APPLICATIONS OF ENZYME-LINKED IMMUNOSORBENT ASSAY IN VETERINARY MEDICINE: A BIBLIOGRAPHY

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ABSTRACT

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During the last decade enzyme-linked immunosorbent assay has been a technique of major interest to those engaged in immunodiagnostics of human and animal diseases. Owing to its simplicity, specificity and sensitivity it has taken precedence over other conventional assays, including radioimmunoassay on the grounds of freedom from radiation hazards. Many applications of this assay have been developed in veterinary medicine and they are listed in this article.

INTRODUCTION

The ideal characteristics of a diagnostic test are speed, sensitivity, specificity, safety, potential for automation, broad applicability and potential for field use. The search for an assay to meet these criteria led to the development of enzyme-linked immunosorbent assay (ELISA) which also has the following advantages:

1. Enzyme-labelled antigens and antibodies stored under sterile conditions can be used for years without any appreciable loss of their enzymatic and immunological activities (Sharma et al., 1982).

2. Enzyme-immunoassays are easy to manipulate and they pose a minimum risk of contamination, pollution and health hazards.

3. There is no need for costly equipment and the assay can be performed easily in a conventionally equipped laboratory.

4. The possibility of using fluorogenic substrates makes enzyme immunoassays a tool of tremendous potential, since they can detect extremely small quantities of antigen or antibody, e.g.
to the extent of $10^{-17}$ g of cholera toxin. The serious limitation of such an assay is that it requires a meticulous standardization for each system independently. The optimal timings for each step and for the other requirements such as concentration, incubation temperature and pH have to be ascertained precisely, maintaining sufficient control for each reagent. Fortunately, monoclonal antibody has been very useful for generating antisera of predictable specificity, able to overcome background reaction.

The enzyme immunoassays were pioneered a decade ago by Engvall and Perlmann (1971) and are now methods of choice in routine diagnosis. In veterinary practice, sero-epidemiological surveillance is often more important than the diagnosis of disease in an individual animal. ELISA can be applied to gain information regarding the spread of infections, the effectiveness of vaccines in stimulating antibody production and the levels of herd immunity. Many reviews dealing with the various aspects of the assay have been published (Schuurs and Van Weemen, 1977; Jacobson et al., 1978; Voller et al., 1978; O'Beirne and Cooper, 1979). The present review summarizes the applications of the technique specifically in veterinary medicine.

APPLICATION OF ELISA

In principle, ELISA can be applied to all antigen-antibody systems. Numerous applications of ELISA have been developed to-date, including infectious diseases (viral, bacterial, parasitic, fungal), hormones, oncofetal proteins, toxins, serum proteins, drugs and others such as snake venom, adenosine and DNA.

Possibly the greatest potential for ELISA rests in its ability to detect the antigens of infectious agents in clinical specimens. The use of staphylococcal protein-A as the substitute for specific immunoglobulin has doubtlessly increased the horizon of the technique by increasing its versatility and rendering it more economical (Potgieter et al., 1980). However, in certain instances it may be at the cost of the specificity. A wide range of applications has been discovered with regard to detecting a single antigen or antibody, and the scope of the technique may be further broadened in future by screening more than one type of antigen or antibody simultaneously in a single sample by carefully sensitizing the solid phase.
TABLE 1

Publications dealing with the applications of ELISA in veterinary medicine

| VIRUS                              | Authors and Years |
|------------------------------------|-------------------|
| African swine fever                | Saunders et al., 1977 |
|                                    | Wardley et al., 1979 |
|                                    | Hamdy et al., 1981 |
| Aleutian disease                   | Wright et al., 1980 |
| Avian adenovirus                   | Dawson et al., 1980 |
| Avian encephalomyelitis            | Sytuo and Matsumoto, 1981 |
| Avian infectious bronchitis        | Garcia and Bankowski, 1980 |
|                                    | Mockett and Derbyshire, 1981 |
|                                    | Soula and Moreau, 1981 |
|                                    | Nandapalan et al., 1982 |
| Avian leukosis                     | Smith et al., 1979 |
| Aujeszky's disease                 | Snyder and Stewart, 1977 |
|                                    | Moutou et al., 1978 |
|                                    | Briaire, 1979 |
|                                    | Todd et al., 1981 |
| Blue tongue                        | Hubschle et al., 1981 |
| Bovine leukemia                    | Ressang et al., 1978 |
|                                    | Behrens, 1979 |
|                                    | Todd et al., 1980 |
|                                    | Gielkens et al., 1981 |
| Bovine parvovirus                  | Albery et al., 1981 |
| Canine adenovirus                  | Noon et al., 1979 |
| Canine distemper                   | Noon et al., 1980 |
|                                    | Bernard et al., 1982 |
| Coronavirus                         | Ellen et al., 1979 |
|                                    | Callebaut et al., 1982 |
| Equine infectious anaemia          | Shen et al., 1979 |
|                                    | Suzuki et al., 1982 |
| Equine infectious peritonitis      | Osterhaus et al., 1979 |
| Feline leukemia                    | Sabin and Finnimore, 1980 |
|                                    | Waits et al., 1982 |
| Foot and mouth disease             | Abu-Elzein and Crowther, 1978 |
|                                    | Abu-Elzein and Crowther, 1979 |
|                                    | Crowther and Abu-Elzein, 1979 |
Infectious bovine rhinotracheitis  Bommeli et al., 1980
Herring et al., 1980
Solsona et al., 1980.
Bolton et al., 1981

Infectious bursal disease  Marquardt et al., 1980
Howie and Thorsen, 1981
Srivastava et al., 1982

Marek's disease  Charan et al., 1981
Charan et al., 1983

Murine leukemia  Nexo, 1976

Newcastle disease  Assaf et al., 1982

Porcine cytomegalovirus  Atanasiu et al., 1977
Slaght et al., 1978
Rossiter et al., 1981
Anderson et al., 1982

Rabies  Scherrer and Bernard, 1977
Ellen and Leeuw, 1978
Yolken et al., 1978
Bachmann, 1979
Payment et al., 1979
Stucker et al., 1979
Grauballe et al., 1981

Rinderpest  Parker et al., 1979

Rotavirus  Hamblin and Crowther, 1982
Roehrig, 1982

Sendai  Houwers and Gielken, 1979

Swine vesicular disease  Byrd et al., 1979
Magee, 1979
Ruppanner et al., 1980
Thoen et al., 1980 b
Rai et al., 1982
Fuentes et al., 1982
Fekadu et al., 1979
Sahu et al., 1979
Ellen et al., 1979 b
Lloyd, 1981
Nicolet et al., 1981

BACTERIA

Brucellosis

Chlamydia

Corynebacterium

Contagious equine metritis

E.coli

Pseudomonas

Haemophilus
| Pathogen       | References                                      |
|---------------|-------------------------------------------------|
| Johne's disease | Jorgensen and Jensen, 1978                      |
| Mycoplasma    | Gee, 1979                                       |
|               | Onoviran and Taylor-Robinson, 1979              |
|               | Ansari et al., 1980                             |
|               | Boothby et al., 1981, 1982                       |
|               | Lutz et al., 1982                               |
| Pasteurella   | Burrells et al., 1979                           |
|               | Marshall et al., 1981                           |
| Pseudomonas    | Ueda et al., 1982                               |
| Streptococcus | Logan et al., 1982                              |
| Tuberculosis  | Morris et al., 1979                             |
|               | Reggiardo et al., 1980                          |
|               | Thoen et al., 1980c                             |
| Parasites     |                                                 |
| Anaplasma     | Thoen et al., 1980a                             |
| Babesia       | Bidwell et al., 1978                            |
|               | Young and Purnell, 1980                         |
| Dictyocaulus  | Marius et al., 1979                            |
| Dirofilaria   | Grieve et al., 1981                             |
| Fasciola      | Burden and Hammet, 1978                         |
|               | Hillyer and Weil, 1979                          |
|               | Farrell et al., 1981                            |
| Ostertagia    | Keus et al., 1981                               |
| Sarcocystis   | Tadros et al., 1979                             |
| Strongyloides | Murrell et al., 1982                            |
| Taenia        | Craig, 1979                                     |
| Toxocara      | Harrison and Sewell, 1981                       |
| Toxoplasma    | Savigny et al., 1979                            |
|               | Ambroise-Thomas et al., 1978                    |
|               | Denmark and Chessum, 1978                       |
|               | Lin et al., 1980                                |
|               | Yen et al., 1981                                |
| Trichinella   | Ruitenbergen et al., 1976                       |
|               | Taylor and Kenny, 1978                          |
|               | Taylor et al., 1978                             |
|               | Ruitenbergen and Buys, 1979                     |
|               | Knapen et al., 1980                             |
| Trypanosoma   | Luckin and Mehlitz, 1978                        |
|               | Luckin et al., 1978                             |
|               | Silayo et al., 1980                             |
MISCELLANEOUS

Enterotoxins
Fungi
Hormones
Immunoglobulins
Meat identification

Fey et al., 1980
Ambroise-Thomas et al., 1978
Richardson et al., 1979
Larsson and Lumsden, 1980
Arnstadt and Cleere, 1981
Butler et al., 1980
Kangethe et al., 1982

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