REVIEW OF LITERATURE
HISTORY OF LEPROSY

Leprosy is a disease of great antiquity; its origin and early spread is, however, largely a matter of surmise. Possibly it originated in Africa and had spread very early to India. Scott (1943) remarked that it was not possible to declare with certainty, in what country leprosy originated but study of available records point out to its first home being Africa.

Shamamata had quoted that "In Sheherat Samite (600 BC) one finds a reasonably good account of clinical features and treatment of disease and references of leprosy are made as "Vat-Sakata" or "Vat-Shonita" and "Kushta" in this book.

If laws of Huns, regarded to contain certain instructions about the prophylaxis of leprosy according to Sager and Nair (1940) and Lowe (1942), the disease mentioned in Vedas as "Kushta" will date back to 1600 BC.

Sir William MacArthur pointed out that word leper is derived from a word meaning, a scale or parchment and that the Latin word for leech-keeper has the same derivation (Ogilvie et al, 1986).

Leprosy is mentioned at several places in Bible but it is doubtful whether the words have same reference to the disease leprosy that we know today.
Sarath in Jewish literature and leprosy in Arabic literature stand for scaly and fungal diseases. The term Sarath in Old Testament and the term leprosy in New Testament have been considered by many authors to refer to leprosy and in all Biblical translations have been rendered as leprosy.

This view however is being challenged by many recent writers including Lio (1939) and Linder (1952). Anderson (1969) has reviewed the whole matter carefully and has concluded that there is no evidence of leprosy in Biblical writings. This is probably an unfortunate association that Biblical leprosy and the disease, as we now know, have assumed the same name.

**Epidemiology of Leprosy**

It is a fact that leprosy is an infectious disease, caused by Mycobacterium leprae. It has attracted and intrigued immunologists over the last decade for various reasons. Firstly, a large population is exposed to Myco.leprae infection and go through a stage of subclinical infection. Most of these people are able to mount a resistance to Myco.leprae infection. A minority group of population, due to unknown mechanism, are unable to mount a proper immune response against Myco.leprae invasion. These people manifest variety of clinical symptoms ranging from single, often self-healing lesions as tuberculoid leprosy, to a disseminated and progressive disease manifested as lepromatous leprosy.
Secondly, despite of long generation time of Mycobacterium leprae, leprosy may be punctuated by acute exacerbation episodes with features in common with hypersensitivity reactions.

Thirdly there is lack of methods for identification of high risk group and immunoprophylaxis in the leprosy naïve (Gedal 1976).

In the great majority, an effective immune response is to arrest the multiplication of Mycobacterium leprae at subclinical level and this prevents the development of clinical manifestations. Among those who develop clinical manifestations, immune responses to Mycobacterium leprae seem to play a major part in expression of clinical symptoms.

1- CHARACTERIZATION OF MYCOBACTERIUM LEPRAE ANTIGEN AND DEMONSTRATION OF HOST RESISTANCE TO INTRACELLULAR BACTERIA:

Mycobacterium leprae is an obligate intracellular organism with especial affinity for skin, nerve and muscle tissues. It has a very long generation time, some where between 10-30 days in comparison to tubercle bacillus which divides about every 20 hours and coliform bacteria every 20 minutes. The leprosy bacillus however, still defies cultivation outside the human body, although the situation has been alleviated to some extent by discovery of amniotic in which
injected human lepra bacilli recovered from leprosy patient can grow and yield substantial quantities of antigenic material (Kirchheiner and Sterre 1971, Kirchheiner and Sanchez 1973).

Harboe et al (1978) carried out immunochromical characterization of Myco. leprae by crossed immunoelectrophoretic analysis, but failed to identify any specific antigen in Myco. leprae. All the seven antigen which they had isolated from Myco. leprae cross reacted very strongly with other mycobacteria.

Moreover, Kronwall et al (1976) isolated Myco. leprae specific antigen from purified Myco. leprae, obtained from unirradiated, non autoclaved infected armadillo tissue. Abe et al (1978) described two protein antigen MSPR and MSCI. Both elicit skin reactions in leprosy patients but only the former produces the antibody in rabbits. Ravalkar (1971) defined five antigens of Myco. leprae three being species specific. Similarly, Stamford and Reck (1976) described twelve antigens, four of which are specific for Myco. leprae. Sreen and Sengupta (1981) also isolated greatly two components from autoclaved leproxia by immunoelectrophoresis. One of these antigens reacts with antibody present in leprosy sera and forms a precipitin line near cathode and other component forms a streak from wall and never
towards anode. The latter component only induces delayed type of hypersensitivity skin reaction in tuberculous patients. This study indicates that specificity of antigen may lie in the latter fraction.

II- HISTOPATHOLOGICAL AND CLINICAL CLASSIFICATION

BASED ON IMMUNITY:

The spectrum of clinical manifestation caused by infection with Myco. leprae includes two polar type of infection lepromatous and tuberculosis leprosy; a very broad range of intermediate forms classified as borderline (Arnold 1974, Reis and Emlay 1978). Ridley and Jopling (1963, 1966) have provided a nomenclature, in the form of system of diagnostic classification, that is fundamental to most current immunological investigations. The following classification was developed as a result of careful correlation of the clinical features of the disease and histopathological pattern in skin biopsies.

TT  Tuberculoid polar (High resistance form)
BT  Borderline tuberculoid
BB  Border line
BL  Borderline lepromatous
LL  Lepromatous polar (Low resistance form)
In study of patients in Malaysia, Ridley and Waters (1969) separated a ninth group from the Ridley-Jopling classification that lay between true polar lepromatous and borderline lepromatous; this subpopulation category was named as leproma indefinite (LI). Patients with LI were found to clear APs more rapidly than patients with LL.

An analogous tuberculoïd indefinite (TI) group that lay between TT and BT was defined by Ridley (1973), which completed a seven numbered spectrum - TT, TI, BT, BI, BL, LI and LL in continuity.

Myrvang et al (1973) studied Mycobacterium leprae induced lymphocyte transformation and migration-inhibition factor production and found that lymphocytes from patients with LI did not respond in a greatly different manner than from those patients with LL, which suggests that distinction between LL and LI may be spurious immunologically. Rao et al (1976) have shown that some histologically classifiable as LI have clinical features of LL. Thus histological distinction between LL and LI is without importance.

It is clear from above that five numbered classification of Ridley and Jopling (1966) is useful in clinical application, where clinicians can have an idea regarding the extent of disease process.
especially when a patient is shifting immunologically
either upward or downward in the spectrum. The stage
of immunity in patients have been worked out in detail
along with Ridley-Jepleing scale. It is obvious from
studies that as a disease glides down gradually in
spectrum from tuberculous to lepromatous end of the
pole, there is gradual decrease in cell mediated
immunity.

Variant forms of leprosy not included in
Ridley-Jepleing scale:

There are two other important variant of
leprosy which are not included in Ridley-Jepleing
classification.

1. Indeterminate leprosy:

The clinical and histological features are
not so distinct in this early stage of disease as to
provide definite nature of immunological status.
There are one or more hypopigmented macule. The
indeterminate lesions may apparently regress
spontaneously or progress to become tuberculous,
borderline or lepromatous leprosy or remain as
indeterminate over a prolonged period of time.
The mechanism behind the hypopigmentation remains
unknown. Gedal (1976) has quoted the possibility
that lym.Pseudo itself interferes with pigment
production. Another is that nonspecific infiltration of inflammatory cells suppresses pigment production. The fact that Myco. leprae may be found in large quantities in lepromatous patients without hypopigmentation favours the last hypothesis.

(3) Primary Neuritic Leprosy:

The cases in which nerve involvement is the result of infection spreading up the cutaneous nerves from a patch of leprosy are known as secondary neuritis. The cases in which the neuritic changes are independent of any existing or part of skin lesions are known as primary or pure neuritis.

Indian classification as suggested by Bhambhore and Chatterjee (1953) and classification suggested by Vaca (1963), has given the name "Pure poly neuritis" for pure neuritis (mono or poly).

III- ADVERSE EFFECTS OF DOWNS RESPONSES TO MYCOBACTERIUM LEPRAE:

In spite of long generation time of Myco. leprae and its low toxicity, leprosy patients may succumb to attacks of acute inflammation in affected tissues which are not due to secondary infection or trauma. Such reactions have been named classified into numerous types. However, two types of these reactions have been clearly defined
and extensively studied from an immunological point of view during the last decade, namely erythema nodosum leprosum and borderline reactions.

(A) Erythema nodosum leprosum (ENL):

ENL is only found in highly bacilliferous patients, i.e. in BL-LL patients especially when they are put on anti-leprosy treatment. The most common symptom is painful erythematous subcutaneous nodules from which the name ENL is derived (See and Levan 1975). The appearance of these nodules is often associated with fever and some times complicated by neuritis, arthritis, iridocyclitis, arthritis, proteinuria, and/or lymphadenopathy. Histology shows microscopic feature akin to Arthus reaction that is perivascular infiltration with granulocytes. Deposition of immunoglobulins and complement (C3) have been shown by immunofluorescence technique in cases of ENL. However workers have also shown presence of higher levels of C3-A in plasma of ENL patient (in 70% cases) as compared to those in LL patient (10% cases) (ENL 1983). Thus in ENL there may be other factors involved in activating complement which are yet to be explored.

Leprosy, like other chronic inflammatory diseases, causes secondary amyloidosis. It is
interesting to note that patients with recurrent ENL reaction seem to especially at higher risk to develop amyloidosis. Other complications reported in lepromatous patients which may be related to circulating immune complexes include glomerulonephritis, polyarthritis and myositis. ENL is an important cause of nerve damage when the reaction takes place in nerve. Another major type of nerve damage in LL appears to be a slow and progressive in nature, primarily affecting cutaneous nerves. Histologically this lesion is characterized by large number of bacilli within Schwann cells, endoneural and perineural macrophages and perineural cells. There is thickening of epimysium with deposition of collagen and fibrosis (Godal 1979).

(3) Borderline reactions:

Borderline patients without bacilliferous lesions may also develop reactions. These lesions are clinically characterized by intracutaneous hyperemia, edema and induration. Such changes may occur in old lesions or new lesions, referred to as lepra-reaction. It is evident that the lepra-reaction is only one type of reaction occurring in the leprosy. It has been assumed that borderline reactions may be subdivided into two types, namely reverse reaction or upgrading reactions and down grading reactions.
(i) Reversal reactions or upgrading reactions:

These reactions occur in BB, BB, BL and rarely in LL subpolar type of leprosy. Reversal or upgrading reactions are associated with a movement towards tuberculoid pole. Clinically the lesions are characterised by skin erythema, oedema and peripheral neuritis. Histologically the lesions consist of mainly lymphocytes and epithelioid cells with or without giant cells. Number of bacilli in the lesions are diminished. Lymphocyte transformation test (LTT) and Lymphocyte Migration Inhibition Test (LMIT) to Mycobacterium leprae are generally much stronger than expected. This type of high immunological boost leads to oedema of nerve. Such a rapid upgrading in immunity often leads to nerve damage, consequently deterioration in the form of deformity is noted in such patients.

Serial lymphnode biopsies have been studied in four patients with reversal reactions (Yusuf and Water, 1971). Little change was noted in two patients who had mild reversal reactions. However, in two patients who had more severe reactions shifting from LI to BB in one case and BB in other was observed.

(ii) Down grading reactions:

These reactions are usually mild and occur in untreated BB, BB and BL patients. In such cases, there is paucity of cell mediated immunity.
Consequently in the immunological scale, these patients move down in the spectrum towards the lepromatous pole.

IV- THE NATURE OF IMMUNOLOGICAL DEFICIENCY IN LEPROSY:

There are two types of immune responses, humoral and cellular. The humoral response is characterized by synthesis of antibody molecule specific to immunizing antigen, their release in circulation and hence appearance in the serum. Lack of such detectable serum antibody distinguishes the cellular immune phenomenon. Various in vivo and in vitro tests have been employed to assess the immunological status of patients.

A- Studies in vivo:

Skin tests:

In men the most important diagnostic test for cell mediated immunity is skin testing with appropriate antigen. When the skin tests are evaluated by an experienced observer for the quality (i.e. induration, edema, time course) as well as the size of reaction, they can provide valuable information.

a) Lepromin antigen:

Studies of immunological reactivity in leprosy patients have demonstrated diverse alteration in the two polar forms of the disease. The lepromatous type of disease goes virtually unchecked
by the host with his macrophage laden with bacilli,
high titre of serum antibodies bathing the tissue,
showing negative delayed hypersensitivity to lepromin;
and self limited course tuberculoid type with few
lepra bacilli, detectable little or no serum antibody
and markedly positive delayed hypersensitivity to
lepromin.

Two types of reactions are observed at the
site of inoculation of lepromin. A tuberculin like
reaction occurring at 34 to 48 hours is called
Fernandez (1940) reaction and indurated nodule which
appears 3 to 4 weeks later is called the Mitenda
(1919) reaction.

Two types of lepromin antigens are commonly
used (i) Mitenda-Nayashi antigen and (ii) Shamendra
antigen. Shamendra antigen gives a well marked
early reaction and weak late reaction whereas
Mitenda-Nayashi lepromin generally gives rise to a
weak early and a strong late reaction. The early
reaction or Fernandez reaction has been described as
a delayed hypersensitivity reaction to soluble
constituents of the leprosy bacillus (Shamendra, 1941)
whereas the bacillary component is needed for
inducing the late reaction.

Bullock (1960) has compared the response of
Mitenda and Shamendra antigen in tuberculoid and
lepromatous patient at 48 hours and at 3 weeks time. He found diminished response in lepromatous patient as compared to tuberculinoid patient with both antigens. Taiwar et al (1972), have studied the lepromin test, both early and late reaction, in the spectrum of leprosy and they found that the early as well as late reactions were negative in LL but early reaction was positive in new BL. EB patient showed only positive early reaction while late reaction was negative while MT, TT patient showed both early as well as late reaction as positive. Similar observations have been of other workers (Bodi et al, 1976; Job et al, 1976; Rao et al, 1976; Sharma et al, 1979; Kumar et al, 1980; Rao and Rao 1981).

b) Candida antigen:

The difference in the response between tuberculinoid and lepromatous cases of leprosy to inoculation of lepromin has been assumed to reflect a particular type of immune response of patients. Studies have been made to find out the differences in the immune response in leprosy cases using non specific antigens like Candida.

Seck et al (1969) have shown diminished response using Candida albicans antigen both in lepromatous as well as in tuberculinoid patients in comparison to controls. Belloiak (1968) studied the
Immunological response in tuberculoid and lepromatous leprosy and diminished response was found in both type of cases, but was more diminished in untreated cases than treated cases.

c) Other antigens:

The ability of an individual to respond to various other types of antigens depends upon previous exposure, age, prior testing and other factors.

Saha and Mittal (1971) have studied normal lymphocyte transfer test (NLT) after intradermal injection of 2.5 million lymphocyte and D2 Mitrochlore Bensone (DNCB) contact delayed hypersensitivity test in both lepromatous and tuberculoid leprosy. In most of the cases of lepromatous leprosy the NLT reaction has been flat. While in tuberculoid first peak was observed. On the other hand in controls two peaks were observed. This indicates that variable number of cases of both lepromatous and tuberculoid are associated with diminished CHI. The frequency and severity is much more common in lepromatous than tuberculoid.

They have also shown that when 100 mg DNCB was challenged to the patients, only 10% of lepromatous and 16.6% of tuberculoid patients gave the positive results. On the other hand when the patients were challenged with 400 mg, 60% lepromatous cases and
100% tuberculoid cases showed positive results. When dose was increased up to 1000 µg then 77% lepromatous and 100% tuberculoid cases showed positive results. Thus if a weak stimulus has not been sufficient to attract the necessary number of healthy immunocompetent cells out of total number of lymphocyte population crowded at the test side, then in the same case a stronger stimulus may attract the required number of immunologically competent cells necessary for expression of delayed allergic response explaining thereby why a bigger dose of an antigen could produce a positive skin test in cases in which lesser dose of same antigen has failed to induce it. Similar observations have been of other workers (Ouniyo 1968; Leiber 1968; Turk and Weters 1969).

Rae et al (1974) have studied 43 lepromatous leprosy cases using streptokinase, streptodornase, umps antigen, trichophyton and histoplasmin. They found diminished delayed hypersensitivity response in lepromatous leprosy cases as compared to controls.

Recently Kumar et al (1980) studied skin delayed hypersensitivity test using PPD, DNCB, Ochtilidium, Croton oil and histamine. They have found that lepromatous group show either very mild
reaction or negative reaction. While significant response in B2 and T1 was observed. Thus showing the importance of cutaneous skin test in B2 to detect the shift towards any end of the immunological spectrum.

B- Studies in vitro:

1) Status of Y and B-cells:

Harris et al (1965) had shown that the lymphocytes were involved in immunological mechanism. It is now recognized that lymphocytes form an indispensable component of body's immune system and act as precursors of cells that will give rise to both cell-mediated and humoral immune responses.

Studies by Claman et al (1966), Davis et al (1967); Miller and Mitchell (1968) indicated that at least two population of lymphocytes were involved in most of immune responses and they differed in their anatomical distribution. Cells of one population were the precursor of plasma cells. They were present in the bone marrow but not in the thymus and they corresponded to the Bursa dependent system of chickens. Another population was dependent on and are derived from thymus and although they had an obligatory role in most antibody responses, they did not themselves turn into plasma cells. These two population of lymphocytes are currently known as Y-cell (Thymus dependent) and B-cell (Bursa equivalent derived) (Mitsut et al 1969).
Graves et al. (1973) had shown that T-cells appear to be concerned with cell-mediated immunity and B-cells with humoral immunity. T-lymphocytes play a major part in immune response to facultative organisms, tissue or organ graft and certain infection with viruses. B-lymphocytes mature to become antibody producing plasma cells and play a role in humoral antibody response (Evans, 1975).

T and B lymphocyte population comprises a number of functionally different subsets and it may be possible to distinguish between these two subsets. T-cells are recognized by their ability to bind with sheep red blood cells spontaneously in a characteristic morphological configuration termed as rosette (Fudenberg, 1975). While human B-cells possess surface immunoglobulin detectable by direct immunofluorescence (Seligman, 1974). They also possess receptors for aggregated immunoglobulin, for antigen antibody complex and for third component of complement (C3). These receptors are detectable by erythrocytes coated with antibody and complement that surround B-lymphocytes in a cluster (Mendes et al. 1975).

Immunity to intracellular organisms is dependent on cell mediated immune mechanisms rather than humoral antibodies. Further more studies on
experimental animals have revealed that carriers of this immunity are T-cells. However T-cells are capable of killing the organism directly but this function is accomplished through the molecular phagocytes (macrophages). At least two phases seem to be involved. In initial phase when foreign antigens are encountered in tissues, T-cell increases the antibacterial activity of surrounding macrophages and this is called as "macrophage activation phase". These macrophages are stimulated by the liberation of lymphokines (molecular mediator) from the T-cells. Later on chemotactic substances are released which increase the influx of macrophage precursors (monocyte) in lesion. This phenomenon has been called as macrophage mobilization (Godel, 1978).

From above description, it is evident that T-cell status is an important factor in the assessment of cell mediated immunity. Various workers have shown that the T-cell count in the peripheral blood had decreased gradually in the spectrum of leprosy from tuberculoid pole to lepromatous pole; maximum fall being in lepromatous and minimum being in tuberculoid pole. Contrary to this T-cell count is found to be increased towards lepromatous pole than tuberculoid pole (Suyer et al 1973; Ganipowonske et al 1973; Liu et al 1974; Shigie et al 1977; Sharma et al, 1979; Sushkov et al, 1980). Verma et al (1971) had
studied only B-cell status obtained by teasing
the lymphnode from lepromatous leprosy patients and
found that B-cell count was increased in the lymphnode
of lepromatous leprosy cases as compared to B-cell
count from lymphnodes of normal human being. It is
similar to the findings of B-cell count in peripheral
blood by other workers.

Mendes et al (1974) have studied T and B
cells in peripheral blood as well as in lymphnode of
lepromatous leprosy cases. A significant decrease in
proportion of T-cells was observed in peripheral blood
and depletion of T-cells in paracortical areas of
involved lymphnode indicating impaired cell mediated
immunity. B-cells were found to be increased in
peripheral blood as well as preservation of B-cell
area was seen in lymphnodes. Similar observations
have been obtained by Mehtian et al (1989) in the
study of cellular changes in spleen.

ii) Status of suppressor cells:

It has been established that there is failure
of T-cells in lepromatous patients to respond to
antigens of lepra bacillus. The mechanism for this
selective unresponsiveness remains unknown (Goda 1978).

It has been postulated that unresponsiveness
of lepromatous patient to the antigen of lepra bacillus,
and their possible responsiveness to related antigens
of tubercle bacillus would be due to presence of a specific population of suppressor lymphocytes capable of being triggered by at least one unique antigen of lepra bacillus. Mehra et al (1980) in their study have shown the ability of lymphocytes from leprosy patients exposed to Dhamondra lepromin to suppress the response of the population of cells to the T cell antigen, Con A. Significant Myco.leprae induced suppression of Con A response was found with peripheral blood lymphocytes of 22 out of 35 lepromatous patients and 15 out of 18 patients with borderline lepromatous or borderline tuberculoïd.

In contrast, lepromin-induced suppression of only 2 out of 11 tuberculoïd patients and 2 out of 30 normal donors was observed, indicating a correlation between suppression in vitro and the degree of unresponsiveness observed in the patients.

iii) Status of macrophages:

The macrophage, a phagocytic cell endowed with bactericidal power in their lysosome, plays a vital defensive role in microbial invasion in host.

In diseases such as leprosy, which are caused by bacteria growing intra cellularly and mainly inside macrophage, this cell is undoubtedly the immediate effector cell which is responsible for death and
elimination of the pathogenic agent. The elegant studies of Mackaness (1969) clearly suggest that the bactericidal and bacteriocytic properties of macrophages in this type of infection reach their fullest expression of these cells by specifically sensitized lymphocytes.

In 1967, Barbieri and Correa reported that macrophages from Mitsuda-negative individuals were inactive in vitro against Myco. leprae, while macrophages from Mitsuda positive persons caused the lysis of bacillus in vitro. Similar results have been observed by Beignelman (1967) and Pissani et al (1979).

Recently Birdi et al (1980) have shown that macrophages from lepromatous patients after phagocytosis of Myco. leprae showed alteration in their surface property as determined by their ability to express Fe receptor. The same macrophage without intracellular Myco. leprae shows normal Fe receptor. The lepromatous macrophages also show very poor interaction with lymphocytes in presence of Myco. leprae, while they are able to interact with lymphocytes when exposed to other antigens. There appears to be a defective macrophage population in lepromatous patients that is unable to process Myco. leprae antigens and initiate the CD2 response.
iv) Lymphocyte blast transformation test:

Mitogenic response of peripheral lymphocytes to phytohaemagglutinin (PHA), in vitro has been used to assess the functional capacity of T-cells, which is an indirect assessment of cell mediated immune response.

Diarks and Shepard (1968) have studied the blastogenic response in leprosy patients using PHA, PPD, and BCG in a 5 days culture of peripheral lymphocytes at 37°C and found that most of lepromatous leprosy cases had markedly depressed lymphocyte response to PHA as well as to mycobacterial antigens. The response to PHA was only moderately depressed in patients with tuberculoa leprosy. Similar type of result had been also observed by other workers either using only PHA or other antigens for 3 to 7 days. (Kan et al, 1971; Puri et al 1971; Nelson et al 1971; Gedal et al 1971; Bullock et al 1971; Mohra et al 1973; Ulrich et al 1973; Talwar et al 1973; Lim et al 1973; and Job et al 1976).

Kokkonen et al (1977) had studied the PHA response along with T-lymphocytes in peripheral blood and had suggested that depressed response to PHA was associated with reduction in circulating T-lymphocytes. The other workers had also observed the same response (Kan et al 1976; Koth et al 1977; Sharma et al 1979; Chen et al 1980; Dubey et al 1981).
v) Leucocyte migration inhibition test (LMIT):

LMIT appears at present to be the most promising test for evaluation of cell mediated immunity. Myrvang et al (1973) have studied the CMI response using lymphocyte transformation test as well as LMIT and found diminished response from TT to LL. Similar have been the observations of Rao and Rao (1981).

vi) Serology of leprosy:

There are evidences that antileprobacterial antibodies are produced in leprosy and these circulating antibodies probably do play an important role in the immunopathology of lepromatous leprosy. Nemhau et al (1969) have reported the presence of immunoglobulins, complement and soluble mycobacterial antigens in the lesions of erythema nodosum leprosum (ENL).

Mohan et al (1978); Hojes-Espinoza et al (1973) and Geiber et al (1974) have demonstrated substances in the sera of patients with ENL which precipitate with C4q component of complement system and may be immune complexes. Several studies have shown the presence of renal lesions, particularly in patients with ENL, which
are consistent with pathology of immune complex
glomerulonephritis (Shue, 1972; Drutz and Gutman,
1973; and Bullock et al, 1974).

Autoantibodies of many type, including
rheumatoid factors, anti-thyroglobulin precipitins,
antinuclear antibodies and antibodies which fix to
intercellular areas of epithelial surfaces have
been reported in lepromatous patients. In vivo
fixation of immunoglobulin in basement membrane
zone of skin of lepromatous patients has been
reported by Bullock et al (1974) and Guimeria

Various serological tests are also
carried out for early diagnosis of leprosy.
These include leproagglutination test, indirect
fluorescent antibody test (IFT-ABS) and
radio-immune assay.