**Circulation Research**  
**SUBJECT INDEX**  
**VOLUME XIII**  
**JULY-DECEMBER, 1963**

**A**  
Absorption, capillary, coefficient in shock, 105  
Acetyi strophanthidin  
  antagonistic effects on sinoatrial node of adrenergic stimulation and, 388  
  effect on myocardial electrolyte and water content in congestive heart failure, 207  
Acidosis, epinephrine response during, 64  
Actin  
  amino acid composition in cardiac and skeletal muscle, 474  
  from heart muscle, isolation and purification of, 187  
  properties of, 187  
Adenosine diphosphate, blood platelet and cell aggregation, 392  
Adrenal glands, during myocardial necrosis, 159  
Adrenergic nerve, stimulation, antagonistic effect on sinoatrial node, 388  
Allantoic fluid, and influenza A virus in production of congenital cardiac disease in chick embryo, 572  
Alveoli, gas diffusion to large pulmonary vessels, 71  
Amino acids, in actin of cardiac and skeletal muscle, 474  
e-Aminocaproic acid, effect on fibrinogen turnover, 432  
Anemia, dextran, myocardial blood flow, and oxygen uptake in, 172  
Aniotensin  
  effect on intact forearm veins of man, 230  
  in lymph and renal venous blood, production by low pressures, 336  
  renal effects in pregnancy, 232  
Aorta  
  atherogenesis, histochemical studies, 401  
  pressure transients in, 585  
  thromboplastic and fibrinolytic activity in wall layers, 253  
Arrhythmia  
  dependence upon electric current and cardiac cycle, 21  
  digitalis-induced, effects of reserpine and βTMI, 149  
  following condenser discharge, 21  
  intracardiac pressures and, 39  
  ouabain-induced, 139  
Arteries  
  carotid  
    injection of radioalbumin and effects of CO₂ on cerebral hemodynamics, 436  
    poststenotic dilatation, 537  
    computer analysis of pressure and flow, 3  
  femoral, poststenotic dilatation, 537  
  poststenotic dilatation, 537  
  pulmonary  
    constriction, cardiac performance during exercise, 410  
    hypertension in newborn calf, 557  
    oxygen and nitrogen ventilation on flow and pressure, 475

*Circulation Research, Volume XIII, December 1963*  

*thromboplastic and fibrinolytic activity in wall layers, 253  
Arteriocapillary sphincters, reactivity, vasoconstrictor nerve impulses, and norepinephrine in shock, 105  
Arterioles, reactivity, vasoconstrictor nerve impulses, and norepinephrine in shock, 105  
Atherogenesis, coronary, histochemical studies, 401  
Atherosclerosis  
  effect of group isolation in cholesterol-fed cockerels, 246  
  environmental changes, effect on, 246  
  histochemical studies, 401  
Atrioventricular conduction system, premature atrial activation of, 308  
Atrioventricular node  
  conduction of premature atrial responses, 308  
  rhythm affected by right and left heart pressures, 39  
Atrium  
  premature responses, atrioventricular conduction, 308  
  pressure  
    left atrial and left ventricular end-diastolic, 261  
    waves and aortic pressure transients, 585  
  rhythm, effect of increased transmural pressures, 39  

*B**  
Blood  
  cells, aggregation by 5-hydroxytryptamine, 392  
  changes in rats fed high-fat diets, 529  
  effect of e-aminocaproic acid on fibrinogen turnover, 432  
  fibrinogen, effects on viscosity, 48  
  5-hydroxytryptamine aggregation of platelets and cells, 392  
  myocardial flow during red cell increments, 172  
  oxygen uptake during red cell increments, 172  
  red cell increments, 172  
  rheology, 48  
  viscosity, effects of fibrinogen on, 48  
Blood flow  
  boundary layer flow, 580  
  calf muscle, effects of epinephrine on tissue clearance, 56  
  cerebral, radioalbumin studies, 436  
  coronary  
    alterations of, and oxygen usage of nonworking heart, 501  
    and cardiac performance, 522  
    effect of Eledoisin, 329  
    myocardial oxygen usage and, 497, 501, 510, 514, 522  
    countercurrent, vasa recta and, 290  
    in ductus arteriosus, 478  
  epinephrine effects  
    coronary, 329  
    in human calf muscle, 56  
  intrarenal distribution determined with K⁺⁸⁵, 290  
  myocardial, and oxygen uptake during acute red cell increments, 172

603
nutrient, intrarenal distribution, 290
oxygen uptake and usage, 172, 497, 501, 510, 514, 522
pulmonary, induced changes in pattern of, 119
pulsatile, and pressure analysis in distensible ves-
sels by computer, 3
rheology of human blood, 48
Blood pressure
aortic, pressure transients of, 585
coronary, and myocardial oxygen usage, 497, 501,
510, 514, 522
depressor effects of renal medullary extracts, 359
hypertensive
hyperoxic
pulmonary artery, in newborn calf, 557
pulmonary artery, experimental renal
vasopressor material in, 552
pulmonary artery, in newborn calf, 557
hypotension, 359
vasopressor material in normal hypertension, 552
Blood vessels
coronary, atherogenesis, 401
pulmonary, reflex constriction produced by right-
heart catheterization, 119
Blood volume
hypervolemia during acute red cell
increments, 172
Body surface potentials
distribution analyzed by
computer, 373
Bradykinin
on coronary blood flow, comparison
with Eledoisin, 329
Brain
vascular disease and effects of carbon dioxide
on cerebral hemodynamics, 436
Burns
thermal, effects of hydralazine and dextran
vascular disease and effects of carbon dioxide
on coronary arteries, 401
C
Calf
newborn, production of pulmonary arterial
hypertension, 557
Capillary sphincters
reactivity, vasoconstrictor
nerve impulses, and norepinephrine in
shock, 105
Carbon dioxide
cerebral circulation in cerebrovascular disease,
436
effects on epinephrine response, 64
Cardiac glycosides
acetyl strophanthidin
antagonistic effects on sinoatrial node, 388
and myocardial electrolytes in congestive car-
diac failure, 207
Cardiac murmurs
damping of sound, 352
Cardiac muscle
See Heart muscle and Myocardium
Cardiac necrosis
myocardial, and histopathological alterations in
rats, 169
potassium deficiency and corticosteroids, 420
Cardiac output
comparison of Pick and photoelectric earpiece
measurement, 80
during exercise in dogs with pulmonary stenosis,
410
hypotensive agents, effects on, 468
response to severe thermal burns, 468
Carotid artery
injection of radionubmin and effects of CO2 on
cerebral hemodynamics, 436
poststenotic dilatation, 537
Catecholamines
reserpine and /3TM 10 on digitalis-
induced ventricular arrhythmias, 149
Catheterization, reflex effects on pulmonal blood
flow, 119
Cells, red, myocardial blood flow and oxygen uptake
during acute increments, 172
Cerebral circulation
atherogenesis, histochemical studies, 401
carbon dioxide effects in cerebrovascular disease,
436
Cerebrovascular disease, carbon dioxide effects on
cerebral hemodynamics, 436
Cholesterin, group isolation and atherosclerosis in
cockerels, 246
Chondroitin sulfate, in early coronary atherogenesis,
401
Coagulation
of blood in rats fed high-fat diets, 529
and e-aminocaproic acid, 432
Cockerels, effect of isolation and cholesterol feed-
ing on atherosclerosis in, 246
Collagen, in early coronary atherogenesis, 401
Computers
analysis of pulsatile pressure and flow in disten-
sible vessels, 3
digital, analysis of body surface potentials with
implanted generators, 373
Conductors, discharges, cardiac arrhythmias pro-
duced by, 21
Contractility, myocardial, effect of Eledoisin, 329
Coomassie Blue dye, comparison of Pick and photo-
electric earpiece measurement of cardiac
output, 90
Coronary artery
histochemical studies of athero-
genesis, 401
Coronary circulation
alterations of coronary blood flow, 501, 510
atherogenesis, histochemical studies, 401
blood flow, oxygen uptake, anemia, and trans-
fusion, 172
and cardiac performance, 522
myocardial oxygen usage and,
497, 501, 510, 514,
522
oxygen uptake and usage, 172, 497, 501, 510, 514,
522
polypeptides, effects of, 329
Corticosteroids, relation to cardiac necrosis, 420
Countercurrent blood flow, vasa recta, and, 290

D
Damping, of heart sounds on the chest surface, 352
Defibrillation, electrical, cardiac arrhythmias pro-
duced by condenser discharge, 21
Dextran, high molecular weight, effect on circula-
tory responses to severe thermal burn, 468
Diet, high-fat, and blood coagulation, 529
Diffusion, of hydrogen into lungs through large ves-
sels, 71
Digital computers, analysis of body surface poten-
tials with implanted generators, 373
Digitalis
cardiac arrhythmia induced by ouabain, 132
ventricular arrhythmia induced by, effects of res-
erpine and /3TM 10 on, 149
Dilatation, poststenotic, production and time course of,
537
Dipoles, equivalent, surface potentials, myocardially
implanted generators, 373
Ductus arteriosus, blood flow, effects of oxygen
and nitrogen in vivo and in vitro, 478
Dye dilution. See also Indicator dilution
comparison of Pick and photoelectric earpiece
measurement of cardiac output, 80

E
Elastic fibers, in early coronary atherogenesis, 401
Electric current, effect on myocardium at high vol-
tage, 21
Electrical activity, atrioventricular conduction, 308
**INDEX**

**Electrocardiogram**
- aortic and atrial pressure transients and, 585
- digital computer analysis, implanted electrodes, 373
- QRS, nondipolar patterns, 373

**Electrolytes**
- myocardial content in congestive cardiac failure, 297

**Eledoisin**
- cardiovasular effects of, 329

**Embolism**
- microembolism by 5-hydroxytryptamine, 392

**Embryo, chick**
- production of congenital cardiac disease, 579

**Fibrinogen**
- fibrin deposition on vessel walls, 253

**Fibrinolytic activity**
- effect of bovine latent plasminogen activator on coronary perfusion pressure and oxygen uptake in dogs with pulmonary stenosis, 410
- effect of Eledoisin, 329
- effect of murine latent plasminogen activator on coronary perfusion pressure and oxygen uptake in dogs with pulmonary stenosis, 410

**Embryo**
- chick, production of congenital cardiac malformations by influenza A virus and allantoic fluid, 572

**Eletrolytes, myocardial content in congestive cardiac failure**
- potassium, 420

**Epsilonaminocaproic acid**
- effects on fibrinogen turnover, 432

**Epinephrine**
- antagonistic effects on sinoatrial node of acetyl strophanthidin and, 388
- on blood flow coronary, comparison with Eledoisin, 329
- in human calf muscle, 56

**Endothelium**
- injury with turbulent flow, 580

**Embolism**
- microembolism by 5-hydroxytryptamine, 392
- endothelial injury with turbulent flow, 580

**Eledoisin**
- cardiovascular effects of, 329

**Fibrin**
- deposition on vessel walls, 253

**Fibrinogen**
- fibrinogen turnover, 432

**Fibrinolytic activity**
- in aorta and veins, species differences, 253

**Fick measurement**
- of cardiac output, compared with photoelectric earpiece measurement, 80

**Filteration**
- capillary, coefficient in shock, 105

**Flow**
- see also Blood flow
- boundary layer, and endothelial injury, 580

**Flow, Blood**
- effect of hypothermia on coronary perfusion pressure and oxygen uptake in dogs with pulmonary stenosis, 410

**Gas exchange**
- between lung and large pulmonary vessels, 71

**Generators**
- body surface potentials from myocardial generators, 375

**Glands, adrenal**
- during myocardial necrosis, 159

**Glycosides**
- myocardial content in congestive cardiac failure, 297
- in congestive heart failure, 207

**Heart**
- acetyl strophanthidin, 388

**Heart disease, congenital**
- produced by influenza A virus and allantoic fluid in chick embryo, 572

**Heart failure**
- congestive, and acetyl strophanthidin on myocardial electrolyte and water content, 307
- oxygen usage, coronary perfusion pressure and flow, 497, 501, 510

**Heart-lung preparation**
- atrial and ventricular rhythms in the dog, 39

**Heart murmurs, damping of sound, 352

**Heart muscle**
- See also Myocardium
- actin from, 187, 474
- development of rigor mortis, 218
- myocardium. See Myocardium
- necrosis, potassium deficiency and corticosteroids, 420

**Heart work rate**
- influence of coronary flow on, 522

**Heat disease, congenital**
- produced by influenza A virus and allantoic fluid in chick embryo, 572

**Heat failure**
- congestive, and acetyl strophanthidin on myocardial electrolyte and water content, 307
- oxygen usage, coronary perfusion pressure and flow, 497, 501, 510

**Heart-lung preparation**
- atrial and ventricular rhythms in the dog, 39

**Heart murmurs, damping of sound, 352

**Heart muscle**
- See also Myocardium
- actin from
- amino acid composition, 474

**Heart murmurs, damping of sound, 352

**Heart muscle**
- See also Myocardium
- actin from
- amino acid composition, 474
- isolation, purification, and properties of, 187
- left ventricular tension and stress in man, 91
- temperature on development of rigor mortis, 218

---

*Circulation Research, Volume XIII, December 1968*
INDEX

Heart rate
- coronary perfusion pressure and flow on myocardial oxygen usage, 497
- effect on potassium flux, 272
- Eledoisin, effect of, 329
- left atrial and left ventricular end-diastolic pressures, 261
- oxygen consumption
  - in nonworking heart, 501
  - in working heart, 510
- Heart sounds, damping of, 352
- Hematocrit, myocardial blood flow in anemia, 172
- Hemodynamics, atrial and ventricular pressures, 261
- Hemorrhage, precapillary and postcapillary resistance, capacitance, filtration, and absorption, 405
- Histamine, pulmonary blood flow during right-heart catheterization, 119
- Hydralazine, effect on circulatory responses to severe thermal burns, 468
- Hydrogen, diffusion into pulmonary arterioles, 71
- 5-Hydroxytryptamine, blood platelet and cell aggregation, 392
- Hypercapnia, test for cerebral circulation, 436
- Hypertension, pulmonary arterial, in newborn calf, 557
- renal, vasopressor material in, 552
- Hypervolemia, dextran, myocardial blood flow, and oxygen uptake in anemia, 172
- Hypotension, depressor effects of renal medullary extracts, 359
- Hypotensive agents, effect on cardiac output, 468
- Hypothermia, effect of epinephrine on mechanical and phosphorylase activity of hypothermic heart, 199

I
- Indicator dilution, radioalbumin studies of cerebral blood flow, 436
- Influenza A virus, and allantoic fluid in production of congenital cardiac disease in chick embryo, 672
- Ions, effects on blood vessels, 223
- Isolation, effect on development of atherosclerosis, 85
- Isoproterenol, myocardial necrosis produced by, 159

K
- Kidney
  - angiotensin effects in pregnancy, 232
  - depressor effects of renal medullary extracts, 359
  - liberation of resin by, 336
  - nutrient blood flow distribution determined with 131I, 290
  - renal hypertension and vasopressor material, 552
- Krypton, determination of intrarenal nutrient blood flow distribution, 290

L
- Lipids, in early coronary atherogenesis, 401
- Lung, See also Pulmonary circulation
  - blood flow patterns produced by right-heart catheterization, 119
  - diffusion of hydrogen into through large vessels, 71
- Lymph, angiotensin in, 336

M
- Medulla, renal, depressor effects of extracts from, 359
- Membrane potentials, atrioventricular conduction system, 308
- Microembolism, by 5-hydroxytryptamine, 392
- Mitral valve, pressure gradient and flow, 261
- Mucopolysaccharides, in early coronary atherogenesis, 501
- Multipole theory, body surface potentials from intramyocardial electrodes, 373
- Mucura, heart, damping of sound, 352
- Muscle, See also Heart muscle and Skeletal muscle
  - actin from, 187
  - exercise, effect on heart size, 448
  - myocardiatal blood flow, and 5-norepinephrine on, 346
- Myocardium, body surface potentials from implanted generators, 373
  - contractility, effect of Eledoisin, 329
  - effect of high-voltage electric current at different phases of cardiac cycle, 21
  - electrolyte content in congestive heart failure, 207
  - necrosis, serum enzymes, and adrenal steroid in rats, 159
  - oxygen uptake and blood flow during anemia, transfusion, and dextran, 172
  - oxygen usage alterations of coronary blood flow in nonworking heart, 501
  - alterations of coronary blood flow in working heart, 510
  - effect of coronary perfusion pressure and flow, 497
  - relationship between coronary blood flow and, 514
- water content in congestive heart failure, 207

N
- Necrosis
  - cardiac, potassium deficiency and corticosteroids, 4:0
  - myocardial, serum enzymes, and adrenal steroids, and histopathological alteration in rats, 159
- Nerves, See also Sympathetic nervous system
  - adrenergic stimulation, antagonistic effect in sinoatrial node, 388
- Nitrogen, and ductus arteriosus circulation, 478
- Nitroglycerin, on coronary blood flow, comparison with Eledoisin, 329
- Norepinephrine
  - effect on vascular smooth muscle, 436
  - reactivity of minute vessels in hemorrhage and shock, 105
  - relation to potassium, 346

O
- Onabain, arrhythmia induced by, 132
- Oxygen
  - effects on ductus arteriosus circulation, 478
  - myocardial usage
    - alterations of coronary blood flow in nonworking heart, 501
    - alterations of coronary blood flow in working heart, 510
    - effect of coronary perfusion pressure and flow, 497
- relation between coronary blood flow and, 514
  - 522

Circulation Research, Volume XIII, December 1967
uptake during acute red cell volume increments, 172

Peripheral resistance
  relation to sodium, 223
  response of heart to, 33

Phosphorylase, effect of epinephrine on mechanical
  and phosphorylase activity of heart, 199

Photoelectric earpiece, comparison with Fick measurement of cardiac output, 80

Polypeptides, effects on coronary blood flow, 329

Potassium
  and cardiac necrosis, 420
  effect on vascular smooth muscle, 346
  exchange in dog heart, 279
  release from vascular system, 223

Potentials
  body surface, distribution analyzed by computer, 373
  membrane, responses of atrioventricular conduction system, 308

Pregnancy, renal effects of angiotensin, 232

Pressure. See also Blood pressure
  coronary perfusion, and myocardial oxygen usage, 497, 501, 510, 514, 522
  left atrial and left ventricular end-diastolic relation between, 261
  pulsatile, and flow analysis in distensible vessels by computer, 3
  renal arterial, angiotensin in blood and lymph after reduction in, 336
  transients in aorta, 385
  transmural, effects on atrial and ventricular rhythm in the dog, 39
  venous, effect of angiotensin on, 239

Pulmonary artery
  constriction, cardiac performance during exercise, 419
  flow and pressure, effects of oxygen and nitrogen ventilation in fetal lambs, 478
  hypertension in newborn calf, 557

Pulmonary circulation
  blood flow patterns produced by right-heart catheterization, 119
  diffusion of gases and, 71
  pulmonary arterial hypertension in newborn calf, 557

Pulmonary stenosis, cardiac performance in dogs with, 419

Purkinje fibers, conduction of premature atrial responses, 308

QRS, nondipolar patterns, digital computer analysis, 373

Radioalbumin, cerebral blood flow studies by carotid artery injection, 438

Radioisotopes
  disappearance rate, 56, 290
  effect of epinephrine on disappearance rate and blood flow in human calf muscle, 56
  intrarenal blood flow distribution determined with Kr85, 290
  NaI131, effect of epinephrine on disappearance rate, 56
  radioalbumin, in cerebral blood flow studies, 436

Rat, perfusion of tail, 223

Red blood cells, myocardial blood flow and oxygen uptake during acute increments, 172

Renal circulation
  effects of angiotensin in pregnancy, 232
  intrarenal blood flow distribution determined with Kr85, 290
  vasopressor material in renal hypertension, 552
  Renal medulla, depressor effects of extracts from, 339
  Renin, release during reduced renal perfusion pressure, 336
  Reserpin, influence on digitalis-induced ventricular arrhythmias, 149

Resistance
  peripheral relation to sodium, 223
  response of heart to, 33

Respiration
  acidosis, influence on circulatory effects of epinephrine, 64
  effects on heart size, 448

Rhoeology, of human blood, 43

Rhythm, atrial and ventricular, effects of transmural pressures, 35

Rigor mortis, influence of temperature on development in heart, 218

Serotonin, aggregation of blood cells by, 392

Shock
  burn, circulatory responses, 468
  hemorrhagic, precapillary and postcapillary resistance, capacitance, filtration, and absorption, 105

Sinoatrial node
  antagonistic effects of acetyl strophanthidin and adrenergic stimulation on, 388
  rhythm affected by right- and left-heart pressures, 39

Skeletal muscle
  actin from, compared with actin from heart muscle, 187, 474
  capillary filtration transfer in cat, effect of hemorrhagic shock, 106
  difference in behavior from cardiac muscle, 474
  Sodium, release from vascular system, 223

Sodium iodide, radioactive, effects of epinephrine on disappearance rate and blood flow in human calf muscle, 56

Sound, damping of on chest surface, 352

Sphincters, arteriovenous and capillary, 105

Stenosis
  poststenotic dilatation of carotid and femoral arteries, 537
  pulmonary, cardiac performance, 410

Steroids. See also Corticosteroids
  adrenal, myocardial necrosis in rats, 159

Stress, left ventricular, in man, 91

Sympathetic nervous system
  antagonistic effects on sinoatrial node of acetyl strophanthidin and adrenergic stimulation, 388
  stimulation frequency and reactivity of minute vessels in hemorrhage and shock, 105

Temperature, influence on development of rigor mortis in heart, 218

Tension, left ventricular, in man, 91

Thermal injury, circulatory responses to effects of hydralazine and dextran, 468
Thrombogenesis, thromboplastic and fibrinolytic activity in arteries, veins, and wall layers, 253

Thromboplastic activity, in aorta and veins, species differences, 253

Thrombosis, in rats fed high-fat diets, 529

Tissue
clearance, Na131, epinephrine, and blood flow in human calf muscle, 56
electrolytes, acetyl strophanthidin and myocardial electrolyte and water content in congestive heart failure, 207

βTM 10, influence on digitalis-induced ventricular arrhythmias, 149

Toad, effect of epinephrine on mechanical and phosphorylase activity of heart, 199

Transaminase, in serum during myocardial necrosis produced by isoproterenol, 159

Transfusion, myocardial blood flow and oxygen uptake during anaemia, 179

Transmural pressure, effects of increase on atrial and ventricular rhythms in the dog, 39

Trauma, See also Shock
thermal, 468

Trimethyl(2,6-dimethyloxy)propyltrimethylammonium chloride (βTM 10), effect on digitalis-induced arrhythmias, 149

Turbulent flow, and endothelial injury, 290

V

Vasa recta, blood flow in, 290

Vascular reactivity, during shock, 105

Vasodilators, the polypeptide, Elodeisin, 329

Vasopressors, in renal hypertension, 532

Veins
catheterization and reflex effects on pulmonary blood flow, 119
catheter, effect of angiotensin on, 239

Veins, catheterization and reflex effects on pulmonary blood flow, 119

Ventricles
arrhythmia, digitalis-induced, effects of reserpine and βTM 10, 149
electrical defibrillation, 21

left end-diastolic and atrial pressure, 261
response to increased peripheral resistance, 33
tension and stress in man, 91

rhythm, effect of increased transmural pressures, 39

right catheterization on pulmonary blood flow, 119
changes in exercising dogs with pulmonary stenosis, 410

Ventricular fibrillation, by condenser discharges, 21

Venules, reactivity, vasoconstrictor nerve impulses, and norepinephrine, 105

Vessels
damage to walls by turbulent boundary layer flow, 580
distensible, pulsatile pressure and flow by computer analysis, 3
resistance and capacitance, effect of hemorrhagic shock on reactivity, 105

Virus, congenital malformations produced by influenza A in chick embryo, 572

Viscosity, of blood, effects of fibrinogen, 45

W

Water, myocardial content in congestive heart failure, 207

Wiggers, Carl John, a memorial tribute, 1

Wolff-Parkinson-White syndrome, single vs. dual atrioventricular transmission system, 308

ERRATUM

Second sentence of footnote on page 213, Volume 13, No. 3 should read:

A copy may be obtained by citing the Document number and remitting $2.00 for 35 mm microfilm or $3.75 for photoprints.

ERRATUM

Volume XI. November 1962. page 844. An asterisk should be added to the end of the last sentence of the Results, just prior to the Discussion. The following footnote should have appeared at the bottom of the page:

*Photomicrographs 4 to 15 have been deposited as Document number 7203 with the ADI Auxiliary Publications Project, Photoduplication Service, Library of Congress, Washington 25, D. C. A copy may be obtained by citing the Document number and by remitting $2.50 for photoprints, or $1.75 for 35 mm. microfilm. Advance payment is required. Make checks or money orders payable to: Chief, Photoduplication Service, Library of Congress.
SUBJECT INDEX

Circ Res. 1963;13:603-608
doi: 10.1161/01.RES.13.6.603

Circulation Research is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 1963 American Heart Association, Inc. All rights reserved.
Print ISSN: 0009-7330. Online ISSN: 1524-4571

The online version of this article, along with updated information and services, is located on the
World Wide Web at:
http://circres.ahajournals.org/content/13/6/603.citation

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in
Circulation Research can be obtained via RightsLink, a service of the Copyright Clearance Center, not the
Editorial Office. Once the online version of the published article for which permission is being requested is
located, click Request Permissions in the middle column of the Web page under Services. Further information
about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Circulation Research is online at:
http://circres.ahajournals.org/subscriptions/