Expression of Laminin Receptor in Normal and Carcinomatous Human Tissues as Defined by a Monoclonal Antibody

P. Horan Hand,1 A. Thor, J. Schlom, C. N. Rao, and L. Liotta

Laboratory of Tumor Immunology and Biology [P. H. H., A. T., J. S.] and Laboratory of Pathology [C. N. R., L. L.], National Cancer Institute, NIH, Bethesda, Maryland 20205

ABSTRACT

It has been hypothesized that epithelial and endothelial cells interact with the laminin component of basement membranes via a cell surface laminin receptor molecule. It has also been proposed that the expression of this molecule may be involved in the invasion of carcinoma cells from their tissue of origin and their subsequent penetration through blood vessel basement membranes. We report here the use of a monoclonal antibody, LR-3, to define the expression of laminin receptor in normal, dysplastic, and carcinomatous human tissues. Monoclonal antibody LR-3 is shown by immunoblotting to recognize the Mr 67,000 laminin receptor protein, to bind to the carcinoma cells, and to constitute approximately 0.1% of total cellular protein. Numerous normal human epithelial and endothelial cell types, as well as pulmonary macrophages, are shown to express laminin receptor to varying degrees. Selected human mammary carcinomas and colon carcinomas are shown to bind more monoclonal antibody LR-3 than normal or dysplastic counterparts. A monoclonal antibody to laminin receptor now makes possible the study of the role of laminin receptor in tumor cell metastases and in the differentiation and function of various normal human epithelial and endothelial cell types.

INTRODUCTION

The mechanism of tumor cell invasion appears to be a highly complex and multistage phenomenon. One necessary step in the invasive process is the movement of tumor cells through the extracellular matrix, which is composed of basement membranes and interstitial stroma and forms a barrier between tissues of different types. One of the components of the basement membrane is laminin, a glycoprotein with a molecular weight of approximately 106 (1–3). A 50-fold greater binding of laminin to unoccupied receptors of human breast carcinoma cells versus normal and benign breast lesions has been reported (4). It has been proposed that laminin receptor may aid in the attachment of tumor cells to laminin in basement membranes, thereby facilitating (a) the exit of tumor cells from their tissue of origin and (b) the penetration of tumor cells through other basement membranes, including those of blood vessels, to result in metastatic lesions (5, 6).

The existence of a laminin receptor was established when a high-affinity receptor for laminin was first identified on the surface of the MCF-7 human mammary adenocarcinoma cell line (5–7). Since this initial observation, the presence of laminin receptor has been demonstrated on the surface of several normal and neoplastic tissues; these are rodent striated muscle (8), rodent macrophages (9, 10), human monocytes (10), as well as human breast cancer cells (4), metastatic murine BL6 melanoma cells (11), and murine fibrosarcoma cells (12, 13). Laminin affinity chromatography studies have demonstrated that both the murine and human receptor molecules have a molecular weight of approximately 67,000 to 69,000 (11, 12).

We have recently generated MAb2 by using purified human laminin receptor as immunogen. Initial characterization of these MAb (14) demonstrated their reactivity to purified laminin receptor. The discovery of a laminin receptor and the availability of a MAb which binds this molecule now make possible many diverse avenues to study the roles of laminin receptor in tumor cell metastases and in the differentiation and function of various normal human cell types.

MATERIALS AND METHODS

Purification of Laminin Receptor Antigen. Laminin receptor was purified from extracts of plasma membranes from pooled human breast carcinoma tissue, as described (4, 7, 11).

Immunizations. Four-week-old BALB/c mice were immunized by i.p. inoculation of 5 µg of laminin receptor purified from human breast carcinomas, mixed with an equal volume of complete Freund's adjuvant. Seven days later, 2 µg of the laminin receptor mixed with an equal volume of incomplete Freund's adjuvant were inoculated i.p. On Day 14, 2 µg of the laminin receptor were injected into the mice i.v. Three days later, spleens were removed for cell fusion.

Hybridoma Methodology. Somatic cell hybrids were prepared using the method of Herzenberg et al. (15) with some modifications (16). Hybridoma cell lines were cloned twice by limiting dilution. Ascertes fluid was prepared in pristane-primed BALB/c mice inoculated i.p. with 1 x 107 hybridoma cells (16).

Cells. The MCF-7 (SA9) cell line (17) is a clone of the MCF-7 human mammary adenocarcinoma cell line. The Flow-4000 normal human fetal kidney cell line, the A204 human rhabdomyosarcoma cell line, the WI-38 normal human fetal lung cell line, and the A375 human melanoma cell line were obtained and maintained as previously described (18, 19).

Solid-Phase RIA. Ascertes fluid of one of the MAb, designated MAb Laminin Receptor (LR-3), was used in solid-phase RIA with 5 µg of cell extracts or 25 ng of purified laminin receptor as described (16) with the exception that polyoxyethylene sorbitan monolaurate (Tween-20) (0.05%) was added to wash buffer. The Tween-20 was required to reduce the nonspecific binding of the MAb observed in control wells, i.e., phosphate-buffered saline in place of extract.

Suspension Live-Cell RIA. The suspension live-cell RIA was performed as described (17) with the exception that cells were seeded into round-bottomed, 96-well polyvinyl plates at 2 x 105 cells/well. The plates were then incubated under constant agitation at 37°C for 1 h in a humidified incubator containing 5% CO2 before addition of the primary antibody. All subsequent incubations were performed using identical conditions.

Immunoperoxidase Method. Five-μm sections of formalin-fixed tissues...
sues were stained using a modification of methodology defined previ-
ously (20) and the avidin:biotin:peroxidase complex method (21). To
reduce nonspecific binding of the MAb to the tissue sections, ascites
fluid containing MAb LR-3 was diluted in phosphate-buffered saline
containing 0.1% bovine serum albumin and 0.1% Tween-20. MAb LR-3
was incubated with tissue sections for 30 min at room temperature. This
was followed by a 10-min rinse in phosphate-buffered saline containing
0.1% Tween-20 and a 10-min rinse in phosphate-buffered saline prior to
application of the biotinylated second antibody.

RESULTS

Generation of MAb. Mice were immunized with laminin recep-
tor purified from plasma membranes of pooled human breast
carcinoma tissues (Fig. 1, Lane B). Splenic lymphocytes from
the immunized mice were fused with NS-1 mouse myeloma cells.
Supernatant fluids from these hybridomas were assayed using a
solid-phase RIA for immunoglobulins reactive with the laminin
receptor immunogen. Positive cultures were then expanded and
cloned twice by limiting dilution. Thirty-nine double-cloned cul-
tures representing 6 primary hybridoma cultures were selected
for further study. Immunoglobulins from all 39 cultures were demonstra-
ted to be IgM and demonstrated reactivity in solid-
phase RIA with purified laminin receptor. One of the MAb,
designated LR-3, was chosen for further studies based on high
titer and efficacy in immunohistochemical assays using formalin-
fixed tissue sections (see below).

Reactivity of MAb LR-3 to Human Breast Carcinoma Biopsy
Tissue. To define the specificity of the MAb LR-3 reaction,
protein extracts of membranes of breast carcinoma tissue were
reacted with MAb LR-3 using the immunoblot method; as seen
in Fig. 1C, a single protein component with a molecular weight
of approximately 67,000, characteristic of laminin receptor, is
observed. No binding of a MAb which reacts with a human
thymus antigen (data not shown) or tissue culture supernatant
fluid of NS-1 mouse myeloma cells (Fig. 1D) was observed using
the immunoblot method to the breast carcinoma membrane
extract.

Reactivity of MAb LR-3 to Occupied versus Unoccupied
Laminin Receptors. The MAb generated versus laminin receptor
differ in their ability to block the binding of laminin to laminin
receptors (14). Although some of the MAb inhibit 100% of the
binding of laminin to its receptor on isolated breast carcinoma
membranes or live cells (MCF-7), MAb LR-3 had no effect on
laminin binding under identical conditions (data not shown). MAb
LR-3 therefore recognizes a site on the laminin receptor which
is distinct from the binding site and is therefore capable of
detecting both occupied and unoccupied laminin receptors.

Expression of Laminin Receptor in Cell Extracts. Experi-
ments were then conducted in an attempt to quantitate the level
of expression of laminin receptor in a human breast carcinoma
cell line versus a normal human cell line. Using a solid-phase RIA,
MAb LR-3 was reacted with various concentrations of purified
laminin receptor and protein extracts of the MCF-7(5A9) and
WI-38 cells. As shown in Table 1, 1000-fold more MCF-7(5A9)
extract than purified laminin receptor is required to achieve
approximately the same level of binding of MAb LR-3; it thus
appears that approximately 0.1% of the MCF-7(5A9) cellular
protein represents laminin receptor. In other experiments per-
formed with different extracts of the same MCF-7(5A9) cell line,
the level of expression of laminin receptor in the breast carcino-
amia cells ranged from 0.05 to 0.1% of the total extract protein.

A differential of approximately 1.6- to 3.6-fold was observed
between the level of laminin receptor expressed by the MCF-
7(5A9) cells versus the WI-38 normal fetal lung cells at the
different amounts of protein extracts tested (Table 1). The levels
of laminin receptor observed in MCF-7 cells were also approxi-
mately 3-fold higher than those observed in the A204 human
rhabdomyosarcoma and Flow-4000 kidney cell lines (data not
shown). Using similar concentrations of LR-3 MAb, minimal reac-
tivity was observed to bovine serum albumin (Table 1), thyro-
globulin, and ovalbumin (data not shown), at concentrations as
high as 10,000 ng of each per well.

Cell Surface Expression of Laminin Receptor. Initial at-
tempts to bind MAb LR-3 to the surface of MCF-7 cells grown
in monolayer proved unsuccessful. It has previously been shown
(7, 11, 12, 22), however, that enzymatic digestion of rodent
fibrosarcoma cells with trypsin, followed by a 1-h incubation
period for regeneration of the laminin receptor, enhanced binding
of 125I-laminin to the cell surface. Such a treatment was thus
necessary to expose the laminin receptor determinant. MCF-
7(5A9) and Flow-4000 cells were removed from plastic culture
flasks with 0.1% trypsin containing 0.5 mm EDTA. The cells were

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<th>Protein input (ng)</th>
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<th>1,000</th>
<th>100</th>
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<td>NT</td>
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<td>6,032</td>
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<td>1,776</td>
<td>352</td>
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<td>NT</td>
<td>NT</td>
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</table>

* NT, not tested.

Table 1

Fig. 1. Immunoblot of human breast carcinoma plasma membrane extract with
MAb LR-3. Lane A, molecular weight markers. Lane B, iodinated purified human
breast carcinoma laminin receptor. Lane C, MAb LR-3 blotted to total protein
extract. A single protein component is bound by the MAb. Lane D, tissue culture
supernatant fluid of NS-1 mouse myeloma cells blotted to total protein extract. No
reactivity is observed. Extract and immunoblot methods have been detailed previ-
ously (11, 14).
then incubated in their respective growth media for 1 h at 37°C (5% CO₂) with constant agitation and then maintained in suspension for the duration of the live-cell RIA. As seen in Chart 1, approximately 3-fold more laminin receptor was detected by MAb LR-3 on the surface of the MCF-7(5A9) cells than on the Flow-4000 cells. In contrast to these findings, approximately 7-fold more HLA-A,B,C antigen, as detected by MAb W6/32 (23), was observed on the Flow-4000 cells than on the MCF-7(5A9) cells (Chart 1, inset).

Analysis of Normal Human Tissue. Formalin-fixed 5-μm sections of adult human tissues were assayed for expression of laminin receptor using MAb LR-3 and the avidin-biotin complex-immunoperoxidase method. Many normal tissues tested demonstrated at least one cell type with laminin receptor expression (Table 2). In the majority of tissues, the cell types (epithelium or endothelium) positive for laminin receptor were intimately associated with a basement membrane. Laminin receptor expression was demonstrated in several renal cell types, including the majority of glomerular capillary endothelial cells which stained most intensely (Table 2; Fig. 2, A to C). The interstitial stroma and glomerular mesangial cells were routinely negative (Table 2).

The epidermis (squamous epithelium) of human skin was routinely positive for laminin receptor expression (Table 2; Fig. 2D); expression was transepidermal and heterogeneous. Negative control slides using dilution buffer in place of MAb LR-3 demonstrated melanocytes containing brown melanin pigment. These were examined concurrently with MAb LR-3 assays to prevent misinterpretation of the diaminobenzidine-peroxidase color reaction (Fig. 2E). Several pulmonary cell types were routinely positive for laminin receptor (Table 2) with pulmonary macrophages reacting most intensely with MAB LR-3. The endothelium of all blood vessels (arteries, capillaries, veins) also demonstrated strong laminin receptor expression within all tissues examined. The other cell types listed as positive in Table 2 all demonstrated a heterogeneity in laminin receptor expression, usually with only a small percentage (<10%) scoring positive.

### Table 2

<table>
<thead>
<tr>
<th>Tissue</th>
<th>Cell type</th>
<th>Reactivity</th>
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<tr>
<td>Kidney</td>
<td>Glomerular capillary endothelium</td>
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<tr>
<td></td>
<td>Parietal epithelium of Bowman's space</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Renal tubular, collecting duct, and transitional epithelium</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Glomerular mesangial cells, interstitial stroma</td>
<td>-</td>
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<tr>
<td>Skin</td>
<td>Epidermis, dermal capillary endothelium</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Sebaceous and merocrine gland epithelium</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Dermis, hair matrix</td>
<td>-</td>
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<tr>
<td>Lung and trachea</td>
<td>Respiratory epithelium, type 1 pneumocytes</td>
<td>+</td>
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<tr>
<td></td>
<td>Macrophages (intraalveolar)</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Hyaline cartilage, interstitial stroma</td>
<td>-</td>
</tr>
<tr>
<td>Esophagus</td>
<td>Squamous epithelium, submucosal glands, smooth muscle</td>
<td>-</td>
</tr>
<tr>
<td>Stomach</td>
<td>Mucous and parietal cells</td>
<td>+</td>
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<tr>
<td></td>
<td>Chief cells</td>
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<td>Small intestine</td>
<td>Enterocytes</td>
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<tr>
<td></td>
<td>Goblet and Paneth's (granular) cells</td>
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<tr>
<td>Large intestine</td>
<td>Mucous cells, ganglion cells of Meissner's plexus</td>
<td>+</td>
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<tr>
<td></td>
<td>Interstitial stroma, smooth muscle</td>
<td>-</td>
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<tr>
<td>Breast</td>
<td>Ductal and lobular epithelium</td>
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<tr>
<td></td>
<td>Interstitial stroma</td>
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<tr>
<td>Liver</td>
<td>Hepatocytes, biliary epithelium</td>
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<td></td>
<td>Interstitial stroma</td>
<td>-</td>
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<tr>
<td>Gall bladder</td>
<td>Biliary epithelium</td>
<td>+</td>
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<tr>
<td></td>
<td>Interstitial stroma</td>
<td>-</td>
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<tr>
<td>Spinal cord</td>
<td>White matter, ependymal lining of central canal</td>
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<td></td>
<td>Peripheral nerves</td>
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<tr>
<td></td>
<td>Grey matter</td>
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<tr>
<td>Bladder</td>
<td>Transitional epithelium</td>
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<td></td>
<td>Smooth muscle, interstitial stroma</td>
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<tr>
<td>Cervix</td>
<td>Squamous and endocervical gland epithelium</td>
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<td></td>
<td>Interstitial stroma</td>
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<tr>
<td>Blood vessels</td>
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<td></td>
<td>Smooth muscle</td>
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<tr>
<td>Skeletal muscle</td>
<td>Striated muscle cells</td>
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<td>Smooth muscle</td>
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<td>Prostate</td>
<td>Glandular epithelium</td>
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<td></td>
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<td>Tonsil</td>
<td>Lymphocytes</td>
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<td>Testis</td>
<td>Germinal epithelium</td>
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<tr>
<td></td>
<td>Interstitial stroma</td>
<td>-</td>
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<tr>
<td>Fallopian tube</td>
<td>Tubular epithelium</td>
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<td></td>
<td>Smooth muscle</td>
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<tr>
<td>Oropharynx</td>
<td>Squamous epithelium</td>
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<td>Lymph nodes</td>
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<tr>
<td>Spleen</td>
<td>Lymphocytes, plasma cells, histiocytes</td>
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<td>Adrenal gland</td>
<td>Cortical and medullary cells</td>
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<tr>
<td>Thymus</td>
<td>Lymphocytes</td>
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<tr>
<td>Salivary gland</td>
<td>Gland and duct epithelium</td>
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<tr>
<td>Thyroid gland</td>
<td>Follicular cells, colloid</td>
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![Chart 1](chart1.png)

**Chart 1.** Cell surface expression of laminin receptor on MCF-7(5A9) human breast carcinoma and Flow-4000 normal human fetal kidney cell lines. Using a suspension live-cell RIA, increasing concentrations of MAb LR-3 were tested for binding to the MCF-7(5A9) (×) and Flow-4000 (○) cell lines. Inset: Binding of purified immunoglobulin of MAB W6/32, a MAB reactive with HLA-A,B,C (23), to the surface of MCF-7(5A9) (×) and Flow-4000 (○) cell lines using the suspension live-cell RIA.
Analysis of Malignant and Benign Human Breast. Three infiltrating ductal carcinomas were examined using various concentrations of MAb LR-3. Two of the 3 tumors demonstrated laminin receptor on 70 to 80% of tumor cells at the highest MAb LR-3 concentration used (Chart 2A; Fig. 2F). A linear decrease in laminin receptor detection was demonstrated with MAb LR-3 dilution. Apparently normal mammary epithelium (when seen within the same section containing carcinoma, fibroadenoma, or fibrocystic disease) was either negative or demonstrated very low levels of laminin receptor; breast stroma was also routinely negative. Most fibrocystic disease and fibroadenoma specimens demonstrated <10% of cells staining at all MAb LR-3 concentrations (Chart 2A; Fig. 2, G and H).

Twenty-four infiltrating ductal carcinomas from different patients were then examined using MAb LR-3 (Chart 3A). Eight of 24 breast carcinomas (33%) clearly showed enhanced expression of laminin receptor (>10% of carcinoma cells scoring positive). Twenty (85%) demonstrated some laminin receptor expression (with at least one carcinoma cell scoring positive), and only 4 specimens were completely negative in this assay (Chart 3A). Twenty specimens from different patients with fibrocystic disease, fibroadenomas, or chronic inflammation of the breast were also examined (Chart 3B). Three of 20 specimens (15%) demonstrated significant laminin receptor expression (>10% carcinoma cells positive). Two of these 3 were from patients with a clinical history of multiple fibroadenomas (Fig. 2I; Chart 2B; Chart 3B, a and b). These 2 samples were from 21- and 24-year-old females who collectively have had 7 fibroadenomas removed to date. Titration studies demonstrated that laminin receptor expression in these fibroadenomas (Chart 2B) was similar to that observed in infiltrating ductal carcinomas (Chart 2A).

Analysis of Malignant and Benign Human Colon. The vast majority of normal colonic epithelial cells scored negative for laminin receptor, with the exception of rare mucous-secreting cells. Three adenocarcinomas and 2 tubulovillous adenomas of the colon were examined using multiple concentrations of MAb LR-3 (Fig. 2, J and K; Chart 2C). All 3 adenocarcinomas demonstrated laminin receptor expression (Fig. 2J), with the percentage of positive cells ranging from 20 to 65% at the highest MAb LR-3 concentration used (Chart 2C). Both tubulovillous adenomas examined demonstrated weak (<1%) staining (Fig. 2K; Chart 2C). The colonic stroma including smooth muscle was negative in all assays.

Twenty adenocarcinoma specimens from patients were then examined for laminin receptor (Chart 3C). Six of 20 adenocarcinoma specimens (33%) were strongly positive (>10% of carcinoma cells scoring positive). Fifteen (75%) demonstrated some laminin receptor expression (>1% carcinoma cells positive), and 5 (25%) were completely negative in this assay. Twenty benign colon specimens (tubular adenomas, tubulovillous adenomas, and a hamartomatous polyp) were also assayed (Chart 3C). Benign colon specimens did not demonstrate significant laminin receptor expression (i.e., >10% of benign epithelial cells positive), and only 4 (20%) demonstrated minimal positivity to MAb LR-3 in this assay.

DISCUSSION

It has been hypothesized that all endothelial and epithelial cells attach to basement membranes via the laminin receptor (8, 24-
LAMININ RECEPTOR EXPRESSION IN HUMAN TISSUES

Chart 3. Laminin receptor expression in various breast and colon disease states. All samples were reacted with a 1:400 dilution of MAb LR-3 ascites fluid using the avidin-biotin complex-immunoperoxidase method. A, infiltrating ductal carcinomas (a); B, fibrocystic disease (b); fibroadenomas (c); C, adenocarcinomas of the colon (d); D, tubular adenomas (e); tubulovillous adenomas (f), and a hamartomatous polypl (g). Each symbol represents a tumor from a different patient. The percentage of positive cells denotes for adenocarcinoma or the benign tumors the number of epithelial tumor cells reactive with MAb LR-3 divided by the total number of tumor cells multiplied by 100.

28). Our results with MAb LR-3 define the expression of the laminin receptor molecule in a wide variety of cell types (endothelial and epithelial) and thus substantiate these theories. The studies reported here have shown that more than 33 epithelial and endothelial normal human cell types, virtually all adjacent to basement membranes, are positive for laminin receptor (Table 2). We have also observed that pulmonary macrophages (cells not bound to basement membrane) were uniformly positive for laminin receptor expression. These results complement the findings of Wicha et al. (9) and Huard et al. (10) who demonstrated the presence of this molecule on peritoneal macrophages. Recent findings suggest that macrophage cell surface laminin receptor may play an important role in metastatic tumor cell recognition (10). In addition, laminin receptor expression may facilitate attachment and emigration of the macrophage precursor cell (monocyte) through vascular basement membranes and other extracellular matrices during the inflammatory process.

It has previously been shown that extracts of breast carcinomas express more exposed laminin receptor than normal breast tissues (4). These studies were carried out using 125I-laminin and extracts of breast material. The studies reported here using MAb LR-3 now facilitate the detection of laminin receptor at the single cell level using immunohistochemical techniques. The differences in the immunoreactivity may be related to absolute numbers of unoccupied, internalized, or processed receptors (4, 14). Thus, we have observed subpopulations of cells within a carcinoma mass as well as subpopulations of cells within some "benign" lesions expressing high levels of laminin receptor.

The biology of human mammary carcinoma and colon carcinoma is similar in many respects, including tumor-associated antigens expressed on the cell surface. The studies reported here demonstrate, for the first time, the distribution of laminin receptor in human colon carcinomas and benign lesions. The degree of laminin receptor expression in the colon tissues closely parallels that observed with the breast carcinomas and benign lesions. Not all colon carcinomas expressed detectable levels of the laminin receptor, and higher levels were detected in malignant colon samples versus benign lesions (Chart 3).

A consistent difference in the distribution of immunoreactivity between the benign and malignant was noted. The benign cells appeared to express laminin receptor immunoreactivity at the basal location adjacent to the formed basement membrane. In contrast, the carcinoma cells exhibited staining over the entire surface of the cell, including more pronounced cytoplasmic reactivity compared to the benign cells. This observation suggests that the surface distribution, state of internalization, and/or processing of the receptor may all be altered in the actively invading cells. Studies are now in progress to delineate the role of MAb LR-3, and the other MAb reactive with laminin receptor, on the functional activity of the laminin receptor. These studies should lead to a better understanding not only of the fine specificity of the MAb, but also of the possibility and route of internalization of the laminin receptor and its role in cell growth and migration.

The role of the laminin-laminin receptor complex in the various nonneoplastic disease stages is thus far unknown. It may play a role in normal growth, differentiation, or morphogenesis. Autoimmune states such as Goodpasture's syndrome and Chagas' disease both have been shown to involve the laminin molecule (27, 28). Thus, MAb against laminin receptor may also have potential use in the study of a variety of immunologically mediated disease states which may destroy epithelium, endothelium, or the integrity of the basement membranes.

ACKNOWLEDGMENTS

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REFERENCES

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Fig. 2. Expression of laminin receptor in normal human kidney, skin, and lesions of the breast and colon. MAb LR-3 (at a 1:400 dilution of ascites fluid) was reacted with formalin-fixed, paraffin-embedded tissue using the avidin-biotin-complex-immunoperoxidase method (20, 21). A, laminin receptor expression demonstrated in capillary loop endothelial cells (c) and Bowman’s space (bs) peritubular epithelial cells (p) of a renal glomerulus. Also visualized but unreactive with MAb LR-3 is basement membrane (bm) mesangium (m). The dark staining reflects the reaction of the diaminobenzidene substrate and, thus, MAb LR-3 binding. The lighter nuclear staining is a hematoxylin counterstain, i.e., no MAb LR-3 reactivity. x130. B, renal tubules with intense tubular epithelial laminin receptor expression. x330. C, transitional epithelial cells of the renal pelvis demonstrating MAb LR-3 reactivity and heterogeneity of laminin receptor expression. x330. D, normal skin with MAb LR-3 reactivity to capillary loop endothelial cells (c) and Bowman’s space parietal epithelial cells (p) of a renal glomerulus. The dark staining reflects the reaction of the diaminobenzidene substrate and, thus, MAb LR-3 binding. The lighter nuclear staining is a hematoxylin counterstain, i.e., no MAb LR-3 reactivity. x540. E, normal skin control using phosphate-buffered saline instead of primary MAb LR-3. Melanin pigment is present in the basal epithelial layer of the epidermis (m), and this is readily distinguished from the MAb reactivity of D. x330. F, infiltrating ductal carcinoma of the breast with strong laminin receptor expression. x130. G, fibroadenoma of the breast demonstrating no reactivity. x130. H, fibrocystic disease of the breast with weak laminin receptor expression in scattered lobules. x130. I, fibroadenoma of the breast from a patient (see Chart 39, Patient e) with multiple fibroadenomas. Positivity of epithelial cells demonstrates laminin receptor expression. x130. J, adenocarcinoma of the colon (invasive) with significant laminin receptor expression. x130. K, tubulovillous adenoma of the colon negative for reactivity with MAb LR-3. x54.
Expression of Laminin Receptor in Normal and Carcinomatous Human Tissues as Defined by a Monoclonal Antibody
