CHAPTER 1

١

Introduction to Cell Growth: Growth in Size and DNA Replication R. BASERGA

A.	Introduction
Β.	Doubling of Size in Growing Cells
С.	Replication of DNA in Growing Cells
D.	Independence of Signal to Grow in Size from Signal to Replicate DNA
E.	Mechanism of Action of Growth Factors
Re	ferences

CHAPTER 2

Survival and Growth Requirements of Nontransformed Cells. R. G. HAM

A.	Definitions	13
	I. Normal, Nontransformed, and Transformed Cells	13
	II. Survival and Survival Requirements	14
	III. Cell Cycle, Growth, Division, Multiplication, and Proliferation .	14
	IV. Nutrient, Growth Requirement, Growth Factor, Mitogen,	
	and Hormone.	15
Β.	Assay Systems for the Measurement of Growth Requirements	16
	I. Background	16
	II. Inadequacy for Nontransformed Cells of Classic Assay Systems .	17
	1. Evolutionary Adaptation of Permanent Lines	17
	2. Role of Serum in the Multiplication of Nontransformed Cells	18
	3. Problems Awaiting Solution for Nontransformed Cells	19
	III. Holistic Approach to Cellular Growth Requirements	20
	IV. Development of Specific Assays for Individual Growth	
	Requirements	21
	1. Background Media Lacking a Single Growth-Promoting	
	Substance	22
	2. First Limiting Factor	22
	3. Replaceable Requirements	22
	4. Sequential Depletion	23
	5. Systematic Testing of Suspected Growth-Promoting Substances	23



	V.	Types of Measurement and Analysis of Data	23
		1. Short-Term Vs Long-Term Multiplication	:4
			24
			25
			26
			27
			28
	VI.		28
C.			33
			33
			35
			35
			35
			- 86
			37
			38
			39
	III.		39
			10
		2. Sodium, Chloride, Osmolarity, and Humidification of	
			11
			12
			13
			14
			15
	IV.		16
			16
			17
			17
			18
			19
			50
		7. Inorganic Trace Elements	
	V.	Quantitative Optimization of Synthetic Media	
		1. Species and Cell Type Individuality of Quantitative	
		Requirements	52
		2. Reduction of Requirements for Serum and Growth Factors . 5	
	VI.		54
			54
			55
			56
			56
			56
	VII.		57
			57
			57
			59

.

4. Individuality of Cellular Requirements	59
5. Nontransformed Cells	
6. Relationship to In Vivo Growth Requirements	
VIII. Special Requirements Related to Cellular Density	
1. Requirements for Clonal Growth	
2. Requirements for Multiplication of Dense Cultures	63
IX. Regulatory Interactions and Artificial Stimulation of	
Multiplication	64
1. Borderline Toxicity	65
2. Proteolytic Enzymes	
3. Tumor Promoters	65
4. Inorganic Ions	
5. Cyclic Nucleotides	. 66
6. Defining a Genuine Growth Requirement	. 67
D. Requirements for Survival of Nontransformed Cells Without	
Proliferation	67
I. Early Studies	
II. Survival Factor	
III. Elimination of the Need for Survival Factor	
IV. Nutrients and Survival	
V. Differences in Survival Between Nontransformed and Transformed	
Cells	
E. Future Studies of the Growth and Survival Requirements of	. 07
Nontransformed Cells	. 70
I. Integration of New Findings	
II. Questions Remaining to be Solved After Development Synthetic	
Media	
III. Magnitude of Remaining Work	. 71
IV. Selective Allocation of Resources	. 71
F. Summary and Conclusions	
G. Note Added in Proof	. 73
References	. 74

Epidermal Growth Factor. G. CARPENTER. With 3 Figures

A.	Introduction								-89
B.	Chemical and Physical properties of EGI	₹.							89
	I. Mouse EGF								89
	1. Isolation								89
	2. Chemical and Physical Properties								90
	3. Derivatives								91
	a) EGF-2								91
	b) EGF-5								91
	c) Cyanogen Bromide EGF.								92
	4. High Molecular Weight Mouse E	GF	۰.						92

	II. Human EGF	93
	1. Identification and Isolation	93
	2. Chemical and Physical Properties	93
	3. Relationship of Human EGF and Urogastrone	94
	III. Rat EGF	95
C	Physiological Aspects of EGF	95
U.	I Concentration in Dedu Eluide	
	I. Concentration in Body Fluids	95
	1. Mouse EGF	95
	2. Human EGF	95
	II. Localization	95
	1. Mouse EGF	95
	2. Human EGF	96
	III. Control of Submaxillary Gland Content of Mouse EGF	96
	IV. Secretion of Mouse EGF from the Submaxillary Gland	97
	V. Factors Affecting Levels of Human EGF	97
D.	Biological Activities of EGF In Vivo	98
	I. Škin	98
	II. Corneal Epithelium	99
	III. Respiratory Epithelium	99
	IV. Gastrointestinal Tract	99
	V. Liver	
Б	Organ Culture Studies of EGF.	
E.		
	II. Other Tissues	
	1. Cornea	
_	3. Bone	
F.	Cell Culture Studies of EGF	
	I. Cell Nutrition	
	II. Types of Cells Affected by EGF	
	III. EGF and the Growth of Cell Populations	
	IV. Components of the Mitogenic Response	
	1. Rapid Biological Responses at the Membrane	
	a) Uridine Uptake	
	b) Sugar Transport	105
	c) Cation Fluxes	105
	d) Putrescine Transport	105
	e) Alanine Transport	106
	f) Membrane Ruffling and Macropinocytosis	
	g) Other Membrane Responses	
	2. Responses of EGF Occurring in the Cytoplasm	
	a) Activation of Glycolysis	
	b) Synthesis of Extracellular Macromolecules	
	c) Activation of RNA and Protein Synthesis	
	d) Activation of Ornithine Decarboxylase	
	e) Protein Phosphorylation	
		100

	3. Stimulation of DNA Synthesis	. 108
	V. Responses Not Related to Mitogenesis	
G.	Growth Factor: Receptor Interactions.	
	I. Receptors for EGF.	
	II. Internalization and Degradation of EGF	
	1. Biochemical Evidence	
	2. Morphological Evidence	
	II. Internalization of the Receptor	
	1. Indirect Evidence	
	2. Chemical Evidence	
	3. Morphological Evidence	
	V. Recovery of Receptor Activity	
H.	Relationship of EGF Binding and Metabolism to Biological Activity	
	I. Rapid Changes in Cell Physiology	. 115
	II. Sumulation of DNA Synthesis	. 116
I.	II. Stimulation of DNA Synthesis	
I.	Other Controls of Receptor Activity	. 118
I.		. 118 . 118
I.	Other Controls of Receptor Activity	. 118 . 118 . 119
I.	Other Controls of Receptor Activity	. 118 . 118 . 119 . 120
I.	Dther Controls of Receptor Activity	. 118 . 118 . 119 . 120 . 120 . 121
I.	Dther Controls of Receptor Activity	. 118 . 118 . 119 . 120 . 120 . 121
	Dther Controls of Receptor Activity	. 118 . 118 . 119 . 120 . 120 . 121 . 121
K.	Definition Image: Controls of Receptor Activity Image: Controls of Receptor Activity I. Transforming Agents Image: Control of Receptor Activity Image: Control of Receptor Activity II. Transforming Agents Image: Control of Receptor Activity Image: Control of Receptor Activity II. Tumor Promoters Image: Control of Receptor Activity Image: Control of Receptor Activity III. Differentiation Image: Control of Receptor Activity Image: Control of Receptor Activity IV. Lectins and Glycoprotein Metabolism Image: Control of Receptor Activity Image: Control of Activity V. Glucocorticoids Image: Control of Activity Image: Control of Activity Image: Control of Activity VI. Modulation of Protein Synthesis Image: Control of Activity Image: Control of Activity Image: Control of Activity	 . 118 . 118 . 119 . 120 . 120 . 121 . 121 . 121
K. L.	Definition Image: I	. 118 . 118 . 119 . 120 . 120 . 121 . 121 . 121 . 121 . 122

The Platelet-Derived Growth Factor. R. Ross. With 14 Figures

Α.	Serum, the Platelet-Derived Growth Factor, and Cell Culture	133
B.	The Platelet	135
	Platelet-Structure and Function	
D.	The Gray Platelet Syndrome	138
E.	The Megakaryocyte as the Source of Platelet-Derived Growth Factor .	138
F.	Purification and Characterization of the Platelet-Derived Growth Factor	140
G.	The Spectrum of Cell Response	142
H.	Control of Cell Proliferation by Platelet-Derived Growth Factor	
	and Plasma	144
I.	The Role of Plasma	146
Κ.	Endocytosis and the Platelet-Derived Growth Factor	149
L.	Modulation of Receptors for Epidermal Growth Factor by	
	Platelet-Derived Growth Factor	149
М.	Lipid Metabolism and the Platelet-Derived Growth Factor	150
N.	Platelets and Cell Proliferation In Vivo	154
О.	Summary	156
Ref	ferences	157

Somatomedin: Physiological Control and Effects on Cell Proliferation D. R. GLEMMONS and J. J. VAN WYK. With 13 Figures

Α.	Introduction	161
В.	Assay Systems Used to Measure Somatomedins	162
	I. Biological Assays	162
	II. Radioreceptor Assays	
	III. Protein Binding Assays	163
	IV. Radioimmunoassays	
	V. Standards Used for the Quantitation of Somatomedin Activity	166
С.	Isolation and Properties of the Individual Somatomedins	166
	I. Basic Somatomedins	
	1. Somatomedin-C (SM-C)	
	2. Insulin-Like Growth Factor I (IGF-I)	
	3. Somatomedin in Other Species	
	II. Neutral Somatomedins	. 171
	1. Insulin-Like Growth Factor II (IGF-II)	. 171
	2. Somatomedin-A (SM-A)	. 171
	3. Multiplication Stimulating Activity (MSA)	
D.	Production of the Somatomedins	172
	I. Somatomedin Production by Organs and Tissue Slices	
	II. Somatomedin Production by Monolayer Cultures	174
E.	Molecular Size and Transport of Somatomedins in Plasma:	
	The Somatomedin Binding Proteins	. 175
F.	Control of Somatomedin Concentrations in Blood	178
	I. Blood Concentrations in Normal Individuals	178
	1. Effect of Age	178
	2. Effect of Hormonal Status	
	a) Growth Hormone	180
	b) Prolactin and Placentral Lactogens	182
	c) Thyroid Hormone	183
	d) Cortisol	183
	e) Estrogens	183
	3. Effect of Pregnancy	
	4. Effect of Nutritional Status	184
G.	In Vitro Biological Effects of the Somatomedins	186
	I. Whole Tissue Effects	186
	1. Cartilage	186
	2. Muscle	187
	3. Adipose Tissue	
	II. Correlation Between Biological Responses and Receptor Interactions	
	III. Stimulation of DNA Synthesis and Cell Growth in Tissue Culture	
	1. Range of Responsive Cell Types	. 190
	2. Interaction Between Somatomedin and Other Growth Factors	
	in the Cell Cycle	. 191

Contents

3. Production of Somatomedin-Like Peptides by Cultured Cells																							
and Their Role in Cellular Proliferation													193										
H. In Vivo A	Actic	ons	of t	he	Sor	nat	om	ed	ins						•				•				196
References .	•••			•			•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	198

Glucocorticoid Modulation of Cell Proliferation

V. J. CRISTOFALO and B. A. ROSNER. With 2 Figures

A.	Introduction	209
	I. Historical Perspective	209
	II. Glucocorticoids: General Mechanisms of Action	209
В.	Hormone Responsiveness by Cell Cultures	211
	I. Various Vertebrate Species	211
	II. Human Cell Lines	
	III. Mouse and Rat Cell Lines	
С.	Permissive Effects of Glucocorticoids	218
	I. Glucocorticoid Modulation of Heterologous Receptors	218
	II. Glucocorticoid Effects on Other Factors Implicated in the	
	Regulation of Cell Growth	219
D.	Glucocorticoid Induction of Growth Factors in Normal Human Cells	
	In Vitro	220
E.	Summary and Conclusions	
	ferences	

CHAPTER 7

Proteases as Growth Factors. D. D. CUNNINGHAM

A.	Introduction	229
B.	Stimulation of DNA Synthesis and Cell Division by Proteases	229
	I. Cell-Protease Combinations Which Yield Mitogenic Stimulation .	229
	II. Involvement of Proteases in the Action of Other Growth Factors	231
	III. Protease Activity of Other Growth Factors	232
C.	Mechanisms of Protease-Stimulated Cell Proliferation	233
	I. Mitogenic Stimulation by Proteases Under Serum-Free Chemically	
	Defined Conditions	233
	II. Requirement of Proteolytic Activity.	234
	III. Sufficiency of Cell Surface Action	235
	IV. Cell Surface Receptors for Thrombin	236
	V. Cleavage of Cell Surface Proteins and Stimulation of Cell Division	238
	VI. Perspectives and Future Studies	239
D.	Possible Role of Protease-Stimulated Cell Proliferation in Physiological	
	Processes	240
E.	Conclusions	242
Re	ferences	243

Nerve Growth Factor. MARY J. KOROLY and M. YOUNG

A٩	Discovery of NGF and Its Early History	249
Β.	Multiple Molecular Forms of NGF	250
	I. Cohen's NGF	
	II. 7S NGF	
	III. 2.5S NGF	
	IV. Snake Venom NGF	
	V. What is the Naturally Occurring Form of NGF in the Mouse	
	Salivary Gland?	254
С	The NGF-Zymogen and Its Enzymic Properties	
0.	I. Autocatalytic Self-activation	
	II. Regulation of the Autoactivation Reaction	
	III. Activation of Plasminogen by NGF.	
Б	Role of the Submandibular Gland in Secretion of NGF	
	Secretion of NGF by Cells in Culture	
F.		250
1.	Crest Derivatives	260
	I. Sympathetic and Sensory Neurons	
	II. Adrenal Cells	
	III. Pheochromocytoma Cells	
~	IV. Central Nervous System	
	Retrograde Transport and Trophic Effects	
	Cellular NGF Receptors	
1.	Other Biological Actions of the 116000 Molecular Weight NGF	
	I. Effect of Saliva and NGF on Wounds	
	II. Effect of Saliva and NGF on Stress Ulcers	
Κ.	Summary and Perspectives	267
Re	ferences	268

CHAPTER 9

The Role of Cold Insoluble Globulin (Plasma Fibronectin) in Cell Adhesion In Vitro. F. GRINNELL. With 9 Figures

Α.	Introduction	277
В.	Cold Insoluble Globulin and Fibronectin: Terminology	278
С.	The Role of CIG in Cell Adhesion to Tissue Culture Dishes	278
	I. Historical Overview	278
	II. Identification of CIG as the Serum Factor in Cell Attachment and	
	Spreading	279
	III. Analysis of CIG Adsorption to Tissue Culture Dishes	
	IV. Technical Comments on CIG Purification	. 282
	V. Other Components Which Promote Cell Spreading	. 284
D.	The Role of CIG in Cell Adhesion to Surfaces Other than Tissue	
	Culture Dishes	. 286
	I. Bacteriological Dishes	. 286

II. CIG and the Adhesion of Cells to Collagen			286
III. CIG and the Adhesion of Cells to Fibrin and Fibrinogen			
E. Cell Spreading in the Absence of Serum or CIG			290
F. Mechanism of Action of CIG			
I. Ligand Receptor Hypothesis		•	291
II. Cooperativity and CIG Binding			292
III. Interaction of Multimeric CIG with BHK Cells			
IV. Inhibition of Cell Adhesion with Gangliosides			
V. Isolation of Cell-Substratum Adhesion Sites			
VI. Studies on the Active Site(s) of CIG			294
G. Summary	•		295
References			295

Membrane-Derived Inhibitory Factors. P. DATTA. With 4 Figures

Α.	Introduction and Perspective	301
В.	Some Properties of Membrane-Derived Inhibitory Factors	303
C.	Cell Cycle-Dependent Inhibition of DNA Synthesis and Cell Division	304
D.	The Role of Glycosylation in the Control of DNA Synthesis	306
	Inhibition of DNA Synthesis in Virus-Transformed Cells	
F.	Surface Membranes and Nutrient Uptake	309
G.	Prospects and Conclusions	310
Re	ferences	311

CHAPTER 11

Diffusible Factors in Tissue Cultures. LOUISE HAREL

Α.	Introduction
B.	Metabolic Cooperation
С.	Diffusion of Stimulating Factors
	I. The Feeder Effect
	II. Multiplication-Stimulating Activity from Rat Cells
	1. Purification of MSA
	2. Metabolic Effects of MSA
	3. Cell Surface Receptors
D.	Diffusion of Inhibitory Factors
	I. Problem of Density-Dependent Inhibition
	1. Mechanism of DDI
	II. Inhibitory Factors Released by Cells
	1. Inhibitors from 3T3 Cells
	2. Inhibitors from WI_{38} Cells
	3. Inhibitors from Chinese Hamster Fibroblasts
	4. Inhibitors from a Melanocytic Line
	5. Inhibitors from BSC_1 Cells

E. Diffusion of Transforming Factors				331
I. Diffusion of Protein Factors Which Enhance Malignant				
Transformation				331
Transformation				
Transformation of Cells				
F. Concluding Remarks				
References	•	•		334

Hemopoietic Colony Stimulating Factors. D. METCALF With 6 Figures

Α.	Introduction and Terminology	343
B.	Culture of Hemopoietic Colonies in Semisolid Medium	344
C.	Detection and Assay of Colony-Stimulating Factors	345
	Granulocyte-Macrophage Colony Stimulating Factor (GM-CSF)	
	I. Sites of Production of GM-CSF	347
	II. Purification and Chemical Nature of GM-CSF	350
	III. Mechanisms of Action of GM-CSF	353
	IV. Factors Modifying Responsiveness to GM-CSF	359
	V. Factors Influencing GM-CSF Production and Levels	360
	1. Steady State Production of GM-CSF	361
	2. Increased GM-CSF Production in Response to Infections and	
	Bacterial Products	361
	3. Increased GM-CSF Production Following Lymphocyte	
	Stimulation	364
	4. Other Situations Modifying GM-CSF Levels	365
	VI. Role of GM-CSF In Vivo	367
E.	Eosinophil Colony Stimulating Factor (EO-CSF)	369
F.	Megakaryocyte Colony Stimulating Factor (MEG-CSF)	370
G.	Erythropoietin and Erythroid Colony Stimulating Factor	371
	Final Comments	
	ferences	

CHAPTER 13

Inhibition of Hematopoietic Cell Proliferation. J. H. FITCHEN and M. J. CLINE With 3 Figures

Α.	Introduction
Β.	Hematopoietic Techniques and Nomenclature
	I. Pluripotent Stem Cells
	II. Unipotent (Committed) Stem Cells
C.	Inhibitors of Hematopoiesis
	I. "Physiologic" Inhibitors of Hematopoiesis
	1. Prostaglandins
	2. Neutrophil-Derived Colony Inhibitory Factor
	3. Chalones
	4. Serum Inhibitors

II. Inhibitors of Hematopoiesis in Disease .										393
1. Leukemic Inhibitors										393
2. Immune Suppression of Hematopoiesis	5.								•	394
a) Humoral Inhibitors										395
b) Cell-Mediated Immune Suppression	۱.									398
D. Summary and Conclusions		•								400
References			•	•	•	•	•	•		400

Inducers and Inhibitors of Leukemic Cell Differentiation in Culture JANET ABRAHM and G. ROVERA

А.	Introduction		405
B.	Leukemic Cell Lines Utilized for Differentiation Studies in Culture		406
C.	Inducers of Differentiation in Culture		407
D.	Mechanism of Action of Inducers of Differentiation		413
E.	Clonal Analysis of the Induction of Differentiation		415
F.	Inducers of Leukemic Cell Differentiation and the Cell Cycle		416
G.	Inhibitors of Differentiation		416
H.	Inducers of Differentiation and Treatment of Leukemias In Vivo .		418
Ref	ferences		420

CHAPTER 15

Angiogenesis Factor(s). P. M. GULLINO. With 2 Figures

Α.	Introduction	27
В.	Morphogenesis of Vascular Networks	27
C.	Assays for Angiogenesis	29
	I. Rabbit Eye	
	II. Chick Embryo Chorioallantoic Membrane	31
	III. Hamster Cheek Pouch	32
	IV. Dorsal Air Sac and Intracutaneous Injections	
	V. Endothelial Cell Culture	
	VI. Renal Assay	
D.	Induction of Angiogenesis	
	I. Angiogenesis by Normal Tissues	
	II. Angiogenesis by Normal Cells	
	III. Angiogenesis by Neoplastic Tissues and Cells	
E.	Isolation and Characterization of Angiogenesis Factor(s)	
	I. Fractionation of Fluids or Tissues with Angiogenic Capacity 43	
	II. Angiogenic Capacity of Growth Factors and Prostaglandins 44	
F.	Physiologic Significance of Angiogenesis Factor(s)	
	I. Angiogenesis as a Marker for Neoplastic Transformation 44	
	II. Antiangiogenesis	
G.	Concluding Remarks	
	ferences	

Growth of Human Tumors in Culture. HELENE S. SMITH and CHN M. DOLLBAUM. With 1 Figure

A.	Gen	era	l Introd	luctic	on.																			451
	I.	Th	e Ideal	Syste	em																			451
	II.	Cu	irrent S	tate o	of T	'ech	inc	olo	gy	fc)r	Сı	ltı	ıri	ng	; T	un	no	r (Cel	ls			454
	III.	Ide	entifyin	g Cel	1 Ty	pe	s i	n (Cu	ltu	re													456
		1.	Endot	helial	Cel	ls																		457
		2.	Epithe	lial C	ells																			458
			Fibrot																					
	IV.	Ide	entifyin	g Tu	mor	Vs	s N	loi	nm	al	igr	ıar	nt (Ce	lls	in	C	ul	tu	re				460
	V.	Ide	entifyin	g Cel	l-to	-Ce	ell	Co	ont	tan	air	nat	ioı	n i	n	Cu	ltı	ıre	;					463
В.	Spec	cific	Syster	ns .		•																		464
	Ī.	Ca	rcinom	ias .																				465
		1.	Mamn	nary (Glai	nd					1													465
		2.	Bladde	er and	l Ki	idno	ey						•											469
		3.	Colon			•																		470
		4.	Prosta	te.		•																		471
	II.	Ot	her Ma	aligna	ncie	es												•						473
		1.	Melan	omas			•								•									473
		2.	Gliom	as.														•	•					476
		3.	Sarcor	nas									•					•						477
C.	Sun	nma	ary	•••	•																			478
Re	feren	ices		• •											•	•								478
CH	APT	ER	17																					

The Chalones. O. H. IVERSEN. With 4 Figures

A.	Intro	luction							491
	I.	Definition and Properties							491
	II.	Limitations of This Chapter							492
	III.	The Name							493
	IV.	Theoretical and Biological Background							493
		1. Theory							493
		2. Biology							494
В.	Sourc	es of Chalones: Methods to Extract, Purify and	M	ea	su	re			
	Their	Effects							495
	I.	Sources of Chalones							495
	II.	Methods to Assess Chalone-Mediated Growth I	nh	ib	iti	on			496
	III.	Methods to Purify and Characterize Chalones							497
C.	Some	Chalone Properties							497
	I.	Tissue or Cell Line Specificity or Preference .							497
		Species Non-specificity							
		Sites of Attack in the Cell Cycle							
		Reversibility and Turnover Time of Chalones							
	V.	Chalones and Stimulators of Cell Proliferation							501

	VI. Dose-Response Relationship	501
	VII. Chemical Composition	
D.	Mechanisms of Action	502
	I. General Considerations	502
	II. Do Chalones Primarily Inhibit Proliferation, or Do They Promote	
	Maturation?	
	III. Possible Relationship to Hormones and Cyclic AMP	
	IV. Do Chalones Act via the Cell Membranes?	
E.	Chalones and Malignancy	
	I. General Considerations	
	II. Chalones in Malignant Tumors	
	III. Chalones and Carcinogenesis	
F.	Possible Practical Uses of Chalones	
	I. For Diagnostic Purposes	
	II. For Therapeutic Purposes	
	1. Diseases with Benign Increased Cell Proliferation	
	2. Treatment of Cancer	
	3. Immunosuppression	
	4. A Male Antifertility Drug	509
G.	The Various Chalones	509
	I. The Epidermal Chalones	
	1. The Epidermis	
	2. The Epidermal G_2 Chalone	
	3. The Epidermal G_1 Chalone \ldots \ldots \ldots \ldots \ldots	511
	4. Conclusions About Epidermal Chalones	512
	II. Chalones from Epidermal Derivatives	512
	1. The Mammary Gland Chalone?	
	2. Sebaceous Gland, Sweat Gland and Hair Follicle Chalones? .	
	a) Sebaceous Gland	
	b) Sweat Gland (Eccrine) Chalone	
	c) Hair Root Chalone	
	III. The Melanocyte Chalone (?)	514
	IV. Chalones in the Cells of the Red Bone Marrow, Blood and	
	Lymphoid System	
	1. The Granulocyte Chalone	
	2. The Erythrocyte Chalone	
	3. The Lymphocyte Chalone(s)	
	4. The Monocyte (Macrophage) Chalone (?)	523
	5. The Platelet Chalone $(?)$	
	6. The Stem Cell Chalone (?)	
	7. Conclusion About Blood Cell Chalones	
	V. Chalones in the Gastro-intestinal Tract	
	1. Salivary Gland Chalone (?)	524
	2. Oral Mucosa, Oesophageal and Forestomach Chalone	
	3. Gastric Chalone (?)	
	4. Small Intestinal Chalone	
	5. A Colon Chalone?	525

VI.	The Liver Chalones
	Kidney Chalones (?)
	Chalones in the Male Reproductive Organs (?)
•	1. Testicular Chalone
	2. A Chalone in the Seminal Vesicle?
	3. A Prostatic Chalone?
IX.	Ascites Tumour Cell Chalones
	1. JBI Ascites Tumour Cell Chalone
	2. Ehrlich Ascites Tumour Cell Chalone
Χ.	Connective Tissue and Fibroblast Chalones (?)
XI.	Chalones of the Lung?
XII.	Other Chalones Indicated
	1. Lens of the Eye
	2. Endothelial Chalone?
	3. Smooth Muscle Chalone?
	4. Heart Muscle Chalone?
	5. Placental Chalone?
Reference	es
Addendu	m
Author Ir	ndex
Subject I	ndex