Willoughby Dayton Miller (1853—1907) was the first dentist in history with a thorough training in the natural sciences. He had studied mathematics and physics at the University of Ann Arbor, Michigan from 1871 to 1875 and intended to follow additional courses in Europe. While he studied in Edinburgh, his bank went bankrupt and he lost nearly all his money. Miller then travelled to Berlin where he continued his studies, but in his difficult financial situation he had to earn money. It was not easy for Miller to find a job, but he was lucky to make the acquaintance of an American dentist, Frank Abbot, living and practicing in Berlin, and Miller asked him for help. Dr. Abbot found him a job as a translator, and in addition asked Miller to give lessons to his wife and daughter. How much the ladies learned from Miller in the natural sciences is not known. However, an important side effect of the lessons was that Miller soon became engaged, and determined to marry, Miss
Caroline Abbot. Moreover, Miller began to like his future father-in-law’s profession and, supported by this generous man, returned to the United States to study dentistry.

In Spring 1879 Miller graduated as Doctor of Dental Surgery from the Philadelphia Dental College. Returning to Berlin he assisted in the office of his father-in-law and continued his studies of natural and medical sciences, especially microbiology. The latter had achieved enormous progress under the stimulating influence of Robert Koch whose methods appealed to the research-minded dentist. He worked hard and the dental problems he tackled were solved with a critical sense of logic, a thoroughness and a versatility of methods which is amazing even to the sophisticated research worker of the late 20th century.

Between 1881 and 1907 Miller published 164 scientific articles in German, American and English journals. Of the few books he wrote, the most famous one was first published in German in 1889, under the title ‘Die Mikroorganismen der Mundhöhle’. Better known internationally and more often cited is the English version of this book which has been reprinted in the present edition. ‘The Micro-Organisms of the Human Mouth’ was published in Philadelphia a year after the German original.

The American edition of 1890 is not only better known nowadays than the German edition, but its text had been partly revised besides being translated, and a whole new chapter (III) was added by the author.

Several reasons seem to justify a new edition of this book. First of all, it is so extremely rare that it is nearly inaccessible, although no part of it is obsolete. To say the least, it is a unique document of the first major attempt to solve a number of unsolved dental problems in a scientific way. The etiology of dental caries for which the book is most famous, is only one of them. Miller was an outstanding histopathologist, and the results of his investigations of carious dentine and of infections of the pulp, for their time, were a step from the Stone Age to Modern Science.

The vicinity of Miller’s small laboratory to the institute of Robert Koch obviously explains the keen interest of the Professor of Dentistry not only in oral but also in general microbiology. Miller’s methods of determination and differentiation of strains were as versatile as his very limited facilities would permit (his research laboratory measured about 30 square feet). Miller’s limitations were compensated for by his awareness of the pitfalls, and he knew that an oral microbiologist must not rely on morphology: ‘. . . the form of a fungus alone by no means always entitles us to draw conclusions as to its specific character’. Miller’s
self-critical attitude also becomes apparent when he refers to his great many attempts ‘to cultivate the supposed bacterium of greenstain, but so far without success’, or when he questions the validity of an earlier success in isolating from the mouth ‘the bacterium of brick-colored deposit’: ‘My present opinion however, is that the one I obtained is not the one I have been seeking’ (p. 91 and 92). Few scientists will know that Miller did not claim the ‘chemico-parasitical’ explanation of the caries process to be his own invention, although in retrospect he deserves full credit for the caries theory bearing his name: ‘... in the decay of the hard tooth-structures ‘two factors have always been in operation: (1) the action of acids, and (2) the action of germs’. ‘This theory — which for the sake of distinction may be called the septic — is rather an amplification of the chemical theory than a contradiction of it. Most probably the work of décalcification is entirely performed by the action

W.D. MILLER and his Contributions to Dental Science VII

of acids, but these acids are, we think, secreted by the germs themselves ... (p. 134). This is not a citation from Miller, but Miller’s citation of Milles and Underwood (Transact. Int. Med. Congr. 1881) to whom Miller gives ample credit.

Miller’s comprehension for the possibilities of caries prevention, derived from his ideas of the etiology of caries, was remarkably clear and would have credibility had it been written yesterday: ‘... it must be apparent that there are four ways by which we may counteract or limit the ravages of this disease. We may endeavour (1) by hygienic measures to secure the best possible development of the teeth; (2) by repeated, thorough, systematic cleansing of the oral cavity and the teeth, to so far reduce the amount of fermentable substances as to materially diminish the production of acid, as well as to rob the bacteria of the organic matter necessary to their rapid development; (3) by prohibiting or limiting the consumption of such foods or luxuries, which readily undergo acid fermentation, to remove the chief source of the ferment products injurious to the teeth; (4) by the proper and intelligent use of antiseptics to destroy the bacteria, or at least to limit their number and activity’ (p. 223).

What Miller wanted to say by mentioning as a possibility the ‘proper and intelligent use of antiseptics’ is elaborated in his book in great detail and is worth serious consideration by all those working on this problem today: ‘If a very thorough mechanical cleansing has not preceded the antiseptic, its action upon the centers of decay will be equal to little more than zero’ (p. 225 and 226). This remark is only one of the many
warnings Miller gave as limitations to his general idea. Needless to say, Miller knew from his own investigations that even under optimum conditions not more than a temporary reduction of microbial counts was to be expected after the application of antiseptics.

One of the most interesting facettes of the book is Miller’s misconception about the etiologic role of plaque. This is the more surprising since Miller nearly always was right with the interpretation of what he observed, if he was able to observe it. His failure to recognize the importance of plaque, and his persistance in denying it is perhaps explained by his clinical experience being inferior to that of his famous colleagues and opponents G.V. Black and J.L. Williams.

There is no doubt that Miller payed some attention to aggregates on the surface of teeth, because he states that he isolated ‘more than one hundred different kinds of bacteria from the juices and deposits in the mouth’ (p. 68; emphasis supplied by the editor). Nevertheless, Miller remained reluctant, and from his many experiments, when using bacteria-containing saliva for acid production in vitro, he seemed to believe in the cariogenic effect of free acid in the oral cavity.

Under the impression of the evidence accumulated by Black and Williams, Miller in 1902 published an article on ‘The Presence of Bacterial Plaques on the Surface of the Teeth, and Their Significance’, in Dental Cosmos 44,425—446; May (No. 5) 1902. He begins by defending himself and citing quotations from his earlier writings in which he had pointed at the presence of ‘masses of bacteria’ in a ‘matrix’ on the tooth surface — but the matrix he refers to is the enamel cuticle which is ‘thickened and invaded by masses of bacteria’. Miller then enlarges on Williams’ opinion that all softening of enamel in the caries process ‘is due to the action of acids, and chiefly or wholly to the acids excreted by bacteria in situ’. Miller continues: ‘Others, in commenting upon his communication, have, it seems to me, gone rather farther than Williams himself, and the view seems now to be rather prevalent that the bacteria coating the surface of the enamel cover or invest themselves with a gelatinous substance, underneath which they produce their acids directly in contact with the enamel, and that only acids produced beneath those films and protected from dissipation in the saliva by the films are responsible for the beginning of caries. Acids distributed in the saliva have no influence in causing caries’. Miller then goes on citing Black: ‘Caries of the teeth has its beginning when the conditions of the mouth are such that microorganisms causing caries form gelatinous plaques, by which they are
glued to the surface of the teeth’. Miller’s lack of appreciation of these views culminates in the comment ‘I am not convinced that the nature of this film has been determined with sufficient clearness, or whether its significance and importance may not have been somewhat overrated’. From this statement it is obvious that Miller did not think of extracellular formation of polysaccharide as a specific factor in the cariogenic environment of the teeth. As a matter of fact Miller, in his book (pages 19, 22 and 23), did mention dextran formation as one of the metabolic activiteis bacteria may exert on carbohydrates, and he described the example of Leuconostoc mesenteroides in the molasses of sugar factories; this was mentioned, however, solely for the purpose of giving — as introduction — a complete systematic survey of what Miller called the ‘vital manifestations of microorganisms’.

Miller’s lack of recognition of the importance of plaque, and his experimenting in vitro with incubation mixtures of oral fluid and different carbohydrates explains why he considered starch to be more cariogenic than sucrose. In a mixture of saliva and bacteria where there is no diffusion barrier, and where incubation for hours blurs the details of the degradation, addition of starch as substrate may result in formation of more acid than addition of sucrose. Miller thought that ‘sugar, being readily soluble, is soon carried away or so diluted with the saliva as to be rendered harmless, whereas amylaceous matter (i.e. starch; edit.) adheres to the teeth for a greater length of time and consequently manifests a more continued action than sugar’ (p. 207). Miller, however, adds a — presumably personal - communication saying that ‘Busch, on the contrary, is of the opinion that ‘baker caries’ is due rather to the inhalation of sugar-dust than to that of flour-dust’ (p. 207). In spite of all limitations, Miller’s ‘Micro-Organisms of the Human Mouth’ is highly rewarding reading matter; every page of it reflects stimulating ideas of a sparkling, creative mind — one of the greatest in dental science we ever had.

THE

Micro-Organisms of the Human Mouth.

THE LOCAL AND GENERAL DISEASES WHICH ARE CAUSED BY THEM.
PREFACE.

THE impetus given to the study of bacteriology by the introduction of the exact methods of bacteriological investigation now in vogue, has led to discoveries in the domain of dental and oral pathology which are of the greatest importance not to the dental surgeon alone but equally to the practitioner of general medicine.

It has been established beyond all question that myriads of micro-organisms are constantly present in the human mouth, and that these, under favorable circumstances, are capable of manifesting an action of the utmost significance upon the local as well as the general health of the patient. Not alone are they responsible for the vast majority of those diseases of the teeth and contiguous parts which the dental surgeon is called upon to treat, but they also give rise to other local and general disorders of the most serious nature.

These various disturbances are produced partly by the direct action of micro-organisms and their products upon the teeth and the mucous membrane of the mouth, partly by constant swallowing of large masses of bacteria, partly by carrying them into the lungs, particularly in cases of violent inspiration, and, finally, by their obtaining an entrance into the blood or lymph-vessels in the various ways described in Chapter XI.

The existence of a most excellent nursery for bacteria at the
very portal of the human body is a fact which has only recently begun to receive the attention which its importance demands. It has been my endeavor in the following pages to bring about a better understanding of the nature and extent of bacteriologic growths in the human mouth, of the disastrous effects which they are capable of producing, and, accordingly, a more proper appreciation of the importance of dental surgery and dental hygiene as a branch of general medicine.

The contents of the book consist chiefly of original investigations which, in part, have appeared in different American, English, and German journals, and in part appear here for the first time.

The first three chapters are designed more particularly for those of my readers who may not have occupied themselves with bacteriological studies, it being, in my opinion, utterly impossible for anyone to obtain a proper understanding of the action of micro-organisms in the mouth without a knowledge of at least the elementary principles lying at the foundation of the science of bacteriology.

Of those works to which I am indebted for aid in my labor, I wish to mention in particular the Lehrbuch der Mikroorganismen, by Flügge, and Die Fortschritte in der Lehre von den pathogenen Mikroorganismen, by Baumgarten.

I take pleasure in acknowledging the very valuable assistance rendered me by my friend Mr. Frank Thilly, of Cincinnati, Ohio, in the preparation of the manuscript.

The Author.

Berlin, May, 1890.

CONTENTS.

PAGE
Literature xiii

PART I.

GENERAL BACTERIOLOGICAL STUDIES, WITH SPECIAL REFERENCE TO THE BACTERIA OF THE HUMAN MOUTH.
CHAPTER I.

PAGE
Introductory 1
Short Outline of the Morphology and Biology of Bacteria 4
1. Forms of Bacteria 4
2. Cumulative Forms of Bacteria 7
3. Reproduction of Bacteria 8
4. The Origin of Bacteria 9
5. Life-Conditions of Bacteria 10
6. Influence of Various Conditions on the Growth of Bacteria 11
   a. Action of Temperature 11
   b. Action of Oxygen 11
   c. Action of Acids and Alkalies 12
   d. Action of Light, Electricity, and Pressure 12
7. Antagonism among the Bacteria 13
8. Self-Destruction of Bacteria 14
Vital Manifestations of Bacteria 15
I. Action of Bacteria upon the Living Vegetable or Animal Body 15
II. Action upon Lifeless Matter. 18
   1. Fermentation Bacteria 18
      A. Fermentation of Carbohydrates 19
         a. Lactic Acid Fermentation 20
         b. Mannite Fermentation 22
         e. Dextrane Fermentation 22
         d. Butyric Acid Fermentation 23
         e. Diverse Fermentations 25

vii

viii CONTENTS.

PAGE
B. Fermentation of Polyvalent Alcohols 25
C. Fermentation of Fats, Fatty Acids, and Oxyacids 26
D. Putrefaction 27
Ptomaines 29
E. Oxidation of Alcohol to Acetic Acid 31
F. Ammoniacal Fermentation 32
G. Nitrification and Denitrification 32
2. Chromogenic Bacteria 34
3. Aërogenic Bacteria 35
4. Saprogenic Bacteria (Bacteria of Putrefaction) 36

CHAPTER II.

Nutrient Media for Bacteria in the Oral Cavity .37
1. Saliva 37
2. The Buccal Mucus 42
3. Dead Epithelial Cells 42
4. Tooth-Cartilage 43
5. The Dental Pulp .43
6. Exudations of the Gums 43
7. Accumulation of Particles of Food 44

CHAPTER III.

The Development of the Study of Micro-organisms in the Oral Cavity 45
Methods of Bacteriological Investigation 48
Definitions 48
Apparatus 49
Pure Culture 52
Line Cultures 52
Dilution Cultures 54
Test-tube Cultures 56
Other Solid Culture Media 57
Liquid Media 59
Application of the Above Methods to Cultivations from the Human Mouth 59
Preparation of Nutrient Gelatine, or Agar-Agar 62
Examination of Micro-Organisms under the Microscope 65
Cover-Glass Preparations 66
Tissue Preparations 67

CONTENTS. ix

CHAPTER IV.

PAGE
Biological Studies on the Bacteria of the Moûth 68
Mouth-Bacteria Proper 69
Leptothrix bucealis 70
Mouth-Bacteria which are Uncultivable and whose Pathogenesis is unknown

Mouth-Bacteria which give a Blue or Violet Reaction with Iodine

Cultivable Mouth-Bacteria, partly Non-Pathogenic, partly of Unknown Pathogenesis

Chromogenic Mouth-Bacteria

The Bacteria of Diseased Pulps

The Relation of Mouth-Bacteria to the Formation of Tartar

CHAPTER V.

Mouth-Bacteria as Exciters of Fermentation

General Remarks

A. Action of Mouth-Bacteria upon Carbohydrates
   1. Lactic Acid Fermentation
   2. The Spontaneous Butyric Acid Fermentation
   3. The Acetic Acid Fermentation
   4. Diastatic Action of Mouth-Bacteria
   5. Inverting Action of Mouth-Bacteria

B. Action of the Mouth-Bacteria on Albuminous Substances

C. Fermentation of Fats and Fatty Acids in the Oral Cavity

D. Nitrification and Dénitrification in the Mouth

CHAPTER VI.

Action of the Products of Fermentation on the Different Structures of the Mouth

The Decay of the Teeth

The Stagnation of Depraved Juices in the Teeth

Disturbances of Nutrition as Cause of Decay

Inflammation Theory of Decay

Worm Theory of Caries

Putrefaction as Cause of Decay

Chemical Theory of Dental Decay
X CONTENTS.

PAGE
Parasitic Theory of Dental Decay 132
Electrical Theory of Decay 135
Diverse Causes of Caries 144

CHAPTER VII.

Original Investigations on the Decay of the Teeth 146
Introductory Remarks on the Histology and Chemistry of the Teeth 146
Chemical Composition of the Hard Dental Substance 148
Physical Phenomena of Dental Decay 51
a. Decay of Enamel 151
b. Decay of Dentine.153
c. Decay of the Cement 155
d. Decay of the Enamel-Cuticle 156
Accompanying Phenomena of Dental Decay 156
1. Transparency of the Tissue in Dental Decay 156
2. Pigmentation of the Tissue in Dental Decay.162
Chemical Changes attending Decay of the Teeth.163
Microscopical Phenomena of Decay 165
1. Decay of the Enamel-Cuticle 165
2. Decay of Enamel 166
a. Preparation of Specimens 166
b. Appearances under the Microscope 168
3. Decay of Dentine 171
a. Preparation of Specimens171
b. Methods of Staining 173
c. Appearances under the Microscope 175
Thickening of Neumann’s Sheath 188
4. Decay of Cement 193
Decay of Teeth worn on Plates 194
Artificial Decay 194
Caries of Animal Teeth 199
Spontaneous Healing of Dental Decay 202

CHAPTER VIII.

Etiology of Dental Decay 205
The Micro-Organisms of Dental Decay 214
Predisposing Causes of Dental Caries 216
Influence of Civilization on Decay 218

CHAPTER IX.

Prophylaxis of Dental Decay223
The Use of Antiseptics in the Prophylactic Treatment of Decay 225
The Antiseptic Action of Filling-Materials.237
The Action of Tobacco upon the Teeth.246
The Sterilization of Teeth for the Purpose of Implantation 247

CONTENTS. xi

PART II.

THE PATHOGENIC MOUTH-B ACTE RIA, AND THE DISEASES
WHICH THEY PRODUCE.

CHAPTER X.

PAGE
The Buccal Secretions as Carriers of Toxic Substances and of
Parasitic Excitants of Diseases 253
Toxic Properties of Mixed Human Saliva 254
Pathogenic Bacteria of the Human Mouth 256
1. Non-cultivable Pathogenic Mouth-Bacteria 267
2. Cultivable Pathogenic Mouth-Bacteria 259
a. Micrococcus of Sputum Septicaemia 259
b. Bacillus crassus sputigenus 262
c. Staphylococcus pyogenes aureus and albus Streptococcus pyogenes 263
d. Microeoccus tetragenus265
Biondi’s Mouth-Bacteria 265
e. Bacillus salivarius septicus 266
/. Coccus salivarius septicus 266
g. Streptococcus septo-pyæmicus 266
h. Staphylococcus salivarius pyogenes 267
Original Investigations on Pathogenic Mouth-Bacteria 268
i. Micrococcus gingivae pyogenes 270
k. Bacterium gingivae pyogenes 271
l. Bacillus dentalis viridans 272
m. Bacillus pulpæ pyogenes 273

CHAPTER XI.
Entrance-Portals of the Pathogenic Mouth-Bacteria 274
1. Invasion of Pathogenic Mouth-Bacteria following Mechanical Injuries 274
2. Gangrenous Tooth-Pulps as Centers of Infection 285
3. Complaints caused by the Direct Action of Bacteria upon the Mucous Membrane of the Mouth and Pharynx 295
4. Pulmonary Diseases caused by the Inspiration of Germs from the Oral Cavity 299
5. Complaints of the Digestive Tract caused by Mouth-Bacteria 300
Gas-forming Bacteria of the Stomach 318
Morphology 317
6. Points of Attack furnished by a Lack of Resistance in the Soft Tissues of the Mouth 319
o. Limited Suppurative Processes at the Margin of the Gums 319
b. Abscess-Formation resulting from Impeded Eruption of Wisdom Teeth 320
c. Pyorrhoea Alveolaris 321
Original Investigations concerning Pyorrhoea Alveolaris 328

xii CONTENTS.

PAGE
d. Stomatomycosis sarcinica 334
e. Mycosis tonsillaris benigna 334
/. Stomacace 335
g. Stomatitis phlegmonosa, ulcerosa, etc. 335
7. Infections resulting from the Accumulation of the Excitants of Diphtheria, Syphilis, Typhus, etc., in the Oral Cavity 337
Actinomycosis 339

CHAPTER XII.

Supplementary Remarks on Bud-, Mould-, and Animal Eunqi 343
Bud-Fungi 343
Mould-Fungi 349
Mycetozoa, Animal-Fungi or Fungous Animals 351
Index op Authors 355
General Index 359

LITERATURE.

8 Frank. Leunis’ Synopsis der drei Naturreiche. Bd. III. Specielle Botanik, Kryptogamen. § 842.
7 Leeuwenhoek. Opera omnia sive arcana naturae ope microscopiorum exactissimorum deteeta. 1722.
8 Nencki. Beiträge zur Biologie der Spaltpilze. 1880.
12 D. Biondi. Contribuzione all’ etiologia della suppurazione. (La Riforma medica, 1886. No. 34-36.)
14 Kreibohm und Rosenbach. Experimentelle Beiträge zur Frage: Kann Eiterung ohne Mitbeteiligung, etc. (Archiv f. klin. Chirur. 1888. Bd. XXXVII, S 737.)
18 Scheurlen. Weitere Untersuchungen über die Entstehung der Eiterung, ihr Verhältniss zu den Ptomaünen und zur Blutgerinnung. (Fortschritte d. Medicin. 1887. No. 23, S. 762.)
19 Hoppe-Skylkr. Physiologische Chemie.
20 Miller. Ueber Gab rungs Vorgänge im Verdauungstractus und die dabei heitigten Spaltpilze. (Deutsche med. Wochenschr. 1885. No. 49.)

xiii

xiv LITERATURE.

23 Hüeppe. lieber die Zersetzung der Milch. (Mitth. a. d. Reichsgesundheitsamt.


28 Boutroûx. Sur la fermentation lactique. (Comptes rendus. Bd. LXXXVI, P. 605. 1878.)


30 Nencki. Ueber die Zersetzung der Gelatine und des Eiweisses bei der Fäulniss u. s w. Bern, 1876.


33 Hansen. Contributions à la connaissance des organismes qui peuvent se trouver dans la bière et la moût de bière et y vivre. (Meddelser fra Carlsberglaboratoriet. 1879. Heft 2.)


37 Dehéran et Maquenne. Sur la réduction des nitrates, etc. (Comptes rendus. 1882. II. Bd. XCV, Pp. 691, 732, 854.)


40 Binz. Arzneimittelhlehre. 8. 197, 198.


42 Hoppe-Seyler. Physiologische Chemie. S. 188.

43 Ellknberger und Hofmeister. Der Speichel der Wiederkäuer. (Bericht über das Veterinärwesen im Königreich Sachsen. 1885. S. 119.)

44 The Saml®. Die Function der Speicheldrüsen der Haussäugethiere. (Archiv wissensch. u. prakt. Thierheilk. 11. 1885.)

45 Koux. Gazz. med. veterin. di Milano. 1871. (See Hoppe-Seyler19.)
47 Kirk. A Contribution to the Etiology of Erosion. (Dental Cosmos. 1887. P. 50)

LITERATURE. XV

48 Leeuwenhoek. Opera omnia, etc. Bd. II, S. 40, 1722.
61 Henle. Pathologische Untersuchungen. 1840.
88 Ficinus. Ueber das Ausfallen der Zähne. (Walter’s und Ammon’s Journal für Chirurgie, etc. 1847. Bd. VI, Heft 1.)
84 Bobin. Histoire naturelle des végétaux parasites. 1858.
87 Hallier. Die pflanzlichen Parasiten, etc. Leipzig, 1866.
89 VIGNAL. Recherches sur les Microorganismes de la bouche. (Archives de physiol, norm, et pathol. 1886. No. 8.)
80 Miller. Zur Kenntniss der Bakterien der Mundhöhle. (Deutsche med. Wochenschr. 1884. No. 47.)
61 Lewis. Lancet. September, 1884.
62 Miller. Ueber einen Zahn-Spaltgift, Leptothrix gigantea. (Berichte der Botanischen Gesellschaft. 1883. S. 224.)
84 Black. Trans, of 111. State Dental Society. 1886.
88 Watt. Chemical Essays.
88 VIGNAL. La France médicale. Août 25, 1887.
88 Escherich. Die Darmbacterien des Säuglings. 1886.
70 Kräutermann. Sicherer Augen-und Zahnarzt. 1732. (See Schlenker72.)
72 Schlenker Die Verderbniss der Zähne
74 Eustachius. Opuscula anatomico et de dentibus. 1574.
78 John Hunter. Diseases of the Teeth, etc. 1778.
78 Joseph Fox. The History and Treatment of the Diseases of the Teeth and Gums. 1806.
77 Thomas Bell. Anatomy, Physiology, and Diseases of the Teeth. 1831.
81 Heitzmann and Boedecker. Inflammation of Dentine (Eburnitis). (Indep. Pract. 1886. P. 120.)

XVI LITERATURE.

83 Frank Abbott. Caries of the Human Teeth. (Dental Cosmos. 1879. February, March, April.)
87 Linderer. Handbuch der Zahnheilkunde. 1837 and 1842.
88 W. Robertson. A Practical Treatise on the Human Teeth, etc. 1835.
89 Roonabd. Can. des hôpit. 1838.
90 Magitot. La salive. Paris, 1867.
91 Wedl. Pathologie der Zähne. 1870.
93 J. Taft. Operative Dentistry.
97 Arkövy. Diagnostik der Zahnkrankheiten.
99 A. Gysi. Dental Cosmos. 1887. No. 4.
491 Peirce. Ibid. 1888. P. 583.
106 Miller. Dental Cosmos. 1881 P. 91.
LITERATURE. xvii

124 Bridgman. Ibid. P. 369.
125 MM. Galippe et Vignal. Note sur les microorganismes de la carie dentaire. (L’Odontologie. Mars, 1889.)
128 Magitot. Traité de la carie dentaire. 1867. P. 60.
128 W. C. Barrett. An Examination of the Condition of the Teeth of Certain Prehistoric Races. (Indep. Pract. October, 1883.)
129 Miller. Prehistoric Teeth. (Ibid. 1884. P. 40.)
182 Black. Antiseptics. (Dental Review. 1889. Nos. 2 and 3.)
141 Eberlk. Die Verdauung. 1834. S. 34.
144 Pasteur. Ibid., 18 et 25 Janvier, 1881.
748 Vulpian. Ibid., 29 Mars, 1881.
147 Griffin. Archivio per le scienze mediche. Vol. V, Fase. 3.
182 Kreibohm. Flügge, Mikroorganismen. S. 257.
188 Kreibohm. Lit. 152. S. 260.
188 Black. Indep. Pract. August, 1887.

Xviii LITERATURE.

160 Zakharevitsch. Vrach No. 34. S. 523. (From the Deutsche med. Wochenschr.)
163 Zawadzki. Qaz. lekarska. 1886. No. 8. (From the Deutsche med. Wochenschr.)


169 Porre. ' Dental Record. October, 1887.


172 Fripp. Dental Record. August, 1887.


180 Galippe. Die infectiöse arthro-dentäre Gingivitis. 1888. (Ueberettzung von Manassewitsch.)


184 Arkövy. Diagnostik der Zahnkrankeiten.

185 Kothmann. Patho-Histologie der Zahnpulpa, etc. 1888.


189 Baumgarten. Jahresbericht. 1 Jahrgang. S. 142.


LITERATURE. xix


S. 869.
197 Ewals. Die Lehre von der Verdauung. 1886. 8.104.
198 Eschbrich. Beiträge zur antiseptischen Behandlungsmethode der Magen-Darmkrankungen
des Säuglings. (Therap. Monatshefte. 1887. S. 390) und
Die desinScirende Behandlungsmethode der Magen-Darmkrankheiten des Säuglingsalters.
(Centralbl. f. Bacterial, u. Parasitenkunde. 1887. Bd. II, No. 21.)
202 Socksdorf. Das quantitative Vorkommen von Spaltpilzen im menschlichen
204 Miller. Deutsche med. Wochenschr. 1885, No. 49. 1886, No. 6.
1885. No. 19, etc.)
208 Pbdley. On the Pathology of Riggs’s Disease. (Dental Record. May, 1887.)
207 Bland Sutton. Ibid. May, 1887.
214 Bulkiby. On the Dangers arising from Syphilis in the Practice of Den-
tistry
215 Dulles Medical and Surgical Reporter. January, 1878.
222 Parker. Western Dental Journal. February, 1890.
225 James Israel. Neue Beobachtungen aus dem Gebiet der Mykose des
XX LITERATURE.

228 PoNFiCK. Ueber eine wahrscheinlich mykotische Form von Wirbelcaries.
(Berliner klin. Wochenschr. 1879. S. 845.)

227 James Israel. Klinische Beiträge zur Aktinomykose des Menschen 1885.

228 Hochenegg. Zur Casuistik der Aktinomykose des Menschen. (Wiener med Presse. 1887. No. 16-18.)

229 Botter. Demonstration von Impfaktinomykose. (Tagebl. der Naturforscher-Versammlung. Wiesbaden, 1887. S. 272)


231 Moosbruggeb. Ueber die Aktinomykose des Menschen. (See Baumgarten’s Jahresbericht, 1886. S. 317.)


233 Braun. Ueber Aktinomykose des Menschen.


238 Gbawitz. Ueber die Parasiten des Soors, etc. (Virchow’s Archiv. 1886. Bd. OUI, S. 393.)

239 Frankel. Grundriss der Bacterienkunde.

240 Zopf. Pilzthiere oder Schleim pilze. 1885.


PART I.

General Bacteriological Studies,

WITH
SPECIAL REFERENCE TO THE BACTERIA OF THE HUMAN MOUTH.