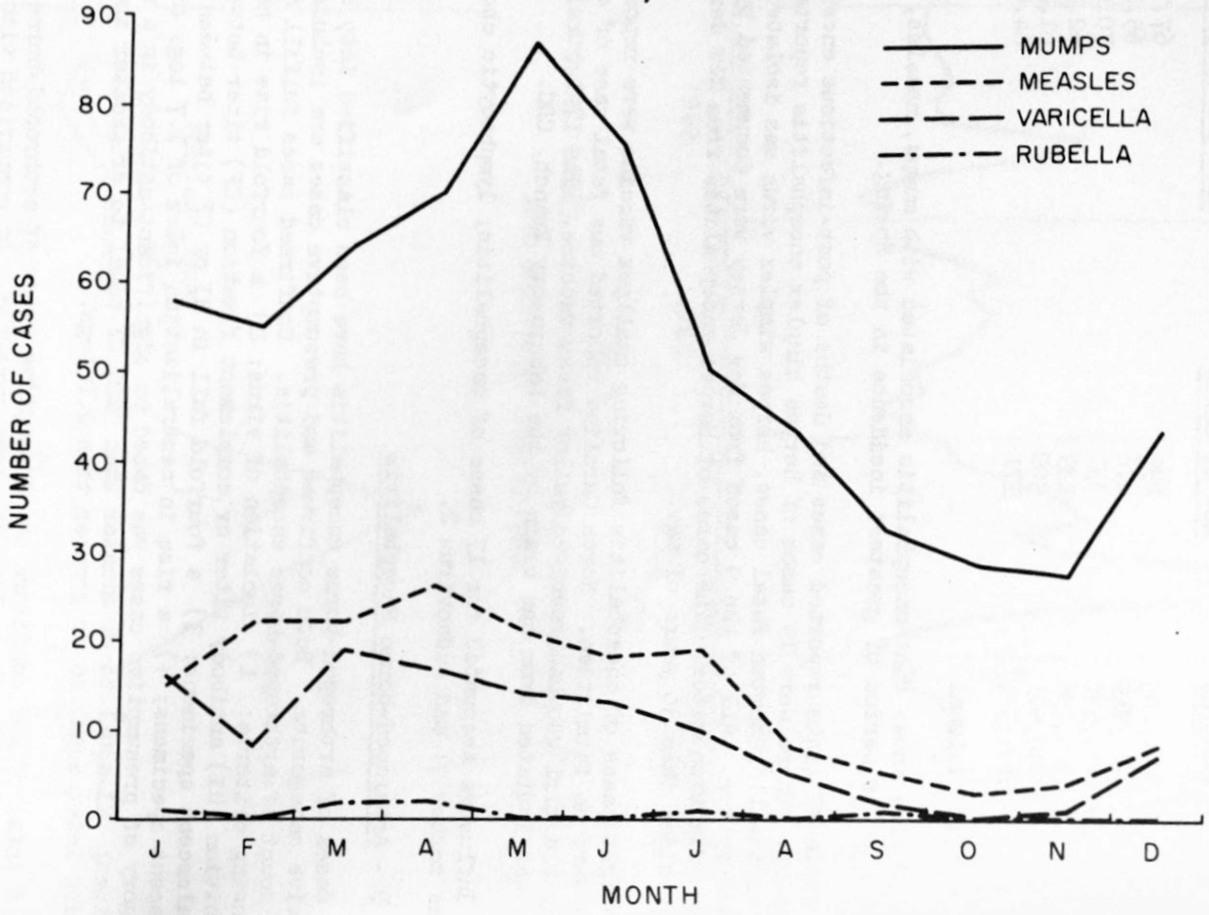


Table VI

Reported Cases and Deaths* of Post-infectious Encephalitis of Low Frequency by Etiology and State, 1965

| State** | Total | Etiology | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Influenza | Lymphocytic Chorio-Meningitis | Herpes Zoster | Herpes Simplex | Adenovirus Type 2 | Adenovirus Type 3 | Post-Vaccinal Smallpox | Post-Vaccinal Yellow Fever |
| Alaska | 1 | 1 | | | | | | | |
| Dist. of Col. | 1 (1) | | | | 1 (1) | | | | |
| Florida | 2 (1) | 1 | | | 1 (1) | | | | |
| Illinois | 1 | 1 | | | | | | | |
| Indiana | 1 | 1 | | | | | | | |
| Kansas | 2 | 2 | | | | | | | |
| Louisiana | 1 | 1 | | | | | | | |
| Maryland | 1 | | 1 | | | | | | |
| Michigan | 2 | 2 | | | | | | | |
| Minnesota | 2 (1) | | | 1 (1) | | | | 1 | |
| Mississippi | 1 (1) | | | | 1 (1) | | | | |
| Missouri | 1 (1) | | | | 1 (1) | | | | |
| Montana | 1 | | | | | | | 1 | |
| New Jersey | 9 (1) | | | | 9 (1) | | | | |
| New York City | 7 | 4 | | | | | | 3 | |
| New York State | 5 (1) | | | | 2 (1) | 1 | 1 | 1 | |
| North Carolina | 3 (3) | 1 (1) | | | 1 (1) | | | | 1 (1) |
| Ohio | 2 (2) | | | | 2 (2) | | | | |
| Oregon | 6 | | 6 | | | | | | |
| Pennsylvania | 4 | | 1 | 1 | | | | 2 | |
| Tennessee | 1 (1) | 1 (1) | | | | | | | |
| Texas | 2 | 2 | | | | | | | |
| Virginia | 1 (1) | | | | 1 (1) | | | | |
| TOTAL | 57 (14) | 17 (2) | 8 | 2 (1) | 19 (10) | 1 | 1 | 8 | 1 (1) |

* Deaths in parenthesis

** Remaining states did not report these encephalitides

Table VII

Human Cases of Arthropod-borne Encephalitis
1955-1965

| Year | Etiology WEE | EEE | SLE | Calif. | Total |
|---|---|---|---|---|---|
| 1955 | 37 | 15 | 107 | 0 | 159 |
| 1956 | 47 | 15 | 563 | 0 | 625 |
| 1957 | 35 | 5 | 147 | 0 | 187 |
| 1958 | 141 | 2 | 94 | 0 | 237 |
| 1959 | 14 | 36 | 118 | 0 | 168 |
| 1960 | 21 | 3 | 21 | 0 | 45 |
| 1961 | 27 | 1 | 42 | 0 | 70 |
| 1962 | 17 | 0 | 253 | 0 | 270 |
| 1963 | 56 | 0 | 19 | 1 | 76 |
| 1964 | 64 | 5 | 470 | 42 | 582* |
| 1965 | 172 | 8 | 58 | 59 | 297 |

* One case of encephalitis attributed to Tensaw virus (reported by Indiana) is included in the total.

The geographic distribution of all arbovirus encephalitis cases is depicted in Figure 4. The marked seasonal incidence of arbovirus encephalitis is shown in Table VIII.

Table VIII

Confirmed and Presumptive Human Cases of Arthropod-borne Encephalitis by Month of Onset, 1965

| Month | Number of Cases — Etiology Western E. | S.L.E. | Eastern E. | California | Total |
|---|---|---|---|---|---|
| January | 0 | 0 | 0 | 0 | 0 |
| February | 0 | 0 | 0 | 0 | 0 |
| March | 0 | 0 | 0 | 0 | 0 |
| April | 0 | 0 | 0 | 0 | 0 |
| May | 0 | 0 | 0 | 0 | 0 |
| June | 2 | 0 | 1 | 1 | 4 |
| July | 16 | 3 | 4 | 7 | 30 |
| August | 114 | 26 | 2 | 23 | 165 |
| September | 30 | 25 | 0 | 24 | 79 |
| October | 3 | 4 | 1 | 3 | 11 |
| November | 1 | 0 | 0 | 0 | 1 |
| December | 0 | 0 | 0 | 0 | 0 |
| Unknown | 6 | 0 | 0 | 1 | 7 |
| TOTAL | 172 | 58 | 8 | 59 | 297 |

Western Encephalitis (WEE)

The most frequently demonstrated arbovirus causing human encephalitis in 1965 was WEE. As compared to 64 laboratory confirmed or presumptive cases reported in 1964, there were 172 such cases in 1965 in association with an extensive epidemic in several of the north central and mountain states. All ages were affected; there were 4 deaths due to WEE (Table IX). WEE virus activity in humans was documented in 14 states, and sizable outbreaks occurred in Montana, North Dakota, Wyoming, Colorado, Kansas, and Texas.

Table IX

Confirmed and Presumptive Human Cases and Deaths*
of Arthropod-borne Encephalitis by Age and Sex, 1965

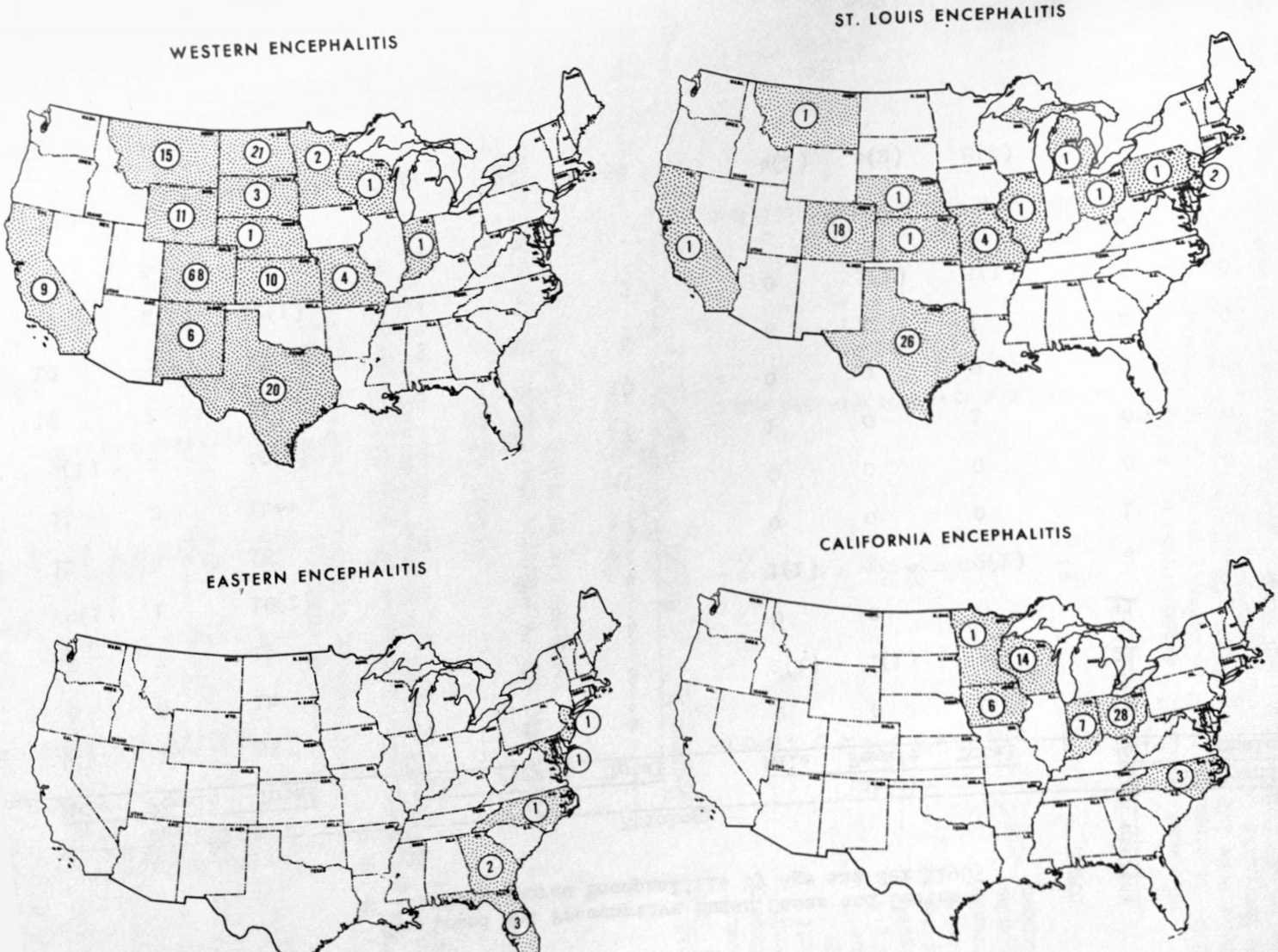
| Age Group | Etiology | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Western | | | S.L.E. | | | Eastern | | | California | | |
| | Male | Female | Total | Male | Female | Total | Male | Female | Total | Male | Female | Total |
| 0-4 | 18 | 15 | 33 | 3 | 1 | 4 | 0 | 0 | 0 | 8 | 5 | 13 |
| 5-9 | 8 | 6 | 14 | 5 | 3 | 8 | 2(1) | 1(1) | 3(2) | 21 | 5 | 26 |
| 10-14 | 12 | 7 | 19 | 1 | 3 | 4 | 0 | 0 | 0 | 11 | 4 | 15 |
| 15-19 | 9(1) | 1 | 10(1) | 2 | 2 | 4 | 1(1) | 1 | 2(1) | 2 | 2 | 4 |
| 20-29 | 12 | 4 | 16 | 3 | 2 | 5 | 0 | 0 | 0 | 1 | 0 | 1 |
| 30-39 | 11 | 2 | 14** | 5 | 2 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 40-49 | 9(1) | 1 | 10(1) | 5 | 2 | 7 | 1 | 0 | 1 | 0 | 0 | 0 |
| 50-59 | 17 | 1 | 18 | 8 | 2 | 10 | 0 | 0 | 0 | 0 | 0 | 0 |
| 60-69 | 10 | 3(1) | 13(1) | 3 | 1 | 4 | 0 | 1 | 1 | 0 | 0 | 0 |
| 70+ | 10 | 2(1) | 12(1) | 2 | 3 | 5 | 0 | 1(1) | 1(1) | 0 | 0 | 0 |
| Unk. | 7 | 6 | 13 | - | - | - | - | - | - | - | - | - |
| TOTAL | 123(2) | 48(2) | 172(4)** | 37 | 21 | 58 | 4(2) | 4(2) | 8(4) | 43 | 16 | 59 |

* deaths in parenthesis

** includes 31-year old unknown sex

*Figure 4.*

## HUMAN CASES OF ARTHROPOD BORNE ENCEPHALITIS BY STATE, 1965



Wyoming reported their first confirmed cases in several years. The dates of onset of the first and last confirmed cases in Wyoming were July 28 and September 2. The concentration of recognized human cases occurred in the North Platte River Valley.

North Dakota, which prior to 1964 had reported no laboratory confirmed cases for at least 10 years, reported 5 cases of WEE in 1964 and 21 cases in 1965. A total of 68 cases of WEE occurred in Colorado in 1965; more details about this outbreak are provided in Section III, State Reports. All were documented by serology with the exception of one case, in which WEE virus was isolated from the central nervous system of a 42-year old male from Colorado by the Disease Ecology Station, Greeley, Colorado.

California Encephalitis

Fifty-nine cases of serologically confirmed or presumptive California encephalitis were reported for 1965. This number is higher than any previous year. Cases were reported from 6 states: Ohio, Indiana, Wisconsin, North Carolina, Iowa, and Minnesota (see Figure 4). In Wisconsin the cases were clustered in the western part of the state. The cases in Ohio occurred in 16 counties. All but one of the cases of California encephalitis occurred in persons under 20 years of age (Table IX). Males were affected more than females. There were no fatalities due to California encephalitis. (See State Report from Florida for clinical characteristics of two cases).

St. Louis Encephalitis (SLE)

In 1965, by contrast to 1964, there were no major urban outbreaks of St. Louis encephalitis. A total of 58 sporadic cases of SLE were reported from 12 states, but only Texas and Colorado reported more than 1 case in a county. Cases of SLE occurred in all age groups. In 1965 there were no deaths reported due to SLE.

Eastern Equine Encephalitis (EEE)

Eight cases of eastern equine encephalitis, including 4 fatalities, were reported in 1965 from 5 states. EEE virus was isolated from the brain of 2 children in Georgia, aged 6 and 7 years, and from the brain of a 74-year old female in Maryland. Outbreaks of EEE in horses occurred along the eastern seaboard.

E - Encephalitis of Unknown Etiology

More than 1400 cases of encephalitis of unknown etiology were reported to the ESU during 1965. Every state except Indiana and New Hampshire reported cases in this category. Notification of deaths in this classification was incomplete (for example, see Table II, which includes several states reporting large numbers of cases and no deaths); nonetheless, the 97 reported fatal cases represented 6.8 percent of the total.

In 1965, as in the past 3 years, encephalitis of unknown etiology accounted for approximately 50 percent of all encephalitis cases (Table X).

Table X

Encephalitis Cases with Etiology Unknown
1962-1965

| Year | Total Encephalitis Cases | Unknown Etiology | Percent Unk. Etiology |
|---|---|---|---|
| 1962 | 2410 | 1125 | 46.7 |
| 1963 | 2362 | 1092 | 46.2 |
| 1964 | 3587 | 1420 | 39.6 |
| 1965 | 2703 | 1425 | 52.7 |

In 1964 and 1965, all cases of encephalitis of unknown etiology showed an abrupt seasonal peak in late summer (Figure 5). The suggestion was made (ESU Summary 1964) that this late summer peak may be due to undiagnosed arthropod-borne viral encephalitis especially in years of high incidence of arthropod-borne encephalitis. Figure 6, which shows monthly incidence of encephalitis of unknown etiology in 1965 for four regions of the U.S., supports this hypothesis. In the north central and mountain states where the majority of arthropod-borne encephalitis cases occurred in 1965, there was a sharp increase in incidence of encephalitis of unknown etiology in August and September. By contrast, along the eastern seaboard where there was little human arthropod-borne disease, there was no seasonal peak of encephalitis of unknown etiology.

These curves also suggest that in all regions of the country there is a baseline of activity of unidentified encephalitis agents in all months. The absence of a seasonal peak in the eastern U.S. suggests that the responsible agents there are not arboviruses or enteroviruses which markedly increase in incidence in late summer and early fall.

Present ESU procedures do not require age information about cases of encephalitis of unknown etiology. However, the age distribution of the 121 cases reported by New Jersey has been obtained as an example. Table XI shows that cases occurred in all age groups but more than one-half the cases were less than 20 years old.

*Figure 5.*

REPORTED CASES OF ENCEPHALITIS WITH ETIOLOGY UNKNOWN BY MONTH, UNITED STATES, 1962 - 1965

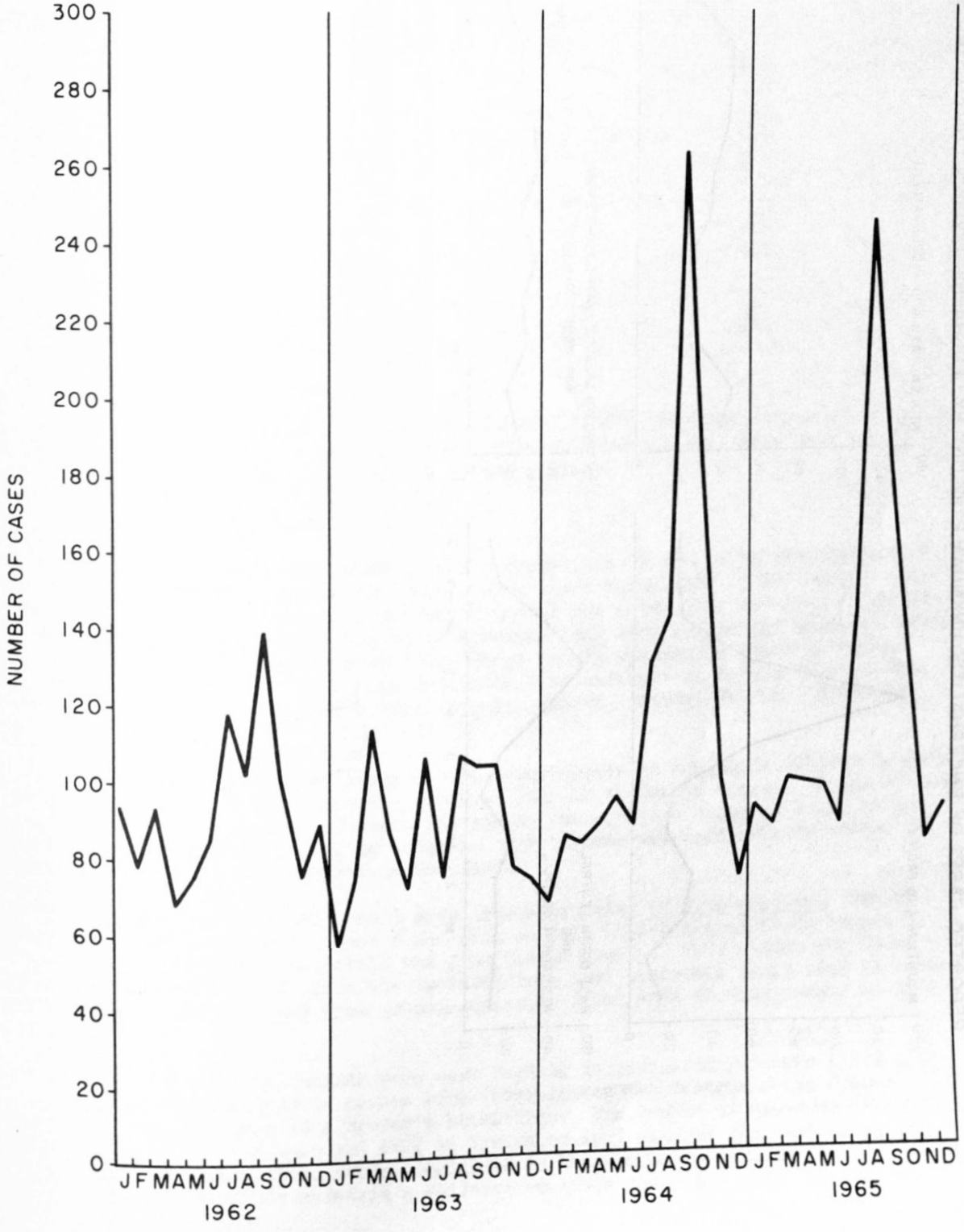


*Figure 6.*

REPORTED CASES OF ENCEPHALITIS, UNKNOWN ETIOLOGY BY GEOGRAPHIC DIVISION, UNITED STATES, 1965

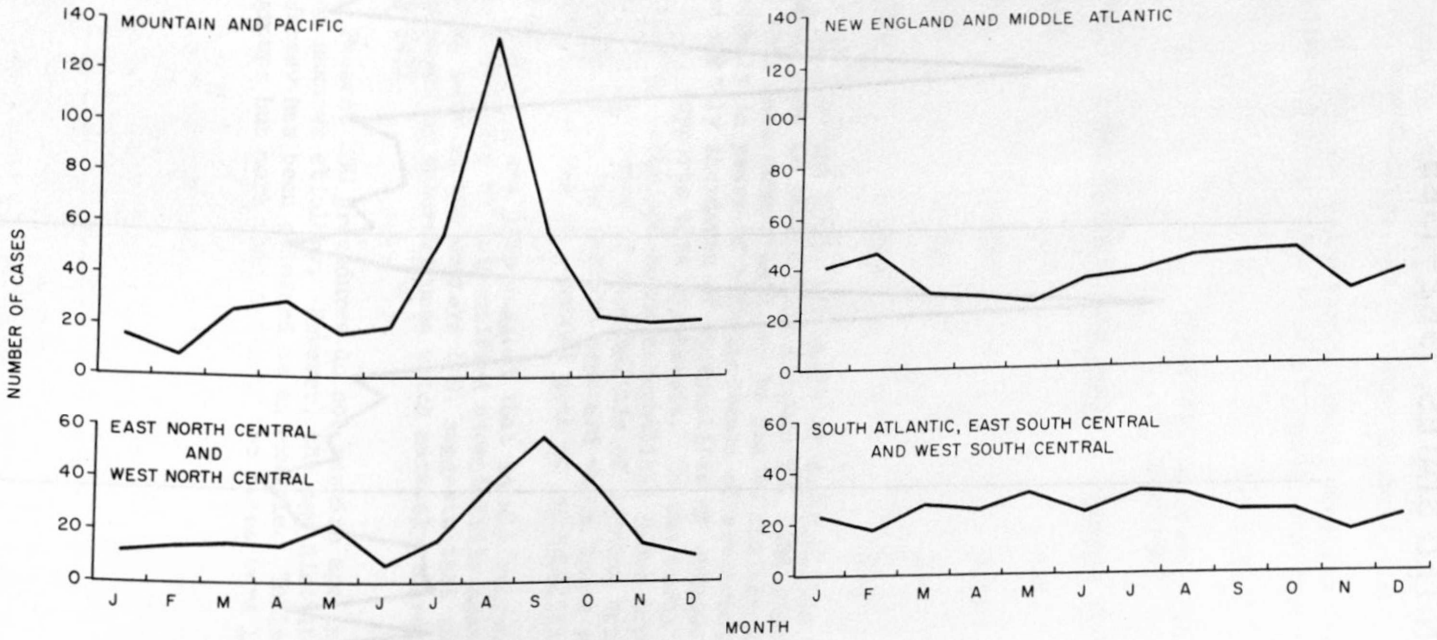



Table XI

Age Distribution of Encephalitis Cases with Etiology Unknown
New Jersey, 1965

| Age Group | Number of Cases | Percent | Rate/100,000 Population |
|---|---|---|---|
| < 1 | 6 | 5.1 | 4.7 |
| 1-4 | 15 | 12.7 | 2.9 |
| 5-9 | 26 | 22.0 | 4.5 |
| 10-14 | 10 | 8.5 | 1.9 |
| 15-19 | 10 | 8.5 | 2.5 |
| 20-24 | 5 | 4.2 | 1.6 |
| 25-29 | 5 | 4.2 | 1.4 |
| 30-39 | 16 | 13.6 | 1.8 |
| 40-49 | 11 | 9.3 | 1.3 |
| 50-59 | 4 | 3.4 | 0.6 |
| 60+ | 10 | 8.5 | 1.2 |
| Unknown | 3 | - | - |
| TOTAL | 121 | 100.0 | 2.0 |

## III. STATE REPORTS

A series of reports which describe, in more detail, the investigation of encephalitis in several states in the past year follows. These reports have been kindly contributed by encephalitis investigators in the states.

### A - California

There were 9 confirmed cases of WEE encephalitis in man in California in 1965. The first case occurred in Shasta County, with onset August 11. There were 3 cases in August, 3 in September, and 2 in October. One of the cases that occurred in August resided in San Diego County, but it is presumed that this person was infected while visiting in Montana. The one case from Orange County was hospitalized in Fresno County and it is presumed that this individual was infected in Fresno County. The other cases were from Sacramento, San Joaquin, Shasta, Sutter, Tehama, Tulare and Yolo Counties.

There were 59 confirmed cases of WEE encephalitis in horses in California during 1965. The first case in California occurred July 21 in Tehama County. Among the confirmed cases where the date of onset was known, there were 4 cases in July, 16 in August, 15 in September, and 1 in October. The disease was particularly active in Fresno, Kern, Sacramento and Shasta Counties.

WEE virus was isolated from 3 gray tree squirrels, Sciurus griseus. Two of these were from Butte County, one found sick on July 16 and the other on August 5. One of the positive tree squirrels was from Shasta County. This animal was found sick on September 5. WEE virus was isolated from tree squirrels found sick in Butte County in 1953 and 1955 and from ground squirrels found sick in this county in 1955 and 1962.

Large flocks of blackbirds were seen feeding in irrigated pastures where clinical cases of encephalitis in horses were investigated in Sacramento and Fresno Counties. Most of these were Brewer's blackbirds. The number of Brewer's blackbirds increases in the late summer and fall in irrigated agricultural land and in grain fields, and presumably these birds do migrate in large numbers into California in the fall. These birds do not maintain a definite roosting place but move from place to

place according to feeding conditions. They are usually seen in flocks of several hundred birds. There is a large influx of redwinged blackbirds and starlings into California in the fall. The estimated winter population in known roosting areas is more than 30 million birds.

A field trial of an attenuated WEE live virus vaccine for horses was carried out in 1965. A total of 367 horses and 1 donkey were vaccinated. There were no illnesses attributable to the vaccine and the pregnant mares that were vaccinated foaled normally.

(Reported by Edwin H. Lennette, M.D., Chief, Viral and Rickettsial Disease Laboratory, and Richard W. Emmons, M.D., Public Health Medical Officer, State of California Department of Public Health; and Harald N. Johnson, M.D., Project Director, Rockefeller Foundation, Co-operative Arbovirus Studies).

B - Colorado

The eastern slope of Colorado experienced an unusually cool and wet spring. The monthly precipitation was 2.7 inches above normal in June and 5 inches above normal in July in the Denver area. This excessive rainfall resulted in unusually large Culex tarsalis populations, six to seven times the population index of 1964. The WEE infection rate for these mosquitoes reached epidemic levels by the second week in July and high infection rates -- 7 per thousand or more -- were maintained through the first week of September. A total of 133 isolations of WEE virus was made from 506 pools of Culex tarsalis mosquitoes. SLE virus was isolated from C. tarsalis as early as the week of July 11-17 and was still present in mosquitoes in the week of September 5-11. Other mosquitoes were minimally involved, there having been one WEE isolation from Aedes dorsalis and two from Aedes vexans.

There were 250 suspect human cases of acute febrile CNS disease. These cases were located along the Arkansas and Platte River Basins, the areas of extensive flooding in June. A total of 68 serologically confirmed or presumptive WEE cases and the 18 serologically confirmed or presumptive SLE cases occurred over an 11 week period from July 12 through September 26. One hundred thirty-six patients from whom adequately timed paired sera were obtained showed no serologic evidence that the illness under investigation was either WEE or SLE. The attack rates for WEE in different areas of eastern Colorado are shown in Table XII and clearly indicate the magnitude of the problem in some of the sparsely settled rural eastern slope counties.

Table XII

Western Encephalitis - Colorado 1965

| Geographical Area | Population | Cases WEE | Attack Rate/ 100,000 |
|---|---|---|---|
| So. Platte Basin-rural (7 counties) | 207,700 | 31 | 14.9 |
| Arkansas Basin-rural (6 counties) | 66,500 | 6 | 9.0 |
| So. Platte Basin-urban (5 counties) | 1,097,000 | 27 | 2.5 |
| Other (4 counties- rural and urban) | 207,400 | 4 | 1.9 |
| | 1,578,600 | 68 | 4.3 |

Sentinel and farm chickens bled in October reflected the high WEE activity in the northeastern part of the state; in 5 of 8 flocks sampled in October, over 60 percent of the chickens had WEE antibody.

(Reported by Cecil S. Mollohan, M.D., Chief of Epidemiology, State of Colorado, Department of Public Health; CDC Disease Ecology Station, Greeley, Colorado, and an EIS Officer).

C - Florida

1 - Reports of two Cases of California Encephalitis Imported from North Carolina

Case No. 1 - This 8-year old boy was apparently well until August 17, 1965, when he awakened with headache. Vomiting and fever followed. On August 22 he had convulsions, became irrational and comatose. His eyes became fixed to the right and he had frequent tonic movements, extending left arm and leg, flexing right arm.

On the next day he had no major seizures, but he developed rhythmic fine twitching movements of facial muscles, right thumb and index finger. His eyes remained deviated to the right, head turned to the left. There was extension of right arm and leg; left arm and leg were held in flexion. Funduscopic examination was normal. No impairment of cranial nerves was detected. He was semi-comatose, but hyperreactive to painful stimuli. He progressed to a restless, confused state during which he spoke jargon. On August 22, a CSF showed 6 WBC, 100% lymphocytes, and protein 11 mg%. By September 1, when dismissed from the hospital, he was able to play with his toys and converse intelligibly. He still showed mental confusion but no focal neurologic signs. Gradually his behavior became less irritable and hyperactive. Memory for his illness and events of the preceding vacation returned slowly. He was able to return to school in mid-October, 1965. In January 1966, he was said to still become forgetful when tired. In other respects recovery is apparently complete and the boy says he feels well.

He left Florida on July 10, 1965, and went by car directly to the family summer home in Maggie Valley, North Carolina. He then made a trip by car, via Blue Ridge Parkway across the Cherokee Indian Reservation, to Clingman's Dome on the North Carolina-Tennessee border. When he became ill August 17, he had been away from his Florida residence 38 days and in North Carolina approximately 37 days. After another 15 days he returned to Florida.

Complement fixation titer against California virus rose from 1:16 to 1:32. Neutralization index fell from 3.25 to 2.7 logs. Tests in the second serum for herpes simplex, LCM, polio, and leptospirosis were negative.

Case No. 2 - This previously healthy 9-year old girl complained of headache on August 17, 1965. The next day she was lethargic and had 100° F. fever. By August 19, her fever was 101°- 102° F., she began to vomit, and headache persisted.

The following morning she had fever of 104.2° F., and a positive Kernig but physical examination was not otherwise remarkable. Lumbar puncture revealed clear fluid with approximately 30 WBC, all PMN's, and protein 17 mg%. She was hospitalized immediately and the procedure repeated later the same day. There were then 100 WBC, 57% PMN's, protein 29 mg%, sugar 77 mg%. Peripheral blood count showed WBC 11,000 with a left shift; hemoglobin 12.5 grams. Urine contained no RBC or sugar, but 8-10 WBC, trace of albumin and moderate amount of acetone. Cultures of blood, CSF and urine were later reported negative for bacteria.

During her first three hospital days she remained rational and cooperative, but she slept much of the time, was irritable when roused, restless when awake, and complained of severe nausea and headache. For a while on the second evening, however,

she became quite alert and sociable. The third day she seemed to regress, speaking only when questioned and sleeping most of the time. Thereafter, her condition improved rapidly and she left quite good when released from the hospital August 26.

The highest recorded fever was 104.8° F., on her first hospital day. It ranged between 100°- 103° F., daily through August 23, when she experienced profuse diapharesis. Thereafter her temperature dropped to 99° F., remained down and was entirely normal after August 25.

Recovery appears complete; her behavior is normal, school progress good. For a few weeks it was noted that she spoke more softly than usual, but her voice now has its normal volume.

She left Florida July 27, 1965, and vacationed in the Franklin-Highlands area of North Carolina after a brief visit in Atlanta, Georgia. A side trip included the Cherokee Indian Reservation and Maggie Valley. She returned to Atlanta August 13 and to Florida the next day.

She demonstrated a rise in CF titer to California virus from <1:4 to 1:16 and a rise in neutralization index from 1:7 to 2:2 logs.

(Reported by Dr. Emily Gates, Assistant Director, Encephalitis Research Center).

2 - Report of the Tampa Bay Encephalitis Research Center

California encephalitis (CE) viruses assumed a role of major importance in the studies of the Encephalitis Research Center (ERC) during 1965. They are now the most frequently recovered mosquito-borne, viral agents in Florida. In 1965 in the Tampa Bay area 21 such recoveries were made; all from the Aedes genus of mosquitoes. Joint studies by the ERC Virology Laboratory and the University of Pittsburgh Laboratory (under the direction of William Mc.D. Hammon, M.D.) identified two distinct serotypes, one of which was unlike any previously described and has been given the new name of Keystone virus.

Two human cases were identified during 1965; both were children and both had probable exposure in North Carolina (see previous report). Each recovered without apparent sequelae.

Serologic surveys in the normal Florida population indicate an inapparent infection rate with CE virus of 5 percent.

The reservoir of CE viruses in nature is presumed to be a mammal rather than a bird. In the Tampa Bay area, very few of the mammals examined during 1965 demonstrated HI antibodies to CE virus. However, the rabbit, raccoon and squirrel were serologically implicated as possible reservoirs. Limited studies of the preferential feeding habits of Aedes mosquitoes in the Tampa Bay area indicate that mammals are a preferred source of blood and, of these, the rabbit, horse, and cotton rat serve as frequent blood meals for these mosquitoes. Both field and laboratory studies are currently underway to describe further the epidemiology of this interesting group of arboviruses which is becoming increasingly important in Florida.

(Reported by Dr. James O. Bond, Director, Encephalitis Research Center).

D - Georgia

Table XIII and Figure 7 show the history of EEE in Georgia since 1948.

Table XIII

Source of Eastern Encephalitis Virus Isolations
by Selected Years, 1948 - 1965

GEORGIA

| Source of Isolation | 1948 | 1949 | 1956 | 1957 | 1961 | 1962 | 1963 | 1964 | 1965 |
|---|---|---|---|---|---|---|---|---|---|
| MOSQUITOES | | | | | | | | | |
| Aedes atlanticus-tormentor | | | | | | | x | | |
| Aedes mitchellae | | | x | | | | | | |
| Anopheles crucians | | | x | | | | | x | |
| Culiseta melanura | | | | | x | x | x | x | |
| Culex (Melanoconion) sp. | | | | | | | | x | |
| Culex nigripalpus | | | | | | | x | | |
| Mansonia perturbans | x | | | | | | | x | |
| Psorophora sp. | | | | | | | | x | |
| *Culicoides sp. | | | x | | | | | | |
| HORSES | x | x | x | x | x | | x | x | x |
| HUMAN | | x** | | | | | | x | x |

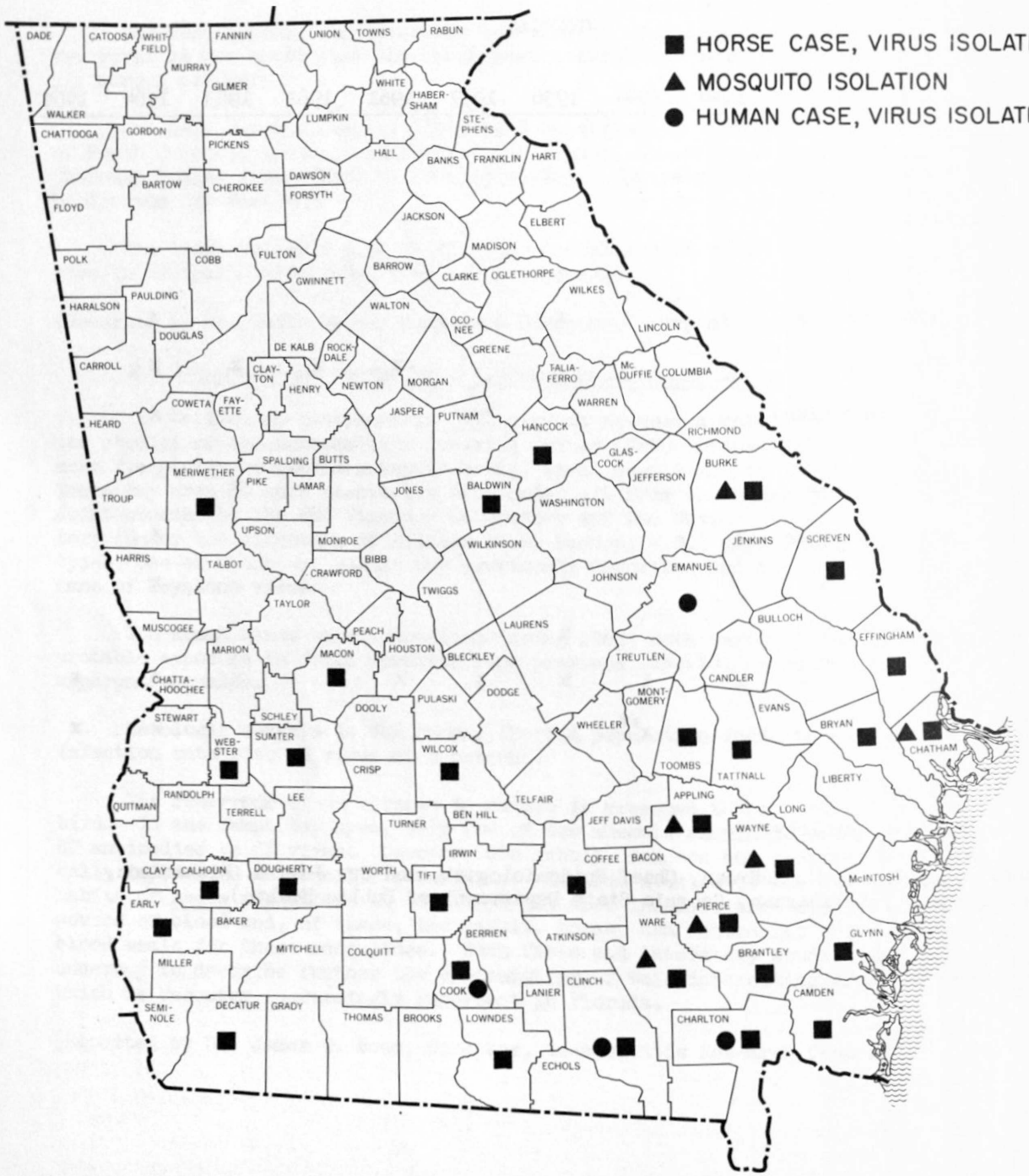
* Biting midge

** Positive serology

(Reported by Dr. J. E. McCroan, Chief Epidemiologist, and Dr. John H. Richardson, Public Health Veterinarian, Georgia State Department of Public Health).

*Figure 7.*

# DISTRIBUTION OF EASTERN ENCEPHALITIS VIRUS GEORGIA, JANUARY 1948 - DECEMBER 1965




* CASE IN CHARLTON COUNTY CONFIRMED BY NEUTRALIZATION ANTIBODY TO EEE, BUT MATERIAL NOT AVAILABLE FOR VIRAL ISOLATION.

E - Massachusetts

In a survey of 72 cases designated as "encephalitis" for which diagnostic material was sent to the Virus Laboratory during 1965, we were able to carry out serum titrations on 51 paired sera. All were negative for Eastern, Western, and St. Louis viruses.

Field findings included the isolation of WEE virus from C. melanura on August 15, 1965. EEE virus was isolated from a black-capped chickadee on October 19, 1965.

No antibodies for EEE or WEE were found in 263 blood specimens collected during the fall migration of birds in 1964. All birds were immature and of species which breed north of southeastern Massachusetts. This is an indication that widespread infection of birds does not occur in northern New England or eastern Canada.

(Reported by Dr. Geoffrey Edsall, Superintendent, Institute of Laboratories, Massachusetts Department of Public Health).

F - Minnesota

Only two human cases of Western equine encephalitis were identified in Minnesota this year; one was fatal. This fatal case, H.M., age 62, a diabetic, was hospitalized on August 20, thought to be in acidosis, she went into coma, spiked a fever up to 103°, nuchal rigidity. Spinal tap showed 80 cells. Before death, August 24, temperature went up to 106°- 107°F. Acetone was normal. Postmortem examination revealed edema of the brain with perivascular cuffing. Unfortunately no material was made available for virus studies. A week prior to admission, patient had a papular rash over chest, arms, and legs and a rather severe diarrhea. No history of travel outside of Minnesota. A single blood specimen collected August 24, 1965, showed negative complement fixation tests for mumps, W.E.E., L.C.M., and Herpes simplex. The neutralization index for W.E.E. was 3,000 and for St. Louis encephalomyelitis was absent.

Through joint agreement with the U. S. Public Health Service Ecology Field Station, Greeley, Colorado, a sentinel flock of thirty six-week-old white leghorns was established at Maple Plain, Hennepin County, Minnesota. One of these chickens converted from negative on August 16, 1965, to positive for W.E.E. on August 30. This was the only converter to W.E.E. There were no converters with the S.L.E. antigen.

(Reported by Dr. D. S. Fleming, Director, Division of Disease Prevention and Control, Minnesota Department of Health).

G - New Jersey

A number of isolations of arboviruses were made from mosquitoes, birds, cold-blooded animals, and mammals. They are summarized in Section IV together with isolations from other states.

Three human cases of arbovirus encephalitis were recognized in New Jersey during 1965. Two were attributed to SLE, and one to EEE.

M.A., a 60-year old female residing in Clermont, Cape May County, New Jersey, developed severe encephalitis on October 9 and was found to have a pleocytosis of 121 WBC per cu mm, 51% of which were polys, and a CSF protein of 160 mg%. Although deeply comatose for many weeks, she is now walking and talking and has regained urinary and fecal continence. Neurologic sequelae are still present, however, including memory loss. Paired bloods yielded a rise in EEE CF titer from 1:4 to 1:16. It is important to note that EEE virus was isolated from A. sollicitans collected about 4 weeks prior to onset of this case near Woodbine, New Jersey, less than five miles from her residence. In addition, EEE was also found in a pool of A. sollicitans collected about 30 miles

north 10 days prior to onset of this case.

This represents the first detected human case of EEE in the epidemic area of New Jersey, as well as the first isolations of EEE from A. sollicitans, since 1959. This would appear to lend further weight to the working hypothesis that this mosquito species may be the important epidemic vector in New Jersey.

S.R., a 44-year old female from Riverside, Burlington County, New Jersey, developed encephalitis on September 19. Bloods collected on September 28 and October 22 revealed an SLE complement fixation titer of 1:16 and an HI titer of 1:40 in both specimens. In addition, the second blood was found to yield a SLE mouse neutralization log index of 2.1. She has apparently made a good recovery, without gross evidence of sequelae.

W.B., a 41-year old male resident of Mt. Laurel Twp., Burlington County, developed encephalitis on October 4. Bloods collected 14 and 24 days after onset revealed CF titers of 16 and 32 for SLE, and HI titers of 20 and 40. The second blood yielded a SLE mouse neutralization index of 2.8 logs. These two cases occurred in the localized area involved the previous year in the large outbreak of St. Louis encephalitis.

The isolation of SLE from two pools of A. sollicitans mosquitoes collected 50-60 miles away from where the SLE cases occurred, about 3 weeks prior to onset of the first case, is quite surprising. The validity of these isolations cannot be doubted, however, since they have been successfully reisolated and reidentified by both neutralization and fluorescent antibody techniques.

(Reported by Martin Goldfield, M.D., Director of Laboratories, and Oscar Sussman, D.V.M., Chief, Bureau of Veterinary Public Health, New Jersey Department of Health).

H - Texas

1 - Isolation of SLE Virus from Bats, 1964

The epidemic of St. Louis encephalitis in Houston, Texas, and environs in 1964 provided an opportunity to explore, under field conditions, the hypothesis that bats may be involved in the epidemiology of certain arbovirus infections. Blood specimens from over 100 Mexican free-tailed bats collected on August 26, 1964, in Angleton, Texas (40 miles south of Houston) at a time subsequently shown to be the peak of the Houston epidemic, yielded several viral isolates; one has been identified as a strain of Rio Bravo virus, and another proved to be a strain of St. Louis encephalitis virus. Other isolates have yet to be characterized.

(Reported by S. Edward Sulkin, Professor and Chairman, Department of Microbiology, U. of Texas, Southwestern Medical School, Dallas).

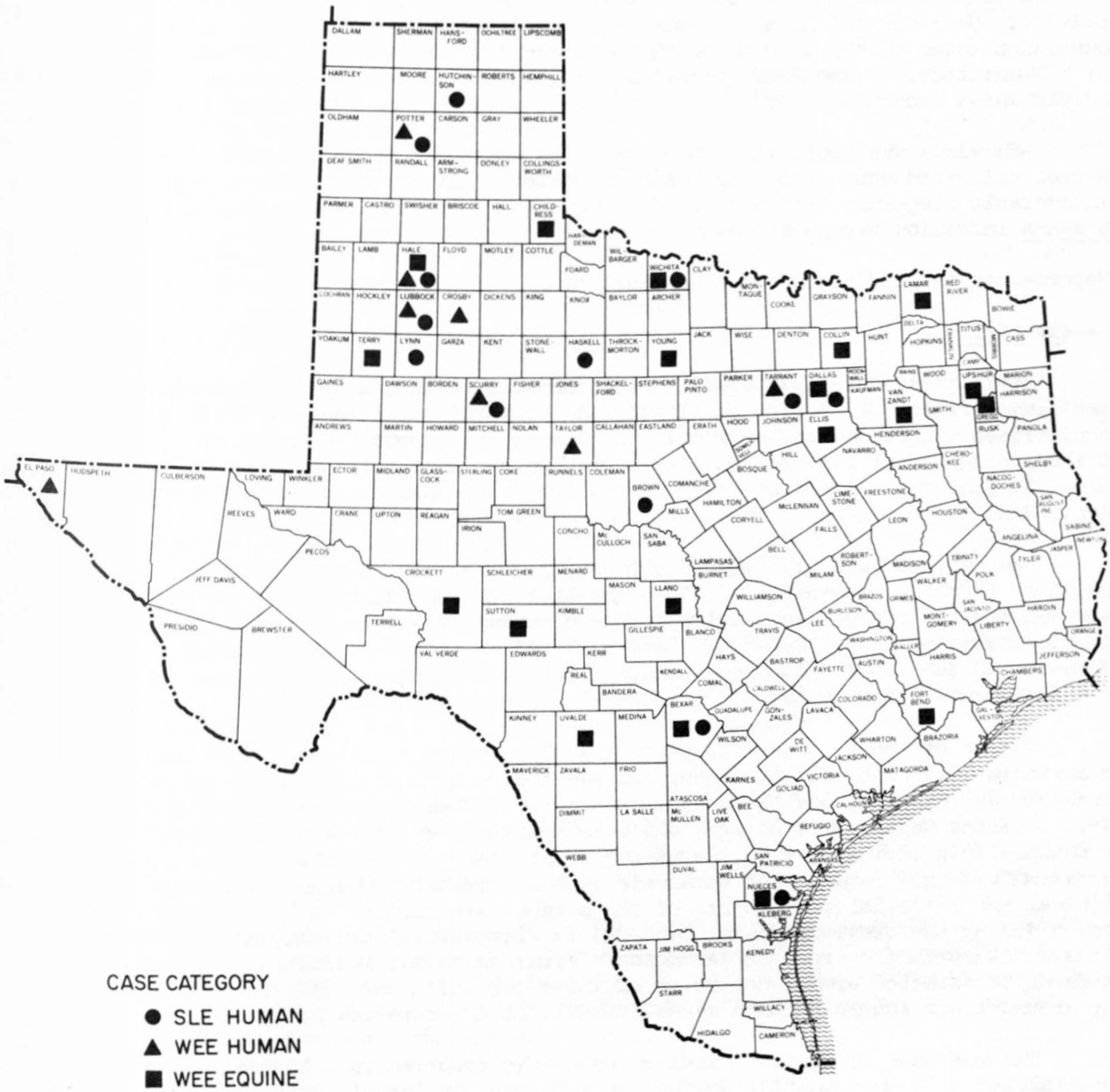
2 - Distribution of Human and Equine Encephalitis, 1965

Figure 8, a Texas county map, shows the distribution of WEE and SLE virus activity, as demonstrated by serologic tests, in humans in 1965. In 5 counties both SLE and WEE transmission to humans occurred.

(Reported by J. V. Irons, Sc. D., Director of Laboratories, Texas State Department of Health).

*Figure 8.*

# LABORATORY-CONFIRMED OR PRESUMPTIVE CASES ARBOVIRAL ENCEPHALITIS IN TEXAS - 1965



3 - Hale County Studies

The 1965 encephalitis outbreak in Hale County, Texas, the site of the Disease Ecology Section's field study site, was smaller than in the past several years. Culex tarsalis populations reached maximum levels four weeks later than in 1964. Infection rates in the C. tarsalis population reached high levels in the week of July 4-10, and these high levels were maintained until the week of September 5-11. There was a total of 45 suspect human cases in Hale County. Twelve confirmed or presumptive human cases of WEE occurred from June 27 through September 4. The first of 5 confirmed SLE cases occurred during the week ending July 31 and the last during the week ending Sept. 25.

Serologic study of 1-year old chickens indicated the extent of WEE and SLE activity. Sentinel chickens in Plainview, Hale Center, and Abernathy had antibody conversion rates of 85% to 96% for WEE by the end of the season, and from 30% to 78% for SLE antibody. Seven farm chicken flocks had WEE antibody rates from 47% to 100% and SLE rates from 22% to 90%.

WEE virus was isolated from jackrabbits collected in July but not from this species collected during the other summer months. Isolations of WEE were made with considerable frequency from wild birds (house sparrows) during the time the Culex tarsalis infection rates were high.

(Reported by the CDC Disease Ecology Section).

I - Wisconsin

During 1965 serologic studies were conducted with 5 arbovirus antigens (Eastern, Western, St. Louis, California and Powassan virus) on sera from 220 patients hospitalized with a variety of febrile illnesses throughout Wisconsin. There was no antibody evidence of Eastern, St. Louis or Powassan encephalitis virus in the sera of these 220 patients. Fourteen cases of California encephalitis and 1 case of WEE were identified.

One case of C.E. (an 8-month old boy) had a 2-fold rise in antibody level while the other 13 cases each had a 4-fold or greater rise in California antibody titers; each convalescent serum also neutralized 2 or more logs of the virus in mice. (California encephalitis virus, Hammon and Reeves' BFS283 strain, was used as an antigen in the HI tests and the La Crosse human isolate strain of California group virus was used in CF and neutralization tests).

Twelve of the 14 cases had histories of exposure in forested areas of western or northern Wisconsin, and the other two cases were from similar rural areas in SE Minnesota and NE Iowa, hospitalized in La Crosse. These cases include 13 boys and 1 girl, 8 months to 16 years of age, who were hospitalized with a diagnosis of meningitis or encephalitis during July(4), August(4), September(5), and October(1). All have recovered with no evidence of paralysis or other readily apparent sequelae. The clinical and epidemiologic aspects of these cases are similar to those of 23 cases reported during the previous years (1960-64) in Wisconsin, indicating continuing endemic virus activity in the area. Epidemiologic evidence so far indicates exposure primarily on farms in forested areas; however 4 of the cases this year occurred in children playing around their suburban homes recently built in the forested hills around La Crosse.

The one case of Western viral encephalitis occurred in a 15-year old boy hospitalized with encephalitis during the last week in August, with probable exposure either around his home in Packwaukee, a small town in central Wisconsin, or during a trip to South Dakota about 12 days before his illness. This is the first known serologically confirmed case of Western encephalitis to be reported from Wisconsin.

Field studies of the circumstances of infections with California encephalitis

group virus are in progress, conducted in collaboration with the University Departments of Veterinary Science, Entomology, and Wildlife Management. These studies are under way on several farms where children live who have been infected with California encephalitis virus. One area is a dairy farm with wooded hills and crop land in southwestern Wisconsin, and the other one is a dairy farm located in Spring Valley Coulee, a long forested valley in western Wisconsin 12 miles south of La Crosse. Antibodies were present in some of the dairy cattle on these farms, and additional sera are being collected from other domestic animals in order to determine more about the distribution of these infections.

Approximately 100 small wild mammals were collected on these farms. Antibodies to California virus were detected in sera from 4 of 12 large chipmunks (Tamias) and 4 of 22 tree squirrels (Sciurus) collected from a forested area. Sera from five other species so far including 29 ground squirrels (Citellus tridecemlineatus), 6 field mice (Peromyscus), 6 rabbits (Sylvilagus), 2 small chipmunks (Eutamias), and 2 opossums (Didelphis), were negative in tests for California group virus antibodies. Two sentinel rabbits placed in this forested area during August and September acquired antibodies to California group virus. Virus isolation studies are in process with tissues from the mammals, ticks and mosquitoes collected from these same areas.

(Reported by Dr. Alfred S. Evans, Director, State Laboratory of Hygiene and Dr. Wayne H. Thompson, Chief, Zoonoses Research Laboratory, Department of Preventive Medicine, U. of Wisconsin Medical School).

## IV. NON-HUMAN ARBOVIRUS ISOLATIONS, 1965

This section attempts to summarize information about arbovirus activity in mosquitoes, birds, and other vertebrates in selected areas where there was a specific research interest in arboviruses.

Table XIV shows arbovirus isolations in 1965 by virus groups, mosquito species and state. WEE virus was found in all of the eastern seaboard states where virus isolations from mosquitoes were attempted, as well as in its traditional locations in the west. The isolations of EEE virus in New Jersey from A. sollicitans, a known feeder on man, may have implications about the vector of that disease in man in that area. California virus group was found in several states, such as Florida, Maryland, New Mexico, and Virginia where indigenous human cases of California encephalitis were not diagnosed as well as in states where human cases were identified. The role in human disease in the United States played by viruses of the Bunyamwara, Flanders-Hart Park, Cache Valley, Turlock, and Tensaw groups remains undefined.

Table XV, Arbovirus Isolations from Birds, 1965, shows that there was an extensive epizootic of EEE in the eastern United States in 1965 even though this was reflected in only 8 human cases. In North Carolina and in Virginia, WEE was also isolated from birds. A number of viruses including A. trivatattus virus was isolated from house sparrows in the Hale County study area of the CDC Disease Ecology Station.

Table XVI presents the isolations of arbovirus from animals other than horses and birds in 1965. WEE virus was isolated from small mammals in Texas, California, and New Jersey. The isolations of EEE virus from cold-blooded vertebrates in New Jersey is of considerable interest. Cold-blooded vertebrates have been suggested as the over-wintering hosts for some arboviruses.

## TABLE XIV
## ARBOVIRUS ISOLATIONS FROM MOSQUITOES, 1965

| State by Division | Reporting Laboratory* | Species | Virus Group | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | WEE | EEE | SLE | CAL. | BUN. | FLANDERS HART PARK | CACHE VALLEY | TURLOCK | TENSAW |
| Massachusetts | E | *Cs. melanura* | + | .... | .... | ..... | .... | ..... | ..... | ..... | ..... |
| New Jersey | G | *A. crucians* | .... | + | .... | ..... | .... | ..... | ..... | ..... | ..... |
| | | *A. punctipennis* | .... | + | .... | ..... | .... | ..... | ..... | ..... | ..... |
| | | *A. sollicitans* | .... | + | + | ..... | .... | ..... | ..... | ..... | ..... |
| | | *A. vexans* | .... | + | .... | ..... | .... | ..... | ..... | ..... | ..... |
| | | *C. pipiens* | .... | + | .... | ..... | .... | ..... | ..... | ..... | ..... |
| | | *C. restuans* | + | + | .... | ..... | .... | ..... | ..... | ..... | ..... |
| | | *Cs. melanura* | .... | + | .... | ..... | .... | ..... | ..... | ..... | ..... |
| Ohio | C, J | *A. canadensis* | .... | .... | .... | + | .... | ..... | ..... | ..... | ..... |
| | | *A. triseriatis* | .... | .... | .... | + | .... | ..... | ..... | ..... | ..... |
| | | *C. pipiens* | .... | .... | .... | ..... | .... | + | ..... | ..... | ..... |
| | | *C. restuans* | .... | .... | .... | ..... | .... | + | ..... | ..... | ..... |
| Illinois | D | *A. quadrimaculatus* | .... | .... | .... | ..... | .... | ..... | + | ..... | ..... |
| | | *C. pipiens* | .... | .... | + | ..... | .... | ..... | ..... | ..... | ..... |
| Maryland | C | *A. atlanticus* | .... | .... | .... | + | .... | ..... | ..... | ..... | ..... |
| | | *A. canadensis* | .... | .... | .... | + | .... | ..... | ..... | ..... | ..... |
| | | *A. vexans* | .... | .... | .... | + | .... | ..... | ..... | ..... | ..... |
| | | *Cs. melanura* | + | + | .... | ..... | .... | ..... | ..... | ..... | ..... |
| Virginia | C | *A. atlanticus* | .... | .... | .... | + | .... | ..... | ..... | ..... | ..... |
| | | *A. crucians* | .... | .... | .... | ..... | .... | ..... | ..... | ..... | + |
| | | *A. infirmatus* | .... | + | .... | ..... | .... | ..... | ..... | ..... | ..... |
| | | *C. restuans* | .... | .... | .... | ..... | .... | + | ..... | ..... | ..... |
| | | *C. salinarius* | .... | + | .... | ..... | .... | ..... | ..... | ..... | ..... |
| | | *Cs. melanura* | + | + | .... | ..... | .... | + | ..... | ..... | ..... |
| North Carolina | C | *A. atlanticus* | .... | .... | .... | + | .... | ..... | ..... | ..... | ..... |
| | | *Cs. melanura* | + | + | .... | + | .... | + | ..... | ..... | ..... |
| | | *P. confinnis* | + | + | .... | ..... | .... | ..... | ..... | ..... | ..... |
| Georgia | C | *Cs. melanura* | + | .... | .... | ..... | .... | ..... | ..... | ..... | ..... |
| Florida | B | *A. atlanticus* | .... | .... | .... | + | .... | ..... | ..... | ..... | ..... |
| | | *A. crucians* | .... | .... | .... | ..... | + | ..... | ..... | ..... | + |
| | | *A. infirmatus* | .... | + | .... | + | .... | ..... | ..... | ..... | + |
| | | *A. taeniorhynchus* | .... | .... | .... | + | .... | ..... | ..... | ..... | ..... |
| | | *C. nigripalpus* | .... | + | .... | + | .... | + | ..... | ..... | ..... |
| | | *C. salinarius* | .... | + | .... | ..... | .... | ..... | ..... | ..... | ..... |
| | | *Cs. melanura* | + | + | .... | ..... | .... | + | ..... | ..... | ..... |
| | | *P. confirmus* | .... | .... | .... | ..... | + | ..... | ..... | ..... | ..... |
| Texas | A, H | *A. nigramaculis* | .... | .... | .... | ..... | .... | + | ..... | ..... | ..... |
| | | *C. quinquefasciatus* | .... | .... | + | ..... | .... | + | ..... | + | ..... |
| | | *C. tarsalis* | + | .... | .... | ..... | .... | + | ..... | + | ..... |
| Montana | F | *C. tarsalis* | + | .... | .... | ..... | .... | ..... | ..... | ..... | ..... |
| Colorado | A | *A. dorsalis* | + | .... | .... | ..... | .... | ..... | + | ..... | ..... |
| | | *A. vexans* | + | .... | .... | ..... | .... | ..... | ..... | ..... | ..... |
| | | *C. tarsalis* | + | .... | + | ..... | ..... | + | ..... | + | ..... |
| | | *Cs. inornata* | .... | .... | .... | ..... | .... | ..... | ..... | + | ..... |
| New Mexico | C | *A. dorsalis* | + | .... | .... | + | .... | ..... | + | ..... | ..... |
| | | *A. species*** | .... | .... | .... | + | .... | ..... | ..... | ..... | ..... |
| | | *A. vexans* | + | .... | .... | + | .... | ..... | ..... | ..... | ..... |
| | | *C. species* | .... | .... | .... | ..... | .... | ..... | ..... | + | ..... |
| | | *C. tarsalis* | + | .... | .... | ..... | .... | ..... | ..... | + | ..... |
| | | *Cs. inornata* | .... | .... | .... | + | .... | ..... | ..... | ..... | ..... |
| Oregon | F | *C. tarsalis* | + | .... | .... | ..... | .... | ..... | ..... | ..... | ..... |

*Reporting Laboratories
- A. Disease Ecology Station, Greeley, Colo., Technology Branch, CDC
- B. Florida State Board of Health, Encephalitis Research Center
- C. Arbovirus Unit, Laboratory Branch, CDC
- D. Center for Zoonoses Research, University of Illinois
- E. Massachusetts Department of Public Health
- F. Rocky Mountain Laboratory, Hamilton, Montana
- G. New Jersey State Health Department, Division of Laboratories
- H. Texas State Department of Health
- I. California State Department of Health
- J. Ohio State Department of Health

**Vesicular stomatitis virus isolated from this mosquito pool.

Table XV

Arbovirus Isolations from Birds*
1965

| State by Division | Reporting Lab** | Bird Species | Virus Isolated |
|---|---|---|---|
| Massachusetts | E | Black-capped Chickadee | EEE |
| New Jersey | G | Carolina Chickadee | EEE |
| | G | Wood Thrush | EEE |
| | G | Red-eyed Vireo | EEE |
| | G | House Sparrow | EEE |
| | G | Gray-cheeked Thrush | EEE |
| | G | Swainson's Thrush | EEE |
| | G | Grackle | EEE |
| | G | American Goldfinch | EEE |
| | G | White-throated Sparrow | EEE |
| | G | Slate-colored Junco | EEE |
| | G | Red-winged Blackbird | EEE |
| | G | Song Sparrow | EEE |
| | G | Starling | EEE |
| | G | Pigeon | EEE |
| | G | Pheasant | EEE |
| Maryland | C | Ovenbird | EEE |
| | C | Whippoorwill | EEE |
| | C | Scarlet Tanager | EEE |
| | C | Swainson's Thrush | EEE |
| | C | Bobwhite | EEE |
| | C | Chukar | EEE |
| Virginia | C | Red-eyed Vireo | WEE |
| | C | Cardinal | EEE |
| North Carolina | C | Blue Jay | WEE |
| | C | Sparrow | EEE |
| | C | Veery | WEE |
| | C | Cardinal | EEE |
| Georgia | C | Painted Bunting | EEE |
| Florida | B | Chukar | EEE |
| Texas | A | House Sparrow | WEE<br>SLE<br>Turlock<br>Hart Park<br>Cal. Complex*** |

* Sentinel flocks not included

** See code at bottom of Table XIV

*** Aedes trivittatus virus

Table XVI

Isolation of Arboviruses from Non-Avian Vertebrates, 1965
(excluding horses)

| State by Division | Reporting Lab* | Animal Species | Virus Isolated |
|---|---|---|---|
| New Jersey | G | Fox | EEE |
| | G | Squirrel | EEE |
| | G | Dog | EEE |
| | G | Opossum | EEE |
| | G | Wild Field Mouse | EEE |
| | G | Cricket Frog | EEE |
| | G | Carpenter Frog | EEE |
| | G | Green Frog | EEE |
| | G | Turtle | EEE |
| | G | Deer | WEE |
| | G | Wild Field Mouse | WEE |
| Florida | B | Fox | Bunyamwara |
| Texas | A | Jackrabbit | WEE, Turlock |
| | A | Ground Squirrel | WEE |
| | A | Prairie Dog | WEE |
| | A | Cotton Rat | WEE |
| California | I | Gray Tree-squirrel | WEE |

* See code at bottom of Table XIV

V. EQUINE ENCEPHALITIS, 1965

A compilation of cases of equine encephalitis in the United States reported to the Animal Health Division has been provided by Ralph C. Knowles, D.V.M., Chief Staff Veterinarian, Infectious Diseases of Equine, U.S. Department of Agriculture.

During 1965 a total of 4,391 cases and 705 deaths due to encephalitis were reported in horses and mules. Reporting practices are not consistent, but this is the largest number of reported equine encephalitis cases since 1947. A long-term trend of reported equine cases and deaths due to encephalitis from 1939 is shown in Table XVII. The number of reported equine cases and deaths in 1965 are shown by state in Table XVIII. An epizootic of encephalitis in equines due to EEE occurred along the eastern seaboard. Several north central and mountain states experienced equine epizootics due to WEE.

A number of different laboratories have reported isolation of arboviruses from horse brains in 1965. EEE virus was isolated from horses in Arkansas, Florida, Georgia, North Carolina, and South Carolina. WEE was isolated from horse brains in California.

Table XVII

Reported Incidence of Arthropod-borne Encephalitis of Equine in the United States 1939-1965*

| Year | Animals Affected | Deaths |
|---|---|---|
| 1939 | 8,008 | 2,471 |
| 1940 | 16,941 | 4,187 |
| 1941 | 36,872 | 8,210 |
| 1942 | 4,939 | 1,334 |
| 1943 | 4,768 | 1,662 |
| 1944 | 19,590 | 4,779 |
| 1945 | 3,212 | 1,165 |
| 1946 | 2,805 | 957 |
| 1947 | 8,716 | 5,086 |
| 1948 | 1,796 | 635 |
| 1949 | 4,037 | 2,426 |
| 1950 | 1,023 | 417 |
| 1951 | 762 | 274 |
| 1952 | 2,226 | 898 |
| 1953 | 2,813 | 827 |
| 1954 | 1,075 | 357 |
| 1955 | 1,236 | 663 |
| 1956 | 1,284 | 493 |
| 1957 | 1,525 | 639 |
| 1958 | 2,054 | 494 |
| 1959 | 817 | 324 |
| 1960 | 813 | 252 |
| 1961 | 781 | 245 |
| 1962 | 734 | 141 |
| 1963 | 2,426 | 162 |
| 1964 | 3,950 | 392 |
| 1965 | 4,391 | 705 |

* Source of data: USDA, Animal Health Division

Table XVIII

Arthropod-borne Encephalitis of Equine Reported in the U.S.
During Calendar Year 1965 *

| State by Division | No. of Horses & Mules Infected | Number of Deaths |
|---|---|---|
| Maine | - | - |
| New Hampshire | - | - |
| Vermont | - | - |
| Massachusetts | - | - |
| Rhode Island | - | - |
| Connecticut | - | - |
| New York | - | - |
| New Jersey | 5 | 5 |
| Pennsylvania | - | - |
| Ohio | - | - |
| Indiana | 1 | - |
| Illinois | 152 | 15 |
| Michigan | - | - |
| Wisconsin | 40 | 1 |
| Minnesota | 12 | 1 |
| Iowa | 812 | - |
| Missouri | 110 | 1 |
| North Dakota | 19 | - |
| South Dakota | 163 | 28 |
| Nebraska | 358 | 57 |
| Kansas | 61 | - |
| Delaware | 8 | 8 |
| Maryland | 7 | - |
| Virginia | 32 | 32 |
| West Virginia | - | - |
| North Carolina | 461 | 461 |
| South Carolina | 40 | 11 |
| Georgia | 60 | 6 |
| Florida | 49 | 34 |
| Kentucky | - | - |
| Tennessee | - | - |
| Alabama | - | - |
| Mississippi | 7 | 7 |
| Arkansas | 114 | - |
| Louisiana | 35 | 19 |
| Oklahoma | 540 | - |
| Texas | 267 | - |
| Montana | 330 | - |
| Idaho | 20 | - |
| Wyoming | 182 | - |
| Colorado | 261 | - |
| New Mexico | 64 | - |
| Arizona | 14 | - |
| Utah | 22 | 14 |
| Nevada | 5 | - |
| Washington | 3 | - |
| Oregon | 25 | 3 |
| California | 112 | 2 |
| Alaska | - | - |
| Hawaii | - | - |
| Puerto Rico | - | - |
| TOTAL | 4,391 | 705 |

- means none, unknown, or not reported
* source of data: USDA, Animal Health Division

Key to all disease surveillance activities are those in each State who serve the function as State epidemiologists. Responsible for the collection, intrepretation and transmission of data and epidemiological information from their individual States, the State epidemiologists perform a most vital role. Their major contributions to the evolution of this report are gratefully acknowledged.

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| Arizona | Dr. Philip M. Hotchkiss |
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| Delaware | Dr. Floyd I. Hudson |
| D. C. | Dr. William E. Long |
| Florida | Dr. E. Charlton Prather |
| Georgia | Dr. W. J. Murphy |
| Hawaii | Dr. Ralph B. Berry |
| Idaho | Dr. John A. Mather |
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| Wisconsin | Dr. Robert Alberts |
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