ARRHYTHMIAS

It has been known since 1950 that diphenylhydantoin is effective in abolishing ventricular arrhythmias resulting from aconitine or digitalis intoxication or from myocardial infarction in dogs. The authors gave diphenylhydantoin by mouth to 20 patients with paroxysmal supraventricular arrhythmias and to 40 with frequent premature contractions (atrial, nodal, or ventricular), all of whom had had an "inadequate" response to other medications (usually quinidine, procaine amide, or digitalis). The initial dose was 100 mg thrice daily. Thirty-seven had a satisfactory response, repeated electrocardiograms showing no recurrence of arrhythmias or of premature contractions. Six showed some improvement and six no improvement. Eleven patients had to stop the drug because of side effects, which included itching, skin rashes, drowsiness, depression, nervousness, arthralgia, and hypertrophy of the gums. There was no evidence of depression of the bone marrow.

MARSHALL


The authors provide a nomenclature for the iatrogenic disorders of rhythm that have occurred after implantation of synchronized pacemakers in man. These arrhythmias include pacemaker escapes (from sinus control), dissociation between atria and pacemaker with pacemaker captures (by the sinus nodes), and the firing of the iatrogenic pacemaker by spontaneous AV nodal beats and ectopic ventricular contractions. One patient demonstrated evidence of a possible dual AV conducting system in which the normal junction was used exclusively by the impulses propagating toward the atria and the artificial communication permitted transmission from the atria to the ventricles only. Illustrated examples of these arrhythmias and of arrhythmias secondary to pacemaker malfunction were presented.

KARPMAN


Dogs weighing 17 Kg. or more were subjected to thoracotomy. A silk ligature was placed around the circumflex coronary artery and the ends were passed through a plastic catheter, around which the chest incision was then closed. After 10 minutes of observation the ligature was tightened to full occlusion. Fifty control dogs continued to breathe room air. Three experimental groups were given 100 per cent oxygen at respectively 1, 2, and 4 atmospheres for 1 hour. Fifty-two per cent of the control animals survived the ligation. Survival in the experimental groups rose with the ambient oxygen pressure,
being 60.4, 70, and 77.8 per cent, respectively. These results approach statistical significance.

CHILDERS


Diphenylhydantoin, administered intravenously to 24 patients with arrhythmias, was particularly effective in supraventricular and ventricular arrhythmias due to digitalis toxicity. No therapeutic effect was noted in patients with atrial flutter or fibrillation. Toxicity consisted of transient bradycardia and hypotension in one patient and short-term atrioventricular block with bradycardia in another.

KALMANSOHN


A series is reported of studies carried out in an asymptomatic 19-year-old man in whom the only abnormality discovered was atrial fibrillation. Strenuous exercise for 4 to 6 minutes resulted in ventricular rates of approximately 250 beats a minute. Digitalization reduced the maximal ventricular rate to below 200 after exercise, but had little effect on rate of increase in heart rate. In addition, the duration of exercise tolerance increased. Intravenous injection of 2 mg. of atropine before digitalization resulted in an increase in heart rate to about half that manifested after exercise; the major effects of digitalization were not blocked with atropine. Normal rhythm was restored with quinidine. The duration of exercise tolerance increased, and the ventricular rates at the end of 3 to 6 minutes of exercise were 43 beats and 16 beats less, respectively, when compared with the patient's performance while his rhythm was atrial fibrillation post-digitalization.

FEDER


Heart block was produced in dogs by implanted suture, incision, or stab wound of tissues of the interatrial septum, 8 to 10 mm. in front of the opening of the coronary sinus. The hearts of these dogs were examined up to 1 year. The heart block produced in six dogs was associated with injury and granulation tissue repair of the posterior portion of the right branch of the bundle or its terminus. The injury, which in four dogs failed to cause heart block, spared the septal tissues with nerves and their associated ganglia, the ovoid mass of muscle in proximal relationship, and the distal terminus of the right bundle branch. The atrioventricular node, the bundle, and the first portions of its right and left branches were extensively destroyed without evidence of heart block. The observations suggested a causal relationship between injury of nervous tissues in the critical region of the interatrial septum behind the pars membranacea and the cardiac disorder designated as heart block.

KALMANSOHN


Disturbances of rate, rhythm, and conduction were monitored in 100 consecutive and unselected patients admitted to the hospital with acute myocardial infarction. Excluding the arrhythmias, which occurred terminally in patients dying of shock or heart failure or after the treatment of ventricular fibrillation, disturbances of rate, rhythm or conduction were observed in 95 of the 100 patients. Frequent ventricular ectopic beats, atrial tachycardia, flutter and fibrillation, nodal rhythm, ventricular tachycardia and fibrillation, and advanced heart block occurred in 56 patients. Their mortality rate was 36 per cent in contrast to the 25 per cent mortality in the remaining 44 patients. Sinus tachycardia was the most common, occurring in 43 patients. Their mortality rate of 44 per cent was largely attributed to the adverse factors (shock, heart failure, or pulmonary embolism) that had caused the tachycardia. Supraventricular ectopic beats occurred in 25 patients but did not significantly alter the prognosis. Thirty-two patients experienced ventricular premature contractions every two to 10 beats, and six of these eventually developed fatal ventricular fibrillation. The R-on-T type of ventricular premature contractions augured sudden death in five of seven patients. Ventricular tachycardia (six) and fibrillation (10) occurred more commonly than was previously observed, and were associated with respective mortalities of 67 and 90 per cent. Disturbances of rate, rhythm, and conduction affected prognosis variously. Bundle-branch block usually reflected extensive myocardial damage. Atrial flutter and fibrillation were likely to be associated with severe disease and the arrhythmias further impaired cardiac function, whereas complete heart block and ventricular fibrillation might be fatal in the absence of...
great cardiac damage. Finally, ventricular ectopic beats were of serious consequence when they occurred at least once every 10 beats, and this was particularly true of the pre fibrillary R-on-T type.

March


This case report is concerned with an adult man who developed vagovagal syncope as a result of diffuse esophageal spasm. The episodes of syncope were precipitated when the patient would drink carbonated beverages, and the diagnosis of diffuse esophageal spasm was demonstrated by manometric cineradiographic studies. When the patient swallowed a carbonated beverage, a prolonged elevation of intraesophageal pressure occurred (possibly because of a continued release of carbon dioxide). The authors speculated that the rise in intraluminal pressure resulted in esophageal muscular spasm with stimulation of vagal afferent fibers resulting in bradycardia and atrioventricular dissociation. Distal esophagomyotomy and high bilateral vagotomy relieved the symptoms and reduced the severity of heart block and esophagospasm, but did not prevent the reflux completely (possibly because the upper esophagus with the nerve supply was left intact).

Karpman


Seventeen patients had an Electrodyne pacemaker implanted under the left serratus anterior muscle because of complete heart block with heart failure (one) or cerebral symptoms (16). During a follow-up period of 2 to 30 months, 15 of them had relief of symptoms and 10 resumed work. The electrode wire disrupted in four patients and the pacemaker failed in two; all required reoperation, and all except one had implantation of an entire new unit. Electromagnetic flowmeter studies in eight patients during surgery suggested a heart rate of 70 per minute as optimal.

Rogers


Fixed-rate electric pacing of the heart in atrioventricular block has generally been effective and safe. However, several instances were cited in which ventricular tachycardia or fibrillation was induced, mainly in severely diseased hearts. A new portable pacemaker has been developed, and its successful use in 25 patients is described. It delivers a stimulus, similar in nature to that of previous equipment, but only when the preset rate exceeds that of the natural pacemaker. Thus, a constant R-wave-pacemaker stimulus interval is maintained, avoiding the possibility of arrhythmia induction during the vulnerable T-wave phase.

Rogers


By connecting the skin areas overlying the myocardial electrodes to a D.C.-coupled oscilloscope the time constant of the pacemaker stimuli can be determined (in the case of unipolar pacemakers one electrode is placed over the case of the pacemaker). The time constant decreases with increasing resistance between the electrodes; an increase of this constant indicates that this resistance has decreased perhaps because of inflammatory exudation near the electrodes whereas a decrease suggests formation of scar tissue, breakage of electrode cables, or disengagement of an electrode. A convenient measure of the time constant is the ratio between the voltage 0.5 millisecond after beginning of the stimulus to the peak voltage at the beginning of this stimulus. In the case of the Elema-Schönander pacemaker the usual ratio is about 0.53; in that of the Medtronic pacemaker it is about 0.7. The absolute voltage of the impulse peak was on the average 20 millivolts but can be much higher in slender persons. In two patients intermittent or absent response to pacemaker stimuli was accompanied by a decrease in the quotient, while after anti-inflammatory treatment the quotient increased and full pacemaker response returned. Determination of the quotient at regular intervals can accordingly allow early recognition and treatment of impending pacemaker failure.

Lepeschkin


Three patients sustained myocardial infarction within a few days of being electrocuted. The authors found 18 previous cases in the world
literature. In one of their three patients, ventricular tachycardia (rate up to 190 per minute) developed and persisted for 41 days. Attempts to restore sinus rhythm by drugs, including procaine amide, quinidine, digitalis, and infusion of norepinephrine, were unsuccessful. Eventually AC countershock was used to abolish the arrhythmia.

**Peleska, B.: Cardiac Arrhythmias following Condenser Discharges Led through an Inductance: Comparison with Effects of Pure Condenser Discharges. Circulation Research 16: 11 (Jan.), 1965.**

When an inductive resistance is inserted between a condenser and an animal, the form of the condenser discharge curve is altered; the voltage is reduced, the duration is increased, and the wave form is changed. Experiments were performed in dogs in order to ascertain whether inclusion of an inductance would reduce the incidence and severity of arrhythmias that resulted from graded condenser discharges. The applied voltages ranged from 0.5 to 6 kilovolts, the condenser capacities from 0.5 to 100 microfarads, and the energies from 0.06 to 1,800 watts. An inductance of 0.29 henry was connected in series with the condenser. This modification resulted in a much higher threshold for arrhythmias. For example, it reduced the incidence of ventricular fibrillation by two thirds. Ventricular fibrillation in fact occurred only during 36 of 2,160 damped discharges, and all 36 were administered during the relative refractory period of the cardiac cycle. Fibrillation never occurred with discharges applied in the absolute refractory period or in the excitable period.


Of 11 patients who were successfully converted from atrial fibrillation to a sinus rhythm with oral quinidine, nine showed a rise in cardiac output and index of more than 10 per cent, one showed a slight decrease, and one showed a drop of 10 per cent. The mean increase in cardiac output after reversion was 34.7 per cent and ranged from —9.9 to 118 per cent. There was no significant change in pulse rate following conversion while the mean stroke volume rose from 63 to 85 ml. The cardiac outputs and indices showed a greater increment with exercise after reversion as compared with the values during the presence of atrial fibrillation. It is suggested that the technic would be useful in determining which patients would benefit from quinidine therapy for conversion of atrial fibrillation to normal sinus rhythm.


Hemodynamic studies were obtained from 35 patients afflicted with complete heart block and 41 other patients with this conduction defect were studied clinically. Cardiac outputs were determined 4 minutes after changes occurred in the cardiac rate and were found to be nearly independent of the ventricular rate in 14 patients without evidence of myocardial disease, but were critically dependent upon the rate in 14 patients with myocardial disease both at rest and after exercise. Most patients had an optimal ventricular rate when the cardiac output was maximal, the venous pressure was at its lowest, and atrial rate was minimal; these optimal rates ranged between 55 and 90 beats per minute, with a mean of 71 beats. The optimal cardiac rates upon exercise for patients with myocardial disease was very close to the optimal rates when at rest. A fixed rate pacemaker was found to be acceptable in most patients and enabled moderate physical activity to be endured; a rate of 65 to 70 beats per minute was found to be satisfactory for most patients. Artificial pacing increased the mean cardiac output in 28 patients from 2.9 to 4.4 liters per minute, and exercise with a fixed ventricular rate increased the mean cardiac output in 10 patients from 4.0 to 10.2 liters per minute. The author stated that, at the present time, the implantable fixed-rate pacemaker was the most satisfactory method for long-term artificial pacing. However, he recognized that the newly developed implantable pacemakers that produced synchronized atrial and ventricular contractions may eventually supersede the fixed-rate pacemakers.
tically a normal life for 14 months. The second patient had five episodes of cardiac arrest during the first seven days after myocardial infarction.

KALMANSOHN


The period preceding ventricular fibrillation was studied in 43 dogs. Following ligation of the left anterior descending artery or the subepicardial administration of conitin, coronary venous blood was analyzed with respect to oxygen content and potassium levels. Results showed that in the pre fibrillatory period myocardial cells surrender potassium as the arteriovenous oxygen difference widens. At the same time it was observed that left ventricular pressure fell and right ventricular failure developed.

CHILDERS

ATHEROSCLEROSIS


A case is described in which embolization of several different organs by atheromatous material resulted in clinical features simulating those of polyarteritis nodosa. Antemortem diagnosis of atheromatous embolism was made on the basis of muscle biopsy. At autopsy, the pancreas, the gastrointestinal tract, and various skeletal muscles showed necrotizing angiitis associated with cholesterol embolization. The angiitis was similar to that seen in hypersensitivity states or in polyarteritis nodosa. Thus, unless cholesterol crystals are also seen in the inflamed vessels, muscle biopsy could be misleading.

MARSHALL


It has been postulated by others that the lipid and cholesterol components of the human atherosclerotic plaque may be derived from thrombus or hemorrhage occurring earlier in the evolution of the plaque. The experimental evidence for this is meager, however; and in the present study the authors have applied their arterial preparation for the study of atherogenesis to this question. The preparation consists of a doubly ligated segment of rabbit carotid artery which characteristically undergoes intimal hyperplasia, and exhibits sudanophilia when excess cholesterol in suitable amount and form is available. Whole blood and its various components were placed in direct contact with this hyperplastic arterial segment, which the authors believe to be the analogue and forerunner of the mature atherosclerotic lesion. Whole blood evokes an accumulation of stainable lipid in this preparation. The lipid accumulation required more than 4 days, suggesting that it did not stem directly from the blood lipid, but that the latter either fosters the accumulation of triglyceride or becomes esterified with long-chain fatty acids. Moreover, the experimental arterial segments no longer exhibited sudanophilia at 28 days unless concentrated lipid and cholesterol extracts of red cells were introduced. It is unlikely, then, that a single thrombus or hemorrhage in a plaque could serve as an important source of lipid retention, although it is granted that the experimental preparation is not quite the same as the relatively avascular, mature human coronary plaque. The lipid-accumulating potential of whole blood appears to be limited to the red cell, and hypercholesteremic plasma rich in cellular and platelet components failed to produce these changes. With respect to its "atherogenic" potential, the cholesterol of the red cell resembles the behavior of crystalline and chylomicronic cholesterol rather than lipoprotein cholesterol in doubly ligated segments of rabbit carotid artery.

MARCH

VALVULAR HEART DISEASE


The data from 20 patients with significant mitral stenosis but with very few clinical symptoms are presented. Illustrative case reports of four patients are outlined. The dissociation of clinical symptomatology with the severity of mitral stenosis in these patients has led the authors to the conclusion that the severity of mitral stenosis should be assessed on purely objective evidence without regard to symptoms. Objective data would include the length of the mitral diastolic murmur, the closeness of the opening snap to the second sound, radiographic findings of pulmonary congestion, septal lines, and evidence of pulmonary hypertension, as well as a dilated right atrium, and electrocardiographic evidence of left or right atrial and right ventricular enlargement. Particular attention is drawn to the hazards of pregnancy in some of these asymptomatic women with mitral stenosis.

RAKITA

Circulation, Volume XXXII, October 1965
ABSTRACTS


A prospective (hemodynamic) study of 57 patients with pure mitral stenosis and a retrospective (clinical) study of 1,600 patients who had undergone surgery for predominant mitral stenosis was carried out, with examination of certain functions for their possible role with respect to occurrence of systemic emboli. The hemodynamic study (all patients had left heart catheterization) revealed that patients with systemic emboli were 8.6 years older (p <0.005) than patients without emboli, had 85.7 per cent incidence of atrial fibrillation, compared to 33.3 per cent for the control group (p < 0.005), and had a lower cardiac index (p <0.01). Pulmonary artery pressure, left atrial pressure, and mitral valve area revealed no relationship to the incidence of systemic emboli. The retrospective study resulted in very similar data. There was no relationship between clinical severity of the disease and incidence of emboli. Early surgical treatment, including resection of the left atrial appendix, is suggested. In patients with mild obstruction (by catheterization) yet a history of systemic emboli, long-term anticoagulant therapy appears preferable.

THILENIUS


The authors discuss the difficulties and potential fallacies in the preoperative assessment of patients with multivalvular lesions, and stress the dangers of operating to correct a single valve defect when two or more valves are seriously damaged. Errors fall into three categories. Disease of a second valve may not be suspected, due to the masking effect of the more obvious first valve lesion, may erroneously be considered to be insignificant, or may be considered to be merely a consequence of the first valve lesion rather than an independent lesion. It is recommended that, whenever open-heart surgery is contemplated, all four valves should be studied physiologically no matter how "normal" some of them may appear to be on clinical grounds. In bivalvular disease angiography should be performed as well as the measurement of pressure gradients and of cardiac output. Mitral and tricuspid valvar regurgitation can never be attributed with certainty to the consequences of aortic and pulmonary valvular lesions, respectively, but require direct examination and assessment at the time of operation.

MARSHALL


In all of four patients with aortic valve stenosis and four with muscular subaortic stenosis, the inhalation of amyl nitrite was followed by a substantial increase in the left ventricular-aortic systolic gradient, due principally to a fall in arterial pressure. Two patients in each group had a nondiagnostic systolic gradient in control studies. Such an effect was not observed in individuals with essential hypertension or normal persons. In two patients with muscular stenosis having no gradient at rest, the gradient appeared only after the arterial pressure had fallen considerably. This led to the belief that a reduction in systolic size of the left ventricle was the mechanism associated with outflow-tract obstruction in these patients.

ROGERS


The clinical features of congenital aortic stenosis were summarized from an experience with 300 patients, age 30 years or under, at the Hospital for Sick Children, Toronto. The male:female ratio was 2.5:1, and 24 were under 1 year of age. The main symptoms were dyspnea in 71, syncope in 34, angina in 18, and heart failure was observed in 25, 18 of whom were infants. The principal physical finding was the systolic ejection murmur which was accompanied by a thrill in 239 patients and by an ejection click in 158. An early diastolic murmur was heard in 20 per cent of cases over age 1 year. The pulse pressure was 25 mm. Hg or less in 114 patients. The electrocardiogram showed left ventricular hypertrophy in 179, right ventricular hypertrophy in 18. The chest x-ray showed a cardiothoracic ratio over 50 per cent in 120 and poststenotic dilatation of the aorta in 53. Eighty-three of the group had catheter studies, revealing the stenosis to be valvular in 64 and subvalvular in 19. An early systolic ejection sound was found in none of the subvalvular cases but was heard in 39 of the 40 valvular patients who had systolic gradients of 50 mm. Hg or more. Subvalvular stenosis was not detected under age 5 years. In
contrast, valve stenosis frequently was discovered in infancy, and when troublesome then it was often associated with other lesions. The incidence of sudden death in aortic stenosis was estimated at 1 to 2 per cent of patients, but clinical assessment should indicate the severity of obstruction in such patients, leading to catheter studies and corrective surgery.

**Rogers**


Muscular subaortic stenosis is characteristically associated with a normal or small ascending aorta and absence of an early systolic ejection sound, in contrast with aortic valve stenosis which is usually accompanied by poststenotic dilatation of the aorta and often by an ejection sound. The authors report, from a total of 11 patients with the disease, two women aged 43 and 58 years and a man aged 33 years, in whom the diagnosis of subaortic stenosis was convincingly established. In all three patients aortography showed pronounced diffuse dilatation of the ascending aorta; the third patient also had, at times of increased aortic blood flow, a distinct ejection sound preceding the onset of the systolic murmur. The authors do not speculate as to whether the aortic dilatation is in some way directly related to the subaortic stenosis or, alternatively, reflects coexistent atherosclerosis. They conclude that, while the absence of dilatation of the aorta and of ejection sounds remain useful clinical signs, their presence no longer rules out the possibility of muscular subaortic stenosis as the underlying lesion. It might be added that Braunwald et al. noted prominence of the ascending aorta in only three of their 64 patients with muscular subaortic stenosis; these three (41, 39, and 37 years) were also older than the majority.

**Marshall**

**VASCULAR DISEASE**


The natural history of cerebral ischaemia was evaluated in 82 patients followed for an average period of 40 months. Fifty-nine patients were symptom-free and seven have shown only moderate disability. Only 22 per cent died or were disabled from cerebral vascular disease and if patients with moderate disability are excluded, the figure is 13 per cent. Seven patients died from other causes.

Kalmansohn


An experimental model was designed to study the disappearance of pedal pulses following exercise in mongrel dogs. In the resting state it was necessary to constrict the iliac artery to 75 to 90 per cent of its cross-sectional area before the distal iliac and posterior tibial arterial pulse pressure decreased significantly. The pulse pressure in the posterior tibial artery and iliac artery became insignificant following exercise if a critical stenosis of the iliac artery was produced. Increased blood flow through the iliac artery was observed. These data suggested that the disappearance of pedal pulses following exercise in the presence of arterial localized disease is an exaggerated normal response. Fifteen patients with localized areas of stenosis in their femoral arteries showed disappearance of their pedal pulses after exercise before surgery and a reversion to normal dynamics after reconstructive surgery.

Kalmansohn


Direct surgery was used in 216 extremities of 206 patients with advanced ischemia, 101 of these facing immediate amputation. Surgery extended distally to the terminal popliteal, tibial, or perineal arteries in 50 per cent of the patients. The follow-up period averaged 2 years. The procedures used were thromboendarterectomy or saphenous vein bypass. The over-all success rate was 82.9 per cent, while the salvage rate in extremities facing immediate amputation was 72.3 per cent. The late results were dependent upon the extent of the disease.

Kalmansohn


This report concerns three women, aged 34 to 41 years, who had large fistulas between the internal iliac artery and vein. All three were multiparas and their babies had been large. Detailed obstetrical histories were not available, but the authors suggested that the fistulas may have resulted from trauma during labor. Two of the women had increasing dyspnea on exer-
ABSTRACTS


Four patients (56 to 69 years of age) are reported in whom postmortem mesenteric arteriography demonstrated complete or partial obstruction of the celiac, the superior, and the inferior mesenteric arteries, thrombotic or thromboembolic in origin. Characteristic postprandial abdominal angina was present in two patients. All patients had a history of abdominal pain of varying duration and severity. It is suggested that patients with mesenteric arterial insufficiency be divided into two groups: those with typical abdominal angina, exhibiting occlusion of at least two of the main arteries, and those with transient or absent abdominal pain, showing only occlusion of peripheral branches of the mesenteric arteries.

Thilenius


The authors describe a 74-year-old white man with a history of diastolic hypertension and a pulsating epigastric mass who subsequently developed congestive heart failure and a continuous murmur over the mass. The heart failure then improved as the murmur assumed only a systolic character. The abdominal mass enlarged and the continuous murmur returned. Postmortem examination revealed extensive coronary and aortic atherosclerosis with a 5 cm. intact aortic aneurysm just below the diaphragm and a second aneurysm above the bifurcation 10 cm. in diameter. Near the proximal end of this aneurysm there was a perforation with recent hemorrhage of an estimated 600 ml. into the retroperitoneal space and a communication inferiorty with the adjacent inferior vena cava.

Kalmansohn

OTHER SUBJECTS


This article describes the design and instrumentation of the hyperbaric chamber installed at the Royal Victoria Hospital. Two sources of compressed air are used for pressurization and ventilation which permit pressurizing to three atmospheres in 4 to 5 minutes. Instrument ports for fluid and gas lines as well as for pCO₂ and pO₂ and other physiologic measurements are described as well as wall connections between the exterior and interior of the chamber for equipment too bulky or risky to be placed inside the chamber. Precautions to protect patients and medical personnel recommended are chest radiographs to detect lung cysts, blebs, or obstructive pulmonary diseases; radiographs of weight-bearing areas should bone and joint problems arise; and a trial run in the chamber to uncover the minor problems of blocked Eustachian canals, tooth abscesses, blocked paranasal sinuses, and bone cysts which cause pain in up to 10 per cent of persons during decompression. No complications were encountered in 113 runs in the chamber, half of which were for patient treatment.

Feder


A technic for aspiration biopsy of the ventricular septum via a Menghini needle was developed in 10 dogs and applied with increasing success in 10 patients. Under local anesthesia, the needle was inserted at the point of maximal impulse into the left ventricular cavity, then directed upward and to the right into the septum. The specimen averaged 1 by 3 mm. Multiple premature beats were observed as the needle entered the heart, and pericardial friction was heard later in two patients. There was no hypotension, tamponade, or serious complication in the clinical group. Photomicrographs were depicted in five cases.

Rogers
ABSTRACTS
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