

Index

A

Acrosome reaction (AR), 205–206
ACT, spermatogenesis role, 61–63
Ago3, 98
Airn, 174
AKAP4, 120
AKT, 14
ALG-2, 127
ALIX, 124–127
AMEIOTIC1, 30
Angelman syndrome (AS), 170–171, 173
APC/C, 154, 159
Argonaute, 98–100, 132
Arp2/3, 117
AS, *See* Angelman syndrome
ATM, 45
ATR, 45
Aubergine, 98, 100
Aurora B, 123
AZF, deletions, 39, 41

B

Balbani body, 86
BAM, 4–6, 26–27
Beckwith–Wiedemann syndrome (BWS), 170–171
BGCN, 6, 26
Bindin, oyster sperm
 structure, 210–211
 variability, 211
Bindin, sea urchin
 alleles and selection in maintenance, 203–204
 EBR1 receptor, 202–204
 positive selection in allopatric species, 205
 rapid evolution in sympatric species, 203
 slow evolution in allopatric species, 204–205
 starfish bindin comparison, 201–202
 structure, 201
BLIMP1, 13
BWS, *See* Beckwith–Wiedemann syndrome

C

CAF1, 57
Calmodulin-dependent protein kinase II (CaMKII),
 154, 159
CaMKII, *See* Calmodulin-dependent protein kinase II

CAR1, 101
caudal, translational regulation in oogenesis, 76
Cdk1, 151, 153–154, 156–159, 161
Cdk2, 157
CEP55, 124–127
Chromatid body, 92
COX, *See* Cyclooxygenase
CPE, *See* Cytoplasmic poladenylation element
CPEB, 77–79
CPSE, 77–78
CREM, spermatogenesis role, 59, 61–63
CSF, *See* Cytostatic factor
CSR-1, 100
CTCF, 174, 179
Cup, 72–73
Cyclin B, 153–154, 156–159, 161
Cyclooxygenase (COX), 158
Cyst stem cell, germline stem cell association, 9–11
Cytokinesis, intercellular bridges, 122–124
Cytoplasmic poladenylation element (CPE), 77
Cytostatic factor (CSF), 153–154

D

DALLY, 6
DAZ, mouse sex determination, 29
DHH1, 101–102
Dlk1, 170, 172, 174, 179
DNA methyltransferases, 173, 175–177
Double Y syndrome, 38–39, 48
DREAM, 57–58
DRH-3, 100
DRM, 57

E

EBR1, 202–204
EGG proteins, 156
EGO-1, 100, 102
EKL-1, 100
 α -Endosulfine, 157–158
ESCORT-1, 124

F

FBF-1, 25–26
FBF-2, 25–26

Index

Fertilization, *See* Gamete recognition; Oogenesis;
Spermatogenesis

4EHP, 76

Fusome, ring canal, 116

G

Gamete recognition

bindins

oyster sperm

structure, 210–211

variability, 211

sea urchin

alleles and selection in maintenance,
203–204

EBR1 receptor, 202–204

positive selection in allopatric species, 205

rapid evolution in sympatric species, 203

slow evolution in allopatric species, 204–205

starfish bindin comparison, 201–202

structure, 201

lysin, abalone sperm

crystal structure, 207

gene duplication in evolution, 207–208

positive selection, 206

vitelline envelope receptor for lysin, 208–209

marine invertebrate models, 200

mussels, 207

overview, 199–200

prospects for study, 211–212

protein module conservation in eukaryotes, 211

selection modes driving rapid evolution of

fertilization proteins

balance between sperm competition and egg

polyspermy avoidance, 201

reinforcement, 200s

sexual selection, 201

specialization following gene duplication,

200–201

sperm receptor for egg jelly protein evolution,

205–206

turban snails, 206–207

GASZ, 99

GDNF, *See* Glial cell-derived neurotrophic factor

Genomic imprinting

diseases, 171

evolution, 178–179

functions, 170–172

gene identification, 169–170

germline establishment, 175–177

history of study in mammals, 167–169

maintenance of imprints, 177–178

mechanism, 172–175

prospects for study, 179

Germ granules, *See* RNA granules, germ cells

Germinal vesicle breakdown (GVBD), 153

Germline stem cell (GSC)

lineages, 2–3

mitosis/meiosis transition in *Caenorhabditis*
elegans, 23–26

niche

Drosophila

ovary, 4–6

testes, 8–12

maintenance, 2, 4

mammalian testes, 12–16

overview, 1–2

phylogenetic distribution of female cells, 6–8

GLD-1, 25–26

GLD-2, 25–26

GLD-3, 25–26

Glial cell-derived neurotrophic factor (GDNF),
14–15

GLP-1, 25

GPPX3Y motif, 126

grk, translational regulation in oogenesis, 75–76

GSC, *See* Germline stem cell

GVBD, *See* Germinal vesicle breakdown

H

H2AX, 45

H19, 169, 173–175, 178–179

Hen1, 99

Hrp48, 84

hunchback, translational regulation
in oogenesis, 76

I

ICR, *See* Imprinting control region

Igf2, 169–170, 173–175, 179

Igf2r, 169, 174–175, 178

IMC, *See* Intermitochondrial cement

IME1, 23

Imprinting, *See* Genomic imprinting

Imprinting control region (ICR), 170, 173–177

Intercellular bridges, germ cells

mammals

cytokinesis, 122–124

formation, 124–126

functions, 126–127

overview, 118–122

overview, 113, 115

prospects for study, 127

ring canals in *Drosophila*, 114–117

Intermitochondrial cement (IMC), mouse
spermatocytes, 95–96

Inx2, 157

J

JAK-STAT signaling, germline stem cells, 4–5, 10–11

K

Kelch, 117–118
KIF17b, spermatogenesis role, 61–63
KIF4, 123
Klinefelter syndrome, 38–39

L

L3MBTL, 178
LH, *See* Luteinizing hormone
LIN-3, 25
LIN28, 14
LINC, 57–58
Luteinizing hormone (LH), oogenesis regulation, 153
Lysin, abalone sperm
 crystal structure, 207
 gene duplication in evolution, 207–208
 positive selection, 206
 vitalize envelope receptor for lysin, 208–209

M

MAEL, 99
Mael, 141
Major sperm protein (MSP), 155, 160–161
Male sex chromosome inactivation, *See*
 Y chromosome, 44
Matrimony, 158
MBK-2, 156, 161
MEI-1, 156
Mei2, 23
Meiosis, *See also* Mitosis/meiosis transition
 arrest in gametogenesis, *See* Oogenesis;
 Spermatogenesis
 general features, 21–22
 sex chromosome inactivation, 44–47
Messenger RNA (mRNA), RNA granule regulation
 localization, 100–101
 stability, 102
 translation, 101–102
MEX-2, 156
MEX-6, 156
MgcRac-GAP, 123–124
MicroRNA, *See* miRNA
Mip120, 57
Mip130, 57
miRNA
 characterization and function, 133–134
 germline functions, 134
 overview, 131
MitoPLD, 96, 99
Mitosis, *See also* Mitosis/meiosis transition
 chromosomal protein exchange in somatic cell
 nuclear transfer, 193–194
 general features, 21–22
 RNA granule function, 100

Mitosis/meiosis transition
 emerging themes, 30–31
 general features, 21–22
 molecular regulation
 Caenorhabditis elegans germline stem cells,
 23–26
 Drosophila cyst formation, 26–27
 mouse sex determination, 27–29
 plant germline/soma decision, 29–30
 yeast
 overview, 22–23
 Saccharomyces cerevisiae, 23
 Schizosaccharomyces pombe, 23
 prospects for study, 31–32
Miw2, 141
MKLP1, 116, 123–126
MMB/dREAM1 complex, 57
MPK-1, 25
MPM2, 158
mRNA, *See* Messenger RNA
MSP, *See* Major sperm protein
MyoD, 194

N

NANOS, 4, 8, 98, 101
NANOS2, 15–16
NEB, *See* Nuclear envelope breakdown
NGN3, 16
NLRP2, 178
nos, translational regulation in oogenesis, 74–75
NOS2, mouse sex determination, 29
NPPC, 151
NPR2
Nuclear envelope breakdown (NEB), 157–158
Nuclear transfer, eggs and oocytes
 development
 abnormal outcomes
 early gene expression, 190
 epigenetic memory, 189–190
 progressive cell differentiation, 189
 normal outcomes
 cancer nuclei, 188–189
 cell type switching, 188
 cross-species transfer, 189
 early gene expression, 188
 totipotency, 187–188
 experimental systems, 186
 historical perspective, 187
 mechanisms of somatic nucleus reprogramming to
 embryo nucleus
 chromatin access, 194–195
 chromosomal protein exchange at mitosis,
 193–194
 DNA replication initiation, 193
 transcription factor supply, 194

Index

- Nuclear transfer, eggs and oocytes (*continued*)
 molecular changes
 cell extract studies, 192–193
 chromatin condensation and protein exchange,
 191–192
 DNA methylation, 190–191
 epigenetic modification, 191
 somatic mutation, 190
 telomere replacement, 191
 overview, 185–186
- O**
- Oct4*, 190, 194
OMA-1, 101
OMA-2, 101
OOC, *See* Oocyte-cumulus complex
Oocyte-cumulus complex (OOC), 151
Oogenesis
 Caenorhabditis elegans
 maturation regulation by sperm, 154–156
 oocyte to zygote transition regulation, 156–157
 coordination between developmental and cell cycle
 control, 161
 Drosophila
 egg activation and entry into embryogenesis,
 159–160
 meiotic maturation, 157–158
 metaphase I arrest and release of arrest, 158–159
 prophase I arrest, 157
 mammals
 egg activation and entry into embryogenesis, 154
 maintenance of meiotic arrest, 149–152
 meiotic maturation, 153
 metaphase II arrest and release, 153–154
 stages, 150
 meiotic arrest
 events, 149
 intercellular communication and second
 messengers, 161
 overview, 148–149
 reproductive strategy relationship with meiotic
 regulation, 160
 Piwi role, 135–136
 sex chromosome gene expression, 41–44
 translational control
 Drosophila
 caudal, 76
 grk, 75–76
 hunchback, 76
 nos, 74–75
 oskar, 72–74
 oocyte maturation, 76–77
 overview, 71–72
 polyadenylation in vertebrates, 76–79
 prospects for study, 79–80
- Orb, 74
oskar, translational regulation
 in oogenesis, 72–74
- P**
- PARN, *See* Poly(A) ribonuclease
PATR-1, 94, 102
P-body, 92–94, 141
Peg1, 172, 178
Peg3, 172
Peg10, 170
PGC, *See* Primordial germ cell
PGL-1, 94–95
PGL-3, 95
piRNA
 biogenesis
 ping-pong-independent generation, 139
 posttranscriptional amplification, 138–139
 precursor processing, 138
 RNA granules in formation, 98–100
 epigenetic regulation, 139–140
 identification and characterization
 Caenorhabditis elegans, 138
 insects, 136–137
 mammals, 136
 zebrafish, 137–138
 overview, 131
 prospects for study, 142
 translation and mRNA turnover regulation, 142
Piwi domain proteins
 epigenetic regulation, 139–140
 germline functions
 oogenesis, 135–136
 primordial germ cell formation, 135
 spermatogenesis, 135
 overview, 132, 134
 translation and mRNA turnover regulation, 142
 transposon activity regulation, 140–141
Piwi-interacting RNA, *See* piRNA
Plagl1, 172, 177
PLZF, 13–14
PNG kinase complex, 159–160
Polo, 158
Poly(A) ribonuclease (PARN), 77–78
Prader–Willi syndrome (PWS), 169–171, 173
PRC1, 41, 59, 123
PRC2, 41
PRDM1, 13
PRDM14, 13
PRG-1, 99, 138
Primordial germ cell (PGC)
 gametogenesis, 41–42
 germline stem cell derivation, 2, 4, 8
 origins, 41
 Piwi in formation, 135

PUMILIO, 4, 8

PWS, *See* Prader–Willi syndrome

R

RA, *See* Retinoic acid

RBM, *See* RNA-binding motifs

REDD1, 1

Retinoic acid (RA), mouse sex
determination, 28–29

Ring canals, *See* Intercellular bridges, germ cells

RINGO, 78

RNA granules, germ cells

assembly

nucleation

organelles, 95–96

proteins, 95

Tudor domain binding to methylated
arginine, 96–97

conserved components and functions

protein, 87–88

RNA, 88–90

dynamics, 94–95

functions

germ cell fate specification and
differentiation, 97–98

messenger RNA regulation

localization, 100–101

stability, 102

translation, 101–102

mitosis and chromatin organization, 100

piRNA generation, 98–100

overview, 85

types

Balbiani body, 86

chromatid body, 92

germ plasma granules, 91–92

P-body, 92–94

perinuclear granules, 86

sponge body, 86, 90

RNA interference, *See* siRNA

RNA-binding motifs (RBMs), 126–127

Rtl1, 170

S

Silver–Russell syndrome (SRS), 170–171

siRNA

characterization and function, 132–133

germline functions, 134

overview, 131

SLY, 45–46

Small interfering RNA, *See* siRNA

SMURF, 6

SNARE complex, 124

SNRPN, 172, 177

Somatic cell nuclear transfer, *See* Nuclear transfer,
eggs and oocytes

Sperm competition, *See* Gamete recognition

Sperm receptor for egg jelly proteins (SuREJ), sea
urchin, 205–206

Spermatogenesis

Drosophila studies

mechanisms of meiotic arrest, 58–60

meiotic arrest genes, 56–57

primary spermatocyte gene expression
program, 56

tMAC complex, 57–58

intercellular bridges, 118–120

mouse studies

ACT, 61–63

CREM, 59, 61–63

KIF17b, 61–63

promiscuous transcription, 64–66

TRF2, 63–64, 66

TRF3, 63–64

overview, 55–56

Piwi role, 135

sex chromosome gene expression, 41–44

Sponge body, 86, 90

Src64, 118

SRM, *See* Silver–Russell syndrome

STAT, *See* JAK–STAT signaling

STELLA, 178

STET, 6

STRA8, mouse sex determination, 28–29

Su-bindin, *See* Bindin, sea urchin

SUMO-1, 45

SuREJ, *See* Sperm receptor for egg jelly proteins

SWITCH1, 30

SYCP3, 45

T

TAFs, *See* TATA-binding protein-associated factors

TA strategy, *See* Transit-amplifying strategy

TATA-binding protein-associated factors (TAFs),
spermatogenesis role, 58–60, 65

TB-RBP, 120

Tc3, 99

TCEA2, 66

TDRD proteins, 99, 141

Tec29, 118

Telomere, somatic cell nuclear transfer
effects, 191

Testis meiotic arrest (tMAC) complex, 57–58

TEX14, 121–122, 124–127

TIA-1, 97

tMAC complex, *See* Testis meiotic arrest complex

TPT-1, 194

Transit-amplifying (TA) strategy, germline stem
cells, 2–3, 10, 16

Index

Translation

oogenesis translational control

Drosophila

caudal, 76

grk, 75–76

hunchback, 76

nos, 74–75

oskar, 72–74

oocyte maturation, 76–77

overview, 71–72

polyadenylation in vertebrates, 76–79

prospects for study, 79–80

Piwi protein and piRNA regulation, 142

RNA granule regulation, 101–102

TRF2, 63–64, 66

TRF3, 63–64

TSG101, 125–126

Tudor domain, RNA granule assembly, 96–97

Turner syndrome, 38–39

U

UBE3A, 172

V

VAB-1, 155

VASA, 4, 6, 72, 94, 97, 102

VERL, *See* Vitalize envelope receptor for lysin

Vitalize envelope receptor for lysin
(VERL), 208–209

X

X chromosome

abnormalities and infertility, 38–41

evolution, 37

gametogenesis and gene expression, 41–44

meiotic inactivation, 44–47

reactivation and meiotic silencing as causes
of infertility, 47–49

Y

Y chromosome

abnormalities and infertility, 38–41

deletions, 39

double Y syndrome, 38–39

evolution, 37

gametogenesis and gene expression, 41–44

meiotic inactivation, 44–46

Z

Zac1, 172

ZFP57, 177

Zili, 99, 137

Ziwi, 99, 137