

# INDEX

- Advertisements, 80
- American Heart Association, 74, 76
- Aorta:
  - atherosclerotic change, 48-50
  - bifurcation, 38-43, 50
  - dissecting hematoma, 48, 50
- Arteriovenous fistula, 55
- Artery(ies):
  - attachment zone, lateral pressure at, 35
  - blood flow characteristics, 19-27
    - (See also Blood flow, arterial)
  - common iliac, bifurcation, 38-39, 50
  - coronary, 48-49
  - elasticity, 21
  - pulmonary, 55
  - splenic, 50
- Atherosclerosis:
  - accelerated, 17, 57
  - age and, 65, 67, 84
  - aortic, 48, 50
  - as biologic response, 1, 89
  - blood viscosity and, 20
  - contributory factors, 2-3
  - coronary, 48
    - exercise and, 73
    - hypertension and, 72
  - cure vs. control, 68-69, 90
  - diet and, 74-84
  - diminished lateral pressure and, 1
    - (See also Diminished lateral pressure)
  - exercise and, 73
  - experimental, in dogs, 59-62
  - genetic tissue differences and, 65
  - hemodynamics, 5, 59
  - hypertension and, 72
- Atherosclerosis (*Cont.*):
  - mechanical factors, 3
  - pathological course, 3
  - pulmonary artery, 55
  - pulsatile flow and, 20, 69, 89
  - regression, 70, 74
  - research approaches, 69
  - restenosis, 57, 71
  - sites of predilection, 1, 18, 54
  - splenic arteries, 50
  - stimulus vs. response, 63-68
  - veins, 55, 56
- Atherosclerotic plaque, 15-16
  - early stage, 68
  - hydraulic conditions for, 36
- Bernoulli's equation, 6, 29
- Bernoulli's theorem, 6
- Bifurcation, 38-44
  - angles of, 38, 50-52
  - aorta and common iliac arteries, 50-52
  - blood flow through, 7, 9, 38-44
- Blood:
  - flow characteristics, 19-28
  - physical characteristics, 11
- Blood flow:
  - arterial, 19-28, 69
  - through bifurcation, 7, 9
    - computational simulation of, 38-44
  - characteristics, 11, 19-28
  - Eulerian, 27
  - in converging channel, 23-24
  - in curved path, 29-35
    - velocity distribution, 33-34
  - in diverging channel, 23-24
  - LaGrangian, 27

- Blood flow (*Cont.*):  
 patterns, 29-46  
   bifurcation, 36-44  
   branching, 35-36  
   curved path, 29-35  
   tapering vessel, 29  
   theoretical calculations for, 29-44  
   trifurcation, 44  
   zones of attachment, 35  
 pressure gradient and, 21-22  
 pressure-radius of curvature relations, 31-34  
 pulsatile, 20, 69, 89  
 secondary, 35  
 streamline (laminar), 5-6  
   velocity distribution through  
     bifurcation, 8, 38  
   velocity distribution through  
     trifurcation, 44  
 stress and, 24-25  
 velocity, 56, 72  
   determination of, 72, 73  
   research implications, 68, 69  
   pressure gradient and, 21
- Blood vessel:  
 anatomic pattern, 12  
 attachment, and lateral pressure, 35  
 mural factors, 12  
 reparative response, 65-68  
 shear stress, 25  
 taper, 29
- Blood viscosity, 20
- Boundary layer, separation of, 22-24
- Boundary layer theory, 22
- Calculations:  
 for blood flow patterns, 29-43  
 pressure distribution in free vortex, 33
- Cavitation, 22
- Cholesterol, 74, 85
- Cholesterol - low levels, 80
- Circulatory system, hydraulic parameters in, 11-12
- Converging channel, blood flow in, 23
- Controversy, 74
- Coronary atherosclerosis, 48  
   exercise in, 73  
   hypertension and, 72
- Coronary circulation, hydraulics, 48, 49
- Cost of treatment, 79, 80
- Cost-effectiveness, 82
- Critique, cholesterol-heart disease hypothesis, 85
- Diet, atherosclerosis and, 74, 85
- Dilatation, post stenotic, 24
- Diminished lateral pressure, 1, 6, 13, 18, 35, 38  
   effect at zone of external attachment, 8, 35  
   regions of, 7-8  
   at site of branching, 35
- Diverging channel, blood flow in, 23
- Divider flow, 28
- Ductus arteriosus, 56
- Economics of cholesterol program, 80
- Elbow flowmeter, 7
- Embryology, vascular system, 47
- Endothelial proliferation, 65-68
- Ethical considerations, 79
- Eulerian flow, 27
- Exercise, 73
- Fats, 74, 85
- Fibroblastic proliferation, 14-15
- Fissure of plaque, 17
- Fluid mechanics, 5-9  
   cavitation, 22  
   pressure-flow relations, 5-9, 21-22  
   streamline (laminar) flow, 5-6  
   turbulent flow, 5-6, 27
- Force equation, 6, 29  
   for curvatures and bends, 29-31
- Free vortex, pressure distribution, 33
- Gradient, 72
- Hematoma, dissecting, 49-50
- Hemodynamics, 5-9
- Hemorrhage, intimal, 16
- Heredity, 26
- Heredity and intimal biologic response, 68, 69
- Hydraulic factors, 11-12  
   in stress, 25
- Hydraulic models, 63
- Hydraulic system (*see* Circulatory system)
- Hypertension, 72
- Intima:  
   biologic change in atherosclerosis, 2-3, 13-18, 55-57  
   hemorrhage, 16  
   reparative biologic response, 47  
   thickening, 13, 56

- LaGrangian flow, 27
- Laminar flow (*see* Streamline flow)
- Lateral pressure, diminished (*see* Diminished lateral pressure)
- Linear lesions, 45
- Lipidemia, 74
- Lipids:
  - atherosclerosis and, 74, 85
  - and fibroblastic proliferation, 13, 14
- Low Density Lipoprotein (LDL), 78, 79
- Marathon, 73
- Marketing - cholesterol, 76
- MRFIT study, 79
- National Academy of Sciences, 76
- Occlusion, 18
- Ostial (branch) lesions, 36, 53
- Oxidized LDL, 78, 79
- Plaque, atherosclerotic (*see* Atherosclerotic plaque)
- Poiseuille flow (*see* Streamline flow)
- Poiseuille's law, 19
- Pressure gradient:
  - blood flow and, 21-22
  - determinants of, 22
- Pulmonary artery, atherosclerosis, 55
- Pulsatile flow, 20, 69, 89
- Regression, 70, 74
- Restenosis, 57, 71
- Reynolds number, 13
  - definition, 20
  - zero, 39
- Risk factors, 79
- "Sentinel patch," 50
- Shear stress, 25-27
- Six-country study, 77
- Smooth muscle cells, 67
- Splenic artery, atherosclerosis of, 50
- Statistical studies, 78
- Statistics - interpretation, 82
- Stagnation point, 38
- Stokes flow (*see* Reynolds number, zero)
- Streamline (laminar) flow, 5-6, 19
  - arterial, 19
  - vascular elasticity and, 21
  - velocity distribution, 8
- Stress:
  - physical, blood flow and, 24-25
- Stress (*Cont.*):
  - definition, 25
  - hydraulic factors, 26
  - normal, 25-25
  - shear, 24-25, 43
- Suction effect, 28
  - (*See also* Diminished lateral pressure)
- Tensile stress (*see* Diminished lateral pressure)
- Thrombus, 3-4, 16
- Transfatty acids, 83
- Trifurcation, 43-44
- Turbulence, 27
- Ulceration, 3
- Vascular system, embryology, 47
- Veins, atherosclerosis in, 55-56
- Velocity of flow, 72
- Venturi meter, 6
- Vortex (*see* Free vortex)
- "Waterfall" lesion, 48
- Wound healing, 57
- Zero velocity, 38