

Index

- 1-methyl adenine (1-MA), and oocyte maturation, 9
- abalone oocytes, 42
- acetylcholine receptor, 108
- acrosomes, 14, 36
 reaction in *Saccoglossus*, 44
- actins, 92
- adenosine triphosphate (ATP),
 production, 77
- adluminal compartment, 13
- ADP-ribose, in fertilization channel gating, 59
- aerobic respiration, 116, 117
- aging, 79
- allantois, 12
- Amot cortical protein, 104
- amphibians
 cortical reaction, 73
 early studies, 2
 oocyte activation, 66
 oocyte jelly layer, 39
 oocytes, 26
 oogenesis, 17
 protamines and histones, 90
 soluble sperm factors, 51
 spermatogenesis in, 16
 vitelline envelope in, 42
 vitelline envelope in oocytes, 41–43
 voltage gated current, 11
 yolk, 4
- anaerobic respiration, 116
- anaphase, 112, 114
 trigger for entry, 115
- Anaphase-promoting Complex/
 Cyclosome (APC/C), 114
- animal dimple, 58
- animal pole, 4, 7
- animalcules, 1
- annelids
 cortical reaction, 72–73
 gametogenesis in, 18
 nurse cells, 6
 oocyte activation, 66
- Annelids, spermatozoa, 28
- Antheraea* (silk worm), RNA synthesis, 7
- Anthozoa (the corals), 22
- Anti-Mullerian hormone, 14
- antral follicle phase (secondary or Graafian) of oogenesis, 14
- anuran, 84
 calcium wave, 84
- aphids, parthenogenesis in, 82
- Arenicola marina* (marine worm),
 oocytes, 25
- ARIS (acrosome reaction inducing substance), 44
- Aristotle, 1
- arthropods, oocyte activation, 66, 67
- artificial insemination, 1, 3
- artificial parthenogenesis, 1
- artificial vaginas, 3
- Ascaris* (nematode worm), 2
 oocytes, 21
 refringent body, 21
- ascidian *Ciona intestinalis*, fertilization channels, 57
- ascidian oocytes, 8, 63–65
 axes formation, 86
 chorion, 41–43
 cortical contraction, 75–76
 fertilization channels, 58, 59, 61
 fertilization currents in, 52
 fertilization potential, 55
 formation and behaviour of the male and female centrosomal complexes, 95
 plasma segregation, 100
 voltage gated current, 11
- ascidians, 39
 spermatozoon binding to chorion, 42
- assisted reproductive technologies (ART), 3
- Asterias* (starfish), 2
- Asterina pectinifera* (starfish),
 oocytes, 25
- Asterosap, 44
- Astropecten aranciacus* (starfish), 6
- ATP-gated sodium channel, 12
- Auerbach, Leopold, 92
- Austin, Chris, 38
- autosomal transcription, 14
- BAPTA, and calcium currents, 65
- basic fibroblast growth factor (bFGF), 14
- bees, parthenogenesis in, 82
- Beroe, fertilization process, 82
- Berridge, M.J., 110
- bindin
 in oysters, 43
 in sea urchins, 42
- birds
 cleavage in, 99,
 sperm quantity in fertilization, 83
 spermatozoa, 33
 vitelline envelope in, 42
 yolk, 4
- black flounder, micropyle in
 oocyte, 47
- blastocoel, 97
- blastocyst, 4
 aerobic respiration, 117
 formation, polarization and,
 103–106
- blastodisc, 99
- blastomeres, 96
 developmental behaviour
 differences, 99
 from ascidian, 100
 size, 96
- blastula, 97
- Boveri, Theodor, 79, 86
- bovine, oocyte plasma membrane and intracellular calcium in fertilization, 60
- Brachet, Jean, 3
- bracken fern, chemotaxis in, 39
- brine shrimp, parthenogenesis in, 83
- Brown, Louise, 3
- Bufo arenarum*, 51
- C. elegans*
 blastomeres polarization, 103
 cortical polarity, 104
- cADPr, 111
- Caenorhabditis elegans* (round worm),
 spermatogenesis, 12
- calcium channels, 12
 types, 110
- calcium events, in oocyte activation,
 60–62
- calcium signals, 114
- calcium spike, 111

- calcium waves, 2, 111
in ascidian oocyte fertilization, 64
in fish, 65–66
vs. cortical flash, 62
- calcium-induced calcium release, 111
- calmodulin, 111, 114
- calreticulin, 71
- CaM kinase II, 111
- cAMP-dependent protein kinase, 116
- capacitation, 38, 45, 78, 83
- carnitin, and sperm motility, 38
- CatSper, 39
- Caveolin, 46
- CD9, 48
- cell cycles, 111–116
calcium increase and, 115
checkpoint controls, 112–114
meiosis and mitosis, 113
- intracellular mechanisms, 114
- meiosis and mitosis
meiosis regulation
CSF, 115
meiosis resumption, 115–116
MPF regulation, 114–115
- cell lines formation, and cytoplasmic segregation, 99–101
- cells. *see also* ion regulation in cells
calcium regulation, 109–111
energy production within, 116
membrane storage of potential energy, 107
metabolism, 116–118
uncontrolled division, 112
- centrioles, 92, 93
structure, 94
- centrosome, 2, 86, 92–93
- Centrosome Attracting Body (CAB), 100
- Cephalopods, spermatozoa, 31
- Ceratitis capitata* (medfly), spermatozoa, 27
- chemical agents, early experiments, 1
- chemical embryology, 3
- chemotaxis, 39, 83
- chicken, rooster spermatozoa, 34
- cholesterol, in spermatozoa plasma membrane, 38
- chorion
in fish, insects and squid, 46–48
in oocytes, 24
- chromatin, decondensation, 89
- chromosomes, 2, 91, 92
mixing of genes between, 112
- Ciona intestinalis* (ascidian)
fertilization channels, 57
intracellular calcium, MPF activity, cortical contraction and polar body extrusion, 64
oocytes, 25
- citrate synthase, 66
- cleavage, 86, 96
and mitosis, 96–99
spiral, 97
- Cnidaria (Coelenterates)
gametogenesis in, 22–23
oocyte activation, 67
spermatozoa, 31
- Co-ARIS, 44
- Colwin, A., 3
- Colwin, L., 3
- Conklin, E., 2, 64, 75, 99,
corpus luteum, 15
- cortical actin
in oocyte activation, 74
in sea urchin oocytes, 74
- cortical contraction, in mammals, 76
- cortical flash, vs. calcium wave, 62
- cortical granule serine protease, 70
- cortical granules, 67
absence of, 84
in human oocyte, 80
in unfertilized sea urchin oocyte, 80
- cortical reaction, 78
amphibians, 73
annelids, 72–73
early embryo protection by, 80
fish, 71–72
mammals, 71
sea urchins, 68–71
- CRISP 1, 39
- CRISP family (cysteine rich secretory proteins), 49
- Crustaceans, spermatozoa, 33
- CSF (cytostatic factor), 50
- cumulus oophorus, 40, 84
- cyclic adenosine monophosphate (cAMP), 15
- cyclic Guanosine monophosphate (cGMP), 111
- cyclin B, 65
- cyclins, 114
- Cynops pyrrhogaster*, 52
- Cynthia partita*, 2
- Cytochalasin, 75
- cytokines, gonadotropins and, 15
- cytokinesis, 112
- cytoplasm, 5
calcium transients, 111
volume vs. nuclear volume, 102,
cytoplasmic maturation, 4, 76
cytoplasmic segregation, 86
and cell lines formation, 99–101
- cytostatic factor (CSF), 115
- Dan, J., 3, 39
- daughter cells, 112
after mitosis, 112
- De Generatione Animalium*, 1
- de Graaf, Reinier, 1
- decapods, spermatozoa, 33
- Dentalium* (mollusc), oocyte, 8
- deuterostomes, activation events, 60–61
- differentiation, 4
- dilution bottleneck, 83–84
- dimple, 84
- Discoglossus pictus* (painted frog)
fertilization potential, 58
needle prick to activate, 58
oocytes, 27
sperm entry to oocyte, 58
- dithiothreitol, and sperm nuclear decondensation, 90
- DNA, 3
in mammal oocytes, 77
paternal, 86
RNA, and meiosis completion, 95–96
- Drosophila* (fruit fly), 6
axes formation, 86
fertilization, 67
germ cell division, 18
micropyle in oocyte, 46
oogenesis main stages, 21
sperm count, 82
spermatozoa, 27
testis, 19
transcription factor Zelda, 102
- Dynein, 36
- echinoderms, 24
calcium waves, 60, 84
oocyte jelly layer, 40
vitelline envelope in oocytes, 41–43
- Ect-aquasperm, 29
- egg coat bottlenecks, 84–85
- electrical depolarization, 78
- electrical events at oocyte activation
fertilization potential, 57–59
initial step depolarization and latent period, 53–57
- electron microscopy, 3
- electrophysiology, for studying sperm-oocyte dynamics, 81–82
- embryo. *see also* zygote
early protection from environment, 80
intercellular junction types, 104
zygotic genome activation (ZGA), 101–103
- embryonic axes, formation before fertilization, 100
- embryonic surface waves, 2
- endoplasmic reticulum, as nuclear envelope source, 91
- energy, production within cell, 116
- Ent-aquasperm, 29
- epididymal fluid, 38

Index

- eukaryotic cells, calcium pathways
in, 110
- eutherian mammals, 26
oocyte-sperm contact, 87
protamines and histones, 90
- exocytosis, 68
- extracellular matrix, 15
in oocytes, 24
- fast electrical block to polyspermy, 82
- fertilization, vii
artefacts in studies, vii
early theories, 2
events time sequence in hamsters, 87
history, 1–3
mammal behavioural adaptations
for, 83
quantitative aspect of, 3
- fertilization channels, gating of, 58–61
- fertilization cone, 87
- fertilization dynamics, 77
polyspermy, 78
- fertilization membrane, 70, 87
cortical reaction and elevation of, 82
- fertilization potential, 57–59
- fertilization under natural conditions,
82–85
animals with high sperm numbers,
83–85
animals with low sperm numbers,
82–83
dilution bottleneck, 83–84
egg coat bottlenecks, 84–85
sperm reduction by elimination, 83
- fibronectin, 40
- fish
calcium waves, 60, 84
chorion and micropyle in, 46–48
cleavage in, 99,
cortical alveoli in oocyte cortex, 72
cortical granules absence, 84
cortical reaction, 71–72
oocyte acrosome reaction, 65–66
oocytes, 26
spermatozoa, 33
unfertilized oocyte, 72
vitelline envelope in, 42
- flatworms, oocyte activation, 66
- fodrin, 92
- Fol, Hermann, 2
- follicle cells, 5–6
- follicle stimulating hormone (FSH), 14,
- follicular fluid, 15
- frog oocyte
activation events, 66
axes formation, 86
fertilization potential, 55
growth, 4
jelly layer, 40
unpigmented region, 7
- frogs
centrosomes in sperm, 93
ovaries, 16
spermatogonia, 16
- fruit fly. *see Drosophila* (fruit fly)
- fusosomes, 6
- gametes, 112
- gametogenesis, 4–23
follicle cells, 5–6
in invertebrates, 18–23
in lower vertebrates, 16–17
in mammals, 12–16
information storage, 6–7
ion channels and, 10–12
oocyte growth, 4–5
oocyte maturation, 8–9
oocyte regional organization, 7–8
schematic outline, 5
spermatogenesis, 10
- Gastropods, spermatozoa, 31
- gated cell channels, 107
- gating of fertilization channels, 58–61
- genital ridge primordia, 12
- germinal vesicle, 4, 8
position, 9
- germinal vesicle stage oocytes,
fertilization, 53
- glucose, energy from oxidative
phosphorylation of, 77
- glycolysis, 116
- glycoproteins, in zona pellucida, 41
- Golgi apparatus, 5
- gonad stimulating substance (GSS),
and oocyte maturation, 9
- gonadotrophic hormones, and oocyte
maturation, 9
- gonadotropin releasing hormone
(GnRH), 14
- granulosa cells, 13, 14, 15
- Hagstrom, Berndt, 40
- hamster oocyte, cortical granules, 71
- hamster sperm
acrosome reaction, 45
and acrosome reaction, 45
- hamsters
decondensation, 90
fertilization events time
sequence, 87
fertilization potential, 58
- Harvey, William, *De Generatione
Animalium*, 1
- Hemicentrotus pulcherrimus* (sea
urchin), unfertilized oocytes, 24
- heparin, as inhibitor of IP₃-induced
calcium release, 110
- Hertwig, Oskar, 2, 79
- Hippo signalling pathway, 104
- Hippocrates, 1
- Histone H1 kinase activity in ascidian
oocytes, 65
- histone H1 phosphorylation, 116
- histones, 89
- homunculus, 1
- Horstadius, Sven, 3, 8, 100
implantation experiments, 101
- Hoshi, Motonori, 44
- house fly (*Mus Domestica*)
micropyle in oocyte, 48
oocytes, 26
- human
cervix as barrier to sperm
ascension, 83
spermatogenesis in, 14
- human blastocysts, 106
- human embryo
gap junctions, 106
tight junctions, 106
- human oocyte, 14, 40
activation in, 59
cortical granules, 71, 80
fertilization channels, 61
fertilization currents, 59
lipid raft micro-domains, 47
Metaphase11, 27
microvilli on, 104
mitochondrial aggregation, 118
plasma membrane, 104
sperm penetration, 48
zona pellucida, 42
- human spermatozoa, 34
acrosome structure, 45,
- hyaluronic acid, 40
- hydrogen peroxide, 70, 71
- hydrophobic lipid bilayer, 107
- Hydrozoa (Hydroids), 22
- hyperactivation, in mammalian
spermatozoa, 38
- hypothalamo-pituitary-gonadal axis,
in amphibians, 16
- inositol trisphosphate (IP₃), 110
- inositol trisphosphate (IP₃)-sensitive
calcium release channel, 110
- insects
centioles, 93
chorion and micropyle in, 46–48
cleavage in, 99
cortical granules absence, 84
gametogenesis in, 18–19
nurse cells, 6
oocyte, 5
oocyte activation, 67
- intracellular cAMP, and sperm
motility, 37
- Introsperm, 29
- invertebrates
acrosome reaction, 43–46
gametogenesis in, 18–23

- ion channels, 107–108
gametogenesis and, 10–12
ion concentration, and fertilization, 3
ion regulation in cells, 107–109
antiporters, pH and Ca^{2+} regulation, 108
 Na^+/K^+ Pump, 108–109
transporters or pumps, 108
ionophores, 70
irritable protoplasm, 2
IVF technology, 3
Izumo 1, and gamete fusion, 48
- Jamieson, Barrie, 29, 33,
Jeffery, Bill, 99
jellyfish, calcium wave, 84
Juno, and gamete fusion, 48
Just, Ernest Everett, 3
- laminin, 40
lamins, 89
lampbrush chromosomes, 7, 17
latent period, 68
in sperm–oocyte interaction, 56
leech, oocyte growth, 7
Leeuwenhoek, Antonie van, 1
Leydig cells, testosterone
production, 14
ligand-gated ion channels, 108
Lillie, Frank, 3, 39, 50
lipid rafts, 46
lipids, in plasma membrane, 46
lipophilic structures (LS), 90
lizards, parthenogenesis in, 83
Loeb, Jacques, 3, 50
Longo, Frank, 55
lower vertebrates, gametogenesis in,
16–17
luteinizing hormone (LH), 14
Lymnaea (mollusc), oocyte, 8
- macromeres, 97
macromolecules, 6
changes during activation, 76
synthesis, 76–77
major yolk protein (MYP), in sea
urchins, 18
mammalian oocytes, 26
growth, 4
ion permeability changes, 12
mammalian zygotes, DNA synthesis in
pronuclei, 95
mammals
calcium oscillations, 66
calcium waves, 60, 84
cell division in the early embryo, 102
chemoattractants in, 39
cortical contraction in, 76
cortical reaction, 71
embryo development, 116
fertilization potential, 58
gamete fusion, 87
gametogenesis in, 12–16
nuclear envelope, 90
oogenesis, 14–16, 117
RNA synthesis, 7
sperm
oocyte ratio, 83
sperm physical changes, 89
spermatogenesis, 13–14
spermatozoa, 33
spermatozoa activation, 37–39
transcription factors for ZGA, 102
man. *see* human
MAPK, 65
marine teleosts, spermatozoa
activation, 37
Masui, Y., 50, 114, 115
maternal genome, protection, 95
maternal-to-zygotic transition
(MZT), 101
Maturation Promoting Factor (MPF),
50, 65, 114
main components, 65
regulation, 114–115
maturation, of mammalian
spermatozoa, 37
Mazia, Daniel, 60
medfly (*Ceratitis capitata*),
spermatozoa, 27
meiosis, 4, 112, 113
and fertilization, 8
cell cycle checkpoints, 112
completion, and RNA, and DNA,
95–96
in spermatocytes, 13
intracellular mechanisms, 114
resumption after oocyte
activation, 77
meiosis activating sterols (MAS), 116
meiotic spindle, 92
mesonephric primordia, 13
messenger-operated calcium
channels, 110
metabolism of cells, 116–118
metaphase, 112
metazoa, 60
methyl-beta-cyclodextrin (MBCD), 46
micromeres, 97
micropylar sperm attractant
(MISA), 46
micropyle, 27, 84
in fish, insects and squid, 46–48
of insects, 26
of microscope, oocyte observed under, 1
microtubule organizing centre
(MOTC), 9
microvilli, on oocyte surface, 5
midblastula transition (MBT), 102
mitochondria, 77, 117
sub-cortical localization, 99
mitochondrial DNA, 118
mitosis, 12, 113
and cleavage, 96–99
checkpoints, 112
first division, 95
growth phases, 111, 112
intracellular mechanisms, 114
mitotic proliferation, 4
mitotic spindles
metaphase, 91
position, 99
tension, 112, 114
molluscs
gametogenesis in, 22
nurse cells, 6
oocyte, 8
oocyte activation, 66,
sperm shapes, 22
spermatozoa, 29
spiral cleavage, 97
Mos protein, 115
mouse
embryo blastomeres, 103
fertilization potential, 58
pronuclei migration in oocyte, 92
sperm membrane potential, 37
sperm pronucleus, 91
spermatogenesis, 12
spermatozoa deposit, 83
mouse oocyte, 9
cortical granules, 71
growth, 4
MPF. *see* Maturation Promoting
Factor (MPF)
Mus domestica (house fly), oocytes, 26
Myosin light chain kinase (MLCK),
111
Mytilus, spermatozoa, 31
- Na^+/K^+ Pump, 108–109
 Na^+ driven antiporters, 108
NAACP, 62
Naples, Hermann Folin, 43
Nassarius reticulatus, oocytes, 22
Nassarius, polarized vegetal pole of
oocyte, 22
nematodes, 2
gametogenesis in, 19–21
oocyte activation events, 67
sperm count, 82
sperm nucleus decondensation, 86
spermatozoa, 32
nemertean oocytes, oocyte
activation, 67
Nereis grubei, oocytes, 25
Nereis limnicola which, oocytes, 25
Nernst equation, 107
Newport, George, 2
newt, activation events, 66

Index

- nicotinamide, 59
and calcium, 65
- nitric oxide (NO)
and calcium release in sea urchins, 62
in ascidian oocyte fertilization, 59
- nuclear envelope, 92
- nuclear maturation in vitro, 3
- nucleic acids, advances in detection, 3
- nucleoplasmin (NPM), 90
- nurse cells, 6
in *Drosophila*, 18
- nutritive phagocytes (NPs), in sea urchins, 18, 19
- octopus
fertilization in, 39
oocytes, 22
spermatozoa, 31
- oestrogen, and primordial follicle production, 14
- oocyte activation, 50–77
aging and cytoplasmic maturity, 76
calcium events, 60–62
electrical events, 53–61
events in deuterostomes, 60–61
fertilization potential, 73–74
first signs, 80
in amphibian oocytes, 66
in annelids, 66
in arthropods, 67
in Cnidaria (Jellyfish), 67
in mammal oocytes, 66
in molluscan oocytes, 66
in nematodes, 67
in nemertean oocytes, 67
in protostomes, 66
in sea urchins, 61
in starfish, 62–65
in teleost oocytes, 65–66
intracellular Ca²⁺ increase, 62
mammal oocyte DNA and protein synthesis, 77
meiosis resumption and the cell cycle, 77
metabolism and macromolecule synthesis, 76–77
mitochondria, 77
pH and, 67
speed of calcium waves, 62
spermatozoon process, 50–54
structural changes, 67–76
surface contraction and cortical actin, 74
- oocytes, 24–27 *see also* sperm–oocyte interaction
calcium release mechanisms, 110
growth, 4–5
human, 14
jelly layer, 39
maturation, 8–9
maturation arrest, 115
maturation resumption, 116
methods to isolate and manipulate, 3
penetration location, 27
plasma membrane, 70
pre-activation events, 36
programmed for rapid change, 80–81
regional organization, 7–8
release, 15
spermatozoa penetration, 2
under microscope, 1
variation in size and form, 24
zona pellucida, 41–43
- oogenesis, 4
completion frequency, 15
in Annelids, 18
in mammals, 14–16
vs. cleavage, 96
- oogonia, 13
in frog ovaries, 16
in human female, 14
- Ortolani, Giuseppina, 75, 99
- ovaries
development, 13
immature oocytes at puberty, 4
- ovastacin, 71
- oyster, 22
sperm in cross-fertilization experiments, 51
spermatozoa, 43
- pacific herring (*Clupea pallasii*), 46
sperm activating factors, 46
- paddlefish, spermatozoa, 33
- painted frog (*Discoglossus pictus*)
oocytes, 27
spermatozoa, 27
- Paracentrotus lividus* (sea urchin), 2, 8
- parthenogenesis, 82
artificial, 1
- patch clamping, 108
- pathological polyspermy, 78
- Pelecypoda, 22
- perivitelline space, 41
- Peroxidase, 70
- pH
and oocyte activation, 67
regulation, 108
- Phallusia mammillata*, 99
- phosphatidic acid (PA), 46
- phosphatidylinositol-3-kinase (PI3 K)
pathway, 14
- Phospholipase C (PLC), 110
- phospholipase C zeta 1 (PLCζ), 50
- phosphorylation/dephosphorylation reactions, 114
- physiological polyspermy, 78
- plasma membrane
fusion with oocyte, 46–49
ion permeability changes, 50, 80
Na⁺ driven antiporters in, 108
voltage-gated cation channels, 107
- polar bodies, 4
- polarization, 7
- polarity regulators, 103
- polarization, 86
and blastocyst formation, 103–106
- Polge, Chris, 3
- polyspermy, 78, 79
excess centrosomes from, 93
fast electrical block to, 82
- potassium (K⁺) channels, 107
- pre-antral follicle, 14
- pre-antral phase (primary) of oogenesis, 14
- pre-granulosa cells, 14
- pre-ovulatory follicle, 14, 15
- primitive sex cords, 13
- primordial cells, in nematodes, 21
- primordial follicles, 14,
primordial germ cells, in mammals, 12–13
- progesterone, and primordial follicle production, 14
- prometaphase, 112
- pronucleus formative material (PFM), 91
- pronucleus, formation, 87, 90–92
- protamines, 86
- protein kinase A, 37
- proteins
and cortical granule docking and exocytosis, 71
phosphorylation and dephosphorylation, 107
synthesis, 77
trans-membrane, 107
- protostomia, 60
oocyte activation, 66
- pumps, 108
- Purkinje cells, 110
- quantitative aspect of fertilization, 3
- Rab proteins, 45, 71
- rabbit
acrosome reaction in sperm, 45
spermiogenesis in, 11
- radial polarity, 103
- radial polarization, 103
- Rana pipiens*, 58
- rats
sperm pronucleus, 91
spermatogenesis in, 13
- receptor-operated calcium channels, 110
- recombination, 112
- Redi, Francesco, 1

- regulation, 100
REJ (sperm plasma membrane protein of 210 kDa), 44
reptiles
 cleavage in, 99
 vitelline envelope in, 42
 yolk, 4
Resact, 39
respiration, 116
resting membrane potential, 107
retinoic acid, 14
Reverberi, G., 99
RNA, 3
 DNA, and meiosis completion, 95–96
 maternal stores depletion, 86
rodents. *see also* mouse; rats
 centioles, 93
Rothschild, Lord, kinetic experiments, 79–80
round worm (*Caenorhabditis elegans*), spermatogenesis, 12
Rouse, G., 29
rRNA synthesis, 6
Russian School of Ivanov, 3
ryanodine, 111
ryanodine-sensitive calcium release channel, 110
- Saccoglossus, acrosome reaction, 44
Santella, Luigia, 74
Satoh, Norio, 99
Sawada, T., 99
schizocoely, 66
Scyphozoa (jellyfish), 22
sea squirts. *see* ascidian oocytes
sea urchin (*Paracentrotus lividus*), 8
sea urchin embryos, cleavage planes, 96, 97
sea urchin oocytes
 actin in, 74
 activation events, 61
 cortical granules, 68, 70
 jelly layer, 84
 laboratory experiments and, 79
 oxygen consumption, 76
 schematic of voltage changes, 81
 spermatozoon successful entry, 69
 surface, 78
 unfertilized, cortical granules in, 80
 voltage clamp experiments in, 82
sea urchin spermatozoa
 acrosomal tubule, 87
 concentration in testis, 83
sea urchins, 2, 24
 acrosome reaction trigger, 44
 bindin in, 42
 cortical flash, 60
 cortical reaction, 68–71
 embryo organization, 100
 fertilization membrane, 70
 fertilization potential, 55
 gametogenesis in, 18–20
 gene expression profiles, 20
 initial phase of the activation potential in oocytes, 53
 latent period in sperm–oocyte interaction, 56
 male pronucleus development, 90, 91
 meiosis, 4
 nuclear lamina, 89
 nutritive phagocytes (NPs) in, 18
 oocyte changes in fertilization, 68
 oocyte vitelline coat, 41–43
 oocyte–sperm contact, 88,
 pronuclei migration in oocyte, 92
 Rothschild's kinetic experiments, 79–80
 Speract and Resact, 39
 sperm
 oocyte ratio, 83–84
 sperm DNA, 89
 spermatozoa activation, 36
 sperm–oocyte fusion, 86
 sperm–oocyte interaction in GV oocyte, 56
 unfertilized oocytes, 24
 voltage changes in oocyte at fertilization, 51
 serine/threonine protein kinases, 111
 Sertoli cells, 13,
 shells of reptile and bird eggs, 24
 silk worm (*Antheraea*), RNA synthesis, 7
 snails, spermatozoa, 31
 SNARES (soluble NSF-attachment protein receptors), 45
 sodium (Na⁺), entry into cell, 107
 soluble cytolytic factor from sperm, 50
 evidence for, 52
 Spallanzani, Lazzaro, 9
 Spemann, Hans, 2
 Speract, 39
 sperm activating factors, 86
 sperm activating peptides (SAP's), 39
 sperm function, ion channels and, 12
 sperm nucleus, cytoplasmic environment, 91
 sperm–oocyte ratio, 79
 at fertilization site, 78
 sperm pronucleus, development factors, 92
 spermatids, 4
 spermatocytes, of Cnidaria (Coelenterates), 23
 spermatogenesis, 4, 10
 in frogs, 16
 in mammals, 13–14
 in man, 14
 in sea urchins, 18
spermatozoa, 24
 discovery, 1
 entry prevention after fertilization, 82
 freezing and storing, 3
 in nematodes, 19
 mitochondria and tail, 87
 nucleus decondensation, 89–90
 penetration of oocyte, 2
 pre-activation, 36–39
 production count, 4
 reduction by elimination, 83
 reproduction without, 82
 successful, 82
 unsuccessful, 82
sperm–oocyte fusion, 86–89
sperm–oocyte interaction, 80
 acrosome reaction, 43–46
 chemotaxis, 39
 chorion and micropyle in fish, insects and squid, 46–48
 electrophysiology for studying, 81–82
 frequency in nature, 85
 gamete release, 36–39
 spermatozoon plasma membrane fusion with oocyte, 36–49
 with outer extracellular coat, 39–43
sperm–oocyte ratios, 85
 external fertilization and, 84
spiral cleavage, 97, 98
squid
 chorion and micropyle in, 46–48
 cortical granules absence, 84
Sreenan, Joe, 3
Sry gene, 13
starfish, 2, 6
 acrosome reaction, 43, 80
 calcium release, 62
 cortical flash, 60
 cortical flash and calcium wave, 63
 microfilaments, 86
 spermatozoa, 44
starfish oocytes, 24, 25
 acrosome reaction, 43
 actin cytoskeleton in, 74–75
 actin network in, 75
 fertilization membrane, 70
 immature, 41
 optimal fertilization period, 74
 vitelline coat, 41–43
 voltage gated current, 10
Stazione Zoologica (Naples), 2, 86
stem cell factor (KIT-Ligand), 14
sturgeons, spermatozoa, 33
Suzuki, Norio, 39
Swammerdam, J., 1
syngamy, 92

Index

- telophase, 112
 temperature, and spermatozoa fertility, 1
 testis
 development, 13
 in Annelids, 18
 in *Drosophila* (fruit fly), 19
 testis cords, 13
 theca, 14, 89
 Toad sperm, 1
 transamidation, 70
 transforming growth factor
 β (TGF β), 14
 trans-membrane proteins, 107
 transporters, 107, 108
 trout, spermatozoa activation, 36
 tunicates, sperm entry into oocyte, 84
 Tyr15, 114

 unilaminar follicle, cortical granules
 in, 71
 Urodele, sperm quantity in
 fertilization, 83

 vaginas, artificial, 3
 vegetal contraction pole, 100
 vegetal factors, 100
 vegetal pole, 4, 7
 vertebrates. *see also* lower vertebrates
 acrosome reaction, 43–46
 chemoattractants in, 39
 Victor Vacquiers group (California),
 41–43, 44

 vitelline coat of oocyte, before and after
 fertilization, 70
 vitelline envelope
 in oocytes, 24
 zona pellucida and, 43
 vitelline membrane, 5
 vitellogenesis, 18
 voltage clamp experiments, in sea
 urchin oocytes, 82
 voltage-clamp studies, 53
 voltage-dependent calcium channels,
 110
 voltage-gated calcium channels, 108, 110
 voltage-gated chloride channels, 108
 von Baer, Karl Ernst, 1

Xenopus
 cell cycles, 102
 oocyte development, 17
 rRNA synthesis, 6
 ZGA in, 102
Xenopus laevis, 52, 58
 fertilization potential, 57
Xenopus oocytes
 fertilization currents, 59
 nucleoli, 7

 Yap transcriptional co-activator, 104
 yolk
 and cleavage, 98
 chemical composition, 4
 in molluscan oocytes, 22

 zebrafish
 Brambleberry protein, 91
 cell cycles, 102
 micropyle, 48
 transcription factors
 for ZGA, 102
 ZGA (Zygotic genome activation), 86
 models to explain timing, 102
 zona pellucida, 14, 84, 106
 glycoproteins, 41
 in mammal oocytes, 24
 spermatozoon adhesion to, 38
 vitelline envelope and, 43
 zona radiata, 5
 zygote, 86–106
 centrosome, 92–93
 cleavage and mitosis, 96–99
 cytoplasmic segregation and cell
 lines formation, 99–101
 DNA, RNA, and meiosis
 completion, 95–96
 formation of polarized, 86
 polarization and blastocyst
 formation, 103–106
 pronucleus formation,
 90–92
 sperm nucleus decondensation,
 89–90
 sperm–oocyte fusion, 86–89
 syngamy, 92
 zygotic genome activation (ZGA),
 101–103