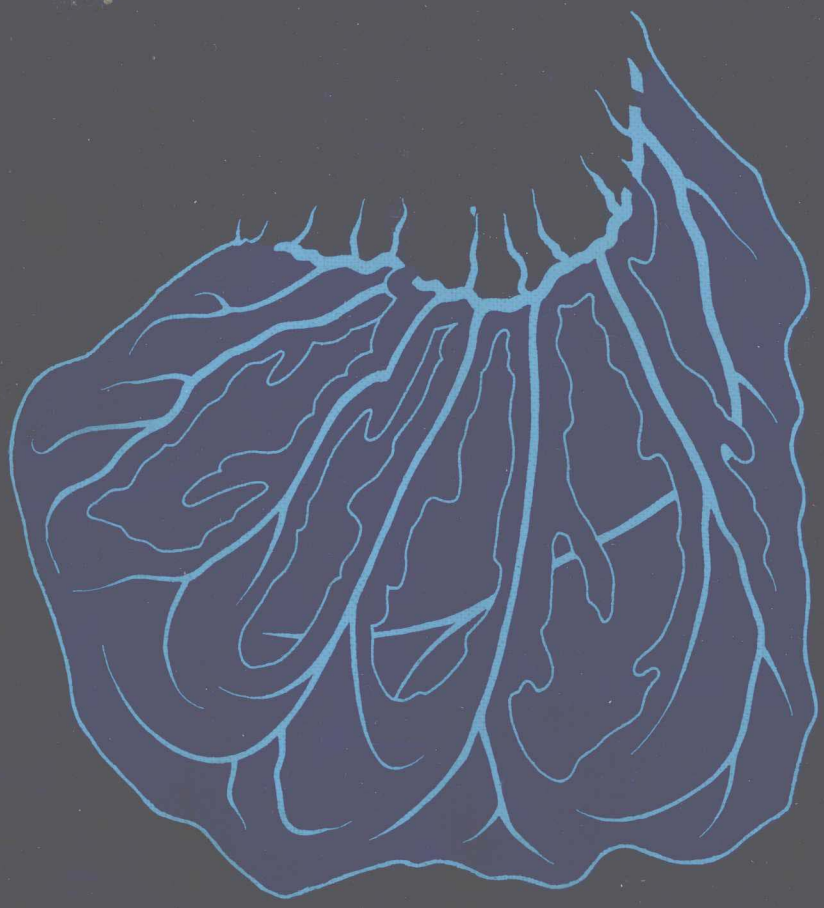
The Greater Omentum

Anatomy, Physiology, Pathology, Surgery
With an Historical Survey

Editors
D. Liebermann-Meffert and Harvey White
Consulting Editor for Section of Surgery E. Vaubel



Springer-Verlag Berlin Heidelberg New York

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With a Foreword by Sir Alan Parks

With 262 Figures, Some in Color

Springer-Verlag
Berlin Heidelberg New York 1983

ISBN 3-540-11882-9 Springer-Verlag Berlin Heidelberg New York
ISBN 0-387-11882-9 Springer-Verlag New York Heidelberg Berlin

Library of Congress Cataloging in Publication Data
Main entry under title: The Greater omentum. Bibliography: p. 1. Omentum – Surgery. 2. Omentum. I. Liebermann-Meffert, D. (Dorothea), 1936–. II. White, Harvey, 1938–. III. Vaubel, E. (Ekkehard) [DNLM: 1. Omentum. WI 575 G786] RD548.G73 1983 617'.558 82-19495

Printed in Germany.

Reproduction of figures: Gustav Dreher GmbH, Stuttgart
Typesetting, printing, and bookbinding: Universitätsdruckerei H. Stürtz AG, Würzburg.

2124/3130-543210

Foreword

Since RUTHERFORD MORISON left us with the concept of the Omentum being the 'abdominal policeman', clinicians have tacitly assumed that they know sufficient about the structure and function of this organ. However interest in the omentum and its relationship to clinical surgery has recently been developing. This book examines all aspects with special reference to surgery and should provide a welcome impetus in research and clinical practice.

The editors and contributors have produced a book which is comprehensive and well illustrated and contains detailed references to the important original sources – so essential in a work of this nature. It is written for those who wish to share the delight of acquiring knowledge – even about a comparatively humble organ – as well as for practical surgeons. Both will find ample information to arouse their interest and expand their surgical horizons in exciting ways of which they will almost certainly not have dreamt.

I welcome a book of this calibre on a subject which deserves our increasing interest. I delight in the fact that it is dedicated to my friend and colleague MARTIN ALLGÖWER.

ALAN PARKS
President
Royal College of Surgeons of England

While this book was in press, Sir ALAN PARKS died. The editors would like to pay tribute to a great and compassionate surgeon with an enquiring and inventive mind. They are very grateful for his interest in their subject and for his generosity in allowing his name to be associated with the book.

Preface

Late in 1976 DOROTHEA LIEBERMANN-MEFFERT and I realized that there was a clear requirement for a small book on the uses of the omentum in the practice of surgery with a special emphasis on the surgical techniques of transposition and transplantation. When we started to plan a small and modest manual we identified a need far greater than our original concept and the book became more ambitious. We decided that it was important that a comprehensive book should be written. However, our aim was first and foremost the production of a book for surgeons which would help to establish the techniques more widely. Although omental surgery is undertaken in numerous centres – and notably by IAN KIRICUTA in Rumania and HARRY GOLDSMITH in USA – its application is somewhat neglected.

During the next two and a half years a number of sections including the historical appendix and sections on embryology, anatomy and pelvic surgery were nearly completed. However, a new stimulus was required and we saw a need for others with experience different from our own to be associated with a book which was more comprehensive than our original concept. We therefore asked EKKEHARD VAUBEL to become consulting editor and in addition invited a number of experts to contribute to the book. They have greatly enriched our original endeavour and without their experience and contributions the book would have lacked many essential aspects and we are deeply grateful to them.

The original idea was born during a conference at which Professor MARTIN ALLGÖWER was President. Many of the contributors and DOROTHEA LIEBERMANN-MEFFERT, with her remarkable editorial skills and industry, work in his internationally acclaimed department. It seemed appropriate therefore to dedicate the book to this great and stimulating surgeon. We hope that our attempt to re-examine an apparently pedestrian subject and approach it with a new stimulus and from new angles will be a fitting tribute to him on his sixty-fifth birthday. This has been a book of international cooperation which is one aspect of surgery close to his heart. Although the omentum is not his field of special interest, I hope that he will realize that one of the signs of greatness is that personal enthusiasms can provide a stimulus beyond ones own endeavour. It is in this spirit that

we offer the book as a tribute to a remarkable surgeon and director of research.

In addition to recording a personal debt to DOROTHEA LIEBERMANN-MEFFERT who has tirelessly undertaken so many of the tasks required in writing a book with editors and contributors in different countries, I would like to record our gratitude to our families for their understanding and support. We owe a special debt to Mrs. TH. DEIGMÖLLER, Mrs. D. GROSSHANS and Mr. R. BRECH of the Springer-Verlag, Heidelberg, for their help, encouragement and patience over three years and to their artist Mr. KEN FINCH, Heidelberg, for his careful and clear diagrams.

It is impossible to acknowledge all those who have given such willing help but we would especially thank our secretaries and particularly Miss ELISABETH SCHEURER, Basel, who prepared the typescript, Mr. PETER ARGAST and Mr. MARK KAUFMANN, Institut für Pathologie, Basel for technical support in experiments undertaken to clarify some anatomical questions which arose while writing the book. We are indebted to Mr. DIETMAR HUND, Mrs. ELEONORE HUND and Mrs. ESTHER GISIN, Photoabteilung Kantonsspital, Basel, who photographed many of the figures specifically for this book to Mrs. ADÈLE HERZFELD and the staff of the Medizinische Bibliothek der Universität, ZLF, Basel for their help.

As we intend the book primarily for surgeons, it is inappropriate that all sections should contain the same depth of detail. Our aim is that they should have insight in areas which now require their understanding because of the growing multidisciplinary approach to problems. The use of the omentum in surgery with newly developing techniques such as microvascular anastomoses seems destined to increase. We hope that this book will serve as a foundation to such developments.

HARVEY WHITE

In honor of

Martin Allgöwer's

65th birthday

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Anatomy and Functional Anatomy

Physiology and Functions

Clinical Aspects

Pathological Conditions, Specific Investigations, and Therapy

Experimental Basis for Reconstructive Surgery Using the Omentum

Protective and Reconstructive Surgery with the Omentum in Man

Anatomy and Functional Anatomy

1 Anatomical Definitions, Composition, and Configuration

D. LIEBERMANN-MEFFERT

The *greater omentum* is the free hanging mesenteric tissue apron in the peritoneal cavity, arising from the stomach and covering the intestines (Fig. 1). *The lesser omentum* is the membrane between the lesser curvature of the stomach and the liver hilum. Though both structures have the same name they differ in shape, morphology, development, and functional behavior. In this book by "omentum" we understand the greater omentum.

Composition

The omentum is composed of a trabecular connective tissue framework which carries (Fig. 2):

Arteries, veins, and lymphatics

Transparent thin membranes between the trabeculae containing tissue-free interstices, i.e. holes

Fat tissue, connective tissue cells, and cellular aggregations called "milky spots"

Mesothelial lining on both surfaces with a single layer of flat cells which are interrupted over the milky spots

Configuration

The macroscopic aspect of the omentum depends on the species, the age of the individual, nutrition, and the state of stimulation, eg., pathological conditions. In man and animals the omentum of the embryo, neonate, and infant is poor in fatty substance; age increases the fat content.

◀ **Fig. 1.** The greater omentum in its natural position in man. Anatomical waxwork 1789, Collection of the Josephinum, Vienna. (Photograph: R. NEDOROST, Vienna, 1980, courtesy of Prof. E. VAUBEL)

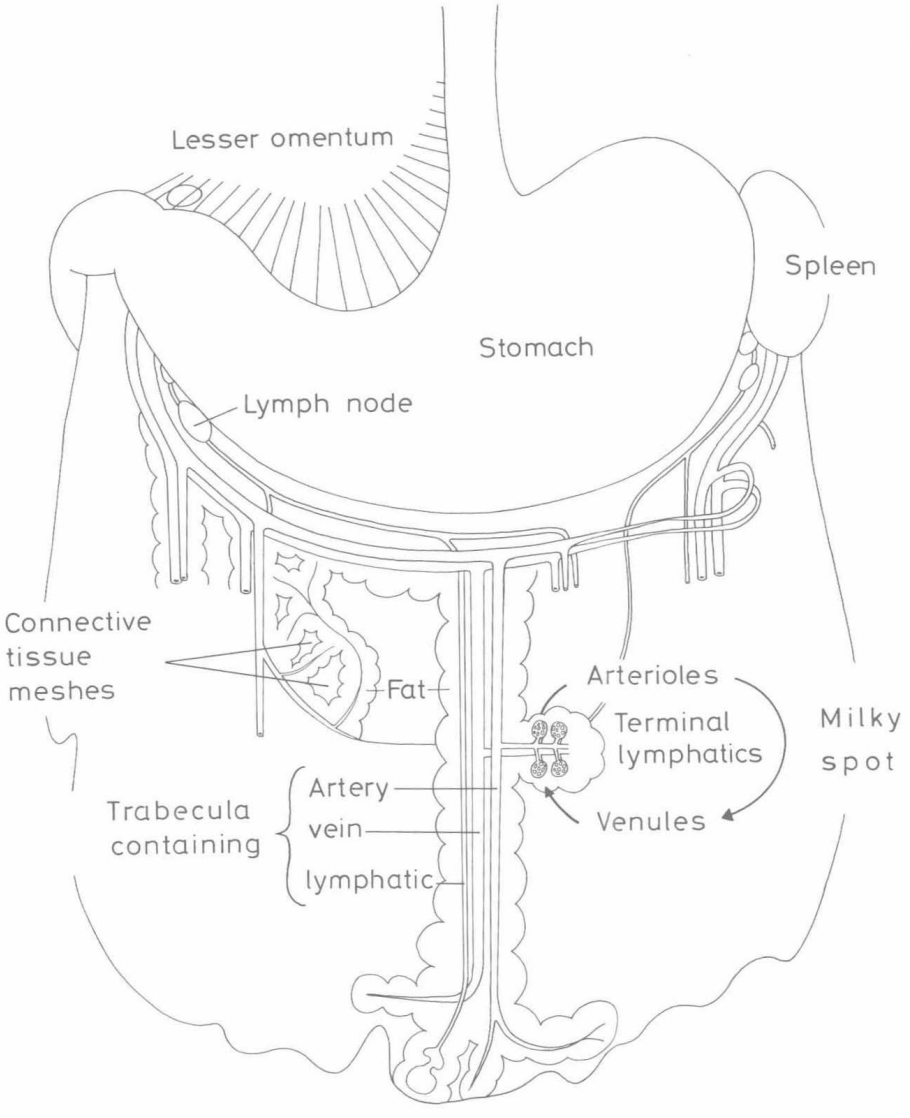


Fig. 2. Main tissue texture and constituents of the omentum

2 Topographical Relations

D. LIEBERMANN-MEFFERT

2.1 Relations in Man (Fig. 3a, b)

Location

The omentum usually extends over a large area. Arising from the greater curvature of the stomach it crosses the transverse colon and descends in front of the abdominal viscera, occasionally down to the symphysis. Its right upper edge faces the liver, and on its left is the spleen; its anterior surface faces the parietal peritoneum, i.e., the abdominal wall, and its posterior surface passes over the viscera. The omental portion between the stomach and colon is called the *gastrocolic ligament*, and the portion below the colon is the "apron."

Under *pathological conditions*, for example, if the stomach or the transverse colon are prolapsed or markedly distended, the omentum will extend further toward the pelvis. Axial rotation of the stomach will also effect its relations (see Sect. 7.1). In severe meteorism or colonic distension, and in the presence of intra-abdominal exudates, the omentum may be coiled up, lying in the upper abdomen. If the abdomen contains large quantities of fluid it may even lie on the anterior surface of the liver.

Attachments to the Viscera

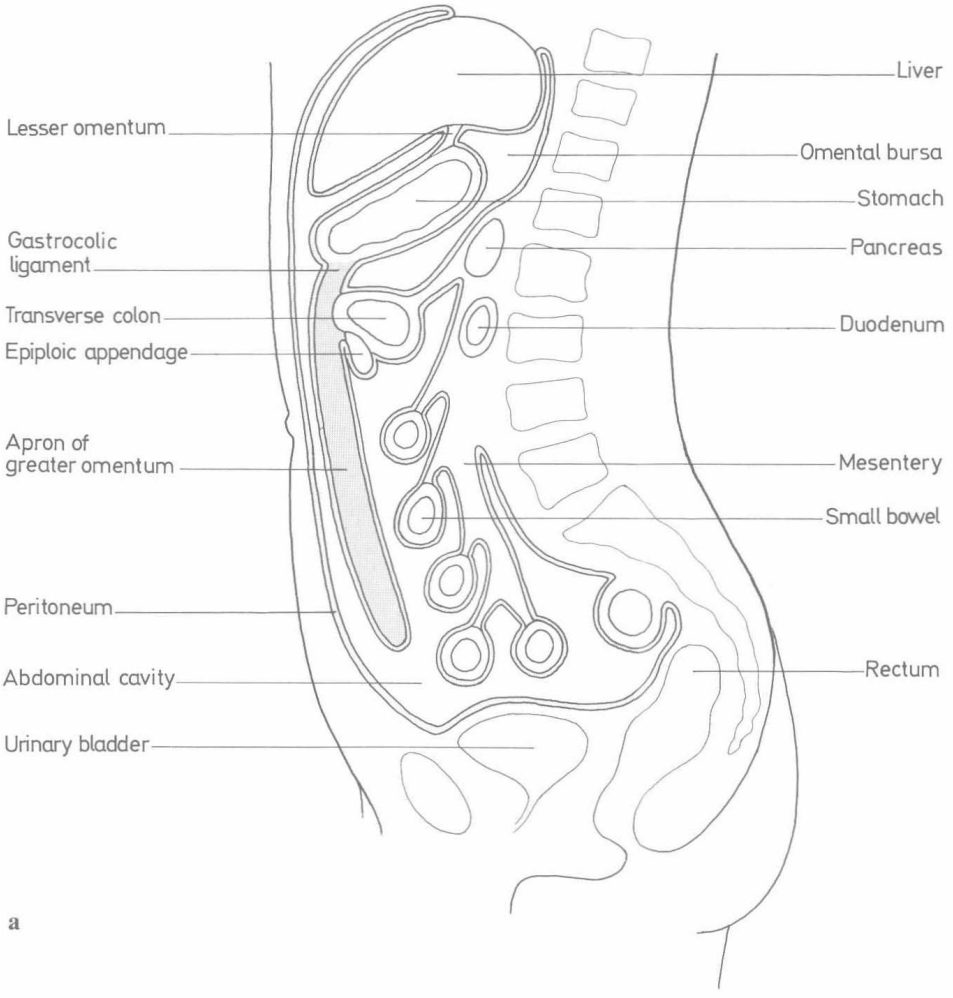
The origin of the right omental edge varies; it may arise from the duodenum and ascending colon or it may hang down merely from the pyloric area. On the left side, an extension of the gastrocolic omentum may lie over the anterior surface of the stomach, or over the upper part of the spleen [19]. The omentum is attached to various organs (for details see [9, 10]). Such attachments of peritoneal tissue are called ligaments.

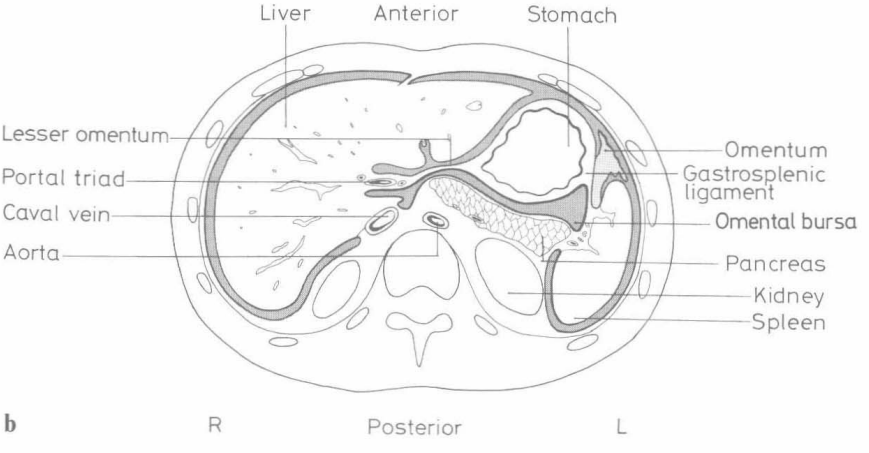
Spleen. The omentum forms the ligament between the spleen and stomach and attaches the spleen to the dorsal abdominal wall. This fine membraneous ligament is frequently given off to the lower part of the spleen just below the hilum; another membrane forms the phrenocolic ligament, upon which the spleen is incompletely fixed.

Gallbladder. The right edge of the gastrocolic ligament, particularly when it exceeds the pylorus, forms a mesentery for the gallbladder. This ligament may be very broad in children and may extend from the cystic duct to the anterior portion of the fundus of the gallbladder [82].

Transverse Colon. Epiploic appendices in many individuals form the antimesenteric surface of the transverse colon; they are

Fig. 3a, b. Diagram showing peritoneal reflections and topographical relations of the omentum **a** in the sagittal section and **b** transverse section





located in the area where the posterior surface of the omentum becomes attached to the colon. Both may appear as a homogeneous mass of fatty tissue, but there are criteria by which the structures can be distinguished [76]:
The omentum has a more granular surface pattern
The epiploic appendices have a smoother surface
The embryological attachment of the omentum can be recognized as fusion line of fibrous tissue.

Omental Bursa (Lesser Sac)

Head of the Pancreas. The portion of the omentum which comes off the greater curvature of the gastric antrum fuses to the anterior surface of the head of the pancreas [1, 17].

Dorsal to the gastrocolic ligament and the stomach lies the cavity called the "omental bursa," which communicates with the main peritoneal cavity through the epiploic foramen of Winslow. In relation to the total abdominal volume the omental bursa represents a potentially large cavity with various extensions (recesses) into the subphrenic area above and into the greater omentum below [37]:
The subphrenic (superior) recess is the most voluminous of the spaces and extends between the caudate lobe of the liver and the diaphragm.
The lineal recess lies between the spleen and stomach.
The inferior recess includes all the remaining lower part in the area of the transverse colon, the gastrocolic ligament, and the vault between the main epiploic vessels [49].
Occasionally an incomplete caudal recess exists in the left portion of the apron, confirming BOUCHET's [11] description. Saccular protrusions independent of the main recesses may also be found, but we, as well as others [9, 11, 37, 49, 89], have seldom observed large recesses extending to the caudal edges of the apron producing the two double layers of mesentery as usually shown in anatomical textbooks.

2.2 Relations in Animals

Incidence

Phylogenetic Distribution of the Omentum. Low vertebrates such as fish, amphibia, reptiles, frogs, and birds have no omentum, with the exception of the giant salamander and the chicken embryo, where it is rudimentary [46]. Mammalia have an omental apron along the greater curvature of the stomach; it is small in low Mammalia, and large in predatory and domesticated animals such as the dog and cat in which it envelops all the intestinal loops [33, 44, 46, 75].

Attachments

No attachment to any part of the viscera occurs in low Mammalia, rodents, hoofed animals, and carnivores. Fusion to the colon beginning at the right colonic flexure is found progressively in marsupials and half monkeys [46]. In monkeys and men the omentum is fused to the entire transverse colon. The spleen is located in the tissue of the left edge of the omentum in all laboratory animals and is not fixed to any other part of the abdominal wall. Occasionally additional spleens are found.

Omental Bursa

All vertebrates have a bursa behind the liver and stomach, which is differently shaped in each species [46]. The omental apron is patent in rodents, and the cat and dog: it forms a sac of two sheets with mesothelial surfaces, the outer facing the peritoneal cavity, the inner the bursa.

Similarities Between Omenta of Man and Animals

Description of the gross and cellular morphology in the text is generally applicable to all omenta [33]. The human omentum and the animal omentum have the same texture, mesothelial lining, and cellular content [8, 89] in the milky spots, which are discrete opaque nodules [77] in the transparent tissue. However, the human omentum has not yet been studied in great depth. Most information on the tissue and its function is available from studies of laboratory rodents. Ultrastructure investigations have been performed in the mouse and rat [6, 14, 28, 39], and there seems to be little variation.

Comparative Architecture of Omenta in Laboratory Animals

Pig (Fig. 4). The omentum covers the entire intestines and consists of a trabecular framework which contains a small amount of adipose tissue along the vessels and thin mesothelial membranes between them.

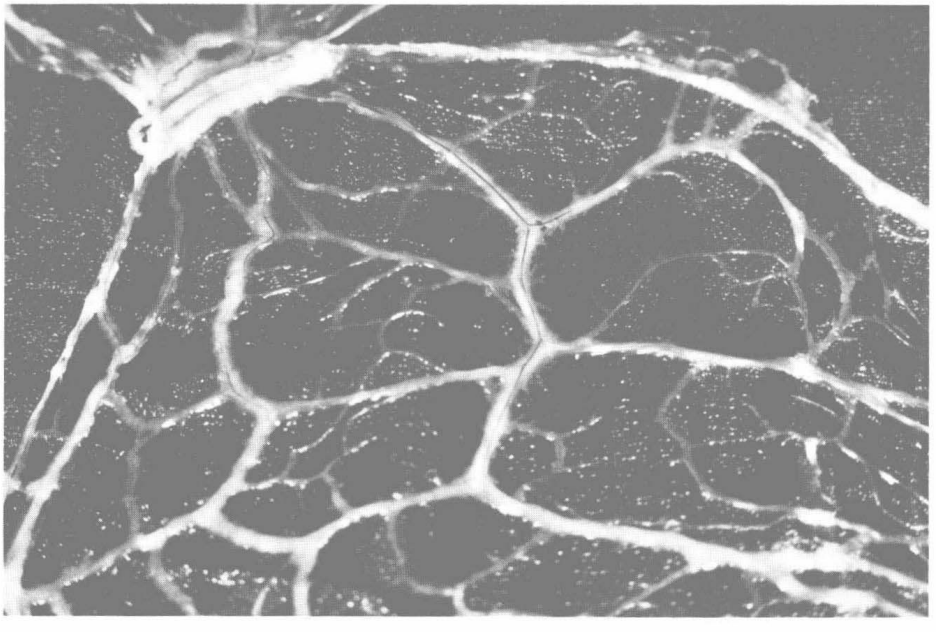


Fig. 4. Pig omentum. (DITTLER)