207. H. Schneider, "The Birkhoff–Egérvary–König theorem for matrices over lattice ordered Abelian groups," Acta Math. Acad. Sci. Hung., 30, Nos. 1-2, 91-94 (1977).
208. E. B. Scrimger, "A large class of small varieties of lattice-ordered groups," Proc. Am. Math. Soc., 51, No. 2, 301-306 (1975).
209. B. F. Sherman, "Cauchy completion of partially ordered groups," J. Austral. Math. Soc., 18, No. 2, 222-229 (1974).
210. B. F. Sherman, "Cauchy completion of tight Riesz groups," J. Austral. Math. Soc., 19, No. 1, 62-73 (1975).
211. W. S. Sizer, "Group retractions induced by a total order," Houston J. Math., 5, No. 2, 267-268 (1979).
212. B. Smarda, "The lattice of topologies of topological l-groups," Czech. Mat. J., 26, No. 1, 128-136 (1976).
213. B. Smarda, "Connectivity in TL-groups," Arch. Mat., 12, No. 1, 1-7 (1976).
214. J. E. Smith, "The lattice of l-group varieties," Trans. Am. Math. Soc., 257, No. 2, 347-357 (1980).
215. K. L. N. Swamy, "Isometries in autometrized lattice-ordered groups. II," Math. Semin. Notes Kobe Univ., 5, No. 2, 211-214 (1977).
216. K. L. N. Swamy, "Isometries in autometrized lattice-ordered groups," Algebra Univ., 8, No. 1, 59-64 (1978).
217. I. Tofan and S. Nistor, "Sur les groupes linéarisables," An. Sti. Univ. Iasi, Sec. 1a, 23, No. 1, 17-20 (1977).
218. K. M. Van Meter, "Les sousgroupes d'un groupe quasi-réticulé," Semin. P. Dubreil. Algèbre Univ. Paris, 25, No. 1, 4/1-4/13 (1971-1972(1973)).
219. H.-J. Vogel, "Gruppen inäquivalenter z-Erweiterungen linear geordneter abelscher Gruppen mit natürlich geordneten Monoiden," Math. Nachr., 74, 289-294 (1976).
220. A. Wirth, "Locally compact tight Riesz groups," J. Austral. Math. Soc., 19, No. 2, 247-251 (1975).
221. S. Wolfenstein, "Valeurs normales dans un groupe réticulé," Atti Accad. Naz. Lincei. Rend. Cl. Sci. Fis., Mat. e Natur., 44, No. 3, 337-342 (1968).
222. S. Wolfenstein, "Groupes réticulés singuliers," Sémin. P. Dubreil. Algèbre Univ. Paris, 25, No. 1, 5/1-5/9 (1971-1972 (1973)).
223. S. Wolfenstein, "Représentation d'une classe de groupes archimédiens," J. Algebra, 42, No. 1, 199-207 (1976).
224. F. Ziemke, "Ordnungsfähige topologische Gruppen," Diss. Dokt. Naturwiss. Fak. Math. Naturwiss. Techn. Univ. Hanover (1978).

MODULES

V. T. Markov, A. V. Mikhalev,
L. A. Skornyakov, and A. A. Tuganbaev

UDC 512.553

A survey is given of results on modules over rings, covering 1976-1980 and continuing the series of surveys "Modules" in Itogi Nauki.

The present survey covers the materials from the reviewing journal Matematika for 1976-1980 and can be considered as a continuation of the surveys [130, 131, 99, 100, 137] on modules, covering the materials of 1961-1962, 1963-1965, 1966-1968, 1969-1971, and 1972-1975, respectively, and also the survey [97] on rings of endomorphisms. In particular, in citing papers reflected in these surveys, the reader, as a rule, is referred to the corresponding survey paper. References to the bibliography of the surveys cited are formulated as [M62:000], [M65:000], [M68:000], [M71:000], [M75:000], and [KE:000], respectively. For example, [M65:121] means that one has in mind paper 121 from the survey M65 ≡ [131], relating to 1963-1965. References of the type Paragraph 3.1 indicate Section 3 Paragraph 1 of the present survey. In the bibliography as a rule, we do not include reports to conferences or seminars, if the corresponding results have already appeared in the form of journal publications. An exception is made only for survey reports. Definitions of concepts which are in the monographs of Lambek [M71:59] and Faith [161] are usually not given.

Translated from Itogi Nauki i Tekhniki, Seriya Algebra, Topologiya, Geometriya, Vol. 19, pp. 31-134, 1981.

 0090-4104/83/2306-2642$7.50

Unfortunately, the restricted size of the survey forced the authors to leave outside consideration a series of important sections, in which modules play an essential role. In the first place this relates to commutative algebra, homological algebra, algebraic K-theory, the theory of representations (of groups, associative algebras, orders, Lie algebras, etc.), modules with semilinear and quadratic forms, category theory. Each of these directions deserves separate consideration. The line of demarcation with the theory of rings and the theory of Abelian groups, to which special surveys are devoted, is entirely subjective. Thus, by tradition, there are included in the present survey the homological classification of rings and localizations, including the classical ring of fractions. At the same time, far from all papers on ring theory where modules play an auxiliary role (for example, in the definition of radicals) appear in the survey. From the theory of Abelian groups, only results of special interest for the theory of modules are elucidated (there is the survey of Mishina [96] on Abelian groups). As in the preceding survey M75 ≡ [137], there is missing the large and important section concerning rings of endomorphisms and the structure of submodules (a separate survey will be published on this theme). During the period considered, several textbooks appeared, devoting considerable space to the theory of modules. Here one can mention the books of Blyth [270], Kasch [696], Kertesz [709], Nastasescu [859]. The books of Geramita and Small [505], Raghavan, Singh, and Sridharan [974] are devoted to homological methods in commutative algebra. There appeared Russian translations of the two-volume monograph of Faith [161], Cohn's book [87] on free rings, where the theory of modules is broadly represented. During this time there also appeared in Russian translation the second volume of the monograph of Fuchs [163] on Abelian groups, in which homological methods play an essential role. The books of Behrens [245], McDonald [811], Oystaeyen and Verschoren [935], Vasconcelos [1172] are closely connected with the theory of modules. The theory of modules is also represented in the materials of a series of conferences and symposia [167, 168, 169, 170, 1010].

If nothing is said to the contrary, the ground ring is denoted by R, all rings considered are assumed to be associative and to have a unit, and modules are left and unitary. If nothing is said to the contrary, Noetherian, Artinian, etc. mean on the left. The word "ideal" always means a two-sided ideal. As in the preceding surveys, the following notation is used widely:

R-Mod is the category of all R-modules;
$\prod A_\alpha$ is the product (complete direct sum) of the modules A_α;
$\coprod A_\alpha$ is the coproduct (direct sum) of the modules A_α;
$A \oplus B$ is the direct sum of the modules A and B;
S(M) is the socle of the module M;
Z(M) is the singular submodule of the module M;
$\hat{M}$ is the injective hull of the module M;
$\mathrm{End}_R(M)$ is the ring of endomorphisms of the R-module M;
$M_n(R)$ is the ring of $(n \times n)$-matrices over the ring R;
$\mathscr{L}(M)$ is the lattice of submodules of the module M;
J(R) or J is the Jacobson radical of the ring R;
U(R) is the group of invertible elements of the ring R;
Z, **Q**, **R** are the rings of integers, rational, and real numbers, respectively;
$\mathrm{Ann}_R S = \{r \in R \mid rS = 0\}$ is the annihilator of the subset S of the R-module M;
$l(M)$ is the length of the module M.

1. Category of Modules

1.1. General Questions. We begin with results not appearing in specialized sections. In [1081, 1233] there were considered basis submodules of modules over rings similar to discrete normed rings. A density theorem for basis homogeneous modules is given in [796]. In [275] there are studied properties of modules over commutative principal ideal rings. Tests for the isomorphism of two torsion-free modules of rank 2 over commutative Dedekind domains are given in [402]. Separable modules over commutative Dedekind domains were studied in [1194]. In [204] the following conditions on a module M over a commutative ring were considered: (1) each countably-generated submodule of M is contained in some finitely generated submodule of M; (2) the module M cannot be represented in the form of a union of a strictly increasing countable chain of submodules. Let R be the group ring of a quasicyclic group over the ring of p-adic integers. In [13] for irreducible R-modules there is introduced and studied a certain arithmetic invariant. Vamos [1161] studied modules M over a ring R such that $\mathrm{Hom}_R(N, M) \neq 0$ for any nonzero R-module M. Rossoshek [119] continued the study of correct modules started in [M75:128].

In a series of papers there were considered classes of modules, introduced by analogy with certain classes of rings. Primary and semiprimary modules, primary left ideals were studied in [4, 253, 399, 985]. Regular modules (that is, modules all of whose submodules are pure), were studied in [351] (cf. also [M75: 519, 521, 525, 529]), semiregular modules in [877]. Factorial modules over commutative rings, which are analogs of factorial rings, were studied in [379, 880] (cf. also [M75: 1039-1041, M71: 829]). Mehdi and Singh [816, 817, 1084] studied properties of multiplication modules over commutative rings (a module M is called multiplicational if for any submodules L, N, of M, where $L \subseteq N$, one can find an ideal A, such that $L = NA$).

A module, all of whose proper submodules are small, is called hollow. Harada [603] continued the study of hollow modules started by Fleury [M75: 537]. In particular, he proved that a finitely generated homogeneous hollow module over a right or left perfect ring has local endomorphism ring. Rangaswamy [978] studied modules, in which each finitely generated submodule is small. Harada [606] studied nonsmall modules, that is, modules not small in their injective hull. The dual concept is also considered. Modules over commutative Noetherian rings, each proper submodule of which lies in a maximal submodule, were considered in [1236]. Tiwary and Paramhans gave a condition on submodules $A \subseteq B$ of a module M, equivalent with the fact that B/A is the singular submodule of the module M/A. Andrunakievich [6] studied the Σ-radical of a module, where Σ is a special class of modules in the sense of [M65: 5], satisfying the additional requirement: if $M \in \Sigma_A$, $0 \neq N \subseteq M$, then $N \in \Sigma_A$. Nita [888] considered modules over commutative rings, containing as submodules, isomorphic copies of any simple module. Osterburg [913] gave a series of remarks on modules over the crossed product of a semilocal ring R and a finite group of automorphisms of the ring R, inducing a group of completely outer automorphisms on the quotient-ring $R/J(R)$. Let all finitely generated left ideals of the ring R be free modules of identical rank, $M \in R\text{-Mod}$, $M \cong R^m/R^n$, A be a matrix of the module M, $h(M) = m - n$. If $\mathrm{Hom}_R(M, R) = 0$ and the inner rank of the matrix A is equal to min(m, n), then the module M is called complete. A complete module is called positive (negative, periodic), if $h(M) \geq 0$ ($h(M) \leq 0$, $h(M) = 0$). Cohn [366] proved that any finitely generated R-module is the direct sum of a free module and an extension of a negative module by a positive one. Labute [738] considered free Lie algebras as modules over their enveloping algebras. Shudo [1073] studied properties of comodules over coalgebras. In [117, 1140] familiar results about Abelian groups were carried over to the case of modules over bounded hereditary Noetherian primary rings. Dlab and Ringel [420] attached module theoretic value to the property of summation of the root system of the Dynkin diagram.

1.2. Properties of Direct Sums. We shall say that the subset A of the module M is exchangeable with respect to the direct decomposition $M = A \oplus B$ if the equation $M = A \oplus B$ implies the existence of submodules $C'_\alpha \subseteq C_\alpha$, such that $M = A \oplus (\coprod_\alpha C'_\alpha)$. The submodule A of the module M is called (finitely) exchangeable in the module M, if it is exchangeable with respect to any (finite) direct decomposition of the module M. The module A is called (finitely) exchangeable, if it is (finitely) exchangeable in any module containing it. Nicholson [878] proved that ${}_RM$ is finitely exchangeable if and only if in the ring $\mathrm{End}_R(M)$ idempotents can be lifted modulo any left (right) ideal. It is also proved there that the finite exchangeability of a projective module P is equivalent with the fact that if $P = M_1 + M_2$, then one can find a direct decomposition $P = P_1 \oplus P_2$, where $M_i \supseteq P_i$, $i = 1, 2$. Exchangeable modules are also considered in [691]. Harada and Ishii [607] reproved the results of Yamagata [M75: 1455] on projective exchangeable modules.

We shall say that in the direct decomposition $A \oplus B \cong A \oplus C$ one can cancel (weakly cancel) by the module A if $B \cong C$ (one can find a natural number n such that $B^n \cong C^n$). The property of (weak) cancellation was considered in [539, 541, 548, 587, 1111]. Goodearl [539, 541], in particular, proved that one can weakly cancel by the module A if A is a finitely generated module over any subring of a finite-dimensional algebra over the field of rational numbers. Goodearl and Warfield [548] considered the case when A, B, C are finitely generated modules over an algebra R over a commutative ring S such that the module of fractions R_M is a finitely generated S_M-module for any maximal ideal M of the ring S. They proved that: (1) if $A \oplus B \cong A \oplus C$, then $B \cong C$; (2) if $A^n \cong B^n$, then $A \cong B$; (3) if A^n is isomorphic with a direct summand of B^n, then A is isomorphic with a direct summand of B. In [649] the theory of cancellation is developed for a series of categories, which applies to modules over rings of algebraic numbers.

Gruson and Jensen [577] characterized modules M for which there exists a cardinal t such that each direct power of the module M splits into a direct sum of submodules, whose cardinality does not exceed t. Lenzing [762] explained when for a fixed module F any homomorphism $F \to \prod_t M / \coprod_t M$ can be lifted to a homomorphism $F \to \prod_t M$, where t is an arbitrary cardinal. There too the question is studied when the module $\coprod_t M$ is distinguished as a direct summand in the direct power $\prod_t M$. This result is applied to the case when $M \cong {}_RR$. In

[244] it is explained when a module has a free direct summand of infinite rank. In [480, 781, 783, 784] properties of subdirect products of modules are studied.

Ringel [1013] studied properties of indecomposable modules over finite-dimensional hereditary algebras. In [1087] finite-dimensional indecomposable modules over the quotient algebra of polynomials $K[x_1, \ldots, x_n]/(x_1, \ldots, x_n)^2$ were considered. Indecomposable modules over the group algebra of a noncyclic Abelian group of exponent p over a field of characteristic p were studied in [308]. Indecomposable modules over various algebras of infinite type of representations were considered in [285, 1192]. Jondrup [687] studied the question of when a ring R with a finite number of cyclic (finitely generated, finitely representable) R-modules is left Artinian. Warfield [1187] studied properties of (indecomposable) modules over commutative Artinian rings and discrete normed rings. Indecomposable modules over certain quasifrobenius rings were studied in [212, 490]. By an Artinian algebra is meant an Artinian ring, which is a finitely generated module over its center. Indecomposable modules over Artinian algebras were studied in [207, 209, 210, 211, 216, 217, 304, 552, 566, 567]. In the book of Gordon and Green [554] a study is made of a special class of indecomposable modules – with a core. One says that a module M has a core, if the intersection of all nonsmall submodules of the module M is not equal to zero. Certain properties of indecomposable modules were considered by Green [568, 570]. Zimmerman-Husigen [1231] proved that a countable direct power of the module M is a direct sum of modules with local endomorphism rings if and only if any direct sum of copies of the module M is algebraically compact. In [1226, 1230] other properties of direct powers of modules were investigated. In [250] properties of direct sums of antisingular quasiinjective modules over a left antisingular ring are studied.

In [254, 639, 1080] familiar results on direct decompositions of Abelian groups are carried over to special classes of modules. Stanton [1116–1118], Zöschinger [1235] and Lady [741] investigate direct decompositions of modules over commutative discrete normed rings. Arnold [203] studies the connection and parallel between the theory of lattices over orders and the theory of torsion-free modules of finite rank over Dedekind subrings of an algebraic number field, which are applied to direct decompositions of Abelian groups. Direct decompositions of modules of a very special form were considered in [28, 871]. A series of properties of high subgroups of Abelian groups are carried over in [454] to modules over Dedekind rings.

1.3. Modules with Finiteness Conditions. Anderson [190] noted that Artinian modules over a commutative ring are countably generated and Hartley [608] gave an example of an Artinian module over a countable ring, which is not countably generated. It is shown in [608] that the group algebra over a field of a group of countable rank has an Artinian module, all of whose submodules are totally ordered by inclusion and the order type of this totally ordered set is equal to the first uncountable ordinal. Snider [1100] proved that all injective hulls of simple modules over the integral group ring of a finitely generated nilpotent group are Artinian modules. Lenagan [757] proved that if the ideal A of the right Noetherian ring R has a composition series as a left R-module, then A has a composition series as a right R-module. Goodearl [545] gave examples of Artinian modules as well as Noetherian modules over a regular primary ring, which do not have composition series. In [581] it is shown that an indecomposable Artinian purely injective module has local endomorphism ring. The action of an ideal on an Artinian module was considered in [395]. Roberts [1017] introduces and studies for Artinian modules over a commutative local ring, a dimension, whose definition is dual to the usual definition of Krull dimension, introduced by Gabriel and Rentschler [M71: 924]. Results announced earlier on Artinian modules were published in [225].

A module having an essential Artinian submodule is called finitely embedded. Schelter [1054] proved that finitely embedded finitely generated module over a left completely bounded Noetherian ring, all of whose right-primitive quotient groups are Artinian, is an Artinian module. Ginn [511] gave an example of a right and left primitive principal ideal domain over which there exists a nonartinian module which is an essential extension of a faithful simple module. In [376], to characterize commutative coherent rings and commutative rings of weak homological dimension one, there are used modules M such that $\hat{M}/M$ is a finitely embedded module. Finitely embedded left ideals occurred in [175, 692]. Finitely embedded modules were also considered in [410, 1094, 1214].

Shock [1070] proved that if each quotient module of the module M has a finitely generated socle and small Jacobson radical, then M is a Noetherian module. Karakas [695] proved that a module over a commutative ring is Noetherian if and only if all its primary submodules are finitely generated. The Krull dimension of the module M (defined as the deviation of the set of all its submodules, partially ordered by inclusion) is denoted by K dim (M). Any Noetherian module has a Krull dimension. A module is called compressible if it can be isomorphically imbedded in any of its nonzero submodules. A module M having a K dim (M) is called critical, if K dim (N) < K dim (M) for any of its proper quotient modules N. It is proved in [1185] that if R is a right

Noetherian ring, integral over its center, then all finitely generated critical R-modules are compressible. With the help of the concept of reduced rank for finitely generated modules over left Noetherian rings and rings having left Krull dimension, in [346, 531, 760] many familiar results on left Noetherian rings and rings with Krull dimension are reproved. Jategonkar [666] to prove an analog of Krull's principal ideal theorem for primary rings with polynomial identity introduces and uses a certain analog of the length of a module over a completely bounded Noetherian ring. Amitsur and Small [189] proved that if D is a field, then all simple modules over the polynomial ring $D[x_1, \ldots, x_n]$ are finite dimensional over D.

Let A, B be submodules of the module M, $C = A \cap B$, f be a maximal extension of the identity mapping 1_C, considered as a homomorphism from A to B, D be the domain of definition of the homomorphism f, d(X) be the Goldie dimension of the module X. Camillo and Zelmanowitz [318] proved that $d(A + B) = d(A) + d(B) - d(D) + d(D/C)$, and gave an example when $d(A + B) \neq d(A) + d(B) - d(A \cap B)$. Some applications of the formula of Camillo–Zelmanowitz are given in [314, 523]. Properties of minimal systems of generators for a module were studied in [608, 980]. Systems of generators of modules over semigroup algebras were studied in [60ˇ'. Gilmer [507] described modules over commutative rings, all of whose proper submodules are finite direct sums of simple modules. Modules, dual to modules, finite-dimensional in the sense of Goldie, were studied in [1139, 1169, 1170]. Camillo [313] characterized modules, all of whose quotient modules are Goldie finite-dimensional. Segal [1058] proved that a finitely generated module over the integral group ring of a finitely generated almost nilpotent group has a finite series of submodules, whose quotients have zero Jacobson radical. Free modules with a maximality condition for n-generated submodules for each fixed number n were studied by Renault [1000]. Constructive modules, which are a generalization of finitely representable modules, were considered by Ribenboim [1004]. Cohen [362] proved that if M and N are stably equivalent modules over the integral group ring of a finite group, which are free noncyclic Abelian groups, then their minimal numbers of generators are equal. A left fully bounded left Noetherian ring is called a left FBN-ring. Warfield [1191] generalized to left FBN-rings of finite Krull dimension the theorem of Forster–Swan [M68: 388] on the limit of the number of generators of a finitely generated module. He also [1190] studied relations between a system of generators and a system of stable generators of a finitely generated module. Faith [451] studied the concept of the genus of a module M, that is, the minimal number, for which there exists an epimorphism $M^n \to {}_R R$. Robson [1018] proved that if M is a finitely generated module over a Noetherian ring, whose ideals are pregenerators, while $K\dim(M) = n$, then M is generated by n + 1 elements. Bounds on the number of generators of ideals and modules over commutative rings were considered in [274, 1177]. Properties of the length of the quotient module M/J(M) of a finitely generated module M were studied in [984]. Beachy [236] considered finitely generated fully bounded Artin–Rees modules over Noetherian rings and proved that a finitely generated module over a FBN-ring has only a finite number of maximal elements in its support. Properties of finitely generated modules over semihereditary primary rings were studied by Miller [825], and over various classes of simple Noetherian rings by Stafford [1106, 1110, 1112] and Robson [1019]. The module M is called finitely annihilated if it contains a finite subset F, such that $\mathrm{Ann}_R M = \mathrm{Ann}_R F$. Finitely annihilated modules were used in [243] to characterize various classes of rings. Existence theorems for basis elements in Stein modules are proved in [302]. Nastasescu [860] proved that the module of power series M[[X]] over the ring R[[X]] has Krull dimension if and only if M is a Noetherian module. Coprimary decomposition of an Artinian module was considered in [830]. Primary decompositions of various classes of modules were considered in [45, 255, 550, 891]. Tertiary decompositions of a finitely generated module over a Noetherian ring were studied in [751]. Nastasescu [864] studied Noetherian and Artinian modules with respect to the additive topology on the ground ring. He also [861] considered Artinian objects in Grothendieck categories. Isomorphism of pairs of finitely generated modules over commutative principal ideal domains were investigated in [61]. Anderson [191] studied finitely generated modules M over a commutative Noetherian ring, such that $N + (\bigcap_\alpha N_\alpha) = \bigcap_\alpha (N + N_\alpha)$ for any submodules N and N_α of the module M. Rangaswamy [978] investigated modules with minimal condition for nonsmall submodules. Modules, having Krull dimension K dim and Gabriel dimension G dim were considered in [184, 277, 278, 279, 340, 522, 595, 596, 597, 727, 730, 749, 756, 758, 761, 1044, 1145]. Lenagan [761] proved that if the module M is represented as the union of a transfinite sequence of modules M_α such that $K\dim(M_\alpha) \leq t$ for all α and a fixed transfinite number t, then the Krull dimension of the module M exists and does not exceed t. He also [758] studied the connection between K dim R and K dim R/A, where A is an invertible ideal of the left Noetherian ring R. A series of results on rings and modules having Krull dimension were obtained by Lemonnier [756]. In particular, he proved that a module with Krull dimension over a V-ring is Noetherian. In addition, if R is a commutative ring, all of whose quotient rings are finite-dimensional in the sense of Goldie, then the existence of K dim R is equivalent with the fact that R satisfies a maximality condition for simple ideals and each ideal of the ring R contains a product of simple ideals. The Krull dimension of modules over left Noetherian rings, integral over their centers, was studied by Chamarie and Hudry [340]. Boyle and Feller [278] investigated modules over a left Noetherian ring for which the Krull dimensions of all nonzero finitely generated submodules coincide. Boyle [277] considered modules M such that K dim M/N < K dim M for any essential submodule N. The Gabriel dimension of idealizers and subidealizers was calculated in [597, 727, 730]. Lanski [749] used a noncategorical approach to the Gabriel dimension for considering the Gabriel dimension over rings with involution. Golan [522] considers in his book functions of quasidimension, covering the Gabriel dimension.

1.4. Projective and Flat Modules. For properties of projective and flat modules connected with localizations and torsion, cf. Section 3. Results, closely connected with algebraic K-theory are hardly considered.

Below in this paragraph, by R we denote the ring of polynomials $D[x_1, \ldots, x_n]$ in n independent variables with coefficients in the ring D, by P we denote a finitely generated projective R-module. It was already mentioned in the preceding survey [137] that Suslin [M75: 146] and Quillen [M75: 1128] independently solved Serre's problem positively, proving that if D is a field, then P is a free module. A series of papers was devoted to Serre's problem and its generalizations. After the preprint of Quillen [M75: 1128] there appeared his paper [971] in which it is proved that if D is a commutative principal ideal domain, then P is a free module. The book [745] is devoted to a complete account of the results of A. A. Suslin and Quillen, and also contains a series of open questions on this theme. Partial results on Serre's problem are contained in [1025, 1026]. Suslin [140] proved that if D is a skew-field, finite-dimensional over its center, and the rank of the module P is greater than one, then the module P is free. Stafford [1115] proved that if D is a skew-field with infinite center, then the module P is either free or isomorphic with a left ideal of the ring R. Serre's problem in the noncompact case is also considered in [724]. Serre's problem is solved positively for the following cases: (1) D is a commutative one-dimensional Bezout domain [791]; (2) D is a commutative Bezout domain, all of whose simple ideals have finite height [763]; (3) D is the ring of formal power series in a finite number of variables over a field [779]; (4) D is an affine normal subring of the ring of polynomials in two variables over a field, generated by monomials [194]. In [287, 778, 1028] for certain commutative rings D it is proved that the module P is an extension of a certain finitely generated projective D-module Q. Kang Ming–Chang [694] proved that if D is a commutative Noetherian ring with finite normalization and either $1/2 \in D$ or the rank of P is not equal to 2, then the module P is isomorphic with the direct sum of a free R-module and a projective R-module of rank 1. Anderson [192] proved that if A is an affine subring of the ring of polynomials in two variables over a field, then any finitely generated projective A-module is the direct sum of a free module and a projective module of rank 2. In [731, 1026] results are given concerning the complement of a unimodular row with respect to an invertible matrix. Suslin [140] proved that if A is an affine algebra of dimension d over an algebraically closed field, then each finitely generated projective A-module, whose rank is not less than d, is free. Suslin [1125] and Stafford [1108] are devoted to the cancellation problem for projective modules. A finitely generated module ${}_RM$ is called a stably free module of type n if $M \oplus R^n$ is a free module. Lam [744] proved that the direct sum of a sufficiently large number of stably free modules of type n is a free module.

Properties of the stable rank of the ring of polynomials in a finite number of variables over a commutative ring were studied by Gabel [498]. Stafford [1107] proved that any projective module over the Weyl algebra $A_n(D)$ is stably free. Suslin [101, p. 97] gave a construction, allowing one, for a pair (M, f), where f is a nilpotent endomorphism of the finitely generated module M over the commutative Noetherian local ring R, to construct a finitely generated projective R[x]-module P(M, f), whose rank is equal to the dimension of the kernel of the endomorphism $\mathrm{Tor}_1(f, K)$, where K is the residue field of the ring R. Let R be a Noetherian commutative ring, $A = R[x_1, x_1^{-1}, \ldots, x_n, x_n^{-1}, y_1, \ldots, y_m]$, P be a finitely generated projective A-module. Swan [1128] under certain additional assumptions proved the existence of a projective R-module Q, such that $P \cong A \oplus_R Q$. Carter [331] gave examples of projective modules over the integral group rings of the groups $SL_n(\mathbf{Z})$, $GL_n(\mathbf{Z})$, which are not stably free. Berridge and Dunwoody [248] constructed examples of nonfree projective modules over the integral group rings of torsion-free groups. Michler [822, 823] proved that if F is a field of characteristic $p > 3$, G is a finite group, which is not p-solvable, M is an indecomposable projective nonsimple FG-module of F-dimension p, then M has a composition series of length 3 and the socle of the module M is one-dimensional. Projective and free modules over group rings were also considered in [228, 320-322, 356, 582, 723].

Stafford [1110] proved that any projective module over the Weyl algebra $A_n(K)$, where K is a field of characteristic zero, is either free or isomorphic with a left ideal. Levy [768] studied the structure of finitely generated projective modules over commutative Noetherian Krull one-dimensional domains. Fuller and Shutters [497] and Brockmann [289, 290] elucidated the structure of projective modules over a semilocal p-connected ring. Fuller and Shutters [497] also proved that over a semilocal ring there exist only a finite number of classes of isomorphic projective indecomposable finitely generated modules. Parimala and Sridharan [949, 950] investigated projective modules over generalized quaternion algebras. Projective and flat modules over Frobenius algebras and the Steenrod algebra were considered by Lin and Margolis [776]. Projective modules over nonassociative rings were studied by Wisbauer [1202, 1207]. Projective ideals of rings of continuous functions were investigated by Vechtomov [27] and Brookshear [291, 292]. Beck and Trosborg [244] gave conditions on a "large" projective module, equivalent with its freedom. Conditions for the finite generation of a projective module which is finitely generated modulo the Jacobson radical of the ring, were considered by Sakhaev [124], Jondrup [683], Valette [1160]. Fröhlich [473] studied locally free modules over orders in a finite-dimensional semisimple algebra over an algebraic number field. Warfield [1188], associating with each matrix with coefficients in some ring the cokernel of the homomorphism of free modules, defined by this matrix, investigated the question when this cokernel defines the matrix up to equivalence. In [336] free and projective graded modules were investigated. Reflexive modules were studied in [585, 675, 1057, 1155]. Masaike [800] gave conditions on the ring R with left self-injective maximal left ring of fractions Q, equivalent with the fact that each finitely generated R-module M, isomorphic with a submodule of the direct product of copies of the module ${}_R\hat{R}$, can be imbedded in a free R-module. Bruns and Vetter [303] proved that if M is a finitely generated torsion-free module over a commutative Noetherian ring R, while M_A is a free R_A-module for each simple ideal A with the condition grade $(A) \leq 1$, then the module M contains a free submodule F, such that M/F is isomorphic with an ideal of R. Projective modules, all direct powers of which are projective, were studied by Zimmermann [1227] and Jeremy [673]. Nicholson [876] and Jansen [664] considered projective modules, certain of whose quotient modules have projective coverings. Projective modules, all of whose quotient modules are injective, were investigated in [790]. Dominant projective modules were studied by Kato [697] and Kawada [699, 700]. The connection between the properties of an infinitely generated projective module and its endomorphism ring was studied by MacDonald [812]. Let P be a finitely generated projective module over the ring A, $B = \mathrm{End}_A P$, T be the trace ideal of the module P. Miller [826] gave characterizations of the following conditions: (1) P_B is a projective module; (2) P_B is a flat module; (3) T_A is a projective module; (4) T_A is a flat module; (5) the functor $\mathrm{Hom}_B(P, -)$ commutes with direct sums. Hill [623] studied modules, all of whose submodules are projective. Landrock [747] calculated the Loewy length of projective modules over symmetric finite-dimensional algebras over a field. In Dicks' book [406] there is given a self-contained proof of the fact that the projectivity of the fundamental ideal of the group ring RG, where R is a nonzero ring, is equivalent with the fact that G is the fundamental group of a graph of finite groups whose orders are invertible in the ring R. Projective modules of differentials over algebras were considered in [305]. Ramamurthi [975] studied modules with projective modules of characters. Swan [1127] gave a simpler proof of the fact that vector bundles over a finite complex can be represented as projective modules over a Noetherian ring. Projective and free modules over special classes of commutative rings were considered in [226, 676, 854]. Gruenberg and Roggenkamp [575] studied projectivity in full additive subcategories in R-Mod, closed with respect to isomorphisms and finite direct sums. Levaro [766] considered structural sheaves on the spectrum of a commutative ring, which are projective modules. Nicolas [882] generalizes to the case of modules certain familiar results on free Abelian groups. Free and projective resolutions of modules over commutative rings were studied in [300, 1121, 1173].

Passing to generalizations of projective modules, we begin with work on quasiprojective modules. A module M is called projective with respect to the module N, or an N-projective module, if for any epimorphism $h: N \to \bar{N}$ and an arbitrary homomorphism $\bar{f}: M \to \bar{M}$ one can find a homomorphism $f: M \to N$, such that $\bar{f} = hf$. By a quasiprojective module is meant an M-projective module M. Tuganbaev [149, 150] described the structure of quasiprojective modules, respectively, over bounded Dedekind primary rings and over bounded hereditary Noetherian primary rings. The work of Singh [M75: 1295, M75: 1296, 1079], Singh and Talwar [1086] was devoted to the partial solution of these problems. Glavatskii [36] studied topological quasiprojective modules. Hill [622] described semilocal rings, over which each submodule of a quasiprojective module is quasiprojective. Harada [600] reproved by ring-theoretic methods his results [M75:673] on direct decompositions of quasiprojective modules over semiperfect and perfect rings. Quasiprojective modules over semilocal rings were touched on by Ahsan [179, 180]. A wider class of modules in comparison with quasiprojective modules is formed by the class of unprojective modules. A module M is called unprojective if for any epimorphism $h: M \to \bar{M}$ and an arbitrary $\bar{f} \in \mathrm{End}\bar{M}$ one can find a $f \in \mathrm{End}M$, such that $hf = \bar{f}h$. Tuganbaev [143, 152] described the structure of unprojective modules respectively over bounded Dedekind primary rings and over bounded hereditary Noetherian primary rings. He also proved that the classes of quasiprojective and slightly projective modules over a left perfect ring coincide [145, 151], and used slightly projective modules to characterize hereditary, semihereditary, perfect, Artinian, semiprimitive, and completely reducible rings [151]. Zimmermann–Huisgen [1229] studied locally projective modules, that is, modules M, such that for any epimorphism $h: A \to B$, arbitrary $g: M \to B$, and any finitely generated submodule F of M, one can find a homomorphism $f: M \to A$, such that $(g-hf)F = 0$. In particular, any locally projective module is a flat module and is isomorphic with a pure submodule of the direct power of the ground ring, pure submodules of locally projective modules are locally projective; moreover, there are described locally projective modules over semihereditary rings. Modules, projective with respect to endomorphisms $h: A \to B$, where B is a finitely generated module, were considered by Hiremath [630]. On other generalizations of projective modules, cf. [253, 258, 260, 269, 616, 678, 680, 721, 1149, 1167].

Passing to flat modules, we note that for applications of flat modules to problems on the homological classification of rings, cf. Sec. 2. The connection of flat modules with rings of fractions is reflected in Sec. 3. Clarke [361] proved that if M is a flat module over a left and right Noetherian ring, then one can find a free module F, such that $M \oplus F$ is the filtered union of free modules. Dicks and Sontag [408] proved that flat modules over certain domains (Sylvester domains) are locally free modules. For example, a free algebra over a commutative principal ideal domain is a Sylvester domain. Sklyarenko [128] gave a characterization of flat modules in terms of duality homomorphisms. He also [129] studied modules, flat with respect to proper classes in the sense of Buchsbaum–MacLane. Modules, flat with respect to torsion, were considered by Bland [268], Miller and Teply [827]. Jiraskova [679] investigated modules, flat with respect to the preradical. Strictly flat modules were studied by Rangaswamy [979]. Flat ideals of commutative rings were considered by Dobbs [423], Glaz and Vasconcelos [513], Sally and Vasconcelos [1042]. The works of Jondrup [685] and Rush [1033] are devoted to conditions for the projectivity of flat modules. On other works on this question, cf. Paragraph 2.7. Nobile [890] proved that if $f: A \to B$ is a homomorphism of commutative rings, B is a Noetherian ring, N is an ideal of the ring B such that $N \subseteq J(B)$ and all the induced homomorphisms $f_n: A \to B/N^n$ are flat, then f is a flat homomorphism. A new proof of the familiar result that a flat homomorphism of commutative rings has the property of going down was given by Dobbs and Papick [425]. On other works on flat homomorphisms of rings, cf. Paragraph 3.6. Lady [739] studied properties of direct sums of flat submodules of the field of fractions of a Noetherian commutative locally factorial domain. Evans [436] found conditions under which torsion-free modules in the sense of Hattori form a class of torsion-free modules with respect to some hereditary torsion theory, corresponding to a perfect topology.

1.5. Injective Modules (and Similar Classes of Modules). With respect to the use of injective modules in the homological classification of rings, cf. Sec. 2, in localizations, cf. Sec. 4. These or other injectivity properties in Abelian groups and endomorphism rings of injective modules are only partially reflected.

Matlis [803] published a survey paper on the properties of injective and divisible modules over commutative rings. Let E be the injective hull of a simple module over the ring R. In the case of a Noetherian PI-ring R, that the module E is Artinian was proved by Jategaonkar [667], and in the case of the integral group ring of a finitely generated nilpotent group, by Snider [1100]. Injective modules over group rings were considered by Brown and Lawrence [297], Goursaud and Valette [563], Hartley [609], Musson [855]. Goodearl and Boyle [546] developed for antisingular injective modules a theory of types, analogous to the theory of types of a Baer ring, and a theory of dimension functions, analogous to the theory of Loomis and von Neumann for regular rings. They applied these tools to study self-injective regular rings. A module is called completely decomposable, if it is a direct sum of indecomposable injective modules. Let N be a direct summand of a completely decomposable module M. There remains unsolved the problem of Matlis [M75: 943]: is N a completely decomposable module? Yu Chi Ming [1222] gave a positive answer in the case when N contains the singular submodule Z(M) of the module M. Kutami and Oshiro [736] proved that if Z(N) = 0, then N is a quasiinjective module. Moreover they elucidated when an antisingular module, containing the injective hulls of its cyclic submodules, is a completely decomposable module. Subproducts of injective modules are investigated in the works of Fuchs and Loonstra [480, 781]. Miller and Turnidge [829] studied injective modules, all of whose finitely embedded quotient modules are injective. Choudhury and Tewari [355] used for the characterization of left V-rings, modules M such that M and $\hat{M}/M$ are cocyclic modules. Indecomposable injective modules over chain rings were considered by Roux [1030] and Törner [1152, 1153]. Hauger [614] studied injective cogenerators over rings of linear differential operators. Roggenkamp [1020] classified injective modules over Gorenstein orders (in particular, over integral group rings of finite groups). Injective modules over Frobenius algebras and over the Steenrod algebra were considered by Lin and Margolis [776], over enveloping algebras by Ballard [223], over nonassociative algebras by Wisbauer [1202]. Fuelberth and Kuzmanovich [485] proved that an injective module over a split subdirect product of rings A and B is a direct sum of an injective A-module and an injective B-module. Camillo [315] studied commutative rings with the property Hom(M, N) = 0, where M, N are injective hulls of nonisomorphic simple modules. Foxby [471] investigated the injectivity behavior under change of commutative Noetherian rings with the help of a flat homomorphism. Injective graded modules over commutative graded rings were considered by Goto and Watanabe [555, 556]. Injective modules over special classes of commutative rings are studied in the works of Nastasescu [862] and Harui [610-612]. Vechtomov [26, 27] described injective and pure ideals of rings of continuous functions. Sharp [1063] proved that each injective module over a commutative Noetherian ring is a direct sum of modules where multiplication by any element of the ring is either an epimorphism or a nilpotent endomorphism. Vamos [1164] proved that the injective hull E of the direct sum of all simple modules over a semilocal Noetherian PI-ring induces a duality between the J(R)-adic completion $\bar{R}$ of the ring R and the ring $T = End_R E$. Moreover, the module E_T is Artinian. Injective left ideals of Noetherian rings were studied by Chatters, Hajarnavis, and Norton [348]. Properties of simple injective modules were studied by Anderson [195]. Cauchon [333] found conditions under which all indecomposable injective modules over a left Noetherian ring are defined by associated primary ideals. On rings over which all quasiinjective modules are injective, cf. Sec. 2 and the works of Bunu [23], Boyle and Goodearl [280], Faith [442]. We proceed to classes of modules similar to injective. Let A and B be quasi-injective modules. Goodearl [538] proved that if the module A^n is isomorphic to the module B^n (to a direct summand of the module B^n), then the module A is isomorphic to the module B (to a direct summand of the module B). Properties of direct sums of antisingular quasiinjective modules over left antisingular rings were studied by Berry [250]. Boyle [276] characterized homogeneous quasiinjective modules, not containing proper quasiinjective submodules. Hill [622] described semilocal rings, over which quotient modules of quasiinjective modules are quasiinjective. Alamelu [181] studied quasiinjective modules over commutative Noetherian rings. Ahsan's works [173, 177-180] are devoted to quasiinjective modules. Glavatskii [35, 36] studied topological quasiinjective modules. A module is called slightly injective if all endomorphisms of its submodules extend to the whole module. Tuganbaev proved that: (1) a slightly injective module which has Gabriel dimension and an essential socle, is a quasiinjective module [148]; (2) each submodule of a slightly injective module is an essential submodule of a direct summand of the whole module [144]; (3) a slightly injective nonhomogeneous antisingular module over a right primary Goldie ring is injective [144]. He also described slightly injective modules over commutative Dedekind rings [147] and used slightly injective modules to characterize hereditary Noetherian, regular rings and Artinian principal ideal rings [151].

Bunu [20-22] considered modules, injective with respect to idempotent preradicals, pretorsion, and pairs (F, M), where F is a function, M is a class of modules. Bican [252] considered modules, injective with respect to pairs of preradicals, Nishida [886] with respect to torsion. Beachy [238] elucidated when a ring has finite length with respect to torsion, defined by a fixed module. Modules and Abelian groups, divisible with respect to some purity were studied by Ivanov [69]. Modules, divisible relative to torsion, are investigated by Sarath and Varadarajan [1045]. On other connections of injectivity and divisibility with the theory of radicals and purity, cf. Sec. 3. Bicommutators of completely divisible hulls of modules were studied by Zakharov [68].

Modules, injective with respect to embeddings of finitely embedded modules, were considered by Hiremath [631]. Yu Chi Ming [1218, 1224] to characterize various classes of rings, used the concept of a p-injective module, that is, an R-module M, such that any homomorphism $Ra \to M$ ($a \in R$) extends to the entire ring R. Modules over special classes of commutative rings, similar to injective in some sense or other, were considered in [53, 230, 377, 390, 574, 578, 722, 735, 883]. Kurata and Katayama [735] studied QF-3'-modules (introduced and studied by Tsukerman [M73: 122] under another name). Cf. also [M75: 76; 286]. A module M is called pseudoinjective if any monomorphism $N \to M$, where $N \subseteq M$, extends to an endomorphism of the module M. Tuganbaev [145, 150] proved that a pseudoinjective module which is not singular over a left primary Goldie ring is quasiinjective, and described pseudoinjective modules over bounded hereditary Noetherian primary rings. Zimmerman and Zimmermann–Huisgen [1228, 1231, 1232] studied algebraically compact modules. Linearly compact modules were investigated in [377, 578-580, 901, 1184]. The properties of finite axiomatizability and elementary closedness of certain classes of modules, similar to injective, were considered by Jensen and Vamos [671]. On the connection of injectivity with the theory of sheaves, cf. [534]. Modules similar to injective in some sense or other are dealt with in [18, 53, 265, 267, 426, 514, 940].

2. Homological Classification of Rings

2.1. Homological Dimension of Rings and Algebras. An account of a series of questions about homological dimensions of rings and modules appeared in the books of Geramita and Small [505], Raghavan, Singh, and Sridharan [974], and Vasconcelos [1176]. An axiomatic approach to dimensions (injective, projective, flat, etc.) was proposed by Ohm [893]. A cycle of papers of G. L. Fel'dman [162], Chiplunkar [354], Goodearl [535], Rosenberg [1029], McConnell [810] and Desrochers [404] is devoted to the calculation of the global dimension of rings of differential operators, Weyl algebras, and Ore extensions. Malliavin–Brameret [788] proved the finiteness of the global homological dimension of the localization with respect to a prime ideal of the universal enveloping algebra of a finite-dimensional Lie algebra. Osofsky [911] made a calculation of the global dimension of the twisted group algebra of an Abelian group over a field of characteristic zero. In [251, 327] there are calculated the global dimensions of a series of filtered algebras. Govorov [37] used new associativity formulas for the functors Hom and ⊕ to get estimates of homological dimensions of modules and rings. Boyarkin [168, pp. 12-13] gives an estimate of the homological dimension of algebras with the standard identity. Datuashvili [168, pp. 32-33] calculates the homological dimension of certain linear topological matrix rings. Connections between homological dimensions of a ring and a quotient ring, a ring and its flat extension, a ring and the idealizer of its unilateral ideal, were considered in [273, 809, 1143]. Examples of calculations of global dimensions of rings of endomorphisms of certain modules are given in [383, 1088]. In [780, 941] global dimensions are calculated of extensions of rings by bimodules. Greenberg [572] analyzes the behavior of the global and weak dimension upon passage to the fibre product of rings. Resco [1002] elucidates when

$$\mathrm{gl{\cdot}dim}\,(D\otimes_k k(x_1,\ldots,x_n)=n,$$

where D is a division algebra over the field k, and $k(x_1,\ldots,x_n)$ is the field of rational functions. Jain and Singh [660] note that if in a ring all left ideals are quasiprojective, then its global dimension can only assume the values 0, 1, and ∞. Greenberg and Vasconcelos [573] showed that if R is a commutative coherent ring of global dimension two, then the polynomial ring $R[x_1,\ldots,x_n]$ is coherent. Roggenkamp [1022-1024] constructs examples of Artinian algebras and orders of global dimension two. If S is a Boolean ring of idempotents of a commutative regular ring R, then $\mathrm{gl{\cdot}dim}\,R \le 2$ if and only if $\mathrm{gl{\cdot}dim}\,S \le 2$. Examples of rings of global dimension three with additional properties arise in [771]. Boyle and Goodearl [280] note that the global dimension of a ring with injective and quasiinjective modules does not exceed its Krull dimension. Ramras [977] studies properties of the center of a local ring of finite global dimension. Vasconcelos [1174] considers commutative local coherent rings, whose global dimension is finite and coincides with its weak dimension. Cozzens [384] investigates the structure of localizable algebras of finite global dimension. Jensen [669] proved the existence of rings, elementary equivalent with the ring of integers, and having any preassigned global dimension.

In connection with the study of modules over Artinian algebras, there were considered properties of global dimensions in the theory of dualizing varieties (cf. [213, 214, 215, 992]).

Rings with weak dimension equal to one are considered in [376, 288], and to two in [247, 421]. Lenzing (cf. [1010]) announced that from the equality to zero of the left and right pure global dimensions follows the finiteness of type of representations of the ring. Vasconcelos [1173] studied properties of the global dimension connected with resolutions of free modules of finite rank. Injective, projective, and quasiprojective dimensions of modules were considered in [328, 653]. Dominant and codominant dimensions are touched on in [328, 430, 638, 900]. Osofsky [910] carries over to the case of Abelian categories many of the results on projective dimension of various classes of modules, representable in the form of direct unions of given cardinality, while in addition as consequences she gets a series of new theorems on projective dimensions of modules over various classes of rings.

2.2. Hereditary and Semihereditary Rings. Their Generalizations. Fuelberth and Kuzmanovich [462] described semiprimary hereditary rings. Drozd [57] published proofs of results announced earlier (cf. [M75, p. 86]). Tests for the hereditariness and semihereditariness of generalized rings of triangular matrices were proposed by Page [936, 1011]. It is also shown there that a left semihereditary PI-ring is right semihereditary. New tests for hereditariness and semihereditariness are given in [49, 151, 441, 442] and [644, 715], respectively. Hereditary Noetherian primary rings were investigated by Agapitov [1] and Jategaonkar [665], and semihereditary rings by Goldie–Chatters and Smith [350]. The center C of a hereditary (primary semihereditary) ring, finitely generated as a C-module, is hereditary (is a Prüfer domain) [684, 825]. Auslander and Reiten [213-215] continued their investigation of Artinian algebras, stably equivalent with hereditary ones. New tests for Prüferness are in [423, 453, 462]. Boisen and Sheldon [271] considered commutative rings, all of whose proper quotient rings are Prüfer. Noncommutative versions of Prüferness and Dedekindness were considered in [445, 825, 1011]. Dicks [405] proved that the group ring RG is hereditary if and only if at least one of the following conditions holds: (1) R is classically semisimple, and G if the fundamental group of a connected graph of groups without R-torsion; (2) R is a regular ring with countably generated left ideals, and G is a countable local group without R-torsion; (3) R is left hereditary, and G is a finite group without R-torsion. A description of locally solvable groups for which the group algebra over any field is hereditary, was proposed by Goursaud and Valette [564]. Fieldhouse [457], Goursaud and Pascaud [561] established the equivalence of the following properties of a self-injective ring R: (1) the ring of polynomials R[x] is semihereditary; (2) R decomposes into the direct sum of matrix rings over reduced regular rings; (3) R[x] is coherent and R is regular (cf. [M71: 1026, M75: 369, M75: 956]). From the right semihereditariness of the ring R[x] follows the regularity of the ring R (cf. [955]). The semihereditariness of the ring of twisted polynomials was investigated in [562, 1197]. Vechtomov [168, p. 16] proved that the ring of functions C(X) is hereditary if and only if the space

X is extremally disconnected. The hereditariness of the tensor algebra of a bimodule over a classically semisimple ring and the semihereditariness of its completion with respect to the standard filtration were established by Yu. V. Roganov [114]. The theory of representations of hereditary Artinian algebras, recounted in the language of diagrams, can be found in Platzeck, Auslander and Reiten [212]. Hereditary and semihereditary rings were also considered in [156, 481, 483, 1086, 1157] and [384, 436, 448, 466, 481, 483, 549, 1079, 1225], respectively. A characterization of hereditary rings of finite representation type is given in [427].

Rings with quasiprojective left ideals were considered in [660, 1082]. Rings with a class of quasiprojective modules, closed with respect to passage to submodules, were considered by Hill [622], and with a class of quasiinjective submodules, closed with respect to passage to quotient modules, by Ahsan [178]. Evans [437] considered generalized hereditary rings, defined by requiring the projectivity of submodules of the flat epimorphic hull, and Nauwelaerts and Oystaeyen [868] considered a class of modules, including both hereditary Noetherian primary PI-rings, and classical orders in central simple algebras. Miller and Turnidge [829] considered (strictly) cohereditary rings, defined by requiring the injectivity of finitely embedded (cf. p. 37) quotient modules of any finitely embedded injective modules. In [344, 437, 466, 481, 644, 662, 1097, 1135] as well as elsewhere PP-rings are touched on. Lee [754] considered rings over which all injective modules are projective, and E. M. Vechtomov [169, Part 2, p. 12] considered rings of functions with flat ideals. Further we note the theorem of Dicks and Menal [407]: the group ring RG is a semi-FI-ring if and only if R is a skew-field and the group G is locally free. Wong [1209] proved that the semigroup ring RS, where S is a module, is a left and right FI-ring if and only if R is a skew-field and S is a free product of a free monoid and a free group. Kozhukhov [168, p. 51] announced a similar result for a left FI-ring, formulated, it is true, in a considerably more complicated way. Localizations of FI-rings were investigated by Cohn and Dicks [368]. Szendrei [1129] characterized skew fields by properties of idempotent reductions of modules over them. In [381, 894] a skew field is again characterized as a ring over which all modules are free, without assumption of unitariness. There were considered noncommutative analogs of Gorenstein rings ([652, 1021, 1047, 1048]) and Cohen–Macaulay rings [1061]. A series of new characterizations of regular rings was obtained. Thus, Tuganbaev [151] proved that R is a regular ring if and only if all modules of characters M^*-$\mathrm{Hom}_Z(M, Q/Z)$ of R-modules M are slightly injective. In [1221] it is noted that the regularity of a ring is equivalent with the fact that each cyclic singular module is flat. A commutative ring, as proved by Jondrup [687] is regular if and only if all indecomposable modules are irreducible. Semiartinian regular rings were considered in [317, 771, 964], and in particular, in [317] an example was constructed of a right and left semiartinian regular ring with minimal condition for ideals, over which there exists a nonzero module without maximal submodules. In [1219] there are given characterizations of left continuous regular rings in terms of p-injective modules. Cheatham and Smith [351] proved that the quotient ring $R/J(R)$ is regular if and only if a direct product of regular modules is regular (here by a regular module is meant a module in which all submodules are pure). Oshiro [906] noted a series of properties of finitely generated faithful modules over commutative regular rings. Handelman [586] investigated properties of normalized rank functions on regular rings. Wisbauer [1204] considers modules over nonassociative regular and biregular rings.

2.3. V-Rings and Similar Classes of Rings. There are rather few results on V-rings themselves. Sarath [1044] and Tisseron [1146] characterized Noetherian V-rings, and Goursaud and Valette [563] characterized group V-rings (cf. [M75: 510]). Regular V-rings were considered by Goursaud [557]. Chandran [343] proved that in the class of duorings, V-rings and only these are regular rings. Another class of rings with this property was given by Licoiu [771]. There are also some results on V-rings in [5, 188, 379, 563, 629, 1221, 1223]. Classes of rings containing both V-rings and regular rings were considered by Couchot [380] and Raphael [983].

Results on V-rings of functions were obtained by E. M. Vechtomov [170, Part II, p. 27]. Goursaud and Jeremy [559] constructed a regular V-ring, whose injective hull is not a V-ring, indicating an error in [M75: 1165]. A nonassociative generalization of V-rings was considered by Wisbauer [1203].

Fuller [491] established the equivalence of the following properties of an Artinian ring R: (1) each indecomposable R-module is quasiinjective; (2) each indecomposable R-module is quasiprojective; (3) for any primitive idempotents e, f∈R one has: (a) Re is a uniserial R-module; (b) if $J^2e \neq 0$ and $Je/J^2e \cong Jf/J^2f$, then $Re \cong Rf$; (c) $l(eJ/eJ^2) \leq 2$; (d) eR is a distributive right R-module. All modules over a ring with these properties turn out to be semidistributive. Tisseron [1146] characterized QI-rings (in [M75] they are called QII-rings) as semiprimitive rings, the class of quasiinjective modules over which is closed with respect to direct products, and Bunu [23] characterized them as rings over which all pretorsion is stable. If in addition one assumes that the quotient module R/L has zero socle for any essential left ideal L, then the QI-ring R splits into the direct sum of a classical semisimple ring and a ring with zero socle, over which all singular modules are injective (cf. [M75, p. 91]). Faith [442] verified the conjecture (Boyle, [M75: 330]) on the hereditariness of QI-rings under an additional assumption. Boyle and Goodearl [280] established that each QI-ring is a Noetherian V-ring, but the opposite implication does not hold (cf. also [M75: 330], [442]). They also obtained some results on the global dimension of QI-rings (cf. Paragraph 2.1). The Krull dimension of V-rings and modules over them were investigated in [280, 1044]. Damiano [394] and Mohamed [832] reproved Faith's theorem [M75: 498] on the structure of PCI-rings (cf. [M75, p. 90]). Faith himself published a correction to his work [439].

A series of results on PCQI-rings, i.e., on rings, over which all proper cyclic modules are quasiinjective, were obtained by Jain, Singh, and Symonds [661]. In particular, a nonlocal PCQI-ring turns out to be primary or semiprimary, and a local one is either a chain ring or has the properties $J^2 = 0$ and $l(J) = 2$.

Hill [622] established the equivalence of the following properties of a semilocal ring R: (1) each simple R-module is projective or injective; (2) each submodule of a quasiprojective module is quasiprojective; (3) all quotient rings of the ring R are hereditary; (4) R is hereditary and $J(R)^2 = 0$. In the class of duorings the following properties turn out to be equivalent: (1) each simple R-module is p-injective (i.e., injective with respect to embeddings of principal left ideals); (2) simple R-modules are flat and the right annihilator of any element of R is contained in its left annihilator; (3) R is strictly regular [353, 1217, 1220]. In the last two of these works there is established the equivalence of the following properties of an arbitrary ring R: (1) each simple R-module is flat or p-injective; (2) all cyclic modules with zero Jacobson radical are p-injective; (3) R is regular. Rings with p- and f-injective (i.e., injective with respect to embeddings of finitely generated left ideals) simple modules were considered also in [1218]. The class of rings, over which any module having Krull dimension is Noetherian was studied by Sarath [1044]. This class includes V-rings and perfect rings.

The following classes of rings were considered: CPQI — each cyclic module is projective or injective; CDPI — each cyclic module is equal to the direct sum of a projective and an injective; SI — all singular modules are injective; RIC — quotient modules R/L, where L is an essential left ideal, are injective; CPP — each cyclic module is projective or p-injective; DCI — all cyclic modules are injective; CPF — each cyclic module is flat or p-injective. Connections among the classes CPP, DCI, and CPF were studied by Yu Chi Ming [1221], and among the classes CPQI, CDPI, SI, and RIC by Smith [1096]. In particular, the latter established the equivalence of the following properties of a commutative ring R: (1) $R \in SI$; (2) $R \in RIC$; (3) R is regular, and its quotient ring by its socle splits into the direct sum of fields. He also [1095] proved many assertions about the classes CDPI, RIC, and similar ones. In particular, it turned out that $R \in RIC$ if and only if each cyclic module is an extension of a projective module by an injective one. Koifman [168, pp. 53-54] generalized the results of the last work and answered questions posed in it. Koifman [169, Part 2, pp. 38-39] also considered rings, each module over which splits into a direct sum of projective, injective, and simple ones (cf. [M71: 54], [M71: 55]), and gave a complete description of indecomposable Artinian rings from this class. Ponomarev [169, Part 2, p. 62] announced this result: each R-module is an extension of a completely decomposable projective module by a singular one if and only if the square of the left socle is essential in Teply [1142] generalized results of Goodearl [M75: 609] on rings, where the singular submodule is distinguished as a direct summand of each module. Fuelberth and Kuzmanovich [486] under certain additional conditions described the structure of rings where the singular module is distinguished as a direct summand of all finitely generated modules. The structure of commutative rings with singular submodules distinguished as direct summands of cyclic modules was described by Oshiro [908].

Smith [1093] proved that each cyclic R-module is free or has finite length if and only if R is either Artinian or is a Noetherian domain, where $l(R/L) < \infty$ for any essential left ideal L, and that each finitely generated R-module splits into the direct sum of a free module and a module of finite length if and only if R is either Artinian or is a principal right and principal left ideal domain.

Rings with quasiinjective left ideals (i.e., q-rings) were considered in [310, 515, 710, 837, 1220], rings for which all left ideals not isomorphic with the ring itself are quasiinjective, in [834, 836], and rings, all of whose quotient rings are q-rings, in [837]. In [174, 175, 176] there were investigated rings over which all cyclic modules are quasiinjective. Goel and Jain [514] considered rings with Π-injective cyclic modules, and Tuganbaev considered rings with slightly injective cyclic [154] and finitely generated [103, p. 94] modules. A survey of results connected with the imposition of certain homological restrictions on left ideals or on cyclic modules is contained in Jain's report [659].

Hirano and Tominaga ([628, 629]) carried over to rings without unit a series of results on V-rings and their generalizations.

2.4. QF-Rings and Their Generalizations. We begin with an entirely unexpected result of Lawrence [752]: a countable self-injective ring is quasifrobenius (QF). Armendariz [201] proved that a self-injective ring satisfying a minimal condition for essential left or right ideals is quasifrobenius. Other new characterizations of QF-rings can be found in [76, 616, 681, 1049, 1138]. Jensen [670] noted that the class of QF-rings is elementarily closed. Fleury [464] gave a representation of a QF-ring as a direct sum of matrix rings over skew fields and endomorphism rings of certain special modules. Horn [634] generalized a result of Hughes [M75: 736] on a group ring being quasifrobenius. Kozhukhov [102, p. 101] reported that the semigroup ring RS, where S is an inversal semigroup, turns out to be quasifrobenius if and only if R is quasifrobenius and S is finite. Nachev [105] got tests for an incidence ring to be quasifrobenius. New methods of constructing Frobenius algebras were proposed by Green [569]. Kupisch [733] considered QF-algebras of finite type. Certain classes of QF-rings are considered in [151] and [708]. Pascaud and Valette [951] noted that the ring R^G of elements of the QF-ring R, invariant with respect to the action of the finite group of automorphisms G, will not necessarily be a QF-ring, even if $|G|$ is invertible in R. However, the ring of invariants is quasifrobenius if the ring R is semiprimary or if R is a flat R^G-module [937]. The finite generation of the latter module was investigated by Renault [1001]. Miller and Turnidge [829] studied injective modules over QF-rings.

Quentel [970] established the equivalence of the following properties of a commutative ring R: (1) any injective R-module is flat; (2) R is coherent and the injective hulls of irreducible R-modules are irreducible; (3) R is coherent and any system of equations over R, solvable in some extension of it, is solvable in R. Rings were also considered where each finitely generated injective module turns out to be flat [378].

For a ring R with maximal condition for annihilators of left ideals, as Rutter [1034] proved, these properties turn out to be equivalent: (1) R is a left and right QF-3 ring; (2) R has faithful injective projective modules (left and right) projective; (4) the injective hull of any projective R-module is (left and right) projective. The characterization of QF-3 rings by properties of their maximal rings of fractions was proposed by Masaike [800]. There are other characterizations in [616]. Noetherian QF-3 rings where $\mathrm{inj\cdot dim}_R R$, $\mathrm{inj\cdot dim} R_R \leq 1$, where considered by Sato ([1047, 1048]) and Sumioka [M75: 1332]. The latter, in particular proved that under certain additional restrictions they are characterized as rings of triangular matrices over QF-rings. Sumioka [1123] considered also QF-3' rings with the same and certain other restrictions. He also characterized semiprimary QF-3' rings. Shock [1071] and Asano, Motose [205] considered QF-2 rings, i.e., rings, which split into the direct sum of homogeneous left ideals. QF-2 and QF-3 rings are touched on in [347, 654], QF-1 rings in [1059, 1136, and 1138], balanced rings in [920 and 1083], rings having a dominant module in [700].

New characterizations of self-injective rings were proposed by Yu Chi Ming ([1218, 1219]) and Tuganbaev [153]. Semiperfect self-injective rings were considered by Faith [444, 446]. He also gave new examples of self-injective rings [450]. Simple self-injective rings were investigated by Goodearl and Handelman [547]. Kamil [693] noted that a left and right self-injective simple ring is isomorphic with a matrix ring over a skew field. Tuganbaev [153] gave tests for the decomposability of a self-injective ring into a direct product of local rings. Martin [792] gives a decomposition of a self-injective ring with certain additional conditions, similar to decomposability, holding for Baer rings. He also elucidated [793] when the property of self-injectivity is inherited by a quotient ring of a polynomial ring with respect to some principal ideal. He also solved the analogous problem for QF-rings. Birkenmeier [266] considers in a self-injective ring a direct summand (in the module sense), containing all nilpotent elements. Kozhukhov [82] proved that the semigroup ring RS, where S is semilattice, is self-injective if and only if R is self-injective and S is finite. The same result is true if S is an inversal semigroup [101, p. 101]. Self-injective incidence rings were characterized by Nechaev [105]. Vechtomov [26] found conditions for the self-injectivity of the ring of continuous functions with values in a topological field. Sugano [1122] proved that both self-injectivity and quasifrobeniusness are preserved under passage to separable extensions. Kamil [692] characterized rings over which each module is completely faithful (this is a generalization of QF-rings) as self-injective quasiartinian rings, where being quasiartinian means the existence of an Artinian left socle. In their own right, quasiartinian rings are characterized as rings over which each faithful module is cofaithful. Ahsan [175] proved that being quasiartinian is equivalent with finite embeddability (cf. p. 37) of each left ideal. It is also established there that a ring R with quasiinjective cyclic modules turns out to be a pseudofrobenius ring (i.e., R is an injective cogenerator in the category of R-modules) if and only if it is quasiartinian. He also [179] characterized semilocal rings in terms of quasiinjectivity of modules. The question of left-right symmetry of the concept of Frobeniusness is discussed in Faith's report [448].

Koehler [725] considered rings with self-injective quotient rings. Rings, all of whose quotient rings turn out to be slightly injective modules, were investigated by Tuganbaev [154].

Goursaud and Jeremy [558] proved that a regular ring is left and right self-injective if and only if it is left $\aleph_0$-continuous (cf. also [1219]). Carson [329] gave tests for the self-injectivity of a strictly regular ring, using its representation as ring of sections of a neighborhood space. Page [939] proved that all finitely generated modules over a regular ring R are generators if and only if R is self-injective and its index of nilpotency is bounded. Goodearl [540] established that a self-injective Dedekind finite regular ring is invertibly regular, i.e., the equation $axa = a$ has an invertible solution. He also [543] investigated the center of a self-injective regular ring. The occurrence of self-injective regular rings upon completing a regular ring is discussed in [379, 537, 542, 586]. The rank function was also considered in [559] and [672]. In [560] it is proved that the ring of fixed elements of a self-injective regular ring with respect to a given finite group of automorphisms is also self-injective and regular: Self-injective regular rings were also considered in [544] and in [546, 674, 982]. Certain problems concerning these rings can be found in [461]. On regular rings, cf. Paragraph 2.2.

2.5. Rings of Finite Type. Ringel [1010] noted that the confirmation of the second conjecture of Brauer–Thrall, obtained by Nazarova and Roiter (cf. M75, p. 95]) in the case of a perfect field, remains valid also for arbitrary fields. The paper [1090] is devoted to the inductive step in the solution of this problem for an Artinian algebra. A survey of results connected with the Brauer–Thrall conjectures was given by Drozd and Roiter [103, pp. 91-92].

Levy [767] proved that an Artinian ring R has finite type if and only if one can find a number m such that the collection of rows and columns in a matrix over R, not equivalent with any diagonal matrix with more than one diagonal block, does not exceed m. Müller [848] characterized Artinian rings of finite type, having Morita duality, and constructed all indecomposable modules over such rings. Quasifrobenius algebras of finite type were considered by Kupisch ([733, 734]). Riedtmann [499] proposed a classification of self-injective finite-dimensional algebras of finite type. Tests for finiteness of type of the ring of lower triangular matrices over an Artinian ring were given by Leszczynski and Simson [765]. Kirichenko and Nikulin [168, p. 49] proposed tests for finiteness of type for a class of finite-dimensional algebras. Finiteness of type of semimaximal rings (cf. Paragraph 2.7) are discussed in [63] and [64]. Crossed group rings of finite type were considered by Barannik and Gudivok [14] (cf. [M75, p. 97]). Janusz [M75: 765] showed that a semichain ring will not necessarily be a ring of finite type, although this is so for rings which are left and right semichain. Tachikawa [1136] got that a semichain QF-1 algebra has finite type. Using the Coxeter functors, Dowbor and Simson [427, 428] characterized hereditary rings, bimodules and quasiartinian species of finite type.

Simson [1077] proved that an Abelian category, each object of which is isomorphic with a coproduct of Noetherian subobjects, having only a finite number of simple objects, is equivalent with the category of all modules over an Artinian ring of finite type(it is true that the proof given in the paper needs some corrections). In [1078] he studies the category of representations of species.

Yamagata [1215] gave a description of indecomposable modules over an Artinian ring of finite type, connected with a specific partition of the set of irreducible modules. A description of matrix representations of hereditary algebras of finite type is given in [495]. Bimodules over Artinian rings of finite type were considered by Waschbusch [1193].

Jensen [1010] established that a ring R has strongly finite type if and only if each left and each right R-module splits into a direct sum of finitely representable ones. Baur [229] proved that this is equivalent with the $\aleph$-categoricity of the theory of any R-module. There are sufficient conditions for the strong finiteness of type of the ring of lower triangular matrices over an Artinian ring in [218] and [552]. Kupisch [734] established the finiteness of the number of n-dimensional symmetric algebras over an algebraically closed field having strongly finite type. Lenzing [1010] announced: each left and each right P-module splits into a direct sum of finitely representable submodules if and only if R is Artinian and there exists only a finite number of indecomposable R-modules of finite type.

We shall say that R is a ring of weakly bounded type if the number of generators of indecomposable finitely generated [finitely representable] R-modules is bounded in aggregate. Generalized uniserial rings have weakly bounded type ([M75: 50; M75: 1421]). An Artinian ring of weakly bounded type turns out to be a ring of finite type [47]. Jondrup [687] proved that a PI-ring with a finite number of indecomposable cyclic modules is Artinian, and proved that a ring of weakly bounded type is not necessarily Artinian. Semiperfect Noetherian hereditary rings of weakly bounded type were described by Gubareni [47]. She also [47] described rings of weakly bounded type in one class of generalized matrix rings, which are automatically hereditary. In the course of these investigations there arise mixed matrix problems over skew fields and discrete normed rings. Kirichenko [170, Part II, p. 74] announced: a semiprimary Noetherian semiperfect ring has weakly bounded type if and only if it is right Noetherian and hereditary. Rings with a finite number of simple modules were considered by Miller and Turnidge [829].

2.6. Koethe Rings, Uniserial and Semidistributive Rings. There were efforts of Brandal, Vamos, and the Wiegands [281-284, 1163, 1199] at the complete solution of Kaplansky's problem on commutative Koethe rings, i.e., rings over which all finitely generated modules split into a direct sum of cyclic submodules. It turns out that a commutative ring is a Koethe ring if and only if it can be represented as a direct sum of linearly compact chain rings, almost maximal Bezout domains (almost maximality means that the quotient rings by all ideals different from the entire ring are linearly compact) and torch rings. The latter are defined by the following properties: (1) R is not local; (2) there exists a smallest prime ideal of R, having the following properties: a) P is a nonzero chaon R-module; b) each nonzero element of the quotient ring R/P belongs to only a finite set of maximal ideals and each of its nonzero prime ideals is contained in only one maximal ideal; c) the localization R_P is an almost maximal Bezout ring. This result is recounted in Brandal's book [283]. In it there is also contained the history of the question and the necessary examples. The description of semiprimary Koethe rings was also obtained by Oshiro [909], also considering rings over which each antisingular finitely generated module splits into a direct sum of cyclic modules. Faith [447] gave a survey of results on noncommutative Koethe rings. The role of the theory of sheaves in the description of these rings is discussed in [1166]. Vamos [1163] proved that ideals of a commutative Koethe ring can be represented as intersections of finitely reducible ones if and only if each finitely generated module M admits a representation $M=\sum_{i=1}^{m} R/I_i$, where $I_1 \leq \ldots \leq I_m$. Many questions concerning Koethe rings are touched on in Roux [1030]. There too, and also in Poneleit [961] there are results on Koethe duorings. Ivanov [651] characterized rings over which all finitely generated modules are semichain, by certain properties of cyclic modules. Miller [825] proved that finitely representable modules over a primary semihereditary rings, finitely generated as a module over its center, are isomorphic with a direct summand of a direct sum of cyclic modules. The embeddability of modules over a Noetherian ring in a direct sum of cyclic modules was studied by Bruns [301]. Oshiro [904, 905] investigated the decomposability into a direct sum of cyclic modules and the embeddability in such a direct sum of certain finitely generated modules over a commutative von Neumann regular ring. Fuller [489], introducing into consideration the ring E of all endomorphisms of the direct sum of all finitely generated R-modules, established the equivalence of the following properties: (1) each finitely generated R-module splits into a direct sum of finitely generated submodules; (2) each R-module has a direct decomposition, complementing direct summands; (3) the ring E is left perfect; (4) the direct product of any set of projective E-modules is projective. Simson [1077] gave a category-theoretic generalization of this result. Jondrup and Ringel [689] established that in the case of a quasifrobenius ring R the decomposability of any R-module into a direct sum of cyclic submodules is equivalent with its representability as a direct sum of left ideals. In the same work he established that the latter property is not inherited by the ring of matrices and indicated an error in Skornyakov [132]. However, the results of the latter concerning the description of rings over which any cyclic module can be represented as a direct sum of left ideals, ramain valid. We note the result of Gruson and Jensen (cf. [577] and [1010, p. 6]): if there exists a cardinal number $\mathfrak{C}$, such that each R-module splits into a direct sum of $\mathfrak{C}$-generated submodules, then each R-module splits into a direct sum of finitely representable submodules. For a ring R with zero singular ideal the following properties turn out to be equivalent: (1) R is finite-dimensional in the sense of Goldie; (2) a direct sum of antisingular quasiinjective modules is injective; (3) there exists a cardinal number $\mathfrak{M}$, such that each antisingular quasiinjective module splits into a direct sum of $\mathfrak{M}$-generated submodules [250]. Wiegand [1198] considered rings, each finitely generated module over which splits into a direct sum of n-generated modules. Zimmerman–Huisgen [1231] proved that all algebraically compact R-modules split into direct sums of indecomposable ones if and only if in the category of R-modules all pure monomorphisms split.

Kirichenko ([168, p. 48]; [103, p. 91]) considered a ring R with nilpotent primary radical H and Noetherian quotient ring R/H and announced: all finitely generated R-modules are semichain if and only if R is a semichain ring and for any idempotents e and f of the ring R/H^2 the inequality $e(H/H^2)f \neq 0$ implies that $f(R/H^2)e$ turns out to be a skew field or a discrete normed ring. He also [74, 75] got a complete description of left and right semichain hereditary rings. The question of self-duality of generalized uniserial rings is discussed by Haack [584]. Generalized uniserial QF-algebras, connected with QF-algebras of finite type, were considered by Kupisch [733]. Here too one can mention the works [77, 219, 348, 961]. Artinian rings, whose quivers are trees were studied by Fuller and Haack [495]. Other generalizations of uniserial rings appeared in [493, 494, 706].

One can also relate to this same circle of questions the investigation of rings, all modules over which are semidistributive, i.e., split into a direct sum of modules with distributive lattice of submodules. Tuganbaev [155] proved that such rings coincide with the class of Artinian rings, all of whose modules over the base ring are direct sums of completely cyclic modules. We note that such base rings are described [M65:135-139] in a very complicated way, it is true. Another characterization of this class of rings, from which follows its left-right symmetry, was proposed by Fuller [494]. He established that the semidistributivity of all modules is equivalent with the semidistributivity of all so-called standard modules, defined in terms of cyclic modules. Some results on left distributive rings were obtained by Tuganbaev [157].

2.7. Perfect and Semiperfect Rings. Tuganbaev [151] proved that a ring is perfect if and only if all flat modules over it are slightly projective. Nicholson [877] established that a ring R is perfect if and only if for any projective R-module P the ring End(P) is semiregular, i.e., its quotient ring by the Jacobson radical is regular and idempotents lift modulo this radical. A duoring R is perfect if and only if each R-module contains a maximal submodule and in R there are no infinite systems of orthogonal idempotents [343], which partially confirms Bass' conjecture. Rant [980] noted that a local ring is perfect if and only if each module over it has a minimal system of generators. Other new characterizations of perfect rings can be found in [518, 607, 711, 762, 835].

Roux [1030] proved that a ring is perfect if each finitely generated module splits into a direct sum of local ones. Under certain additional conditions, the converse is also true. Perfect rings with quasiprojective left ideals were considered in [660], and commutative perfect rings in [1138]. The papers [411, 412, 415, 1119] are devoted to the purely ring-theoretic investigation of perfect rings. In them, in particular, it is established that the periodic part of a perfect ring is distinguished as a direct summand. In [414, 416, 417] rings are considered, all of whose proper quotient rings are perfect. Domanov [54] reduced the question of the perfectness of the semigroup ring RS to the consideration of cases when the semigroup S is T-nilpotent or 0-simple. In the first of these cases RS is perfect if and only if R is perfect, and in the second, if and only if R is perfect, all subgroups of the semigroup S are finite and the semigroup ring BS, where B is the subring of the ring R generated by the unit, satisfies a polynomial identity. Faith [444, 445, 446] established a series of results on perfect and semiperfect rings, over which each faithful finitely generated module is a generator, and on self-injective perfect rings (cf. [M71:1069]). The structure of semiperfect rings with commutative Jacobson radical was investigated by Ratinov [111, 112]. Szeto [1131] proved that a semiperfect ring splits into a direct sum of matrix rings over local rings, if the central idempotents lift to central idempotents modulo the Jacobson radical. Okninski [896] showed that for the group algebra KG, where K is a field of characteristic 0, the following properties are equivalent: (1) KG is semiperfect; (2) KG is semilocal; (3) G is finite; (4) KG is an algebraic algebra of bounded degree. A semiperfect semiprimary Noetherian ring, the rings of endomorphisms of indecomposable projective modules over which are discrete normed rings, is called semimaximal. A semimaximal ring R turns out to be hereditary if and only if each submodule of an indecomposable projective module over it contains exactly one maximal submodule [63]. Zavadskii and Kirichenko [63] described semimaximal rings as direct sums of rings of generalized matrices of special form. In these same terms Gubarenii and Kirichenko [50] described semiperfect Noetherian hereditary primary rings R, where $R/J(R)$ is a direct sum of skew fields. Semimaximal rings are also considered in [64]. One old theorem of Michler on the structure of semiperfect hereditary Noetherian rings was reproved by Upham [1156]. Perfect and semiperfect rings are also touched on in [47, 48, 220, 350, 445, 489, 515, 603, 661, 707, 708, 912, 1037, 1057, 1077, 1134]. Lin [775] investigated semiperfect coalgebras.

Nicholson [877] proved that each finitely representable module has a projective cover if and only if R is semiregular (cf. above). All ideals of a commutative indecomposable ring have projective cover if and only if it is either perfect, or local Noetherian, or Dedekind [1098]. Semiregular rings were studied by Jansen [664]. In [872] there were considered rings, satisfying a minimal condition for principal right ideals, which are not direct summands, and commutative rings from this class are characterized. In the noncommutative case these rings are characterized by the requirement: any principal right ideal not satisfying the minimal condition for submodules, is distinguished as a direct summand. Renault [1000] considered rings with maximal condition for certain chains of submodules of free modules. Neggers [869] studied so-called cyclic rings, which are, as he assumes, perfect. A class containing V-rings and perfect rings was considered by Sarath [1044].

We recall that a ring is called semiartinian if the socle of any nonzero module over it is different from zero. Camillo and Fuller [317] proved that each nonzero right module over a semiartinian pseudofrobenius ring (cf. Paragraph 2.4) contains a maximal submodule, although even for regular semiartinian rings this does not hold. Commutative semiartinian group rings were considered by Salles [1041]. We note also her old paper [1040], where she characterized these rings in terms of localization systems (cf. M75:1240; M75:1241]).

Popescu and Spircu [964] noted that in contrast with the commutative case a semiartinian subring of a regular semiartinian ring is not necessarily regular. Semiartinian regular rings were also considered by Locoiu [771], who pointed out an error in [M75:1120]. A survey report on semiartinian rings, including various characterizations of them, was made by Salles [1039].

There are new characterizations of classical semisimple rings in [151, 358, 693, 1148, 1216, 1219].

Let Λ be an Artinian algebra (i.e., an Artinian ring, finitely generated as a module over its center). The nonsplit exact sequence

$$0 \to A \overset{i}{\to} B \overset{p}{\to} C \to 0$$

with indecomposable modules A and C is called almost split if for any homomorphism $g: A \to Y$, which is not a splittable monomorphism, there exists a homomorphism $h: B \to Y$, such that $g = hi$. The theory of almost split sequences has found wide application to the study of indecomposable modules over Artinian algebras: [207, 211, 216, 217, 795, 995, 998].

There was actively continued (cf. [M75: 216, 220, 221]) the investigation of stably equivalent Artinian rings (in particular, questions of stable equivalence of hereditary rings, self-injective rings, uniserial and generalized uniserial rings, rings of finite representation type, etc.): [211, 213-215, 272, 496, 638, 992-997].

2.8. Finiteness Conditions in Homological Classification. In a series of papers there are considered coherent rings. Belesov [18] showed that the coherence of the ring R is equivalent with the $\aleph_0$-injectiveness of any filtered product of $\aleph_0$-injective modules. Bernecker [247] proved that the ring R with w.gl.dim $R \leq 2$ is coherent if and only if the class of pure R-modules is closed with respect to direct, and the class of flat R-modules with respect to inverse limits. The coherence of rings of polynomials in various cases was established in [330, 561, 573], of the ring of formal power series in [1010]. (Ratter).

Bieri and Strebel [262] described completely finitely generated solvable groups G such that the ring ZG is coherent. Coherence conditions and semiartinianness of the group ring of an Abelian group were studied by Salles [1041]. In [815] there was investigated the coherence of certain rings of bounded analytic functions. Various properties of coherent rings were noted in [393, 635, 762, 814, 1774], Dobbs [422], Dobbs and Papick [424] studied coherent (pseudo)valuation rings, Papick [942, 943] studied coherent overrings of commutative domains.

Couchot [376] considers the dualization of coherence, and Hannick [594] its generalization to rings with many objects, and also the generalization of Noetherianness, Artinianness, etc.

Sklyarenko [128] investigated homological properties of pure modules over coherent rings and got characterizations of coherent, semilocal, and Noetherian rings in terms of duality.

We note the following characterizations of Noetherian rings with the help of concepts similar to injectivity: the ring R is Noetherian if and only if direct sums of injective hulls of irreducible modules are injective (for commutative rings – Harui [611]) or direct powers of injective modules are injective (Ahsan [173]) or direct sums of injective modules are slightly injective (Tuganbaev [151]) or all injective modules are purely proper (Rososhek [118]).

Skornyakov [133] described commutative rings, all of whose ideals are homomorphic images of injective modules, Quartararo and Butts [969] considered commutative rings R such that no R-module (ideal in R) is a union of proper submodules. Nita [888] proposed a new characterization of S-rings, i.e., rings over which any simple module is isomorphic with a left ideal, Vamos [1161] characterized commutative rings, over which each test module (cf. M75, p. 70) is a cogenerator.

Properties of rings similar to Steinitzness were considered in [359, 1030]. Anderson [193] explained when each homomorphic image of a ring is a ring with invariant basis number, and Nicholson [878] explained when a ring R has the exchange property as an R-module.

Nicolas [881] considers rings, free modules over which satisfy the maximality condition for n-generated submodules, Couchot [380] considers those rings R such that each finitely generated R-module has zero Jacobson radical, and Crivei [391] considers commutative rings, all of whose maximal ideals are essential.

Hauptfleisch and Loonstra [617] investigated rings of type (n, k), i.e., rings R, for which (n, k) is the minimal pair of natural numbers having the property $R^n \cong R^{n+k}$.

Tisseron [1146, 1147] considered rings over which the product of any set of quasiinjective modules is a quasiinjective module.

Mehdi [816, 817] considered commutative rings having a faithful multiplicative module, i.e., a module M such that for any of its submodules $L \subseteq N$ there exists an ideal $A \subseteq R$ such that $L = AN$.

Harada [606] investigated rings over which each module, which is not a small submodule of its injective hull, contains a nonzero injective submodule. Cauchon [332, 333] established a series of new properties of T-rings in the sense of [M75:899], for example: annihilators of subsets of a finitely generated module over a T-ring satisfy a minimality condition. Properties of annihilators of modules were also investigated in [239, 243].

2.9. Logical Aspects. The investigations started by Eklof and Sabbagh [M71, II p. 41] (cf. also [352]) attracted the attention of many algebraists. In the works of Gorbachuk [168, p. 26], Komarnitskii [86, 168, p. 54] and Prest [965-967] their results were carried over to the case of relative homological algebra, connected with torsion in more detail (cf. Paragraph 3.1). Skornyakov [135] established that the class of all faithful R-modules is finitely axiomatizable if and only if the ring R contains a finite subset of nonzero elements, having nonempty intersection with each nonzero two-sided ideal of the ring R. Tyukavkin [160] proved that the class of irreducible R-modules is axiomatizable if and only if the quotient ring $\bar{R} = R/J(R)$ contains a finite subring $\bar{S}$, such that $\bar{S} + \bar{I} = \bar{R}$ for any maximal left ideal $\bar{I}$ of the ring $\bar{R}$. There is established the left-right symmetry of this property, and its sharpening for the commutative case is given. Generalizations to subrings are noted [101, p. 98]. Tykavkin also characterized rings with axiomatizable class of completely reducible modules as rings with Artinian quotient ring by the Jacobson radical, and announced an assertion about the equivalence of the following properties: (1) the theory of nonzero R-modules is complete; (2) the theory of nonzero R-modules is model complete; (3) R is an infinite simple regular ring [104, p. 100]. It is also proved there that for a Noetherian ring R, both completeness and model completeness of the theory of injective R-modules is equivalent with the fact that R is an infinite Artinian ring with simple quotient ring R/J(R). Further we note the results of Jensen and Vamos [671]: 1) the class of Σ-injective modules is always elementary closed; 2) the class of FP-injective R-modules (i.e., those modules M such that $\mathrm{Ext}^1_R(F, M) = 0$ for any finitely representable module F) is finitely axiomatizable if and only if the class of flat right R-modules is finitely axiomatizable; 3) the class of injective modules over a commutative ring is finitely axiomatizable if and only if this ring is Noetherian semilocal and has only a finite number of prime ideals. There are also results on the axiomatizability of the classes of divisible and FP-modules. Garavaglia [500] proved that a commutative ring without nilpotent elements is regular in the sense of von Naumann if and only if any R-module is elementary equivalent with a direct sum of cyclic modules. Baur [229] established that the theory of any module over a countable ring R turns out to be $\aleph_0$-categorical if and only if R is finite and has only a finite set of indecomposable R-modules. In the commutative case, finite principal ideal rings and only these have this property. Also proved there is the stability of the theory of all R-modules for any ring R. Sabbagh [1037] proved that a countable ring being Noetherian is equivalent with the ω-stability of the theory of any injective module over it. Also established there is the connection between the stability of modules and the perfection of the ring.

The ω-stability of the theory of an individual module was investigated [500]. In particular, in the case of a countable ring the ω-stability of the theory of a certain module A is equivalent with the equational compactness of all modules, elementary equivalent with it. Sabbagh [1036, 1037] investigated the connection between stability and categoricity. A survey on stability was published by Shelah [1066].

Skornyakov [134] proposed an elementary proof of a generalization of the theorem on elementary equivalence of the direct sum and direct product of modules.

Ryatova [123] gave tests for the elementary equivalence of modules over a Dedekind ring. Fisher [458] announced this result: if $\varkappa = \varkappa^{|R|+\varkappa_0}$, then for any R-module one can find a saturated R-module of cardinality $\varkappa$, elementary equivalent with it. Richman [1006] developed the theory of KT-modules ([cf. M75:1419]) from the constructive point of view. Jensen [669, 670] established the existence of rings, elementary equivalent with the ring of integers and having any preassigned global dimension (finite or infinite). A more profound study of a multilingual logic and its applications to the theory of modules was started by Fisher [459].

Shelah [1064, 1065, 1067] solved the famous Whitehead problem, establishing that the assertion of the freeness of an Abelian group C, satisfying the condition Ext(C, T) = 0 for any periodic Abelian group T, depends on the choice of set-theoretic axiomatics. Another proof of this fact was proposed by Eklof [434].

3. Radicals, Localizations, and Purity

3.1. Preradicals, Radicals, and Torsion. By a preradical is meant an arbitrary subfunctor of the identity functor (on an arbitrary Abelian category). The definitions of (co)hereditary, (co)stable, preradical, radical, kernel functor, torsion are given in [137]. The investigations started in [M75:291-294] by Bican, Jambor, Kepka, and Nemec were continued in [256], where it is explained in which cases $\tau(R)$ is a ring direct summand in R, if τ is the cohereditary radical. Kepka's work [702] relates to [M75:296]. In [257] many properties of torsion are carried over to hereditary preradicals, and dual assertions are also obtained. The works of Nemec [870] and Jirasko [677] are devoted to analogous questions. In [259] it is explained when a submodule $N \subseteq M$ or an ideal $I \subseteq R$ has the form r(N) (respectively, r(R)) for some preradical r with given properties. In [255] there is constructed an analog of the primary radical in the category of modules and its connection with general concepts of the theory of preradicals is investigated. Fenrick [455] considers the process of construction of minimal torsion containing a given faithful preradical. Kashu [73] investigates properties of preradicals, defined by situations of conjugacy between the category of modules and an arbitrary Abelian category, where one of these turns out to be the radical and the other the idempotent preradical. Nicholson and Watters [879] call a module M strongly primary if for any nonzero element $m \in M$ one can find $r_1, \ldots, r_n \in R$ such that $\mathrm{Ann}_R(\{r_i m\}) = 0$. If ${}_R R$ is a strongly primary module, then the strongly primary modules form a semisimple class. The authors study properties of the radical obtained. Aoyama [199] found conditions under which the filter of ideals of a commutative ring defines a radical and clarified when this radical satisfies the condition $r(\hat{M}) = r(M)$ for any module M. Varadarajan [1171] connects with each class of modules two preradicals and as application gets, for example, a new sufficient condition for the semiperfection of a ring, using hollow modules (cf. [137, p. 60]). One of these preradicals also occurs in [1168]. Gardner [501] studies radical properties of T-nilpotent rings, while in [502] he establishes a one-to-one correspondence between sets of torsion in R-Mod and in (P/I)-Mod, if I is a T-nilpotent ideal. [708] is also devoted to lifting properties modulo a T-nilpotent ideal. Gorbachuk and Komarnitskii [41] found out when the class $\mathcal{M}_I = \{M \mid IM = 0\}$, where I is an ideal of a ring, is a radical class of some torsion.

With each preradical, by analogy with torsion, one can connect various generalizations of projectivity [253, 678], injectivity [252], etc. Bunu [22] for an arbitrary idempotent preradical r considers modules, injective with respect to all monomorphisms $0 \to A \to B$ such that $r(B/A) = B/A$ (respectively, $r(B) = B$ or $r(A) = A$) and gives conditions for the pairwise coincidence of these three classes of modules. In [258] preradicals are applied to characterize test modules (in the sense of [137, p. 70]). Dauns [398] also relates to this circle.

Perfect torsions in categories of bimodules were studied by Verschoren [1181, 1182]. A large cycle of papers (Andrunakievich, Krachilov, Ryabukhin [7, 8], Andrunakievich, Ryabukhin [9, 10], Andrunakievich, Ryabukhin, Krachilov, Terbyrtse [196], Krachilov [88, 89], Ryabukhin, Krachilov [121], Ryabukhin, Florya [122]) is devoted to the investigation of radicals and torsions in categories of rings and algebras. Some of the results obtained here appeared in the monograph of Andrunalievich and Ryabukhin [11]. Skornyakov [136] abuts on this cycle. These results to a large degree relate to the theory of rings rather than the theory of modules, and in the present survey it is impossible to pay as much attention to them as they require.

We also note the papers of Lambek [746], Diers [409], and Verschoren [1179] on localizations in various Abelian categories, and also Bigard [263], carrying over the theory of torsions to the category of f-modules. Defining radical classes of modules with the help of tensor products also occurs in Harui [611] and Niti [889]. We also note the publication of Raphael [981] known from its preprint [M71:1150].

We proceed to the consideration of papers devoted to more specialized questions of the theory of torsions in the category of modules. Let R-tors be the set of all torsions in the category R-Mod. As is known, R-tors is a complete lattice with respect to the natural order of torsions. For $\tau \in$ R-tors let $\mathcal{T}_\tau$ be the class of τ-radicals, or τ-periodic modules, $\mathfrak{F}_\tau$ be the class of τ-semisimple modules, $Q_\tau(M)$ ($Q_\tau(R)$) be the module (ring) of fractions of the module M (of the ring R) with respect to τ. The connection between R-tors and S-tors for a given homomorphism $f: R \to S$ was studied by Murdoch and Oystaeyen [853]. Golan [521] established when the association R → R-tors is functional – this is true, for example, for the canonical homomorphism $\varphi_\tau: R \to Q_\tau(R)$. Louden [787] compares the rings of fractions with respect to torsions $\tau \in$ R-tors and $\tau^* \in$ S-tors such that $\mathcal{T}_{\tau^*} = \varphi^{-1}(\mathcal{T}_\tau)$, where φ: S-Mod → R-Mod is the functor of "forgetting the S-module structure."

Tebyrtse [158] investigated irreducible elements with respect to intersection in R-tors and showed, in particular, that simple torsions in the sense of Goldman have this property, and if the ring R has Gabriel dimension, then the converse is also true. Popescu [962] showed that R-tors is a lattice with complements if and only if R is a semiartinian ring. The question of the algebraicity of R-tors was investigated by Martinez [794], and Golan [528] gave some conditions for compactness of elements of the lattice R-tors. All torsions over noncommutative principal ideal rings were described in terms of atoms of R-tors by Gorbachuk and Komarnitskii [39]. Bunu and Tebyrtse [24] studied the lattice of hereditary preradicals in R-Mod, proved its modularity and atomicity, described its atoms, and established that it is Booleanness is equivalent with the classical semisimplicity of the ring R.

Simple torsions in the sense of Goldman were considered by Golan [520, 528] and Raynaud [986, 987, 988] In particular, the latter showed that if the Stone topology on SpegR, where SpegR is the set of simple torsions in R-Mod, coincides with the Zariski topology, then the Gabriel dimension of the ring R coincides with the Krull dimension of SpegR as a partially ordered set (i.e., with the TTK-dimension). Goldston and Mewborn [534, 535] used SpegR as the base for an analog of the structure sheaf. Oshiro [907] investigated torsion theories defined by subsets of the spectrum of the ring of idempotents of a commutative ring with the operation of addition $e \oplus f = e + f - Lef$. Ringel [1014] investigated SpegR for a finite-dimensional algebra R.

A series of papers is devoted to "the relative homological classification of rings and modules." Ponomarev [107] studied classically τ-semisimple rings for a hereditary preradical τ, which are characterized by a series of equivalent properties, for example: all R-modules are τ-injective. Another condition for classical τ-semisimplicity was given by Baccella [222]. In [109, 110] Ponomarev investigates τ-regular rings. We also mention here [370, 371, 1015].

Modules satisfying a minimality (maximality) condition for τ-closed submodules are called τ-Artinian (τ-Noetherian). Miller and Teply [828] got a generalization of Hopkins' theorem: if the ring R is τ-Artinian, then any τ-Artinian R-module is τ-Noetherian. Golan [525] found a series of conditions, equivalent with a ring being τ-Artinian. [517, 519, 523] are devoted to rings having finite τ-length, and the first of them abuts on [M75:597]. Here too we mention the paper of Miller and Teply [827] on τ-flat modules and that of Spulber [1102] on commutative τ-Dedekind rings. Sarath and Varadarajan [1045] got an indirect generalization of the familiar test of Chase for a ring being Noetherian.

Questions of the splitting of torsions were investigated by Koifman [83, 84]. Basic result: if R is a commutative ring and $\tau(R) = 0$, then the torsion τ splits if and only if the radical filter corresponding to τ contains a smallest ideal K, where R/K is a finite direct sum of fields and $x \in Kx$ for any element $x \in K$. Another description of split torsions over commutative rings is given in [483]. The results of [185, 415, 1141, 1142] are also connected with splitting properties. E. L. Gorbachuk and N. Ya. Komarnitskii [40] investigate the splitting of S-torsions over right duorings (if S is a left ideal of the ring R, then an S-torsion is defined by the set of those left ideals $T \subseteq R$, such that $T + S = R$, under the condition that this set is a radical filter). The same authors [42] proved that certain torsions do not split. N. Ya. Komarnitskii [85] found out when any torsion over a right duoring is an S-torsion. Fuelberth and Kuzmanovich [482, 486] got conditions for the splitting of the Goldie torsion on finitely generated modules.

The connection of the theory of torsions with the theory of primary and tertiary decompositions and its generalizations is elucidated in Golan's book [522]. Nastasescu [856] studied tertiary and primary elements of the lattice of τ-closed submodules of a finitely generated module. [45, 236, 369, 550] also abut here. Shores [1072] investigated rings over which any module which is periodic in the sense of Dickson decomposes into a direct sum of S-primary modules (for certain simple modules S). Richards [1005] constructed a decomposition of the Goldie torsion over a primary Noetherian ring of Krull dimension 1 into a direct sum of torsions defined by equivalence classes of simple modules with respect to the relation $S_1 \sim S_2 \Longleftrightarrow \mathrm{Ext}^1(S_1, S_2) \neq 0$.

The investigation was continued of stable torsions, i.e., those $\tau \in$ R-tors, such that the class $\mathcal{T}_\tau$ is closed with respect to taking injective hulls. Bunu [23] proved that any pretorsion over R is stable if and only if any quasiinjective R-module is injective. Stable rings, i.e., rings over which any torsion is stable, were characterized by Raynaud [987]. Papp [944, 946-948] investigated stable Noetherian rings. In [945] a torsion τ is called semistable if $\tau(F) = 0$ or $\tau(F) = F$ for any indecomposable injective R-module F. A characterization is given of rings R over which all torsions are semistable, in terms of the topology on SpegR. Manocha [789] gave a sufficient condition for the stability of the torsion τ_R (we recall that τ_M is the largest torsion for which the module M is simesimple).

Attention was drawn to symmetric torsion, defined in [M75:1010] as a torsion whose radical filter has a basis of two-sided ideals. Various aspects of localization with respect to symmetric torsions are discussed by Oystaeyen [927]. He also [918] gave conditions for the perfection of a symmetric torsion. In [926] the ring τ is called Zariski central if the Zariski topology on the set of primary ideals of the ring R (which, as in the compact case, will be denoted by SpecR) is generated by subsets $X_I = \{P \mid P \not\supseteq I\}$, where I runs through the spectrum of the center C of the ring R. It is proved that in this case all symmetric torsions in R-Mod are induced by torsions in C-Mod, and for a perfect symmetric torsion the localization of the ring R can be defined as the module of fractions of the module ${}_CR$. Similar properties, but for a narrower class of torsions, are possessed by birational extensions of the center [930], i.e., rings for which the inclusion of the center induces a homeomorphism of open subsets of the spectra. It is noted that all semiprimary PI-rings relate to this class. [867, 929] also abut here. Sim [1075, 1076] showed that a simple symmetric torsion over a Noetherian ring R is defined by the radical filter φ_{R-P} generated by the set $\{I \triangleleft R \mid I \not\supset P\}$, where P is some primary ideal, and that any torsion over a Noetherian ring is symmetric if and only if this ring is completely bounded [1074]. Beachy [237] gives another characterization of these rings in terms of the theory of torsions.

A series of authors continued the study of colocalizations and concepts connected with them in the category of modules. To the direction started in Beachy's papers [M72: 182, 183] there abuts Ramamurthi and Rutter [976]. Another direction, the investigation of modules, coperiodic in the sense of [M72: 71], is represented by Orsatti [902] and Fuchs [475]. Bland [269] established that the τ_M-codivisibility of the module B is equivalent with its (R/ann M)-projectivity (where M is any R-module). A third direction, the study of colocalizations with respect to an idempotent ideal, also connected with cosemisimple classes of modules, developed by Sato [1050], Ohtake [895], Kato [698], Golan and Miller [529]. To this there also abuts the earlier work of Miller [826] on radically semisimple classes. For any torsion $\tau \in$R-tors there is defined the class of τ-cosemisimple modules $C_\tau = \{M \in R\text{-Mod} \setminus \mathrm{Hom}_R(M, N) = 0 \text{ for any } N \in \mathcal{T}_\tau\}$. It is shown that if the class $\mathcal{T}_\tau$ is radically semisimple (in this case the torsion τ is called Jansian), then the torsion τ can be uniquely established in the class C_τ. The map Δ, which makes the class C_τ and the map Δ^0 correspond to the class $\mathcal{T}_\tau$ such that $\Delta^0(C_\tau) = \{M \in R\text{-Mod} \setminus \mathrm{Hom}_R(M, N) = 0 \text{ for } N \in C_\tau\}$, are considered by Golan [518], who shows that the following conditions are equivalent: (1) R is perfect; (2) the map Δ is surjective; (3) the map Δ^0 is surjective. By τ-colocalization of the module M is meant a homomorphism $\alpha : N \to M$ such that $\ker\alpha \in \mathcal{T}_\tau$, $M/\alpha(N) \in \mathcal{T}_\tau$ and N is a τ-cosemisimple τ-projective module. It turns out that any module has a colocalization if and only if the torsion τ is Jansian [895]. In this case the colocalization is the natural homomorphism $L(\tau) \otimes_R L(\tau) \otimes_R M \to M$, where $L(\tau)$ is the smallest ideal belonging to the radical filter Φ_τ of the torsion τ. Golan's survey [527] is devoted to an account of this direction in the theory of colocalizations. Bland [268] and Gardner and Stewart [504] are connected with the study of radically semisimple classes.

Komarnitskii [86] and Prest [965] established that the class $\mathfrak{F}_\tau$ is a quasivariety if and only if Φ_τ contains a basis of finitely generated left ideals. The latter also found out when the class of τ-injective modules is a quasivariety, characterized Jansian torsion in terms of logic [966] and investigated for certain $\tau \in$R-tors the model completion of the theory of τ-semisimple modules [967].

Brown [294, 295] and Snider [1099] studied the singular ideal of a group algebra. Spulber [1101] considered M-saturated radical filters, i.e., filters Φ_τ, where $\tau = \tau_N$, and $N = M/\tau(M)$. Lin [774] defined two products of radical filters in the direct product of rings and investigated their properties. Evans [436] found when the Hattori torsion is perfect.

Izawa [656] characterized those finitely generated projective right R-modules P such that the module $P \otimes_R X$ is σ-injective (σ-projective) if and only if X is a τ-injective (τ-projective) module, where τ and σ are dual torsions in the sense of [M72:1098] in R-Mod and in $(\mathrm{End}_R P)$-Mod, respectively. Crown and Hutchinson [392] established the connection of properties of the localization functor with properties of the completion functor with respect to some system of submodules. We also mention [278, 319, 374, 625, 959, 1148] connected with localizations and torsion and the surveys [235, 524]. Periodic and semisimple modules also occur in [309, 324, 712, 742, 968].

3.2. Purity. A considerable number of papers was devoted to the investigation of purity in the category of Abelian groups. These papers are not reflected in the present survey, since many of them were considered in the survey of Mishina [96]. Of papers in which analogs of group-theoretic results were obtained for modules over some ring or other, we note the investigations of Ivanov [69] on ω-divisible and ω-flat modules, Manovtsev [95] on purities, closed with respect to direct sums and direct products.

Generalov [30, 31] are devoted to the generalization of weak services on modules. In [1228, 1231] there were considered questions of algebraic compactness (i.e., injectiveness with respect to pure embeddings) of direct sums of algebraically compact modules. Connected with algebraically compact modules is also the paper of Couchaut [377]. Pure quasiinjective modules over a Dedekind commutative domain were studied by Dobrusin [53].

An analog of service hulls of elements for modules without torsion in the sense of Levy is constructed by Rososhek [117]. Rangaswami [979] generalizes to modules the concept of balanced subgroup. Singh and Talwar [1085] got the following test for purity of a submodule $N \subset M$ over a bounded HNP-ring: the submodule N is pure in M if and only if $MA^k \cap N = NA^k$ for any k and any maximal invertible ideal A (here and later, if nothing is said to the contrary, we have in mind purity in the sense of Cohn [M75, p. 112]). Properties of pure submodules were also studied by Rege and Varadarajan [989], Couchaut [379]. Brewer and Costa [286] considered pure extensions of rings and showed that purity is preserved upon passage to the ring of formal power series. In [1229] it is shown that locally projective R-modules are pure in the product of copies of the ring R. Some classes of pure embeddings were also considered in [129, 389, 390, 885, 1016].

Dualizations of the concept of purity were investigated by Choudhury and Tewari [355]. Properties of submodules, similar to purity, occur also in [435, 1213].

3.3. Rings of Fractions with Respect to Torsions. In this section we consider papers in which the basic object of investigation was the ring of fractions with respect to various torsions, among them complete and classical rings of fractions and their generalizations. The ring of fractions of the ring R with respect to the torsion τ or the radical filter Φ will be denoted by $Q_\tau(R)$ or $Q_\Phi(R)$, respectively, the complete ring of fractions by Q(R), the classical ring of fractions by $Q_{cl}(R)$, the ring of fractions with respect to the multiplicative system S by R_S, the primary radical of the ring R by N(R).

Kashu [72], Hauger and Zimmermann [615], Knörr [722], Hedstrom [620], Beachy [234], and Morita [839] studied the representation of rings of fractions by the bicommutator of some module. Oystaeyen [922, 923] showed that the property of a ring being completely bounded and the AR-property carry over to the ring of fractions with respect to a perfect torsion.

Elizarov [59] proved that if Φ is a strongly symmetric filter of left ideals of the ring R, then the ring $Q_\Phi(R)$ is a (semi)simple Artinian ring if and only if Φ is a perfect system consisting of all large left ideals of the ring R, while R is a (semi)primary ring. For radical filters, similar questions were investigated by Zelmanowitz [1225]. Page [938] showed that if the ring R is continuous in the sense of Utumi, $\tau \in$R-tors is perfect and $\tau(R) = 0$, then $Q_\tau(R)$ is also continuous. Nauwelaerts [866] noted that the ring of fractions of an Asano order with respect to a symmetric torsion is an Asano order. Sato [1048] established that if R is a left and right Noetherian ring and $\mathrm{inj.dim}({}_RR) \leq 1$, then the canonical embedding $\varphi : R \to Q(R)$ is a flat endomorphism if and only if R is a left or right QF-3-ring and Q(R) is a quasifrobenius ring. Poneleit [961] found when the classical ring of fractions of a local uniserial ring is self-injective. Chatters [344] showed that if R is a left Noetherian PP-ring, then $Q_{cl}(R)$ is semiprime if and only if any left regular element of the ring R is regular and R/N(R) is a left Goldie ring. Tuganbaev [149] established that if R is a hereditary Noetherian primary ring, the quasiprojectivity of the R-module $Q_{cl}(R)$ is equivalent with the fact that R is the ring of matrices over a local one-sided principal ideal domain A, complete in the J(A)-adic topology. The question of the injectivity of the R-module $Q_{cl}(R)$ for pseudofrobenius and similar rings was considered by Faith [449].

Rutter [1035] characterized those rings R such that the ring Q(R) is a finitely generated projective R-module and has a certain ring-theoretic property. We also mention here [547, 654, 800, 1163].

Rubin [1032] found when the ring Q(R) is simple if R is a nonsingular ring, finite-dimensional in the sense of Goldie (cf. [M75: 100]). Hutchinson and Turnidge [641] gave conditions on a Morita context <R, P, Q, S> under which the rings Q(R) and Q(S) are Morita-equivalent. Stenström [1120] gave a complete description of the ring Q(R), when R is a ring of matrices of special form. Chuchel and Eggert [357] characterized the complete ring of fractions of the homomorphic image of a semilocal Prüfer domain. Dlab [418] described a maximal essential extension for certain nonsingular rings. Gilmer and Heinzer [509] proved that if R is a Noetherian ring, X is an infinite set of commuting variables, then the rings of fractions of the ring R[X] with respect to certain multiplicative systems are Noetherian. The question of the transfer of certain properties from a commutative ring R to the ring R_S was considered in [463].

Beidar [15], Beidar and Mikhalev [101, p. 99] with the help of the concept of orthogonal completeness, reduce the study of rings of fractions of semiprimary rings to the primary case.

The study of Noetherian rings having an Artinian classical ring of fractions, started in the famous series of papers of Small, was continued. Beachy and Blair [243] apply for the description of such rings the theory of torsions. On the other hand, in the papers of Lenagan [759], Müller [844], Krause, Lenagan, and Stafford [729] the Krull dimension is used. An ideal I in R is called weakly ideal invariant if $|I \otimes_R M| < |{}_RR/I|$ for any finitely generated module M such that $|{}_RM| < {}_RR/I|$, where $|M|$ is the Krull dimension. By a Macaulay or k-homogeneous ring is meant a ring R such that $|{}_RR| = |L|$ for any nonzero left ideal L of the ring R. In the last of the cited papers, for example, it is proved that if R is a Macaulay ring, and N(R) is a weakly invariant ideal, then R has an Artinian ring of fractions. Some refinement of this result was obtained by Goldie and Krause [532]. As it turns out, weak ideal invariance can be used successfully to investigate the localizability of primary ideals (cf. 3.4).

Here too we note the results of Sato [1049], finding a radical filter Φ of left ideals of a Noetherian ring R of Krull dimension 1, such that $Q_{\Phi}(R)$ is isomorphic with the two-sided classical ring of fractions of the ring R/A, where A is the Artinian radical of the ring R, and of Stafford [1114]: if R is a completely bounded Noetherian ring and $K|I| \geq \alpha$ for any nonzero ideal I of the ring R, then any left ideal $L \subseteq R$ such that $|R/L| < \alpha$ contains a regular element of the ring R.

For Noetherian rings, integral over a subring of their centers, the problem of existence of an Artinian classical ring of fractions was studied by Wangneo and Tewari [1185], and for Bezout rings, which are Goldie rings, by Warfield [1189]. Wexler–Kreindler [1196] showed that if the ring R has an Artinian classical ring of fractions, then the ring of twisted polynomials over it also has this property.

The existence of a classical ring of fractions for a semiprimary PP-ring, finitely generated as an algebra over its center, was proved by Jondrup [686]. Classical rings of fractions of PP-rings were also studied by Oshiro [908].

In a series of papers, rings of fractions of PI-rings were studied. We note first of all the result of K. I. Beidar [17] on the transfer of generalized identities from the ring R to the ring Q(R) and on the structure of the ring Q(R), when in R there holds the strict identity: $Q(R) \cong \mathrm{End}\hat{P}$, where P is a projective generator over a strictly regular self-injective PI-ring. Another result of Beidar [16]: if a PI-ring has a classical ring of fractions, then the latter is also a PI-ring. Formanek [467, 468] proved that the center of the skew field of fractions of a free affine algebra of order $n = 3$ and $n = 4$ is a purely transcendental extension of the ground field. For $n \geq 5$ the question remains open. Rowen [1031] studied rings with monomial conditions, for which the complete ring of fractions is isomorphic with the ring $\mathrm{End}_D V$, where V is a linear space over the skew field D. Schelter and Small [1055] gave an example of a PI-ring R such that Q(D) does not satisfy any polynomial identity, and also an example of an Artinian ring R such that Q(R) is not even Noetherian.

Faith [443], Kitamura [720], and Renault [1001] are devoted to the elucidation of the connection between properties of the ring of fractions of a ring R and the ring of invariants with respect to the action on R of a finite group. The strongest results in this direction were obtained by Breider and Kharchenko (cf. the recent survey [164]).

The question of the functoriality of the construction of the complete ring of fractions for various classes of morphisms of rings was considered by Kitamura [719] and Louden [785].

A considerable number of papers contain results on rings of fractions of group and similar rings. We note the series of papers of Hannah [589, 590, 591, 592], Hannah and O'Meara [593], O'Meara [898], in which there are studied complete rings of fractions of group algebras over a field K. There are given some classes of groups for which the ring Q(KG) lands in one of the following classes: (a) simple Artinian rings; (b) rings of linear transformations; (c) nonsimple rings with zero socle; (d) von Neumann finite simple rings, i.e., rings in which $xy = 1$ implies $yx = 1$; (e) infinite simple rings. For example: if G is a group with a countable number of conjugacy classes of elements, then case (b) or (e) holds, while if in addition the group G is locally finite, then only case (e) holds.

Brown [296] showed that if G is an FC-group, and $|\Delta^{+}(G)| < \infty$, then the center of the complete ring of fractions of the group algebra of the group G over a field coincides with the complete ring of fractions of its center. Lawrence and Louden [753] proved that if H is a subgroup of the countable group G, the algebra KG is a semiprimary nonsingular ring and the ring Q(KG) is naturally isomorphic with the ring $KG \otimes_{KH} Q(KH)$, then $|G/H| < \infty$. Conditions for continuity and self-injectivity of the ring Q(KG) were given by Brown and Lawrence [297].

Horn [633, 634] gave a certain class of groups G such that if R is an order in a quasifrobenius ring, then RG is an order in an Artinian or quasifrobenius ring. Sufficient conditions for a twisted product to be a semiprimary Goldie ring were found by Reid [990]. Some results on the complete ring of fractions of free Abelian groups were obtained by Wilkerson [1200]. Rings of fractions of semigroup rings were studied by Luedeman and Bate [787]. The connection of localizations of the integral group ring with localization of the group was investigated by Oystaeyen [921]. The question of the existence of an Artinian or quasifrobenius ring of fractions of a group ring was considered by Brown [293].

Complete rings of fractions were also used by Harada [601], Oshiro [904, 905], Facchini [438], Huckaba and Keller [635]. Irlbeck [644] uses them to characterize PP-rings, Lenagan [760] applies the classical ring of fractions to study the reduced rank of modules, Gerstein [506] to prove classical results on diagonalizability of matrices, Cohen and Montgomery [363] to study finite groups of automorphisms of primary rings.

The classical ring of fractions of the algebra A over the commutative ring R, which is a finitely generated flat R-module, was considered by Szeto [1133].

Armendariz [200] considered rings R such that any proper R-submodule in Q(R) is finitely generated. Eggert [431] studied commutative rings R, dubrings of which in Q(R) are integrally closed in Q(R).

Submodules in Q(R) were also considered in [601, 804, 805].

Fisher [460] proves analogs of Goldie's theorem for differential primary rings, Ion and Nastasescu [642, 643] for graded rings. Oystaeyen [928, 931] constructs for graded rings and modules a theory of torsions, defines localization, similar to the classical, etc. Arnautov [12] shows that a locally bounded topology extends from a commutative ring R to R_A, if A does not contain generalized divisors of zero (under certain additional conditions to a locally bounded topology). Localizations of rings with involution were studied in [748], localizations of ordered modules in [470].

Armendariz and Fisher [202] investigated the connection between rings of fractions of a ring and the idealizer of its right ideal, having zero left annihilator, Berrondo [249] the connection between the field of rational functions and the field of fractions of the ring of power series over a commutative integral domain.

Cohn [364], Cohn and Dicks [368] investigated inverting homomorphisms of semi-FI-rings, explaining, for example, when an inverting localization R_Γ of a semi-FI-ring R is a semi-FI-ring, and in [365] inverting localizations of one-sided principal ideal rings. For certain systems Γ inverting localizations R_Γ were described by Beachy [240].

Gerasimov [32] constructed inverting localizations with an explicit construction, and with its help proved that any 2-FI-ring R is potentially invertible.

In [171, 372] there is investigated the skew field of fractions of the universal enveloping algebra of a finite-dimensional Lie algebra. Ore domains and their skew fields of fractions were considered by Irving [648], Jordan [690].

Sherman [1068], Szeto [1130], Oswald [916], and the surveys and reports [526, 531, 728] are also connected with rings of fractions.

3.4. Localization with Respect to (Semi) Primary Ideals. With a (semi)primary ideal P of the ring R there are connected: the multiplicative system C(P) of elements of the ring R, regular modulo P; the torsion $t_P = \tau_{R/P}$; the symmetric torsion t_{R-P}, the radical filter which is generated by the set of ideals having zero annihilator modulo P. With each of the two torsions one can associate the localization R_P and R_{R-P}, respectively, as well as with the multiplicative system C(P), if it satisfies Ore's condition (in this case the ideal P is called localizable, and the corresponding ring of fractions, its classical localization). Conditions under which a primary ideal P of R such that R/P is a Goldie ring is localizable were found by Beachy and Blair [242], in the semiprimary case by Cozzens and Sandomierski [387] in terms of properties of the torsion tp, in the case of a primary ideal of a Noetherian ring by Popescu [963], Lesieur [764], Cauchon and Lesieur [334] under the additional assumption that R is integral over a subring of its center by Chamarie and Hudry [341].

Müller [840, 841] defined a clan as a minimal set $\{P_1, \ldots, P_n\}$ of primary ideals of a Noetherian ring R such that $S = \bigcap_{i=1}^{n} P_i$ is a localizable semiprimary ideal, while the ideal $J(R_S)$ has the Artin-Riesz property. One shows that an ideal cannot belong to more than one clan. A series of properties is given of the ring of fractions R_S for example: the central idempotents of the completion of the ring R_S in the $J(R_S)$-adic topology are in one-to-one correspondence with the subsets $I \subseteq \{P_1, \ldots, P_n\}$ such that $\cap\{P_i \mid P_i \in I\}$ is a localizable ideal. A generalization of clans to nonnoetherian rings was considered by Lai [743].

In Oystaeyen [919] there are investigated localizations of FBN-rings, where the basic attention is on symmetric localizations. Localizations with respect to semiprimary ideals of hereditary FBN-rings were studied in [1157]. We also mention here Müller and Sandomierski [846, 847, 1043].

Müller [842, 844] investigated localizations of Noetherian PI-rings. In particular, he constructs an example of a finitely generated Noetherian PI-algebra over a field, lying in the ring of matrices of order 2 over a commutative Noetherian domain, each primary ideal of which is localizable, but there exists (and it is unique) a prime ideal of the center of the algebra R, which is not reduced. In [843] there are studied localizable ideals of rings of matrices of special form.

Brown, Lenagan, and Stafford [298] proved that a localizable semiprimary ideal S such that the ring R/S is Macaulay, is weakly ideal invariant, and if S has the Artin–Riesz property and R/S is a Macaulay ring, then conversely, from the weak ideal invariance of the ideal S follows its localizability. The connection of localizability with ideal invariance was also investigated by Müller [843].

Dauns [397, 398] studied localizations with respect to one-sided primary ideals, Oystaeyen [917], the connection between the torsions tp and t_{R-p} for a Noetherian ring R and conditions under which they are perfect, Latsis [750], localizations of duorings. Beachy [241] got conditions for the classical semisimplicity of the ring of fractions with respect to the torsion tp modulo the Jacobson radical.

3.5. Sheaves of Modules and Noncommutative Analogs of the Structure Sheaf. If $\mathfrak{R}$ is a neighborhood space, and R is its ring of sections, then one can consider functors $\mathfrak{R}\text{-Mod} \underset{G}{\overset{F}{\rightleftarrows}} R\text{-Mod}$, where $F(\mathfrak{M}) = \mathrm{Hom}_{\mathfrak{R}}(\mathfrak{R}, \mathfrak{M})$, and the fibers of the $\mathfrak{R}$-module G(M) are defined by the equation $G(M)(x) = \mathfrak{R}(x) \otimes_R M$, where x is an element of the base space. These functors are adjoint, and if the base space is compact (paracompact) and only in this case these functors realize an equivalence of the categories of all (finitely generated) modules ([851], cf. also [849]). Mulvey [M71:807], [852] (cf. also [M75:901]) established the equivalence of the following properties: (1) $\mathfrak{R}$ is a generator of the category of $\mathfrak{R}$-modules; (2) each fiber of the sheaf $\mathfrak{R}$ is generated by the sections over the arbitrarily small neighborhood. The specialization and refinement of this result for the case of the sheaf of continuous functions and the structure sheaf of a commutative ring can be found in [850] and [M75:901] respectively. Szeto [1132] showed that an exact sequence of modules $B \to C \to 0$ splits if and only if each of its fibers in the sheaf of the Pierce representation splits. Carral [326] called a commutative ring soft if the localizations with respect to its maximal ideals are surjective, and proved that softness of the ring R is equivalent with the quasicoherence of any sheaf of R-modules over the space of maximal ideals.

In the papers of Verschoren and Oystaeyen [924, 933, 935, 1180, 1183] there is constructed a theory of torsions and localizations in the category of presheaves of modules over a fixed (pre)sheaf of rings. A torsion τ in such a category is called local if it is defined by a family of torsions $\tau(U)$ in the categories $R(\mathcal{U})$-Mod, where $\mathcal{U}$ are open subsets of the base space, $R(\mathcal{U})$ is the corresponding ring of sections. For local torsions and for flabby sheaves there are constructed analogs of modules of fractions. It is found under what conditions the torsion and localization preserve the property of a presheaf being a sheaf. Verschoren [1178] considered analogs of perfect torsions. Under certain restrictions this property turns out to be equivalent with the fiberwise semisimplicity of any sheaf of modules.

Golan, Renault, and Oystaeyen [530] construct an analog of the structural sheaf for a certain class of noncommutative rings, including Azumaya algebras. Oystaeyen [925] found the stalks of this sheaf. Other analogs of the structure sheaf are considered in [867, 920, 926] (cf. also [534]).

For a semiprimary affine PI-ring there is constructed in [934] an analog of the structure sheaf, more similar in its properties to the commutative construction: the base for it is the space of primary ideals of the ring with the Zariski topology, it is functorial with respect to extensions, generated by the centralizing image of elements (in other words, Procesi extensions) and on an open dense subset of its base space, its stalk is the classical localization (cf. 3.4). Applications of perfect localizations in the category of bimodules to these sheaves are described in [1181, 1182]. Another approach to a noncommutative structure sheaf is developed by Cohn [367]. Szeto [1134] and Vamos [1166] are devoted to representations of noncommutative rings by sections of sheaves.

Zakharov [68] constructed a representation by sections of the orthocomplement and divisible hull of a ring.

3.6. Epimorphisms of Rings. Ringel [1014] considers the topological space of (ring) epimorphisms of a finite-dimensional algebra to simple Artinian rings. Olivier [897] shows that an arbitrary epimorphism of commutative rings $\alpha: R \to S$ decomposes into a composition of an epimorphism $\beta: R \to T$, inducing a homeomorphism $\beta^*: \mathrm{Spec}\, T \to \mathrm{Spec}\, R$, and a flat surjective epimorphism $\gamma: T \to S$. Epimorphisms of commutative rings also occur in [721].

Bulaszewska and Krempa [306] show that if $\alpha: R \to S$ is an epimorphism of rings, then commutativity, existence of a unit, nilpotence, and T-nilpotence carry over from the ring R to the ring S. On the contrary, satisfaction of an identity (even the standard of degree 3) does not carry over from the ring R to the ring S (Gardner [503]).

For a flat epimorphism $\alpha: R \to S$ Hudrie [636] establishes when the ring S is local, quasilocal, semilocal. The lift of certain properties under an absolutely flat homomorphism is considered in [952]. The torsion associated with an epimorphism of rings was studied by Lambek [746]. Spulber [1105], Nishida [884], and Vasconcelos [1175] found when a given homomorphism of rings is a flat epimorphism. Shinagawa [1069] established a connection between divisorial and codivisorial modules over Krull domains A and B, if $i: A \to B$ is a flat embedding.

Cipolla [360] considers a generalization of the theory of strictly flat descent of Grothendieck.

Morphisms in the category of rings and in other categories whose properties are similar to the properties of flat ring epimorphisms, were studied in [605, 707, 1211].

3.7. Maximal Orders in Central Simple Algebras and Their Generalizations. In Reiner's book [991] there is recounted the theory of ideals of maximal orders. Faith [445] studies a noncommutative analog of Prüfer rings, and Marubayashi [797] continues to study noncommutative Krull rings.

Cozzens and Sandomierski [385, 386] investigate reflexive ideals in maximal orders, Cozzens [383], reflexive modules over them. Chamarie and Maury [342] proved the following analog of the principal ideal theorem: if R is a primary Noetherian PI-ring, whose center is a Krull domain, then at least one of the radicals of components of the minimal tertiary decomposition of any principal ideal in R is a minimal primary ideal. Some generalizations of this theorem were obtained by Maury [807]. [337, 339, 637, 806] relate to this series.

Stafford [1108] proved a cancellation theorem for certain projective modules over Asano orders (cf. also [1018]).

Ginn and Moss [512] showed that a two-sided Noetherian order in an Artinian ring splits into a direct sum of an Artinian ideal and a ring with zero socle. This result stimulated the investigation of the Artinian radical in such rings (Chatters [344, 345]) and its analogs (Chatters and Robson [349]).

Harada [599] investigates the representation of an order, equivalent with a given one, as an intersection of idealizers.

For a commutative hereditary domain R with field of fractions K, it is shown that any subalgebra Λ in a projective separable K-albegra Σ, integral over R, is an R-order, and that any maximal R-order is hereditary (Kirkman and Kuzmanovich [716]). In [182] it is shown that a certain ring of fractions of a maximal order in a semisimple finite-dimensional algebra over an algebraically closed field is Euclidean. Maximal V-orders in the ring of matrices K_n, where V is a normed ring of height 1 in the field K, were described by Dubrovin [58].

Cozzens [384] calls a semilocal ring Λ with set of maximal ideals $\{M_1, \ldots, M_n\}$ localizable if there exists a set of ring epimorphisms $\{\varphi_i : \Lambda \to \Gamma\}$ such that $(\Gamma_i)_\Lambda$ and $_\Lambda(\Gamma_i)$ are finitely generated projective modules and $\Gamma_i \otimes_\Lambda \Lambda/M_j = 0$ for all $j \neq i$. A series of results is announced about the structure (in terms of block matrices) of localizable orders, finitely generated as modules over the center.

Ramras [977] and Janusz [663] study the question of when the tensor product of rings turns out to be a maximal order, and Chamarie [338] the same question for Ore extensions (cf. also [866]).

Masaike [799] defines and studies an equivalence relation between orders in two different Artinian semisimple Morita-equivalent rings. Nauwelaerts and Oystaeyen [868] consider a class of rings, including along with Noetherian hereditary PI-rings, classical orders in central simple algebras.

4. Modules with Supplementary Structures

4.1. Topological Modules. Kirku [168, p. 50] noted that an arbitrary module over a discrete ring R is a precompact topological R-module. Couchot [377] considers in a module the topology whose basis of neighborhoods of zero consists of all those submodules, the quotient modules by which are modules of finite type. A series of remarks on Zariski topologies on rings and modules is made by Costovici [375]. Prodanov [968] investigates precompact minimal topologies in certain modules without torsion of Arnautov and Mikhalev [170, Part 2, p. 8] obtained a topological analog of Hilbert's basis theorem (for the condition of breaking off of increasing chains of open right ideals) for topological rings and modules. Aleksei and Kalistru in [3] and Kalistru in [71] analyze the question of the completeness of a free topological module, M. I. Vodinchar ([29]; [168, p. 18]; [170, Part 2, p. 30]) investigate algebraic radicals of topological modules. Ballet [224, 225] are devoted to linear topological modules. In [197] it is proved that if R is a complete ring with basis of neighborhoods of zero of left ideals, then R is a semisimple linearly compact ring if and only if each topological R-module is topologically injective. Linearly compact topologies on modules are investigated in [1184] and [578].

The cycle of papers of Glavatskii [33; 34; 168, p. 25] is devoted to a topological analog of quasifrobenius modules, defined by their duals. Linearly compact modules are studied in [379, 580, and 1208]. Questions of duality of the type of Pontryagin duality were considered for topological modules in [232, 400, 465, 479, 902] also.

Completions of linear topological rings and certain types of dualities arising here are considered in [231].

The duality defined by a bilinear form over a commutative topological ring is analyzed in [808]. Topological quasiprojective and quasiinjective modules are studied by Glavatskii [35, 36]. A topological version of perfect rings is investigated by Klyushin [78; 168, p. 50]. Open Noetherian rings and modules are characterized by Klyushin [79].

Projective Banach modules are studied by Selivanov [125-127], finitely generated, Noetherian and Artinian Banach modules by Grabiner [565]. Homological dimensions of Banach algebras and Banach modules are investigated by Khelemskii [165], Golovin and Khemel'skii [38], Moran [838].

4.2. Ordered Modules. A series of questions on ordered modules is found in the book of Bigard, Keimel, and Wolfenstein [264]. A new stimulus to the study of partially ordered rings and partially ordered modules is given by semialgebraic geometry (i.e., the domain of mathematics studying a finite number of polynomial equations and inequalities), Brumfiel's monograph [299] gives an introduction to this part of algebra.

Localizations of ordered modules are considered by Bigard [263] and Fox [470]. A series of remarks on bases of partially ordered modules is made by Belding [246]. Ordered modules of characters are mentioned in [960].

Questions of completeness and various completions and hulls of ordered modules occur in Zakharov [66, 67]. Kutateladze [90] describes modules over l-ring, in which one can develop convex analysis.

Wirth [120] investigates partially ordered Abelian groups, locally compact in the interval topology. Various topologies on Abelian l-groups and completions over them are considered by Kenny [701]. Smarda [1091] studies the lattice of all topologies of an l-group, in which the group and lattice operations are continuous. The closed graph theorem for ordered topological Abelian groups is proved by Khaleelulla [713].

4.3. Valued Modules. A large cycle of papers is devoted to valued vector spaces and Abelian groups: Fuchs [474, 476-478], Rado [973], Richman and Walker [1008]. Richman [1007] offered a guide to the literature on valuated Abelian groups. Liebert [773] investigates valuations and covaluations on periodic complete Abelian l-groups. [311] abuts here. Kirby and Mehran [714] and Ribenboim [1003, 1004] are devoted to valuated modules.

4.4. Graded and Filtered Modules. There was begun the systematic study of graded and filtered modules (categorical properties, projective and injective objects, homological dimension, Krull dimension, graded primary ideals, localizations and versions of Goldie's theorems, primary decompositions, radicals, and other questions) – cf. Fossum and Foxby [469], Nastasescu [857, 860], Ion and Nastasescu [642, 643], Oystaeyen [931], Goto and Watanabe [555, 556], Grünenfelder [576]. The book of Nastanescu and Oystaeyen [865] gives a sufficiently complete account of this circle of questions.

4.5. Differential and Difference Modules. Primary decompositions of differential modules were studied by Ursianu [1158] and Nowicki [891]. Torsions in the category of differential modules were investigated by Gorbachuk and Komarnitskii [170, Part 2, p. 41]. Differential operators and derivatives on modules are touched on in [187]. Properties of integrally closed submodules are given by Trendafilov [142]. Methods of calculation of the differential dimension of a polynomial (using resolutions of the module of differentials and from the characteristic set of a simple differential ideal), and also calculations of the characteristic set and differential dimension of a polynomial for concrete systems of differential equations (wave equation, the equations of Dirac, Euler, Laie, Maxwell, and Einstein) are recounted by Mikhalev and Pankrat'ev (cf. [103, p. 94]; [168, pp. 76-77]). Levin [91, 92] investigates characteristics of polynomials and the difference dimension of filtered modules and extensions of difference fields. He also in [168, p. 67] investigates properties of the functor Ext in the category of inverse difference modules.

Dzhavadov [51] studies differential-difference modules (questions connected with Noetherianness, the Jacobson radical, with versions of the Artin-Riesz lemma, etc.), and in [52] he constructs characteristics of polynomials for differential-difference modules.

5. Generalizations of Modules

5.1. Modules Over Generalized Rings. Affine Modules. In this section there is reflected the content of only those papers in which objects are considered, directly abutting on modules over rings. A significant number of papers devoted to the homological classification of semigroups and other questions associated with properties of polygons over monoids, do not appear in the present survey. This is explained by the inadequacy of space as well as by the fact that the theory of semigroups and polygons over them is dealt with in an independent domain of algebra. For this same reason, we do not deal with papers in which commutative semigroups are studied, although they can also be considered as modules over the semiring of positive integers.

Tyukavkin [159] proved that the regularity of a commutative semiring is equivalent with the fact that all modules over it are flat. Kovalenko [80, 81] considered modules over inverse semirings (i.e., semirings, whose additive subgroup is inverse). Pachkoriya [106] investigated extensions of modules over a semiring.

An additively written groupoid A is called a quasimodule over the ring R, if for all $r \in R$ and $a \in A$ there is defined the product $ra \in A$, where

$$(x+x)+(y+z)=(x+y)+(x+z),\ (-1)x+(x+y)=y,$$
$$r(x+y)=rx+ry,\ (r+s)x=rx+sx,$$
$$r(sx)=(rs)x,\ 1x=x \text{ and } 0x=0y.$$

The structure of quasimodules, generated by three elements, was described by Kepka and Nemec [704]. They also [705] noted the possibility of getting a quasimodule from a module by imposing some additional ternary operation. Kepka [703] considered preradicals of quasimodules and established that subquasimodules of a finitely generated quasimodules over a Noetherian ring are finitely generated.

There were continued the investigations of modules over almost rings. Oswald [915] constructed a counterexample to the results of Sesa and Tewari [M75:1259]. Meldrum [818], Mason [802], Banaschewski and Nelson [227] noted that in the category of modules over an almost ring injective objects, generally speaking, do not exist. Mason [802] considered weakened injectivity properties and used them for the homological classification of almost rings. Oswald [916] constructed an analog of the ring of fractions for an almost ring.

Pseudomodules were considered in Perdew [953] and Rimer [1009], while the latter paper contains errors.

Ponomarev [108] investigated the category of n-modules (cf. [M71 : 121]).

We proceed to papers in which there were investigated modules over not necessarily associative rings and algebras.

Let K be an associative ring with unit and R be a not necessarily associative K-algebra. A module M over the algebra R is defined as a K-module, admitting a unit preserving K-linear mapping $\rho : R \to \mathrm{End}_K M$, where we set $\lambda m = \rho(\lambda)(m)$. Shestakov [166] refined results obtained earlier (cf. [137, p. 60], and also [60]) for the case of modules over an alternative ring and proved that irreducible modules over such a ring are left and right associative. Wisbauer [1202] called an element $m \in M$ associative, if $(\lambda\mu)m = \lambda(\mu m)$ for any $\lambda, \mu \in R$. A module, generated by its associative elements, is called associatively generated. An injective (projective) module is defined as a module, injective (projective) with respect to exact sequences of associatively generated modules. There is proved an analog of the theorem on the homological characterization of classical semisimple rings [1202]. There are investigated connections between the properties: (a) R is regular; (b) each simple R-module is injective; (c) each (left) ideal of R can be represented as the intersection of maximal (left) ideals (cf. [1203]). In [1204] a ring is called left regular, if each of its left ideals is generated by an idempotent. In contrast with the associative case, left-right symmetry, generally speaking, does not exist. It is proved that left regularity of a ring is equivalent with flatness of all associatively generated modules over it. There is also given a homological characterization of biregular rings. There were considered analogs of hereditariness, semihereditariness, and semiperfection for the nonassociative case [1207]. Modules over nonassociative rings were also considered by Osborn [903]. Jacobson McCrimmon and Parvathi [658] studied localizations of Jordan algebras.

Zhozhikashvili [62] proved that the equivalence of the categories of affine modules over rings R and R' implies the isomorphism of these rings. In passing it is established that from the isomorphism of these rings. In passing it is established that from the isomorphism of the semigroups of endomorphisms of free affine modules of rank ≥ 2 it follows that these modules are connected by a semilinear isomorphism. We note also the paper of Szendrei [1129], in which there is established a connection between affine operations on an R-module and pairs (R', I), where R' is a central subring in R, and I is an ideal in R'.

5.2. Category-Theoretic Generalizations. Gruenberg and Roggenkamp [575] studied the category of extensions of modules. Brodskii [104, p. 110] characterized finitely closed subcategories of the category of modules. Questions connected with the embedding of a given category in the category of modules were considered by Verschoren [1179]. In Diers [409] there is studied the localization defined by some functor from the category of modules to an Abelian category. Oystaeyen and Verschoren [935] and Izawa [656] abut this circle of questions.

Dartois [396] considers a series of questions concerning modules over a small additive category. Grigoryan [46] proved that regularity (in the sense of von Neumann) of a small preadditive category π is equivalent with the flatness of all π-modules. Simson [1077] investigated pure semisimple categories and applied them to the study of rings of finite representation type. Reiten [993] gave a method of construction of a hereditary Abelian category, stably equivalent with a given one. Papers concerning projective and injective objects in categories similar to the category of modules are reflected in the corresponding divisions of Section 2, those concerning various preradicals in such categories in 3.1.

LITERATURE CITED

1. K. V. Aganitov, "Hereditary Noetherian primary rings," Moscow State Univ. (1980). (Manuscript deposited in VINITI, June 12, 1980, No. 2334-80 Dep.)
2. K. V. Agapitov, "Epimorphic images of bounded primary Dedekind rings," Vestn. Mosk. Gos. Univ., No. 5, 50-53 (1980).
3. S. F. Aleksei and R. K. Kalistru, "Completeness of free topological modules," Mat. Issled., No. 44 (Kishinev), 164-173 (1977).
4. A. V. Andrunakievich, "Primary modules, primary one-sided ideals, and the Baire radical," Izv. Akad. Nauk Mold.SSR, No. 2, 12-17 (1976).
5. A. V. Andrunakievich, "Primary one-sided ideals and the structure of rings," Mat. Issled. (Kishinev), No. 49, 3-10 (1979).
6. A. V. Andrunakievich, "Special modules and special radicals," Izv. Akad. Nauk Mold.SSR, Ser. Fiz.-Tekh. Mat. Nauk, No. 1, 84-85 (1979).
7. V. A. Andrunakievich, K. K. Krachilov, and Yu. M. Ryabukhin, "Lattice-complemented torsions in algebras over a Noetherian integral domain," Dokl. Akad. Nauk SSSR, 242, No. 5, 985-988 (1978).
8. V. A. Andrunakievich, K. K. Krachilov, and Yu. M. Ryabukhin, "Lattice complemented torsions in algebras over a Noetherian integral domain," Mat. Sb., 109, No. 1, 3-11 (1979).
9. V. A. Andrunakievich and Yu. M. Ryabukhin, "Complemented and dual torsions," Dokl. Akad. Nauk SSSR, 238, No. 4, 769-772 (1978).
10. V. A. Andrunakievich and Yu. M. Ryabukhin, "Complemented and dual torsions," Tr. Mat. Inst. im. V. A. Steklova, 148, 16-26 (1978).
11. V. A. Andrunakievich and Yu. M. Ryabukhin, Radicals of Algebras and Lattice Theory [in Russian], Nauka, Moscow (1979).
12. V. I. Arnautov, "Extension of the topology of a commutative ring to some of its rings of fractions," Mat. Issled. (Kishinev), No. 48, 3-13 (1978).
13. Yu. L. Barannik, "Invariants of modules over the p-adic integral group ring of a group of type p^∞," Dokl. Akad. Nauk Ukr.SSR, A, No. 11, 963-965 (1977).
14. Yu. L. Barannik and P. M. Gudivok, "Crossed group rings of finite groups and rings of p-adic integers with a finite number of indecomposable integral representations," Mat. Sb., 108, No. 2, 187-211 (1979).
15. K. I. Beidar, "Rings of fractions of semiprimary rings," Vestn. Mosk. Gos. Univ., Mat. Mekh., No. 5, 36-43 (1978).
16. K. I. Beidar, "Classical rings of fractions of PI-algebras," Usp. Mat. Nauk, 33, No. 6, 197-198 (1978).
17. K. I. Beidar, "Rings with generalized identities. III," Vestn. Mosk. Gos. Univ., Mat., Mekh., No. 4, 66-73 (1978).
18. A. U. Belesov, "Injective and equationally compact modules," Izv. Akad. Nauk Kaz.SSR, Ser. Fiz.-Mat., No. 1, 85-86 (1976).
19. G. M. Brodskii and A. G. Grigoryan, "Rings of endomorphisms of modules," Dokl. Akad. Nauk Arm. SSR, 69, No. 1, 15-18 (1979).
20. I. D. Bunu, "Concept of injectivity in the category of modules. Rings and modules," Mat. Issled., No. 38, (Kishinev), 71-85 (1976).

21. I. D. Bunu, "(ρ, σ)-injectivity in modules. Rings and modules," Mat. Issled., No. 38, Kishinev, 86-96 (1976).
22. I. D. Bunu, "Comparison of some concepts of injectivity in modules," Mat. Issled., No. 48, Kishinev, 14-23 (1978).
23. I. D. Bunu, "Left QI-rings," Mat. Issled., No. 49, Kishinev, 23-34 (1979).
24. I. D. Bunu and E. I. Tebyrtse, "Lattice of pretorsions and classically semisimple rings," Mat. Issled., No. 49, Kishinev, 35-39 (1979).
25. L. N. Vasershtein and A. A. Suslin, "Serre's problem on projective modules over polynomial rings and algebraic K-theory," Izv. Akad. Nauk SSSR, 40, No. 5, 993-1054 (1976).
26. E. M. Vechtomov, "Projective and injective ideals of rings of continuous functions," in: Abelian Groups and Modules [in Russian], Tomsk (1980), pp. 19-30.
27. E. M. Vechtomov, "Pure ideals of rings of continuous functions," in: Contemporary Algebra [in Russian], Leningrad (1978), pp. 29-37.
28. N. I. Vishnyakova, "Modules over a class of local Noetherian rings," Latv. Mat. Ezhegodn., 18, 3-18 (1976).
29. M. I. Vodinchar, "Algebraic radicals and radically semisimple classes of topological modules," Mat. Issled., No. 53, Kishinev, 43-53 (1979).
30. A. I. Generalov, "Weak and ω-high purities in the category of modules," Mat. Sb., 105, No. 3, 389-402 (1978).
31. A. I. Generalov, "Axiomatic description of weak purities in the category of modules," Mat. Sb., 109, No. 1, 80-92 (1979).
32. V. N. Gerasimov, "Generating homomorphisms of rings," Algebra Logika (Novosibirsk), 18, No. 6, 648-663 (1978).
33. S. T. Glavatskii, "Topological quasifrobenius modules," Moscow State Univ. (1978) (Manuscript deposited in VINITI, July 20, 1978, No. 2448-78 Dep).
34. S. T. Glavatskii, "Topological quasifrobenius modules. II," Moscow State Univ. (1978) (Manuscript deposited in VINITI, October 31, 1978, No. 3411-78 Dep).
35. S. T. Glavatskii, "Topological quasiinjective and quasiprojective modules," Moscow State Univ. (1978), (Manuscript deposited in VINITI, October 31, 1978, No. 3412-78 Dep).
36. S. T. Glavatskii, "Topological quasiinjective and quasiprojective modules," in: Abelian Groups and Modules [in Russian], Tomsk (1980), pp. 31-44.
37. V. E. Govorov, "Associativity formulas," Usp. Mat. Nauk, 32, No. 6, 215-216 (1977).
38. Yu. O. Golovin and A. Ya. Khelemskii, "Homological dimension of certain modules over a tensor product of Banach algebras," Vestn. Mosk. Gos. Univ., No. 1, 54-61 (1977).
39. E. L. Gorbachuk and N. Ya. Komarnitskii, "Radical filters in principal ideal domains," Dokl. Akad. Nauk Ukr.SSR, No. 2, 103-104 (1977).
40. E. L. Gorbachuk and N. Ya. Komarnitskii, "S-torsion in modules," Visnik L'viv. Un-tu, No. 12, 32-34 (1977).
41. E. L. Gorbachuk and N. Ya. Komarnitskii, "I-radicals and their properties," Ukr. Mat. Zh., 30, No. 2, 212-217 (1978).
42. E. L. Gorbachuk and N. Ya. Komarnitskii, "Decomposability of countably-generated torsions," Visnik L'viv. Un-tu, No. 13, 35-37 (1978).
43. I. M. Godn, "Isolated components of submodules," Mat. Issled., No. 49, Kishinev, 54-60 (1979).
44. I. M. Godn and I. D. Kitoroage, "Infinite intersections of primary submodules," Mat. Issled., No. 48, Kishinev, 40-47 (1978).
45. I. M. Godn and I. D. Kitoroage, "Closures of ideals and primary decompositions," Mat. Issled., No. 49, Kishinev, 61-67 (1979).
46. A. G. Grigoryan, "Flat functors and regular categories," Aikakan SSR Gigutyunneri Akademia Zekuitsner. Dokl. Akad. Nauk Arm.SSR, 62, No. 2, 65-71 (1976).
47. N. M. Gubareni, "Semiperfect right hereditary rings of bounded-modulus type," Inst. Mat. Akad. Nauk Ukr.SSR, Preprint No. 1 (1978).
48. N. M. Gubareni, "Right hereditary rings of bounded-modulus type," in: Theoretical and Applied Questions of Differential Equations and Algebra [in Russian], Kiev (1978), pp. 80-84.
49. N. M. Gubareni, Yu. A. Drozd, and V. V. Kirichenko, "Right-serial rings," Inst. Elektrodinamiki Akad. Nauk SSSR. IED Akad. Nauk Ukr.SSR, Preprint, 110, Kiev (1975).
50. N. M. Gubareni and V. V. Kirichenko, "Structure of semiperfect right Noetherian and right hereditary primary rings," in: Mathematical Papers Kiev [in Russian], Naukova Dumka (1976), pp. 18-22.

51. G. A. Dzhavadov, "Differential-difference rings and modules of finitely generated type and the Jacobson differential-difference radical," Dagestan. Gos. Pedagog. Inst. Makhachkala (1979) (Manuscript deposited in VINITI, June 6, 1979, No. 1993-79 Dep).
52. G. A. Dzhavadov, "The Hilbert characteristic polynomial for differential-difference modules and its applications," Dagestan. Gos. Pedagog Inst. Makhachkala (1979) (Manuscript deposited in VINITI, June 6, 1979, No. 1992-79 Dep).
53. Yu. B. Dobrusin, "Modules over Dedekind commutative integral domains, similar to algebraically compact ones," Tomsk. Un-t., Tomsk (1979) (Manuscript deposited in VINITI, December 13, 1979, No. 4237-79 Dep).
54. O. I. Domanov, "Perfect semigroup rings," Sib. Mat. Zh., 18, No. 2, 294-303 (1977).
55. M. M. Drogomizhs'ka, Visnik L'viv. Politekh. Inst., No. 119, 39-41, 185 (1977).
56. Yu. A. Drozd, "Tame and wild matrix problems," in: Representations and Quadratic Forms [in Russian], Kiev (1979), pp. 39-74.
57. Yu. A. Drozd, "Structure of hereditary rings," Mat. Sb., 113, No. 1, 161-172 (1980).
58. N. I. Dubrovin, "Maximal orders in a simple central finite-dimensional algebra over a valued ring of height 1," Mat. Sb., 108, No. 4, 517-528 (1979).
59. V. P. Elizarov, "Rings of fractions," in: Rings and Modules. Mathematical Investigations [in Russian], Vol. 38, Kishinev (1976), pp. 132-149.
60. K. A. Zhevlakov, A. M. Slin'ko, I. P. Shestakov, and A. I. Shirshov, Rings, Close to Associative [in Russian], Nauka, Moscow (1978).
61. Z. P. Zhilinskaya, "Isomorphism of pairs of finitely generated modules," in: Materials of the Twenty-Ninth Scientific Conference of the Professorial-Instructorial Staff of Uzhgorod University, Section of Mathematical Sciences [in Russian], Uzhgorod Univ. (1975), pp. 130-138 (Manuscript deposited in VINITI, March 10, 1976, No. 705-76 Dep).
62. A. V. Zhozhikashvili, "Equivalences of categories of affine modules," Mat. Zametki, 24, No.4, 475-486 (1978).
63. A. G. Zavadskii and V. V. Kirichenko, "Torsion-free modules over primary rings," Zap. Nauchn. Sem. Leningr. Otd. Mat. Inst. Akad. Nauk SSSR, 57, 100-116 (1976).
64. A. G. Zavadskii and V. V. Kirichenko, "Semimaximal rings of finite type," Mat. Sb., 103, No. 3, 323-345 (1977).
65. V. K. Zakharov, "Regular completion of modules," Mat. Zametki, 19, No. 6, 843-851 (1976).
66. V. K. Zakharov, "Orthocomplementation of modules, rings, and Boolean algebras," in: Ordered Sets and Lattices [in Russian], Vol. 4, Saratov Univ. (1977), pp. 48-61.
67. V. K. Zakharov, "Divisible hull and orthocomplementation of lattice-ordered modules," Mat. Sb., 103, No. 3, 346-357 (1977).
68. V. K. Zakharov, "Functional representation of the orthocomplement and divisible hull of torsion-free Utumi modules," Mat. Zametki, 27, No. 3, 333-344 (1980).
69. A. V. Ivanov, "ω-divisible and ω-flat modules," Mat. Zametki, 24, No. 6, 741-747 (1978).
70. V. P. Ivanov, "Isomorphism of simple modules with equal annihilators for certain classes of rings," Inst. Teor. Eksp. Fiz., Moscow, Preprint.
71. R. K. Kalistru, "Completeness of a free topological module, generated by a discrete space," Mat. Issled. (Kishinev), 53, 98-102 (1979).
72. A. I. Kashu, "Bicommutators of completely divisible modules," Mat. Sb., 100, No. 4, 483-494 (1976).
73. A. I. Kashu, "Preradicals in the situation of conjugacy," Mat. Issled. (Kishinev), No. 48, 48-64 (1978).
74. V. V. Kirichenko, "Generalized-uniserial rings," Preprint IM-75-1, Izd. Inst. Mat. Akad. Nauk Ukr. SSR, Kiev (1975).
75. V. V. Kirichenko, "Generalized-uniserial rings," Vestn. Mosk. Gos. Univ., No. 3, 126 (1977).
76. V. V. Kirichenko, "Quasifrobenius rings and Gorenstein orders," Tr. Mat. Inst. im. V. A. Steklova, 148, 168-174 (1978).
77. V. V. Kirichenko, "Classification of pairs of mutually annihilating operators in a graded space and representations of dyads of generalized uniserial algebras," Zap. Nauchn. Sem. Leningr. Otd. Mat. Inst. Akad. Nauk SSSR, 75, 91-109 (1978).
78. A. V. Klyushin, "Topological Jacobson radicals and topological semiperfect rings," Moscow State Univ. (1978) (Manuscript deposited in VINITI, June 20, 1978, No. 2447-78 Dep).
79. A. V. Klyushin, "Open Noetherian rings," Vestn. Mosk. Gos. Univ., Mat. Mekh., No. 5, 48-57 (1979).
80. B. B. Kovalenko, "Generalized modules over inverse semirings," in: Ordered Sets and Lattices [in Russian], No. 5, Saratov (1978), pp. 55-62.
81. B. B. Kovalenko, "Generalized modules," in: Studies in Algebra [in Russian], Vol. 5, Saratov (1977), pp. 30-42.

82. I. B. Kozhukhov, "Self-injective semigroup rings," Mosk. Inst. Elektron. Tekh., Moscow (1978) (Manuscript deposited in VINITI, July 26, 1979, No. 2843-79 Dep).
83. L. A. Koifman, "Decomposability of torsions over commutative rings," Usp. Mat. Nauk, 31, No. 2, 215-216 (1976).
84. L. A. Koifman, "Decomposability of torsion over commutative rings," Tr. Mosk. Mat. O-va, 37, 143-171 (1978).
85. N. Ya. Komarnitskii, "Duo-rings, over which all torsions are S-torsions," Mat. Issled. (Kishinev), No. 48, 65-68 (1978).
86. N. Ya. Komarnitskii, Kiev (1978), pp. 19-21.
87. P. Cohn, Free Rings and Their Relations [Russian translation], Mir, Moscow (1975).
88. K. K. Krachilov, "Coatoms of the lattice of special radicals," Mat. Issled. (Kishinev), No. 49, 80-86 (1979).
89. K. K. Krachilov, "Complementation in the lattice of hypernilpotent radicals," Mat. Issled. (Kishinev), No. 49, 87-104 (1979).
90. S. S. Kutateladze, "Modules admitting convex analysis," Dokl. Akad. Nauk SSSR, 252, No. 4, 789-791 (1980).
91. A. B. Levin, "Characteristic polynomials of difference modules and some properties of the difference dimension," Moscow State Univ. (1980) (Manuscript deposited in VINITI, May 30, 1980, No. 2175-80 Dep).
92. A. B. Levin, "Characteristic polynomials of filtered difference modules and extensions of difference fields," Usp. Mat. Nauk, 33, No. 3, 177-178 (1978).
93. Z. A. Lykova, "Conditions for projectivity of Banach algebras of completely continuous operators," Vestn. Mosk. Gos. Univ., No. 4, 8-13 (1979).
94. A. Sh. Maibalaev, "Definition of an injective module," in: Algebra and Number Theory [in Russian], Alma-Ata (1978), pp. 25-29.
95. A. A. Manovtsev, "Additive purities in the category of A-modules and the functor ω," in: Proceedings of the Twenty-Seventh Scientific—Technical Conference of the Moscow Institute of Radio Engineering, Electronics, and Automation [in Russian], Moscow (1978), pp. 89-95 (Manuscript deposited in VINITI, March 22, 1979, No. 1014-79 Dep).
96. A. P. Mishina, "Abelian groups," in: Algebra. Topology. Geometry [in Russian], Vol. 17, Itogi Nauki i Tekh. VINITI Akad. Nauk SSSR, Moscow (1979), pp. 3-63.
97. A. V. Mikhalev, "Rings of endomorphisms of modules and lattices of submodules," in: Algebra. Topology. Geometry [in Russian], Vol. 12, Itogi Nauki i Tekh. VINITI Akad. Nauk SSSR, Moscow (1974), pp. 51-76.
98. A. V. Mikhalev and E. V. Pankrat'ev, "Differential polynomial dimension of a system of differential equations," in: Algebra [in Russian], Moscow State Univ. (1980), pp. 57-67.
99. A. V. Mikhalev and L. A. Skirnyakov, "Modules," in: Algebra. Topology. Geometry (1968) [in Russian], Itogi Nauki i Tekh. VINITI Akad. Nauk SSSR, Moscow (1970), pp. 57-100.
100. A. V. Mikhalev and L. A. Skirnyakov (ed.), "Modules," Akad. Nauk SSSR Sib. Otd. Inst. Mat. Preprint, Novosibirsk (1973).
101. "Research seminar on algebra," Vestn. Mosk. Gos. Univ., Mat., Mekh., No. 6, 96-101 (1979).
102. "Research seminar on algebra," Mosk. Gos. Univ., Mat., Mekh., No. 3, 101-105 (1980).
103. "Research seminar on algebra," Vestn. Mosk. Gos. Univ., Mat., Mekh., No. 4, 90-97 (1980).
104. "Research seminar on algebra," Vestn. Mosk. Gos. Univ., Mat. Mekh., No. 1, 97-100 (1981).
105. N. Nachev, Nauchn. Tr. Plovdiv. Un-t. Mat., 13, No. 1, 65-79 (1975 (1977)).
106. A. M. Pachkoriya, "Extensions of submodules," Sakartvelos SSR Metsnierebata Akademiis Moambe, Soobshch. Akad. Nauk Gruz. SSR, 84, No. 3, 545-548 (1976).
107. A. I. Ponomarev, "τ-classical semisimplicity of a ring R," Mosk. Gos. Pedagog. Inst., Moscow (1976) (Manuscript deposited in VINITI, April 30, 1976, No. 1481-76 Dep).
108. A. I. Ponomarev, "Category of n-modules," in: Modern Algebra [in Russian], Vol. 5, Leningrad (1976), pp. 102-106.
109. A. I. Ponomarev, "Rings, regular with respect to torsions," in: Algebraic Systems [in Russian], Ivanovo (1978), pp. 61-80.
110. A. I. Ponomarev, "Regular pretorsions," Mat. Zametki, 25, No. 1, 27-35 (1979).
111. V. A. Ratinov, "Semiperfect rings with commutative Jacobson radical," Mosk. Gos. Pedagog. Inst. im. V. I. Lenina, Moscow (1978) (Manuscript deposited in VINITI October 12, 1978, No. 3215-78 Dep).
112. V. A. Ratinov, "Structure of semiperfect rings with commutative Jacobson radical," Mat. Sb., 110, No. 3, 459-470 (1979).
113. V. B. Repnitskii, "Arithmetic modules," Mat. Sb., 110, No. 1, 150-157 (1979).

114. Yu. V. Roganov, "Hereditariness of the tensor algebra and semihereditariness of the completion of the tensor algebra," Dokl. Akad. Nauk Ukr.SSR, A, No. 5, 410-413 (1977).
115. I. Z. Rozenknop, "Isomorphisms of modules with monomial filtration," Mosk. O-va Pedagog. Inst. (1977) (Manuscript deposited in VINITI, November 17, 1977, No. 645-77 Dep).
116. S. K. Rososhek, "Torsion-free modules over semihereditary primary Goldie rings," in: Groups and Modules [in Russian], Tomsk (1976), pp. 57-69.
117. S. K. Rososhek, "Periodic modules over noncommutative Dedekind primary rings," Sib. Mat. Zh., Novosibirsk (1977) (Manuscript deposited in VINITI, January 4, 1977, No. 52-77 Dep).
118. S. K. Rososhek, "Purely correct modules," Usp. Mat. Nauk, 33, No. 3, 176 (1978).
119. S. K. Rososhek, "Correctness of modules," Izv. Vyssh. Uchebn. Zaved. Mat., No. 10, 77-82 (1978).
120. S. K. Rososhek, "Correct and purely correct modules," in: Abelian Groups and Modules [in Russian] (1979), pp. 127-142.
121. Yu. M. Ryabukhin and K. K. Krachilov, "Lattice complemented torsions in algebras," Mat. Issled. (Kishinev), No. 48, 94-111 (1978).
122. Yu. M. Ryabukhin and R. S. Florya, "Atomicity of the 'lattice' of hereditary annihilators of torsions," Mat. Issled. (Kishinev), No. 49, 115-121 (1979).
123. N. A. Ryatova, "Conditions for the elementary equivalence of modules over a discrete valued ring," Mosk. Gos. Pedagog. Inst., Moscow (1977) (Manuscript deposited in VINITI, July 21, 1977, No. 2991-77 Dep).
124. I. I. Sakhaev, "Finite generation of projective modules," Izv. Vyssh. Uchebn. Zaved., No. 9, 69-79 (1977).
125. Yu. V. Selivanov, "Projectivity of certain Banach modules and the structure of Banach algebras," Izv. Vyssh. Uchebn. Zaved., Mat., No. 5, 85 (1976); No. 1, 110-116 (1978).
126. Yu. V. Selivanov, "Biprojective Banach algebras, their structure, and the connection with kernel operators," Funkts. Anal. Prilozhen., 10, No. 1, 80-90 (1976).
127. Yu. V. Selivanov, "Biprojective Banach algebras," Izv. Akad. Nauk SSSR, Ser. Mat., 43, No. 5, 1159-1174 (1979).
128. E. G. Sklyarenko, "Pure and finitely represented duality homomorphisms and the property of correctness of a ring," Mat. Sb., 105, No. 2, 192-206 (1978).
129. E. G. Sklyarenko, "Relative homological algebra in the category of modules," Usp. Mat. Nauk, 33, No. 3, 85-120 (1978).
130. L. A. Skornyakov, "Modules," in: Algebra. Topology. 1962 [in Russian], Itogi Nauki. VINITI Akad. Nauk SSSR, Moscow (1963), pp. 80-89.
131. L. A. Skornyakov, "Modules," in: Algebra. Topology. Geometry. 1965 [in Russian], Itogi Nauki. VINITI Akad. Nauk SSSR, Moscow (1967), pp. 181-216.
132. L. A. Skornyakov, "Decomposability of modules into a direct sum of ideals," Mat. Zametki, 20, No. 2, 187-193 (1976).
133. L. A. Skornyakov, "Commutative rings and subidempotent ideals," Mat. Sb., 102, No. 2, 280-288 (1977).
134. L. A. Skornyakov, "Axiomatizability of the class of injective polygons," Tr. Sem. im. I. G. Petrovskogo, Mosk. Gos. Univ., No. 4, 233-239 (1978).
135. L. A. Skornyakov, "Finite axiomatizability of the class of faithful modules," Coll. Math., 42, 365-366 (1979).
136. L. A. Skornyakov, "A condition of Andrunakievich-Ryabukhin," Mat. Issled., Kishinev "Shtiintsa," Vol. 44, 174-176 (1977).
137. L. A. Skornyakov and A. V. Mikhalev, "Modules," in: Algebra. Topology. Geometry [in Russian], Vol. 14, Itogi Nauki i Tekh. VINITI Akad. Nauk SSSR, Moscow (1976), pp. 57-190.
138. A. A. Suslin, "Stably free modules," Mat. Sb., 102, No. 4, 537-550 (1977).
139. A. A. Suslin, "Cancellation theorem for projective modules over algebras," Dokl. Akad. Nauk SSSR, 236, No. 4, 808-811 (1977).
140. A. A. Suslin, "Structure of projective modules over polynomial rings in the case of noncommutative ring of coefficients," Tr. Mat. Inst. im. V. A. Steklova, 148, 233-252 (1978).
141. N. P. Titov, "Coherence of natural isomorphisms in categories of algebras and modules," Editorial Board of Sib. Mat. Zh., Sib. Otd. Akad. Nauk SSSR, Novosibirsk (1979) (Manuscript deposited in VINITI, October 4, 1979, No. 3470-79 Dep).
142. I. D. Trendafilov, "Integrally closed modules," Godishn. Vissh. Uchebn. Zaved., 13, No. 2, 29-34 (1978).
143. A. A. Tuganbaev, "Slightly projective modules," Sib. Mat. Zh., 21, No. 5, 109-113 (1980).
144. A. A. Tuganbaev, "Modules close to injective," Usp. Mat. Nauk, 32, No. 2, 233-234 (1977).

145. A. A. Tuganbaev, "Modules over hereditary Noetherian primary rings," Usp. Mat. Nauk, 32, No. 4, 267-268 (1977).
146. A. A. Tuganbaev, "Quasiprojective modules," Sib. Mat. Zh., 21, No. 3, 177-183 (1980).
147. A. A. Tuganbaev, "Structure of modules close to injective," Sib. Mat. Zh., 18, No. 4, 890-898 (1977).
148. A. A. Tuganbaev, "Quasiinjective and slightly injective modules," Vestn. Mosk. Gos. Univ., Mat., Mekh., No. 2, 61-64 (1977).
149. A. A. Tuganbaev, "Structure of modules close to projective," Mat. Sb., 106, No. 4, 554-565 (1978).
150. A. A. Tuganbaev, "Pseudoinjective modules and extension of automorphisms," Tr. Sem. im. I. G. Petrovskogo, Mosk. Gos. Univ., No. 4, 241-248 (1978).
151. A. A. Tuganbaev, "Characterizations of rings, using slightly injective and slightly projective modules," Vestn. Mosk. Gos. Univ., No. 3, 48-51 (1979).
152. A. A. Tuganbaev, "Slightly projective modules," Vestn. Mosk. Gos. Univ., No. 5, 43-47 (1979).
153. A. A. Tuganbaev, "Self-injective rings," Izv. Vyssh. Uchebn. Zaved., Mat., No. 12, 71-74 (1980).
154. A. A. Tuganbaev, "Rings, all of whose quotient rings are slightly injective," Usp. Mat. Nauk, 35, No.2, 223-224 (1980).
155. A. A. Tuganbaev, "Rings, over which each module is a direct sum of distributive modules," Vestn. Mosk. Gos. Univ., No. 1, 61-64 (1980).
156. A. A. Tuganbaev, "Distributive Noetherian rings," Vestn. Mosk. Gos. Univ., No. 2, 287-290 (1980).
157. A. A. Tuganbaev, "Distributive modules," Usp. Mat. Nauk, 35, No. 5, 245-246 (1980).
158. E. I. Tebyrtse, "Simple torsions of the category of modules," Mat. Issled. (Kishinev), 44, 104-108 (1977).
159. L. V. Tyukavkin, "Commutative subrings with flat modules," Vestn. Mosk. Gos. Univ., No. 5, 60-62 (1978).
160. L. V. Tyukavkin, "Axiomatizability of the class of irreducible modules," Moscow State Univ. (1980) (Manuscript deposited in VINITI, May 30, 1980, No. 2174-80 Dep).
161. C. Faith, Algebra: Rings, Modules, and Categories [Russian translation], Vol. 1, 2, Mir, Moscow (1977).
162. G. L. Fel'dman, "Global dimensions of general rings of differential operators," Usp. Mat. Nauk, 29, No. 5, 245-246 (1974).
163. L. Fuchs, Infinite Abelian Groups, Vol. 2, Academic Press (1973).
164. V. K. Kharchenko, "Actions of groups and Lie algebras on noncommutative rings," Usp. Mat. Nauk, 35, No. 2, 67-90 (1980).
165. A. Ya. Khelemskii, "Lowest values assumed by the global homological dimension of functional Banach algebras," Tr. Seminara im. I. G. Petrovskogo Mosk. Gos. Univ., No. 3, 223-242 (1978).
166. I. P. Shestakov, "Irreducible representations of alternative algebras," Mat. Zametki, 26, No. 5, 673-686 (1979).
167. Third All-Union Symposium on Theory of Rings, Algebras and Modules. Abstracts of Discussions [in Russian], Tartus. Un-t, Inst. Mat. Sib. Otd. Akad. Nauk SSSR, Mosk. Univ., Tartu (1976).
168. Fourth All-Union Symposium on Theory of Rings, Algebras, and Modules [in Russian], Inst. Mat. Vychisl. Tsentrom Akad. Nauk Mold.SSR, Kishinev (1980).
169. Fourteenth All-Union Algebraic Conference. Abstracts of Reports. Part I. Groups. Algebraic Systems. Part II. Rings. Algebraic Systems [in Russian], Inst. Mat. Sib. Otd. Akad. Nauk SSSR, Novosibirskii Gos. Univ., Novosibirsk (1977).
170. Fifteenth All-Union Algebraic Conference, July 3-6, 1979. Abstracts of Reports [in Russian], Minvyz RSFSR, Krasnoyarsk. Gos. Univ., Inst. Mat. Sib. Otd. Akad. Nauk SSSR, Vych. Tsentr. Sib. Otd. Akad. Nauk SSSR, Part I, Groups, Part II, Rings. Algebraic Systems, Krasnoyarsk (1979).
171. L. Abellanas and L. M. Alonsi, "On the Gelfand–Kirillov conjecture," Commun. Math. Phys., 43, No. 1, 69-71 (1975).
172. V. K. Agrawala and Chong-Yun Chao, "Equalities and inequalities for ranks of modules," Linear Multilinear Algebra, 6, No. 4, 307-315 (1978).
173. J. Ahsan, "A note on direct sums of quasiinjective modules," Punjab Univ. J. Math. (Lahore), 7, 39-43 (1974).
174. J. Ahsan, "Modules over qc-rings," Stud. Sci. Math. Hungar., 9, Nos. 3-4, 321-325 (1974).
175. J. Ahsan, "Rings, all of whose ideals are finitely embedded," Stud. Sci. Math. Hungar., 9, Nos. 3-4, 327-330 (1974).
176. J. Ahsan, "A note on rings all of whose semisimple cyclic modules are quasiinjective," Atti Accad. Naz.-Lincei Rend. Cl. Sci. Fis., Mat. Natur., 59, No. 6, 682-684 (1975).

177. J. Ahsan, "Homomorphic images of certain quasiinjective modules," Boll. Unione Mat. Ital., 13A, No. 1, 101-109 (1976).
178. J. Ahsan, "Completely hereditary rings," Atti Accad. Naz. Lincei Rend. Cl. Sci. Fis., Mat. Natur., 63, Nos. 3-4, 159-163 (1977(1978)).
179. J. Ahsan, "Semilocal rings and σ-cyclic modules," Math. Jpn., 25, No. 1, 117-124 (1980).
180. J. Ahsan, "Semilocal rings and quasiprojective modules," Recz. Pil. Tow. Mat., 21, No. 1, 5-7 (1980).
181. S. Alamelu, "On quasiinjective modules over Noetherian rings," J. Indian Math. Soc., 39, Nos. 1-4, 121-130 (1975).
182. V. Albis-Gonzalez and R. K. Markanda, "Ordres Euclidiens d'algèbres arithmétiques," C. R. Acad. Sci., 284, No. 23, A1485-A1486 (1977).
183. V. Albis-Gonzalez and R. K. Markanda, "Rings of fractions of Euclidean rings," Commun. Algebra, 6, No. 4, 353-360 (1978).
184. T. Albu, "Sur la dimension de Gabriel des modules," in: Algebra-Berichte. Bericht Nr. 21, Verlag Uni-Druck, München (1974), pp. 1-27.
185. T. Albu and C. Năstăsescu, "Modules sur les anneaux de Krull," Rev. Roum. Math. Pures Appl., 21, No. 2, 133-142 (1976).
186. J. L. Alperin, "Diagrams for modules," J. Pure Appl. Algebra, 16, No. 2, 111-119 (1980).
187. J. L. Alvarez, "Operadores de derivacion diferenciacion en modulos," Gac. Mat., 27, Nos. 5-6, 130-135 (1975).
188. I. Amin, "Note on generalized semigroups and rings," Proc. Math. Soc. Egypt, No. 45, 9-17 (1978).
189. S. A. Amitsur and L. W. Small, "Polynomial over division rings," Isr. J. Math., 31, Nos. 3-4, 353-358 (1978).
190. D. D. Anderson, "Artinian modules are countably generated," 38, No. 1, 5-6 (1977).*
191. D. D. Anderson, "The existence of dual modules," Proc. Am. Math. Soc., 55, No. 2, 258-260 (1976).
192. D. F. Anderson, "Projective modules over subrings of k[X, Y]," Trans. Am. Math. Soc., 240, 317-328 (1978).
193. D. F. Anderson, "The chinese remainder theorem and the invariant basis property," Can. Math. Bull., 21, No. 3, 361-362 (1978).
194. D. F. Anderson, "Projective modules over subrings of k[x, y] generated by monomials," Pac. J. Math., 79, No. 1, 5-17 (1978).
195. F. W. Anderson, "Simple injective modules," Math. Scand., 43, No. 2, 204-240 (1978).
196. V. A. Andrunakievic, Ju. M. Rjabuhin, K. K. Kracilov, and E. I. Tebyrce, "Erbliche Radikale von Algebren. (Torsionen von Algebren)," Stud. Alg. Anwend., 1, 1-8 (1976).
197. Pham Ngoc Anh, "On the theory of linearly compact rings. I," Beitr. Algebra und Geom. Wiss. Beitr. M.-Luther-Univ. Halle Wittenberg, 1980 M, No. 15, 13-27.
198. Pham Ngoc Anh and R. Wiegandt, "Linearly compact semisimple rings and regular modules," Math. Jpn., 23, No. 4, 335-338 (1978).
199. Kanroku Aoyama, "On the commutativity of torsion and injective hull," Hiroshima Math. J., 6, No. 3, 527-537 (1976).
200. E. Armendariz, "Rings with an almost Noetherian ring of fractions," Math. Scand., 41, No. 1, 15-18 (1977).
201. E. Armendariz, "Rings with DDC on essential left ideals," Commun. Algebra, 8, No. 3, 299-308 (1980).
202. E. Armendariz and J. W. Fischer, "Idealizers in rings," J. Algebra, 39, No. 2, 551-562 (1976).
203. D. M. Arnold, "General and direct sum decompositions of torsion free modules," Lect. Notes Math., 616, 197-218 (1977).
204. J. Arnold, R. Gilmer, and W. Heinzer, "Some countability conditions on commutative rings," Ill. J. Math., 21, No. 3, 648-665 (1977).
205. Sh. Asano and K. Motose, "On QF-2 algebras with commutative radicals," Math. J. Okyama Univ., 22, No. 1, 17-20 (1980).
206. K. E. Aubert and I. Fleischer, "Tensor products of ideal systems and their modules," Pac. J. Math., 74, No. 2, 285-296 (1978).
207. M. Auslander, "Almost split sequences," Lect. Notes Math., 438, 1-8 (1975).
208. M. Auslander, "Functors and morphisms determined by objects," in: Representation Theory of Algebras. Proc. Philadelphia Conference, New York–Basel (1978), pp. 1-244.
209. M. Auslander, "Applications of morphisms determined by modules," in: Representation Theory of Algebras. Proc. Philadephia Conference, New York–Basel (1978), pp. 245-327.

* Journal citation missing in Russian original — Publisher.

210. M. Auslander, "Preprojective modules over Artin algebras," in: Ring Theory (Proc. Antwerp Confer., 1978) (1979), pp. 361-384.
211. M. Auslander, M. I. Bautista, I. Platzeck, I. Reiten, and S. O. Smalo, "Almost split sequences whose middle term has at most two indecomposable summands," Can. J. Math., 31, No. 5, 942-960 (1979).
212. M. Auslander, M. I. Platzeck, and I. Reiten, "Periodic modules over weakly symmetric algebras," J. Pure Appl. Algebra, 11, Nos. 1-3, 279-291 (1977-1978).
213. M. Auslander and I. Reiten, "Stable equivalence of dualizing R-varieties. II. Hereditary dualizing R-varieties," Adv. Math., 17, No. 2, 93-121 (1975).
214. M. Auslander and I. Reiten, "Stable equivalence of dualizing R-varieties, III. Dualizing R-varieties stably equivalent to hereditary dualizing R-varieties," Adv. Math., 17, No. 2, 122-142 (1975).
215. M. Auslander and I. Reiten, "Stable equivalence of dualizing R-varieties. IV. Higher global dimension," Adv. Math., 17, No. 2, 143-166 (1975).
216. M. Auslander and I. Reiten, "Representation theory of artin algebras. III. Almost split sequences," Commun. Algebra, 3, No. 3, 239-294 (1975).
217. M. Auslander and I. Reiten, "Almost split sequences," Lect. Notes Math., 438, 9-19 (1975).
218. M. Auslander and I. Reiten, "On the representation type of triangular matrix rings," J. London Math. Soc., 12, No. 3, 371-382 (1976).
219. Ch. Ayoub, "Anneaux locaux et unisériels," Semin. P. Dubreil. Algebre. Univ. Paris, 1971-1972, 25, No. 1, 14/1-14/4 (1973).
220. Ch. Ayoub, "Conditions for a ring to be fissile," Acta Math. Acad. Sci. Hungar., 30, Nos. 3/4, 233-237 (1977).
221. G. Azumaya, "Some aspects of Fuller's theorem," Lect. Notes Math., 700, 34-45 (1979).
222. G. Baccella, "Sulla functorialita dell' inviluppo $\mathfrak{F}$-iniettivo," Ann. Univ. Ferrara, 22, 107-113 (1976).
223. J. W. Ballard, "Injective modules for restricted enveloping algebras," Math. Z., 163, No. 1, 57-64 (1978).
224. B. Ballet, "Topologies linéaires et modules artiniens," Thèse Doct. Sci. Math., Univ. Paris-Sud (1971).
225. B. Ballet, "Topologies linéaires et modules artiniens," J. Algebra, 41, No. 2, 365-397 (1976).
226. D. Ballew, "Cyclic ideals in order," Riv. Mat. Univ. Parma, 3, 1-16 (1977(1978)).
227. B. Banaschewski and E. Nelson, "On the nonexistence of injective near ring modules," Can. Math. Bull., 20, No. 1, 17-23 (1977).
228. H. Bass, "Ranks of projective ZG-modules," Queen Pap. Pure Appl. Math., No. 42, 63-69 (1975).
229. W. Baur, "$\aleph_0$-categorical modules," J. Symbol. Log., 40, No. 2, 213-230 (1975).
230. S. Bazzoni, "On the algebraic compactness of some complete modules," Rend. Semin. Mat. Univ. Padova, 56, 161-167 (1976(1978)).
231. S. Bazzoni, "Dualitá sul completamento naturale di un anello noetheriano," Rend. Semin. Mat. Univ. Padova, 55, 63-80 (1976(1977)).
232. S. Bazzoni, "Pontryagin type dualities over commutative rings," Ann. Mat. Pura Appl., No. 121, 373-385 (1979).
233. J. A. Beachy, "Perfect quotient functors," Commun. Algebra, 2, 403-427 (1974).
234. J. A. Beachy, "On Morita's localization," J. Algebra, 38, No. 1, 225-243 (1975).
235. J. A. Beachy, "Some aspects of noncommutative localization," Lect. Notes Math., 545, 2-31 (1976).
236. J. A. Beachy, "On the torsion theoretic support of a module," Hokkaido Math. J., 6, No. 1, 16-27 (1977).
237. J. A. Beachy, "Sur les anneaux FBN à gauche," Ann. Sci. Math. Quebec, 1, No. 1, 59-62 (1977).
238. J. A. Beachy, "Injective modules with both ascending and descending chain conditions on annihilators," Commun. Algebra, 6, No. 17, 1777-1788 (1978).
239. J. A. Beachy, "Fully left bounded left Noetherian rings," Lect. Notes Math., 700, 217 (1979).
240. J. A. Beachy, "On inversive localization," Lect. Notes Math., 700, 46-56 (1979).
241. J. A. Beachy, "On localization at an ideal," Can. Math. Bull., 22, No. 4, 397-401 (1979).
242. J. A. Beachy and W. D. Blair, "Localization at semiprime ideals," J. Algebra, 38, No. 2, 309-314 (1976).
243. J. A. Beachy and W. D. Blair, "Finitely annihilated modules and orders in Artinian rings," Commun. Algebra, 6, No. 1, 1-34 (1978).
244. I. Beck and P. Trosborg, "A note on free direct summands," Math. Scand., 42, No. 1, 34-38 (1978).
245. Ernst-August Behrens, Ringtheorie, B. I.-Wissenschafts-verlag, Mannheim e.s. (1975).
246. W. R. Belding, "Bases for the positive cone of a partially ordered module," Trans. Am. Math. Soc., 235, 305-313 (1978).

247. H. Bernecker, "Flatness and absolute purity applying functor categories to ring theory," J. Algebra, 44, No. 2, 411-419 (1977).
248. P. H. Berridge and M. J. Dunwoody, "Nonfree projective modules for torsion-free groups," J. London Math. Soc., 19, No. 3, 433-436 (1979).
249. F. Berrondo, "Sur le corps des fractions d'un anneau de séries formelles généralisées," C. R. Acad. Sci., 284, A1419-A1432 (1977).
250. D. Berry, "Modules whose cyclic submodules have finite dimension," Can. Math. Bull., 19, No. 1, 1-6 (1976).
251. S. M. Bhatwadecar, "On the global dimension of some filtered algebras. II," J. Pure Appl. Algebra, 12, No. 1, 1-14 (1978).
252. L. Bican, "General concept of injectivity," Stud. Alg. Anwend., 1, 37-40 (1976).
253. L. Bican, "Corational extensions and pseudo-projective modules," Acta Math. Acad. Sci. Hung., 28, Nos. 1-2, 5-11 (1976).
254. L. Bican, "Kulikov's criterion for modules," J. Reine Angew. Math., 288, 154-159 (1976).
255. L. Bican, "The structure of primary modules," Acta Univ. Carol., Math. Phys., 17, No. 2, 3-12 (1976).
256. L. Bican, P. Jambor, T. Kepka, and P. Nemec, "Centrally splitting radicals," Comment. Math. Univ. Carol., 17, No. 1, 31-47 (1976).
257. L. Bican, P. Jambor, T. Kepka, and P. Nemec, "Hereditary and cohereditary preradicals," Czechosl. Mat. J., 26, No. 2, 192-206 (1976).
258. L. Bican, P. Jambor, T. Kepka, and P. Nemec, "A note on test modules," Comment. Math. Univ. Carol., 17, No. 2, 345-355 (1976).
259. L. Bican, P. Jambor, T. Kepka, and P. Nemec, "Generation of preradicals," Czechosl. Mat. J., 27, No. 1, 155-166 (1977).
260. L. Bican, P. Jambor, T. Kepka, and P. Nemec, "Pseudoprojective modules," Math. Slovaca, 29, No.2, 107-115 (1979).
261. L. Bican, P. Jambor, T. Kepka, and P. Nemec, "Prime and coprime modules," Fund. Math., 107, No. 1, 33-45 (1980).
262. R. Bieri and R. Strebel, "Soluble groups with coherent group rings," London Math. Soc. Lect. Note Ser., No. 36, 235-240 (1979).
263. A. Bigard, "Theories de torsion et f-modules," Semin. P. Dubreil. Algèbre. Univ. Paris, 26, 5/1-5/12 (1972-1973).
264. A. Bigard, K. Keimel, and S. Wolfenstein, "Groupes et anneaux rêticules," Lect. Notes Math., 608 (1977).
265. G. F. Birkenmeier, "On the cancellations of quasiinjective modules," Commun. Algebra, 4, No. 2, 101-109 (1976).
266. G. F. Birkenmeier, "Self-injective rings and the minimal direct summand containing the nilpotents," Commun. Algebra, 4, No. 8, 705-721 (1976).
267. G. F. Birkenmeier, "Modules which are subisomorphic to injective modules," J. Pure Appl. Algebra, 13, No. 2, 169-177 (1978).
268. P. E. Bland, "Relatively flat modules," Bull. Austral. Math. Soc., 13, No. 3, 375-387 (1975).
269. P. E. Bland, "Remarks on strongly M-projective modules," Ill. J. Math., 23, No. 1, 167-174 (1979).
270. T. S. Blyth, Module Theory. An Approach to Linear Algebra, Oxford Univ. Press (1977).
271. M. Boisen and Ph. Sheldon, "Pre-Prüfer rings," Pac. J. Math., 58, No. 2, 331-344 (1975).
272. K. Bongartz and C. Riedtmann, "Algèbres stablement héréditaires," C. R. Acad. Sci., 288, No. 15, A703-A706 (1979).
273. M. Boratynski, "A change of rings theorem and the Artin–Rees property," Proc. Am. Math. Soc., 53, No. 2, 307-310 (1975).
274. M. Boratynski, "Generating ideals up to radical," Arch. Math., 33, No. 5, 423-429 (1980).
275. A. Bouvier, "Sur les anneaux principaux," Acta Math. Acad. Sci. Hung., 27, Nos. 3-4, 231-242 (1976).
276. A. K. Boyle, "Injectives containing no proper quasiinjective submodules," Commun. Algebra, 4, No. 8, 775-785 (1976).
277. A. K. Boyle, "The large condition for rings with Krull dimension," Proc. Am. Math. Soc., 72, No. 1, 27-32 (1978).
278. A. K. Boyle and E. H. Feller, "Smooth Noetherian modules," Commun. Algebra, 4, No. 7, 617-637 (1976).
279. A. K. Boyle and E. H. Feller, "Semicritical modules and k-primitive rings," Lect. Notes Math., 700, 57-74 (1979).

280. A. K. Boyle and K. R. Goodearl, "Rings over which certain modules are injective," Pac. J. Math., 58, No. 1, 43-53 (1975).
281. W. Brandal, "On h-local integral domains," Trans. Am. Math. Soc., 206, 201-212 (1975).
282. W. Brandal, "Constructing Bezout domains," Rocky Mountain J. Math., 6, No. 3, 383-399 (1976).
283. W. Brandal, "Commutative rings whose finitely generated modules decompose," Lect. Notes Math., 723 (1979).
284. W. Brandal and M. Wiegand, "Reduced rings whose finitely generated modules decompose," Commun. Algebra, 6, No. 2, 195-201 (1978).
285. Sh. Brenner and C. M. Ringel, "Pathological modules over tame rings," J. London Math. Soc., 14, No. 2, 207-215 (1976).
286. J. W. Brewer and D. L. Costa, "Contracted ideals and purity for ring extensions," Proc. Am. Math. Soc., 53, No. 2, 271-276 (1975).
287. J. W. Brewer and D. L. Costa, "Projective modules over some non-Noetherian polynomial rings," J. Pure Appl. Algebra, 13, No. 2, 157-163 (1978).
288. J. W. Brewer, E. A. Rutter, and J. J. Watkins, "Coherence and weak global dimension of R[[X]] when R is von Neumann regular," J. Algebra, 46, No. 1, 278-289 (1977).
289. W. Brockmann, "Projektive Moduln über semilokalen Ringen," Diss. Dokt. Naturwiss. Abt. Math., Ruhr-Univ. Bochum (1975).
290. W. Brockmann, "Struktur projektiver Moduln über semilokalen Ringen," Arch. Math., 29, No. 4, 406-409 (1977).
291. J. G. Brookshear, "Projective ideals in rings of continuous functions," Pac. J. Math., 71, No. 2, 313-344 (1977).
292. J. G. Brookshear, "On projective prime ideals in C(X)," Proc. Am. Math. Soc., 69, No. 1, 203-204 (1978).
293. K. A. Brown, "Artinian quotient rings of group rings," J. Algebra, 49, No. 1, 63-80 (1977).
294. K. A. Brown, "The singular ideals of group rings. I," Q. J. Math., 28, No. 109, 41-60 (1977).
295. K. A. Brown, "The singular ideals of group rings. II," Q. J. Math., 29, No. 114, 187-197 (1978).
296. K. A. Brown, "Quotient rings of group rings," Compos. Math., 36, No. 3, 243-254 (1978).
297. K. A. Brown and J. Lawrence, "Injective hulls of group rings," Pac. J. Math., 85, No. 2, 323-343 (1979).
298. K. A. Brown, T. H. Lenagan, and J. T. Stafford, "Weak ideal invariance and localization," J. London Math. Soc., 21, No. 1, 53-61 (1980).
299. G. W. Brumfiel, Partially Ordered Rings and Semialgebraic Geometry, London Math. Soc. Lect. Note Series, No. 37 (1979).
300. W. Bruns, " 'Jede' endliche freie Auflösung ist freie Auflösung eines von drei Elementen erzeugten Ideals," J. Algebra, 39, No. 2, 429-439 (1976).
301. W. Bruns, "Zur Einbettung von Moduln in zyklische Moduln und direkte Summen zyklischer Moduln," J. Algebra, 53, No. 1, 239-252 (1978).
302. W. Bruns, "Basische Elemente in Steinschen Moduln," Monatsh. Math., 85, No. 4, 283-295 (1978).
303. W. Bruns and U. Vetter, "Die Verallgemeinerung eines Satzes von Bourbaki und einige Anwendungen," Manuscr. Math., 17, No. 4, 317-325 (1975).
304. Ju. Brzezinski, "Lattices of normally indecomposable modules," Proc. Am. Math. Soc., 68, No. 3, 271-276 (1978).
305. A. Buium, "Asupra algebrelor cu modulele de differentiale Projective," Stud. si Cerc. Mat., 32, No. 2, 135-151 (1980).
306. A. Bulaszewska and J. Krempa, "On epimorphisms in the category of all associative rings," Bull. Acad. Pol. Sci. Ser. Sci. Math., Astron. Phys., 23, No. 11, 1153-1159 (1975(1976)).
307. W. Burgess and R. Raphael, "Sur deux notions de complětude dans les anneaux semipremiers," C. R. Acad. Sci., 283, No. 13, A927-A929 (1976).
308. M. C. R. Butler, "On the structure of modules over certain augmented algebras," Proc. London Math. Soc., 21, No. 3, 277-295 (1970).
309. M. C. R. Butler, "The construction of almost split sequences. I," Proc. London Math. Soc., 40, No. 1, 72-86 (1980).
310. K. A. Byrd, "Right self-injective rings whose essential right ideals are two-sided," Pac. J. Math., 82, No. 1, 23-41 (1979).
311. L. Caire and U. Cervuti, "Fuzzy relational spaces and algebraic structures," Rend. Semin. Mat. Univ. Politechn. Torino, 35, 443-461 (1976(1977).
312. V. Camillo, "Distributive modules," J. Algebra, 36, No. 1, 16-25 (1975).

313. V. Camillo, "Modules whose quotients have finite Goldie dimension," Pac. J. Math., 69, No. 2, 337-338 (1977).
314. V. Camillo, "On a conjecture of Herstein," J. Algebra, 50, No. 2, 274-275 (1978).
315. V. Camillo, "Homological independence of injective hulls of simple modules over commutative rings," Commun. Algebra, 6, No. 14, 1459-1469 (1978).
316. V. Camillo and K. R. Fuller, "Rings whose faithful modules are flat over their endomorphism rings," Arch. Math., 27, No. 5, 522-525 (1976).
317. V. Camillo and K. R. Fuller, "A note on Loewy rings and chain conditions on primitive ideals," Lect. Notes Math., 700, 75-86 (1979).
318. V. Camillo and J. Zelmanowitz, "On the dimension of a sum of modules," Commun. Algebra, 6, No. 4, 345-352 (1978).
319. J. M. Campbell, "Torsion theories for modules over a triangular matrix ring," Bull. Austral. Math. Soc., 19, No. 2, 299-300 (1978).
320. J. F. Carlson, "Free modules over some modular group rings," J. Austral. Math. Soc., 21, Part 1, 49-55 (1976).
321. J. F. Carlson, "Almost free modules over modular group algebras," J. Algebra, 41, No. 2, 243-254 (1976).
322. J. F. Carlson, "Cyclic modules over some modular group algebras," Stud. Sci. Math. Hungarica, 11, Nos. 3/4, 324-333 (1976).
323. J. F. Carlson, "Periodic modules over modular group algebras," J. London Math. Soc., 15, No. 3, 431-436 (1977).
324. J. F. Carlson, "Periodic modules with large periods," Proc. Am. Math. Soc., 76, No. 2, 209-215 (1979).
325. R. Carlson, "Malcev–Moduln," J. Reine Angew. Math., 281, 199-210 (1976).
326. M. Carral, "Modules de type fini sur un anneau mou," C. R. Acad. Sci., 281, No. 4, A129-A132 (1975).
327. J. E. Carrig, "The homological dimensions of symmetric algebras," Trans. Am. Math. Soc., 236, 275-285 (1978).
328. J. E. Carrig and W. V. Vasconcelos, "Projective ideals in rings of dimension one," Proc. Am. Math. Soc., 71, No. 2, 169-173 (1978).
329. A. B. Carson, "Representation of irregular rings of finite index," J. Algebra, 39, No. 2, 512-526 (1976).
330. A. B. Carson, "Coherent polynomial rings over regular rings of finite index," Pac. J. Math., 74, No. 2, 327-332 (1978).
331. D. W. Carter, "Projective module groups of $SL_n(Z)$ and $GL_n(Z)$," J. Pure Appl. Algebra, 16, No. 1, 49-54 (1980).
332. G. Cauchon, "Les T-anneaux, la condition (H) de Gabriel et ses consequences," Commun. Algebra, 4, No. 1, 11-50 (1976).
333. G. Cauchon, "Anneaux de polynomes essentiellement bornes," in: Ring Theory Proc. Antwerp Conf., 1978, New York–Basel (1979), pp. 27-42.
334. G. Cauchon and L. Lesieur, "Localisation classique en un ideal premier d'un anneau noetherian à gauche," Commun. Algebra, 6, No. 11, 1091-1108 (1978).
335. M. P. Cavalliero, "Sui moduli liberi e proiettivi graduati," Publ. Inst. Mat. Univ. Genova, No. 160 (1976).
336. M. P. Cavalliero, "Sui moduli liberi e prieffivi graduati," Boll. Unione Mat. Ital., A14, No. 1, 82-91 (1977).
337. M. Chamarie, "Ordres maximaux et R-ordres maximaux," C. R. Acad. Sci., A285-B285, No. 16, 989-991 (1977).
338. M. Chamarie, "Anneaux de polynomes et ordres maximaux," C. R. Acad. Sci., 287, No. 8, 599-601 (1978).
339. M. Chamarie, "Ordres maximaux et R-ordres maximaux," J. Algebra, 58, No. 1, 148-156 (1979).
340. M. Chamarie and A. Hudry, "Anneaux noetheriens à droite entiers sur leurs centres," C. R. Acad. Sci., 283, No. 15, A1011-A1012 (1971).
341. M. Chamarie and A. Hudry, "Anneaux noetheriens à droite entiers sur un sous-anneau de leur centre," Commun. Algebra, 6, No. 2, 203-222 (1978).
342. M. Chamarie and G. Maury, "Un theorème de l'idéal à gauche principal dans les anneaux premiers, noethériens, à identité polynomial dont the centre est un domaine de Krull," C. R. Acad. Sci., AB286, No. 14, A609-A611 (1978).

343. V. R. Chandran, "On conjecture of Hyman Bass," Pure Appl. Math. Sci., 4, Nos. 1/2, 125-131 (1976).
344. A. W. Chatters, "Two results on PP rings," Commun. Algebra, 4, No. 9, 881-891 (1976).
345. A. W. Chatters, "A note on Noetherian orders in Artinian rings," Glasgow Math. J., 20, No. 2, 125-128 (1979).
346. A. W. Chatters, A. W. Goldie, C. R. Hajarnavis, and T. H. Lenagan, "Reduced rank in Noetherian rings," J. Algebra, 61, No. 2, 582-589 (1979).
347. A. W. Chatters and C. R. Hajarnavis, "Rings in which every complement right ideal is a direct summand," Q. J. Math., 28, No. 109, 61-80 (1977).
348. A. W. Chatters, C. R. Hajarnavis, and N. C. Norton, "The Artin radical of a Noetherian ring," J. Austral. Math. Soc., A23, No. 3, 379-384 (1977).
349. A. W. Chatters and J. C. Robson, "Decomposition of orders in semiprimary rings," Commun. Algebra, 8, No. 6, 517-532 (1980).
350. A. W. Chatters and P. F. Smith, "A note on hereditary rings," J. Algebra, 44, No. 1, 181-190 (1977).
351. T. J. Cheatham and J. R. Smith, "Regular and semisimple modules," Pac. J. Math., 65, No. 2, 315-323 (1976).
352. G. Cherlin, Model Theoretic Algebra. Selected Topics, Lect. Notes Math., 521 (1976).
353. K. Chiba and H. Tominaga, "Note on strongly regular rings and P_1-rings," Proc. Jpn. Acad., 51, No. 4, 259-261 (1975).
354. A. V. Chiplunkar, "Global dimension of algebra of differential operators," J. Indian Math. Soc., 38, Nos. 1-4, 1-17 (1974(1975)).
355. D. P. Choudhury and K. Tewary, "Tensor parities, cyclic quasiprojectivies and cocyclic copurity," Commun. Algebra, 7, No. 15, 1559-1572 (1979).
356. L. G. Chouinard, "Projectivity and relative projectivity over group rings," J. Pure Appl. Algebra, 7, No. 3, 287-302 (1976).
357. J. Chuchel and N. Eggert, "The complete quotient ring of images of semilocal Prufer domains," Can. J. Math., 29, No. 5, 914-927 (1977).
358. L. W. Chung and J. Luh, "A characterization of semisimple Artinian rings," Mat. Jpn., 21, No. 3, 227-228 (1976).
359. B. S. Chwe and J. Neggers, "Some classes of rings defined by properties of modules," Rev. Univ. Mat. Argent., No. 1, 54-59 (1976(1977)).
360. M. Cipolla, "Discesa fedelmente piatta dei moduli," Rend. Circ. Mat. Palermo, 25, Nos. 1-2, 43-46 (1976).
361. T. G. Clarke, "Embedding flat modules in filtered unions of projectives," Commun. Algebra, 5, No. 3, 293-303 (1977).
362. J. M. Cohen, "On the number of generators of a module," J. Pure Appl. Algebra, 12, No. 1, 15-19 (1978).
363. J. M. Cohen and S. Montgomery, "The normal closure of semiprime rings," in: Ring Theory. Proc. Antwerp Conf., 1978, New York—Basel (1979), pp. 43-49.
364. P. M. Cohn, "Numerateurs et dénominateurs dans le corps de fractions d'un semifir," Semin. P. Dubreil. Algèbre Univ. Pierre et Marie Curie, 28, 28/1-28/7 (1974-1975).
365. P. M. Cohn, "A construction of simple principal right ideal domains," Proc. Am. Math. Soc., 66, No. 2, 217-222 (1977).
366. P. M. Cohn, "Full modules over semifirs," Publ. Math., 24, Nos. 3-4, 305-310 (1977).
367. P. M. Cohn, "The affine scheme of a general ring," Lect. Notes Math., 753, 197-211 (1979).
368. P. M. Cohn and W. Dicks, "Localization in semifirs. II," J. London Math. Soc., 13, No. 3, 411-418 (1976).
369. L. R. Colavita, "Sobre una generalizacion del teorema de descomposicion primaria de grupos a ciertas teorias de torsion en anillos commutativos," An. Inst. Mat. Univ. Nac. Auton., Mex., 18, No. 1, 7-12 (1978).
370. L. R. Colavita, F. C. Raggi, and M. J. Rios, "Sobre filtros estables de Gabriel. V. (Algunas interpretaciones topologicas respecto a filtros de Gabriel)," An. Inst. Mat. Univ. Nac. Auton. Mex., 17, No. 1, 1-16 (1977).
371. L. R. Colavita and Montes J. Rios, "Sobre filtros estable de Gabriel. VI. (Filtros neterianos)," An. Inst. Mat. Univ. Nac. Auton. Mex., 18, No. 1, 13-25 (1978).
372. N. Conze-Berline, "Sur certains quotients de l'algebre enveloppante d'un algèbre de Lie semi-simple," Lect. Notes Math., 466, 31-37 (1975).
373. D. Costa, "Unique factorization in modules and symmetric algebras," Trans. Am. Math. Soc., 224, No. 2, 267-280 (1976).

374. M. Coste, "Localization, spectra and sheaf representation," Lect. Notes Math., 753, 212-238 (1979).
375. Gh. Costovici, "General topological frame for Zariski's topologies," Bull. Inst. Politeh. Iasi, 24, Sec. I, Nos. 3-4, 9-12 (1978).
376. F. Couchot, "Sur le dual de la notion de présentation finie," C. R. Acad. Sci., 281, No. 23, A1005-A1008 (1975).
377. F. Couchot, "Topologie cofinie et modules pur-injectifs," C. R. Acad. Sci., 283, No. 6, A277-A280 (1976).
378. F. Couchot, "Anneaux auto-fp-injectifs," C. R. Acad. Sci., 284, No. 11, A579-A582 (1977).
379. F. Couchot, "Sous-modules purs et modules de type cofini," Lect. Notes Math., 641, 198-208 (1978).
380. F. Couchot, "Classes d'anneaux contenant les V-anneaux et les anneaux absolument plats," Lect. Notes Math., 740, 170-183 (1979).
381. R. Couture and M. Lavoie, "Réciproque du théoreme des bases sur un espace vectoriel," Can. Math. Bull., 18, No. 5, 749-751 (1975).
382. S. H. Cox, Jr., "The preparation theorem and the freeness of A[[X]]/J," Proc. Am. Math. Soc., 61, No. 2, 227-231 (1976).
383. J. H. Cozzens, "Maximal orders and reflexive modules," Trans. Am. Math. Soc., 219, 323-336 (1976).
384. J. H. Cozzens, "The structure of localizable algebras having finite global dimension," in: Ring Theory (Proc. Antwerp Conf., 1978) (1979), pp. 599-612.
385. J. H. Cozzens and F. L. Sandomierski, "Reflexive primes, localization and primary decomposition in maximal orders," Proc. Am. Math. Soc., 58, 44-50 (1976).
386. J. H. Cozzens and F. L. Sandomierski, "Maximal orders and localization. I," J. Algebra, 44, No. 2, 319-338 (1977).
387. J. H. Cozzens and F. L. Sandomierski, "Localization at a semiprime ideal of a right Noetherian ring," Commun. Algebra, 5, No. 7, 707-726 (1977).
388. W. Crawley, "Epimorphisms and H-coextensions," Arch. Math., 30, No. 5, 449-457 (1978).
389. I. Crivei, "c-pure exact sequences of R-modules," Mathematica (RSR), 17, No. 1, 59-65 (1975).
390. I. Crivei, "c-pure injective modules," Mathematica (RSR), 17, No. 2, 167-172 (1975).
391. I. Crivei, "Asupra unei clase de inele," Bul. Sti. Inst. Politehn. Cluj. Ser. Mec., 20, 17-19 (1977).
392. G. D. Crown and J. J. Hutchinson, "On the exactness of the completion functor," Commun. Algebra, 8, No. 1, 1-12 (1980).
393. R. F. Damiano, "Coflat rings and modules," Pac. J. Math., 81, No. 2, 349-369 (1979).
394. R. F. Damiano, "A right PCI ring is right Noetherian," Proc. Am. Math. Soc., 77, No. 1, 11-14 (1979).
395. R. S. Dark, "On hypercentral groups and Artinian modules," J. Algebra, 41, No. 2, 597-599 (1976).
396. Ch. Dartois, Categories Preadditives et Modules, Equisses Math., Fac. Sci. Univ. Paris VII, No. 13 (1971).
397. J. Dauns, "Quotient rings and one-sided primes," J. Reine Angew. Math., 278-279, 205-224 (1975); correction: ibid., 280, 205 (1976).
398. J. Dauns, "Generalized monoform and quasiinjective modules," Pac. J. Math., 66, No. 1, 49-66 (1976).
399. J. Dauns, "Prime modules," J. Reine Angew. Math., 298, 156-181 (1978).
400. B. J. Day, "On topological modules and duality," Cah. Topol. Geom. Diff., 20, No. 3, 297-310 (1979).
401. L. de Munter-Kuyl, "Some invariants for rank three torsion-free modules over a Dedekind domain," Atti Accad. Naz. Lincei Rend. Cl. Sci. Fis., Mat. Natur., 59, No. 5, 349-356 (1975(1976)).
402. L. de Munter-Kuyl, "Isomorphisms of rank two torsion-free modules over a Dedekind domain," Atti Accad. Naz. Lincei Rend. Cl. Sci. Fis. Mat. Natur., 60, No. 4, 351-358 (1976).
403. J. Descovich, "Ringe mit monotoner modul dimension," in: Rings, Modules and Radicals, Amsterdam–London (1973), pp. 153-166.
404. M. Desrochers, "Dimensions globales des extensions de Ore et des algèbres de Weyl," Groupe Etude Algebre. Univ. Pierre et Marie Curie, 1976-1977, 6/01-6/31 (1978).
405. W. Dicks, "Hereditary group rings," J. London Math. Soc., 20, No. 1, 27-38 (1979).
406. W. Dicks, "Groups, trees and projective modules," Lect. Notes Math., 790 (1980).
407. W. Dicks and P. Menal, "The group rings that are semifir," J. London Math. Soc., 19, No. 2, 288-290 (1979).
408. W. Dicks and E. D. Sontag, "Sylvester domains," J. Pure Appl. Algebra, 13, No. 3, 243-275 (1978).
409. Y. Diers, "Spectres et localisations relatifs à un foncteur," C. R. Acad. Sci., 287, No. 15, 985-989 (1978).
410. S. Dinca, "On co-noetherian modules," Stud. Cerc. Math., 25, 643-646 (1973).
411. V. H. Dinh, "Über die Frage der Spalbarkeit von MHP-ringen," Bull. Acad. Pol. Sci. Ser. Sci. Math., Astron. Phys., 23, No. 2, 135-138 (1975).

412. V. H. Dinh, "Über Ringe mit Minimalbedingung für Hauptrechtideale," Acta Math. Acad. Sci. Hungar., 26, Nos. 3-4, 245-250 (1975).
413. V. H. Dinh, "Über Ringe mit Minimalbedingun für Hauptrechtideale. II," Stud. Sci. Math. Hungar., 9, Nos. 3-4, 419-423 (1976).
414. V. H. Dinh, "Über Ringe mit eingeschränkter Minimalbedingung höherer Stufe für Rechtsideale. I," Math. Nachr., 71, 227-235 (1976).
415. V. H. Dinh, "Die Spalbarkeit von MHR-ringen," Bull. Acad. Pol. Sci. Ser. Sci. Math., Astron. Phys., 25, No. 10, 939-941 (1977).
416. V. H. Dinh, "Über Ringe mit eingeschränkter Minimalbedingung höhere Stufe für Rechtsideale," Math. Nachr., 86, 291-307 (1978).
417. V. H. Dinh and A. Widiger, "Über Ringe mit eingeschränkter Minimalbedingung höherer Stufe für Rechtsideale," Math. Nachr., 86, 309-331 (1978).
418. V. Dlab, "Matrix rings as injective hulls of torsionfree tidy rings," Ottawa (1972).
419. V. Dlab and C. M. Ringel, "The representations of tame hereditary algebras," in: Represent. Theory Algebras. Proc. Philadelphia Conf., New York–Basel (1978), pp. 329-353.
420. V. Dlab and C. M. Ringel, "A module theoretical interpretation of properties of the root systems," in: Ring Theory. Proc. Antwerp Conf., 1978, New York–Basel (1979), pp. 435-451.
421. D. Dobbs, "On the weak global dimension of pseudovaluation domains," Can. Math. Bull., 21, No. 2, 159-164 (1978).
422. D. Dobbs, "Coherence, ascent of going down, and pseudovaluation domains," Houston J. Math., 4, No. 4, 551-567 (1978).
423. D. Dobbs, "On flat finitely generated ideals," Bull. Austral. Math. Soc., 21, No. 1, 131-135 (1980).
424. D. Dobbs and I. J. Papick, "When is D+M coherent?" Proc. Am. Math. Soc., 56, 51-54 (1976).
425. D. Dobbs and I. J. Papick, "Flat or open implies going down?" Proc. Am. Math. Soc., 65, No. 2, 370-371 (1977).
426. D. Doman and G. J. Hauptfleisch, "Filtered-injective and coflat modules," Quaest. Math., 3, 33-48 (1978).
427. P. Dowbor and D. Simson, "A characterization of hereditary rings of finite representation type," Bull. Am. Math. Soc., 1, No. 2, 300-302 (1980).
428. P. Dowbor and D. Simson, "Quasi-Artin species and rings of finite representation type," J. Algebra, 63, No. 2, 435-443 (1980).
429. F. Eckstein, "Orders in locally pro-Artinian rings," J. Pure Appl. Algebra, 14, No. 3, 253-258 (1979).
430. G. Eerkes, "Rings of equivalent dominant and codominant dimensions," Proc. Am. Math. Soc., 48, No. 2, 297-306 (1975).
431. N. Eggert, "Rings whose overrings are integrally closed in their complete quotient ring," J. Reine Angew. Math., 282, 88-95 (1976).
432. G. Ehrlich, "Units and one-sided units in regular rings," Trans. Am. Math. Soc., 216, 81-90 (1976).
433. D. Eisenbud, "Solution du problème de Serre par Quillen-Suslin," Lect. Notes Math., 586, 9-19 (1977).
434. P. C. Eklof, "Homological algebra and set theory," Trans. Am. Math. Soc., 227, 207-226 (1977).
435. E. Enochs, "A note on absolutely pure modules," Can. Math. Bull., 19, No. 3, 361-362 (1976).
436. M. W. Evans, "Extensions of semihereditary rings," J. Austral. Math. Soc., A23, No. 3, 333-339 (1977).
437. M. W. Evans, "Extended semihereditary rings," J. Austral. Math. Soc., A26, No. 4, 465-474 (1978).
438. A. Facchini, "Reflexive rings," in: Symp. Math. Ist. Naz. Alta Mat. Francesco Severi, Vol. 23, Roma (1979), pp. 415-449.
439. C. Faith, "When are proper cyclics injective?" Pac. J. Math., 45, 97-112 (1973); Correction: ibid., 55, 640-641 (1974).
440. C. Faith, "On a theorem of Chatters," Commun. Algebra, 3, No. 2, 169-184 (1975).
441. C. Faith, "Projective ideals in Cohen rings," Arch. Math., 26, No. 6, 588-594 (1975).
442. C. Faith, "On hereditary rings and Boyle's conjecture," Arch. Math., 27, No. 2, 113-119 (1976).
443. C. Faith, "Galois extensions of commutative rings," Math. J. Okayama Univ., 18, No. 2, 113-116 (1976).
444. C. Faith, "Injective cogenerator rings and a theorem of Tachikawa," Proc. Am. Math. Soc., 60, No. 208, 25-30 (1976).
445. C. Faith, "Semiperfect Prüfer rings and FPF rings," Isr. J. Math., 26, No. 2, 166-177 (1977).
446. C. Faith, "Injective cogenerator rings and a theorem of Tachikawa. II," Proc. Am. Math. Soc., 62, No. 1, 15-18 (1977).

447. C. Faith, "The basis theorem for modules a brief survey and a look to the future," in: Ring Theory. Proc. Antwerp Conf., 1977, New York–Basel (1978), pp. 9-23.
448. C. Faith, "Bounded prime rings, pseudo-frobenius rings, the Jacobson radical of a ring," Lect. Notes Math., 700, 218-223 (1979).
449. C. Faith, "Injective quotient rings of commutative rings," Lect. Notes Math., 700, 151-203 (1979).
450. C. Faith, "Self-injective rings," Proc. Am. Math. Soc., 77, No. 2, 157-164 (1979).
451. C. Faith, "The genus of a module and generic families of rings," in: Ring Theory. Proc. Antwerp Conf., 1978, New York–Basel (1979), pp. 613-629.
452. H. K. Farahat, "Homological dimension and Abelian groups," Lect. Notes Math., 616, 379-383 (1977).
453. S. Feigelstock, "A characterization of Prüfer rings," J. Reine Angew. Math., 282, 131-132 (1976).
454. S. Feigelstock, "On modules over Dedekind rings," Acta Sci. Math., 39, Nos. 3-4, 255-263 (1977).
455. M. H. Fenrick, "Rings for which all preradicals have finite length," Commun. Algebra, 7, No. 17, 1805-1815 (1979).
456. D. Ferrand, "Les modules projectifs de type fini sur un anneau de polynomes sur un corps sont libres (d'après Quillen et Suslin)," Lect. Notes Math., 567, 202-221 (1977).
457. D. J. Fieldhouse, "Semihereditary rings," Publ. Math., 25, Nos. 3-4, 211 (1978).
458. E. Fisher, "Powers of saturated modules," J. Symb. Logic, 37, No. 4, 777 (1972).
459. E. R. Fisher, "Abelian structures. I," Lect. Notes Math., 616, 270-322 (1977).
460. J. R. Fisher, "Goldie theorem for differentiably prime rings," Pac. J. Math., 58, No. 1, 71-77 (1975).
461. J. W. Fisher, "Problem session on regular rings," Lect. Notes Math., 545, 195-199 (1976).
462. M. Flamant, "Une nouvelle caracterisation des anneaux de Prüfer," Publ. Dep. Math., 14, No. 4, 21-25 (1977).
463. C. Fletcher, "Remarque sur les anneaux de fractions et la factorisation," Publ. Dep. Math., 12, No. 1, 1-3 (1975).
464. P. Fleury, "On local QF rings," Aequat. Math., 16, Nos. 1-2, 173-179 (1977).
465. J. Flood, "Pontryagin duality for topological modules," Proc. Am. Math. Soc., 75, No. 2, 329-333 (1979).
466. M. Fontana, "Absolutely flat Baer rings," Boll. Unione Mat. Ital., B16, No. 2, 566-583 (1979).
467. E. Formanek, "The center of the ring of 3 × 3 generic matrices," Linear Multilinear Algebra, 7, No. 3, 203-212 (1979).
468. E. Formanek, "The center of the ring of 4 × 4 generic matrices," J. Algebra, 62, No. 2, 304-319 (1980).
469. R. Fossum and H.-B. Foxby, "The category of graded modules," Math. Scand., 35, No. 2, 288-300 (1974).
470. D. Fox, "On localizing orderable modules," J. Austral. Math. Soc., A26, No. 1, 59-64 (1978).
471. H.-B. Foxby, "Injective modules under flat base change," Proc. Am. Math. Soc., 50, 23-27 (1975).
472. A. Frei and H. Kleisli, "Shape invariant functors: application in module theory," Math. Z., 164, No. 2, 179-183 (1978).
473. A. Fröhlich, "Locally free modules over arithmetic orders," J. Reine Angew. Math., 274/275, 112-124 (1975).
474. L. Fuchs, "Vector spaces with valuations," J. Algebra, 35, Nos. 1-3, 23-38 (1975).
475. L. Fuchs, "Cotorsion modules over Noetherian hereditary rings," Houston J. Math., 3, No. 1, 33-46 (1977).
476. L. Fuchs, "Vector spaces with general valuations," in: Symp. Math. Ist. Naz. Alta Mat., Vol. 21, London–New York (1977), pp. 433-450.
477. L. Fuchs, "Subfree valued vector spaces," Lect. Notes Math., 616, 158-167 (1977).
478. L. Fuchs, "Valued vector spaces and Abelian p-groups," Groupe Étude Algèbre. Univ. Pierre et Marie Curie, 1976-1977, 2, No. 7, 1-12 (1978).
479. L. Fuchs, "On a duality of modules over valuation rings," Ann. Mat. Pura Appl., 117, 227-232 (1978).
480. L. Fuchs and F. Loonstra, "On a class of submodules in direct products," Atti Accad. Naz. Lincei Rend., No. 6, 743-748 (1976).
481. L. Fuchs, E. Kirkman, and J. Kuzmanovich, "Hereditary module-finite algebras," J. London Math. Soc., 19, No. 2, 268-276 (1979).
482. J. Fuelberth and J. Kuzmanovich, "On the structure of splitting rings," Commun. Algebra, 3, No. 10, 913-949 (1975).
483. J. Fuelberth and J. Kuzmanovich, "The structure of semiprimary and Noetherian hereditary rings," Trans. Am. Math. Soc., 212, No. 485, 83-111 (1975).
484. J. Fuelberth and J. Kuzmanovich, "Primary direct sum decomposition," Commun. Algebra, 4, No. 3, 285-304 (1976).

485. "Split subdirect products and piecewise domains," Can. J. Math., 28, No. 2, 408-419 (1976).
486. J. Fuelberth and J. Kuzmanovich, "On the structure of finitely generated splitting rings," Pac. J. Math., 80, No. 2, 389-424 (1979).
487. J. Fuelberth, J. Kuzmanovich, and T. S. Shores, "Splitting torsion theories over commutative rings," Bull. Austral. Math. Soc., 13, No. 3, 457-464 (1975).
488. K. Fujita and S. Itoh, "A note on Noetherian Hilbert rings," Hiroshima Math. J., 10, No. 1, 153-161 (1980).
489. K. R. Fuller, "On rings whose left modules are direct sums of finitely generated modules," Proc. Am. Math. Soc., 54, 39-44 (1976).
490. K. R. Fuller, "Weakly symmetric rings of distributive module type," Commun. Algebra, 5, No. 9, 997-1008 (1977).
491. K. R. Fuller, "Rings of left invariant module type," Commun. Algebra, 6, No. 2, 153-167 (1978).
492. K. R. Fuller, "On a generalization of serial rings. I," in: Representation Theory of Algebras, Proc. Philadelphia Conf., New York–Basel (1979), pp. 353-367.
493. K. R. Fuller, "Biserial rings," Lect. Notes Math., 734, 64-90 (1979).
494. K. R. Fuller, "On a generalization of serial rings. II," Commun. Algebra, 8, No. 7, 635-661 (1980).
495. K. R. Fuller, and J. Haack, "Rings with quivers that are trees," Pac. J. Math., 76, No. 2, 371-379 (1978).
496. K. R. Fuller, J. Haack, and H. Hullinger, "Stable equivalence of uniserial rings," Proc. Am. Math. Soc., 68, No. 2, 153-158 (1978).
497. K. R. Fuller and W. A. Shutters, "Projective modules over noncommutative semilocal rings," Tohoku Math. J., 27, No. 3, 303-311 (1975).
498. M. R. Gabel, "Lower bounds on the stable range of polynomial rings," Pac. J. Math., 61, No. 1, 117-120 (1975).
499. P. Gabriel, "Christine Riedtmann and the self-injective algebras of finite representation type," in: Ring Theory. Proc. Antwerp Conf., 1978, New York–Basel (1979), pp. 453-458.
500. S. Garavaglia, "Direct product decomposition of theories of modules," J. Symbol. Logic, 44, No. 1, 77-88 (1979).
501. B. J. Gardner, "Some aspects of T-nilpotence," Pac. J. Math., 53, 117-130 (1974).
502. B. J. Gardner, "Some aspects of T-nilpotence. II. Lifting properties over T-nilpotent ideals," Pac. J. Math., 59, No. 2, 445-453 (1975).
503. B. J. Gardner, "A note on ring epimorphisms and polynomial identities," Comment. Math. Univ. Carol., 20, No. 2, 293-307 (1979).
504. B. J. Gardner and P. N. Stewart, "On semisimple radical classes," Bull. Austral. Math. Soc., 13, No. 3, 349-353 (1975).
505. A. V. Geramita and Ch. Small, Introduction to Homological Methods in Commutative Rings, Queen's Papers Pure Appl. Math., No. 43 (1976).
506. L. J. Gerstein, "A local approach to matric equivalence," Linear Algebra Appl., 16, No. 3, 221-232 (1977).
507. R. Gilmer, "Modules that are finite sums of simple submodules," Publ. Math., 24, Nos. 1-2, 5-8 (1977).
508. R. Gilmer and A. Grams, "Finite intersections of quotient rings of a Dedekind domain," J. London Math. Soc., 12, No. 3, 257-261 (1976).
509. R. Gilmer and W. Heinzer, "The Noetherian property for quotient rings of infinite polynomial rings," Proc. Am. Math. Soc., 76, No. 1, 1-7 (1979).
510. R. Gilmer and J. F. Hoffmann, "A characterization of Prüfer domains in terms of polynomials," Pac. J. Math., 60, No. 1, 81-85 (1975).
511. S. M. Ginn, "A counterexample to a theorem of Kurshan," J. Algebra, 40, No. 1, 105-106 (1976).
512. S. M. Ginn and P. B. Moss, "A decomposition theorem for Noetherian orders in artinian rings," Bull. London Math. Soc., 9, No. 2, 177-181 (1977).
513. S. Glaz and W. V. Vasconcelos, "Flat ideals. II," Manuscripta Math., 22, No. 4, 325-341 (1977).
514. V. K. Goel and S. K. Jain, "π-injective modules and rings whose cyclics are π-injective," Commun. Algebra, 6, No. 1, 59-73 (1978).
515. V. K. Goel and S. K. Jain, "Semiperfect rings with quasiprojective left ideals," Math. J. Okayama Univ., 19, No. 1, 39-43 (1976).
516. V. K. Goel, S. K. Jain, and S. Singh, "Rings whose cyclic modules are injective or projective," Proc. Am. Math. Soc., 53, No. 1, 16-18 (1975).

517. V. K. Goel, S. K. Jain, and S. Singh, "Semiprime rings with finite length w.r.t. an idempotent kernel functor," Israel J. Math., 28, Nos. 1-2, 110-112 (1977).
518. J. S. Golan, "Matching torsion and cotorsion theories," Glasgow Math. J., 15, 176-179 (1974).
519. J. S. Golan, "Modules satisfying both chain conditions with respect to a torsion theory," Proc. Am. Math. Soc., 52, 103-108 (1975).
520. J. S. Golan, "On the maximal support of a module," Commun. Algebra, 4, No. 3, 219-231 (1976).
521. J. S. Golan, "Some functors arising from the consideration of torsion theories over noncommutative rings," Bull. Austral. Math. Soc., 15, No. 3, 455-460 (1976).
522. J. S. Golan, "Decomposition and dimension in module categories," Lecture Notes Pure Appl. Math., Vol. 33, Marcel Dekker, New York—Basel (1977).
523. J. S. Golan, "Quelques utilisations des formules de Camillo-Zelmanowitz," C. R. Acad. Sci., 286, No. 17, A731-A734 (1978).
524. J. S. Golan, "The lattice of torsion theories associated with a ring," in: Ring Theory. Proc. Antwerp Conf., 1977, New York—Basel (1978), pp. 25-43.
525. J. S. Golan, "Rings having a composition series with respect to a torsion theory," Commun. Algebra, 7, No. 6, 611-623 (1979).
526. J. S. Golan, "Semisimple artinian rings of quotients," Am. Math. Men., 86, No. 6, 474-475 (1979).
527. J. S. Golan, "Colocalization at idempotent ideals," in: Ring Theory. Proc. Antwerp Conf., 1978, New York—Basel (1979), pp. 631-668.
528. J. S. Golan, "Some torsion theories are compact," Math. Jpn., 24, No. 6, 635-639 (1979).
529. J. S. Golan and R. W. Miller, "Cotorsion free modules and colocalizations," Commun. Algebra, 6, No. 12, 1217-1230 (1978).
530. J. S. Golan, J. Raynaud, and F. van Oystaeyen, "Sheaves over the spectra of certain noncommutative rings," Commun. Algebra, 4, No. 5, 491-502 (1976).
531. A. Goldie, "Reduced rank on modules, application to some theorems on Noetherian rings," in: Ring Theory. Proc. Antwerp Conf., 1977, New York—Basel (1978), pp. 45-58.
532. A. Goldie and G. Krause, "Artinian quotient rings of ideal invariant Noetherian rings," J. Algebra, 63, No. 2, 374-388 (1980).
533. B. Goldsmith, "Endomorphism rings of torsion-free modules over a complete discrete valuation ring," J. London Math. Soc., 18, No. 3, 464-471 (1978).
534. B. Goldston and A. C. Mewborn, "A structure sheaf for a noncommutative Noetherian ring," Bull. Am. Math. Soc., 81, No. 5, 944-946 (1975).
535. K. R. Goodearl, "Global dimension of differential operator rings. II," Trans. Am. Math. Soc., 209, No. 482, 65-85 (1975); III. J. London Math. Soc., 17, No. 3, 397-409 (1978).
536. K. R. Goodearl, Ring Theory. Nonsingular Rings and Modules, Marcel Dekker, New York—Basel (1976).
537. K. R. Goodearl, "Completions of regular rings. I," Math. Ann., 220, No. 3, 229-252 (1976).
538. K. R. Goodearl, "Direct sum properties of quasiinjective modules," Bull. Am. Math. Soc., 82, No. 1, 108-110 (1976).
539. K. R. Goodearl, "Power-cancellation of groups and modules," Pac. J. Math., 64, No. 2, 387-412 (1976).
540. K. R. Goodearl, "Regular rings and rank functions," Lect. Notes Math., 545, 83-104 (1976).
541. K. R. Goodearl, "Power-cancellation of modules," in: Ring Theory. II. Proc. 2nd Okla. Conf., 1975, New York—Basel (1977), pp. 131-147.
542. K. R. Goodearl, "Completions of regular rings. II," Pac. J. Math., 72, No. 2, 423-640 (1977).
543. K. R. Goodearl, "Centers of regular self-injective rings," Pac. J. Math., 76, No. 2, 381-395 (1978).
544. K. R. Goodearl, Von Neumann Regular Rings, Pitman, London—San Francisco—Melbourne (1979).
545. K. R. Goodearl, "Artinian and Noetherian modules over regular rings," Commun. Algebra, 8, No. 5, 477-504 (1980).
546. K. R. Goodearl and A. K. Boyle, Dimension Theory for Nonsingular Injective Modules, Mem. AMS, No. 177 (1976).
547. K. R. Goodearl and D. Handelman, "Simple self-injective rings," Commun. Algebra, 3, No. 9, 797-834 (1975).
548. K. R. Goodearl and R. B. Warfield, Jr., "Algebras over zero-dimensional rings," Math. Ann., 223, No. 2, 157-168 (1978).
549. K. R. Goodearl and R. B. Warfield, Jr., "Simple modules over hereditary Noetherian prime rings," J. Algebra, 57, No. 1, 82-100 (1979).
550. R. Gordon, "Some aspects of noncommutative Noetherian rings," Lect. Notes Math., 545, 105-127 (1976).

551. R. Gordon and E. Green, "A representation theory for Noetherian rings," J. Algebra, 39, No. 1, 100-130 (1976).
552. R. Gordon and E. Green, "Indecomposable modules with cores," Bull. Am. Math. Soc., 82, No. 4, 590-592 (1976).
553. R. Gordon and E. Green, "Indecomposable modules: amalgamations," Bull. Am. Math. Soc., 82, No. 6, 884-887 (1976).
554. R. Gordon and E. Green, "Modules with cores and amalgamations of indecomposable modules," Mem. Am. Math. Soc., No. 187 (1977).
555. S. Goto and K. Watanabe, "On graded rings. 1," J. Math. Soc. Jpn., 30, No. 2, 179-213 (1978).
556. S. Goto and K. Watanabe, "On graded rings. 2. (Z^n graded rings)," Tokyo J. Math., 1, No. 2, 237-261 (1978).
557. J. Goursaud, "Sur les V-anneaux réguliers," Sem. Alg. Noncommutative, 1975-1976, Paris XI, Orsay (1976).
558. S. Goto and L. Jeremy, "Un anneau régulier continu à gauche et $\aleph_0$-continu à droite est continu," C. R. Acad. Sci., 283, No. 11, A807-A808 (1976).
559. S. Goto and L. Jeremy, "Une notion de rang dans les facteurs réguliers autoinjectifs à droite," Commun. Algebra, 5, No. 8, 829-839 (1977).
560. S. Goto, J. Osterburg, J.-L. Pascaud, and J. Valette, "Points fixes des anneaux réguliers autoinjectifs,' C. R. Acad. Sci., A290, No. 21, 985-988 (1980).
561. S. Goto and J.-L. Pascaud, "Anneaux semihereditaires," C. R. Acad. Sci., A284, No. 1, 583-586 (1977).
562. S. Goto and J.-L. Pascaud, "Anneaux de polynomes semihereditaires," Lect. Notes Math., 734, 131-157 (1979).
563. S. Goto and J. Valette, "Sur l'enveloppe des anneaux de groupes réguliers," Bull. Soc. Math. France, 103, No. 1, 91-102 (1975).
564. S. Goto and J. Valette, "Sur les anneaux de groupe hereditaires," Lect. Notes Math., 740, 432-443 (1979).
565. S. Grabiner, "Finitely generated Noetherian and Artinian Banach modules," Indiana Univ. Math. J., 26, No. 3, 413-426 (1977).
566. E. L. Green, "A note on modules with waists," Ill. J. Math., 21, No. 2, 385-387 (1977).
567. E. L. Green, "Diagrammatic techniques in the study of indecomposable modules," in: Ring Theory 2. Proc 2nd Okla. Conf., 1975, New York–Basel (1977), pp. 149-169.
568. E. L. Green, "On the structure of indecomposable modules," in: Represent. Theory Algebras. Proc. Philadelphia Conf., New York–Basel (1978), pp. 369-380.
569. E. L. Green, "Frobenius algebras and their quivers," Can. J. Math., 30, No. 5, 1029-1044 (1978).
570. E. L. Green, "On the decomposability of amalgamated sums," J. Pure Appl. Algebra, 14, No. 3, 259-272 (1979).
571. E. L. Green and I. Reiten, "On the construction of ring extensions," Glasgow Math. J., 17, No. 1, 1-11 (1976).
572. B. Greenberg, "Coherence in Cartesian squares," J. Algebra, 50, No. 1, 12-25 (1978).
573. B. Greenberg and W. V. Vasconcelos, "Coherence of polynomial rings," Proc. Am. Math. Soc., 54, 59-64 (1976).
574. R. P. Grimaldi, "Baer and UT-modules over domains," Pac. J. Math., 54, No. 2, 59-72 (1974).
575. K. M. Gruenberg and K. W. Roggenkamp, "Extension categories of groups and modules. I. Essential covers," 49, No. 2, 564-594 (1977).
576. L. Grünenfelder, "On the homology of filtered and graded rings," J. Pure Appl. Algebra, 14, No. 1, 21-37 (1979).
577. L. Gruson and Ch. U. Jensen, "Deux applications de la notion de L-dimension," C. R. Acad. Sci., A282, No. 1, 23-25 (1976).
578. J. Guérindon, "On the linearly compact envelope, Queen's Pap. Pure Appl. Math., No. 42, 249-252 (1975).
579. J. Guérindon, "Séries restreintes et compacité linéaire," Semin. P. Dubreil. Algèbre. Univ. Pierre et Marie Curie, 28, 7/1-7/6 (1974-1975).
580. J. Guérindon, "Sur les modules linéairement compactés," Groupe Étude Algèbre. Univ. Pierre et Marie Curie, 1976-1977, 2, 1/01-1/08 (1978).
581. J. Guérindon, "Décomposition canonique d'un module artinien," C. R. Acad. Sci., 286, No. 20, A867-A869 (1978).

582. W. H. Gustafson, "Remark on relatively projective modules," Math. Jpn., 16, 21-24 (1971).
583. W. H. Gustafson, P. R. Halmos, and J. M. Zelmanowitz, "The Serre conjecture," Am. Math. Mon., 85, No. 5, 357-359 (1978).
584. J. K. Haack, "Self-duality and serial rings," J. Algebra, 59, No. 2, 345-363 (1979).
585. A. Hagnany, "Reflective modules over certain differential polynomial rings," Proc. Am. Math. Soc., 73, No. 3, 313-318 (1979).
586. D. Handelman, "Simple regular rings with a unique rank function," J. Algebra, 42, No. 1, 60-80 (1976).
587. D. Handelman, "Perspectivity and cancellation in regular rings," J. Algebra, 48, No. 1, 1-16 (1977).
588. A. Hanna and S. Khuri, "Modules with irredundant sets of cogenerators," Rend. 1st Mat. Univ. Trieste, 9, Nos. 1-2, 38-45 (1977).
589. J. Hannah, "Maximal quotient rings of prime group algebras. 2. Uniform right ideals," J. Austral. Math. Soc., A24, No. 3, 339-349 (1977).
590. J. Hannah, "Quotient rings of subgroup algebras," Bull. London Math. Soc., 10, No. 1, 81-83 (1978).
591. J. Hannah, "Maximal quotient rings of prime nonsingular algebras," Bull. Austral. Math. Soc., 18, No. 2, 305-306 (1978).
592. J. Hannah, "Simple quotient rings of group algebras," J. Algebra, 59, No. 1, 188-201 (1979).
593. J. Hannah and K. C. O'Meara, "Maximal quotient rings of prime group algebras," Proc. Am. Math. Soc., 65, No. 1, 1-7 (1977).
594. F. T. Hannick, "Some notes on left coherent rings," Proc. Mont. Acad. Sci., 38, 107-110 (1979).
595. F. Hansen, "Schranken für die Gabriel- und Krull-Dimension Idealisatorähnlicher Ringerweiterungen," Arch. Math., 28, No. 6, 584-593 (1977).
596. F. Hansen, "Ringerweiterungen und lokalisation," Commun. Algebra, 7, No. 7, 689-751 (1979).
597. F. Hansen and M. L. Teply, "On the Gabriel dimension and subidealizer rings," Lect. Notes Math., 700, 95-118 (1979).
598. M. Harada, "On the exchange property in a direct sum of indecomposable modules," Osaka J. Math., 12, No. 3, 719-736 (1975).
599. M. Harada, "On a minimal chain of iterated idealizers from an HNP-ring," J. London Math. Soc., 12, No. 2, 183-191 (1976).
600. M. Harada, "A ring theoretical proof in a factor category of indecomposable modules," J. Math. Soc. Jpn., 28, No. 1, 160-167 (1976).
601. M. Harada, "On small submodules in the total quotient ring of a commutative ring," Rev. Union Mat. Argent., 28, No. 2, 99-102 (1977).
602. M. Harada, "Small submodules in a projective module and semi-T-nilpotent sets," Osaka J. Math., 14, No. 2, 355-364 (1977).
603. M. Harada, "A note on hollow modules," Rev. Union. Mat. Argent., 28, Nos. 3-4 (1977-1978).
604. M. Harada, "On the small hulls of a commutative rings," Osaka J. Math., 15, 679-682 (1978).
605. M. Harada, "On small ring homomorphisms," Osaka J. Math., 15, No. 2, 365-370 (1978).
606. M. Harada, "Nonsmall modules and noncosmall modules," in: Ring Theory. Proc. Antwerp Conf., 1978, New York—Basel (1979), pp. 669-690.
607. M. Harada and T. Ishii, "On perfect rings and the exchange property," Osaka J. Math., 12, No. 2, 483-491 (1975).
608. B. Hartley, "Uncountable artinian modules and uncountable soluble groups satisfying Min-n," Proc. London Math. Soc., 35, No. 1, 55-75 (1977).
609. B. Hartley, "Injective modules over group rings," Q. J. Math., 28, No. 109, 1-29 (1977).
610. H. Harui, "Remarks on injective modules over commutative regular rings," Bull. Fukuoka Univ. Educ. Nat. Sci., 25, 1-8 (1975).
611. H. Harui, "On torsion-free injective modules," Bull. Fukuoka Univ. Educ. Nat. Sci., 26, 1-11 (1976).
612. H. Harui, "Decompositions of injective modules over non-Noetherian rings," Acta Math. Hungar., 30, Nos. 3-4, 203-217 (1977).
613. J. Hauger, "Aufsteigende Kettenbedingung für zyklische Moduln und perfekte Endomorphismenringe," Acta Math. Acad. Sci. Hung., 28, Nos. 3-4, 275-278 (1976).
614. J. Hauger, "Injektive Moduln über Ringen linearer Differentialoperatoren," Monatsh. Math., 86, No. 3, 189-201 (1978).
615. J. Hauger and W. Zimmermann, "Lokalisierung und Moritas F_h-bedingung," Commun. Algebra, 4, No. 3, 199-217 (1976).
616. G. J. Hauptfleisch and D. Döman, "Filtered projective and semiflat modules," Quastiones Math., 1, No. 2, 197-217 (1976).

617. G. J. Hauptfleisch and F. Loonstra, "On modules over rings of type (n, k)," Acta Math. Acad. Sci. Hung., 31, Nos. 1-2, 15-19 (1978).
618. M. Hazenwinkel, "Constructing formal groups. VIII: Formal A-modules," Compos. Math., 38, No. 3, 277-291 (1979).
619. M. Hazenwinkel, "Infinite dimensional universal formal group laws and formal A-modules," Lect. Notes Math., 732, 124-143 (1979).
620. J. R. Hedstrom, "Integral closure of generalized quotient rings," Math. Nachr., 69, 145-148 (1975).
621. J. Henderson and M. Orzech, "Cotorsion modules for torsion theories," Port. Math., 36, 33-40 (1977).
622. D. Hill, "The structure of semilocal HQ-rings," J. London Math. Soc., 12, No. 2, 129-132 (1975-1976).
623. D. Hill, "Endomorphism rings of hereditary modules," Arch. Math., 28, No. 1, 63-66 (1977).
624. P. Hill, "Criteria for freeness in groups and valuated vector spaces," Lect. Notes Math., 616, 140-157 (1977).
625. H. L. Hiller, "Derived functors of torsion," Can. Math. Bull., 19, No. 1, 63-66 (1976).
626. H. L. Hiller, "Radicals and local freeness," Arch. Math., 32, No. 2, 123-127 (1979).
627. Y. Hirano, "On Fitting's lemma," Hiroshima Math. J., 9, No. 3, 623-626 (1979).
628. Y. Hirano, Sh. Ikehata, and H. Tominaga, "Commutativity theorems of Outcalt-Yaqub type," Math. J. Okayama Univ., 21, No. 1, 21-24 (1979).
629. Y. Hirano and Sh. Ikehata, "Regular rings, V-rings, and their generalizations," Hiroshima Math. J., 9, No. 1, 137-149 (1979).
630. V. A. Hiremath, "Finitely projective modules over a Dedekind domain," J. Austral. Math. Soc., A26, No. 3, 330-336 (1978).
631. V. A. Hiremath, "On cofinitely injective modules," J. London Math. Soc., 17, No. 1, 28-32 (1978).
632. M. Hochster, "Cyclic purity versus purity in excellent Noetherian rings," Trans. Am. Math. Soc., 231, No. 2, 463-488 (1977).
633. A. Horn, "Quasi-Frobenius quotient rings of group rings," J. Austral. Math. Soc., 20, No. 4, 394-397 (1975).
634. A. Horn, "Twisted group rings and quasi-Frobenius quotient rings," Arch. Math., 26, No. 6, 581-587 (1975).
635. J. A. Huckaba and J. M. Keller, "Annihilation of ideals in commutative rings," Pac. J. Math., 83, No. 2, 375-379 (1979).
636. A. Hudry, "Épimorphisms plats à buts locaux, quasilocaux et semilocaux," Publs. Dep. Math., 12, No. 2, 31-41 (1975).
637. A. Hudry, "Sur la théorie des idéaux dans les anneaux premiers à identité polynomiale," Arch. Math., 31, No. 5, 443-450 (1979).
638. H. L. Hullinger, "Stable equivalence and rings whose modules are a direct sum of finitely generated modules," J. Pure Appl. Algebra, 16, No. 3, 265-273 (1980).
639. R. Hunter, F. Richman, and E. Walker, "Warfield modules," Lect. Notes Math., 616, 87-123 (1977).
640. J. Hutchinson and M. Fenrick, "Primary decompositions and Morita contexts," Commun. Algebra, 6, No. 13, 1359-1368 (1978).
641. J. Hutchinson and D. R. Turnridge, "Morita equivalent quotient rings," Commun. Algebra, 4, No. 7, 669-675 (1976).
642. J. D. Ion and C. Nastasescu, "Anneaux gradués semisimples," C. R. Acad. Sci., 283, No. 16, A1077-A1080 (1976).
643. J. D. Ion and C. Nastasescu, "Anneaux gradués semisimples," Rev. Roum. Math. Pures Appl., 23, No. 4, 573-588 (1978).
644. B. W. Irlbeck, "Finitely generated projective ideals in commutative rings," J. Reine Angew. Math., 298, 98-100 (1978).
645. R. S. Irving, "Generic flatness and the nullstellensatz for Ore extensions," Commun. Algebra, 7, No. 3, 259-277 (1979).
646. R. S. Irving, "Noetherian algebras and the Nullstellensatz," Lect. Notes Math., 740, 80-87 (1979).
647. R. S. Irving, "An algebra whose simple modules are of arbitrary finite degree," in: Ring Theory. Proc. Antwerp Conf., 1978, New York—Basel (1979), pp. 87-96.
648. R. S. Irving, "Finitely generated simple Ore domains with big centres," Bull. London Math. Soc., 12, No. 3 (1980).
649. M. Ishibashi, "A formulation of cancellation theory and its application to modules," Comment. Math. Univ. St. Pauli, 27, No. 1, 43-50 (1978).

650. T. Ishii, "On locally direct summands of modules," Osaka J. Math., 12, No. 2, 473-482 (1975).
651. G. Ivanov, "Decompositions of modules over serial rings," Commun. Algebra, 3, No. 11, 1031-1036 (1975).
652. Y. Iwanaga, "On rings with self-injective dimension ≤ 1," Osaka J. Math., 15, 33-46 (1978).
653. Y. Iwanaga, "On rings with finite self-injective dimension," Commun. Algebra, 7, No. 4, 393-414 (1979).
654. T. Izawa, "A module whose double centralizer is semiprimary QF-3," Repts. Fac. Sci. Shizuoka Univ., 10, 3-8 (1975).
655. T. Izawa, "Torsion theories and torsionless generators," Repts. Fac. Sci. Shizuoka Univ., 11, 1-8 (1976).
656. T. Izawa, "Injectors and projectors relative to torsion theory," Repts. Fac. Sci. Shizuoka Univ., 12, 19-26 (1978).
657. G. Jacob, "Sur certaines catégories de modules, généralisant les modules de type fini et les modules noéthériens," C. R. Acad. Sci., 283, No. 9, 687-690 (1976).
658. N. Jacobson, K. McCrimmon, and M. Parvathi, "Localization of Jordan algebras," Commun. Algebra, 6, No. 9, 911-958 (1978).
659. S. K. Jain, "Rings whose cyclic modules have certain properties and the duals," in: Ring Theory. Proc. Conf. Ohio Univ., Athens, Ohio, 1976, Lect. Notes Pure Appl. Math., Vol. 25, Marcel Dekker, New York (1977), pp. 143-160.
660. S. K. Jain and S. Singh, "Rings with quasiprojective left ideals," Pac. J. Math., 60, No. 1, 169-181 (1975).
661. S. K. Jain, S. Singh, and R. G. Symonds, "Rings whose proper cyclic modules are quasiinjective," Pac. J. Math., 67, No. 2, 461-472 (1976).
662. M. F. Janowitz, "A note on Rickart rings and semi-Boolean algebras," Algebra Univ., 6, No. 1, 9-12 (1976).
663. W. G. Jansen, "FSP rings and modules and local modules," Commun. Algebra, 6, No. 6, 617-637 (1978).
664. G. J. Janusz, "Tensor products of orders," J. London Math. Soc., 20, No. 2, 181-192 (1979).
665. A. V. Jategaonkar, "Structure and classification of hereditary Noetherian prime rings," in: Ring Theory, Proc. Conf., Park City, Utah, 1971, Academic Press, New York (1972), pp. 171-229.
666. A. V. Jategaonkar, "Principal ideal theorem for noetherian PI-rings," J. Algebra, 35, Nos. 1-3, 17-22 (1975).
667. A. V. Jategaonkar, "Certain injectives are artinian," Lect. Notes Math., 545, 128-139 (1976).
668. A. Jebli, "Corps des fractions et topologies linéaires," Thèse Doct. Sci. Math. Univ. Rennes, 1975.
669. C. U. Jensen, "Peano rings of arbitrary global dimension," J. London Math. Soc., 21, No. 1, 39-44 (1980).
670. C. U. Jensen, "Applications logiques en théorie des anneaux et des modules," Conf. Colloque d'Algèbre a Rennes, May 28-31, 1980.
671. C. U. Jensen and P. Vamos, "On the axiomatizability of certain classes of modules," Math. Z., 167, No. 3, 227-237 (1979).
672. L. Jeremy, "Une notion de rang des facteurs réguliers autoinjectifs à droite," Sem. Alg. Non Commutative, 1975-1976, No. 4, Paris XI, Orsay (1976).
673. L. Jeremy, "Modules π-projectifs," Sem. Alg. Commutative, 1975-1976, No. 12, Parix XI, Orsay (1976).
674. L. Jeremy, "L'arithmétique de von Neumann pour les facteurs injectifs," J. Algebra, 62, No. 1, 154-169 (1980).
675. M. I. Jinnah, "Reflexive modules over regular local rings," Arch. Math., 26, No. 4, 367-371 (1975).
676. M. I. Jinnah, "A note on PG-modules," Math. Scand., 37, No. 1, 27-28 (1975).
677. J. Jirasko, "Pseudohereditary and pseudocohereditary preradicals," Comment. Math. Univ. Carol., 20, No. 2, 317-327 (1979).
678. J. Jirasko, "Generalized projectivity. II," Comment. Math. Univ. Carol., 20, No. 3, 483-499 (1979).
679. H. Jiraskova, "Generalized flatness and coherence," Comment. Math. Univ. Carol., 21, No. 2, 293-300 (1980).
680. H. Jiraskova and J. Jirasco, "Generalized projectivity," Czech. Mat. J., 28, No. 4, 632-646 (1978).
681. B. Johns, "Annihilator conditions in Noetherian rings," J. Algebra, 49, No. 1, 222-224 (1977).
682. J. L. Johnson, "Modules injective with respect to primes," Commun. Algebra, 7, No. 3, 327-332 (1977).
683. S. Jondrup, "Projective modules," Proc. Am. Math. Soc., 59, No. 2, 217-221 (1976).

684. S. Jondrup, "The centre of a right hereditary ring," J. London Math. Soc., 15, No. 2, 211-212 (1977).
685. S. Jondrup, "Flat and projective modules," Math. Scand., 43, No. 2, 336-342 (1978).
686. S. Jondrup, "Rings of quotients of some semiprime P. I. rings," Commun. Algebra, 7, No. 3, 279-286 (1979).
687. S. Jondrup, "Indecomposable modules," in: Ring Theory. Proc. Antwerp Conf., 1978, New York—Basel (1979), pp. 97-104.
688. S. Jondrup, "Homological dimensions of some P. I. rings," Commun. Algebra, 8, No. 7, 685-696 (1980).
689. S. Jondrup and C. Ringel, "Remarks on a paper by Skornyakov concerning ring for which every module is a direct sum of s left ideals," Arch. Math., 31, No. 4, 329-331 (1978).
690. D. A. Jordan, "A left Noetherian right Ore domain which is not right Noetherian," Bull. London Math. Soc., 12, No. 3, 202-204 (1980).
691. J. Kado, "Note on exchange property," Math. J. Okayama Univ., 18, No. 2, 153-157 (1976).
692. M. Kamil, "On quasi-artinian rings," Rend. Math., 9, No. 4, 617-619 (1976).
693. M. Kamil, "On simple injective rings," Rend. Math., 9, No. 4, 613-615 (1976).
694. M.-Ch. Kang, "Projective modules over some polynomial rings," J. Algebra, 59, No. 1, 65-76 (1979).
695. H. I. Karakas, "On Noetherian modules," METU J. Pure Appl. Sci., 5, No. 2, 165-168 (1972).
696. F. Kasch, Moduln und Ringe, B. G. Teubner, Stuttgart (1977).
697. T. Kato, "Structure of dominant modules," J. Algebra, 39, No. 2, 569-570 (1976).
698. T. Kato, "Duality between colocalization and localization," J. Algebra, 55, No. 2, 351-374 (1978).
699. Y. Kawada, "On dominant modules and dominant rings," in: Proc. Tenth Symp. Ring Theory, Matsumoto, 1977, Okayama (1978), pp. 62-82.
700. Y. Kawada, "On dominant modules and dominant rings," J. Algebra, 56, No. 2, 409-435 (1979).
701. G. O. Kenny, "The completion of an Abelian L-group," Can. J. Math., 27, No. 5, 980-985 (1975).
702. T. Kepka, "Torsion theories and homological dimensions," Stud. Alg. Anwend., 1, 41-44 (1976).
703. T. Kepka, "Notes on quasimodules," Comment. Math. Univ. Carol., 20, No. 2, 229-247 (1979).
704. T. Kepka and P. Němec, "Quasimodules generated by three elements," Comment. Math. Univ. Carol., 20, No. 2, 249-266 (1979).
705. T. Kepka and P. Němec, "Trilinear construction of quasimodules," Comment. Math. Univ. Carol., 21, No. 2, 341-354 (1980).
706. O. Kerner, "Ringe mit verallgemeinerter Kupischreihe. I, II," J. Reine Angew. Math., 305, 155-181 (1979); 314, 177-195 (1980).
707. O. Kerner and Th. Thode, "Primary rings and related radical. I," Arch. Math., 27, No. 4, 372-377 (1976).
708. O. Kerner and Th. Thode, "Primary rings and related radicals. II," Commun. Algebra, 4, No. 11, 1029-1044 (1976).
709. A. Kertesz, Rings, Modules and Radicals, Colloq. Math. Soc. Janos Bolyai, 6, North-Holland, Amsterdam—London (1973).
710. M. N. Khan, "A continuous ring in which every large right ideal is two sided," Riv. Mat. Univ. Parma, 2, 277-280 (1973).
711. M. Z. Khan, "A note on RSI-ring," Tamkang J. Math., 8, No. 2, 153-164 (1977).
712. M. Z. Khan, "Modules over bounded hereditary noetherian prime rings," Can. Math. Bull., 22, No. 1, 53-57 (1979).
713. S. M. Khaleelulla, "A closed graph theorem for ordered topological Abelian groups," Tamkand J. Math., 7, No. 1, 31-35 (1976).
714. D. Kirby and H. A. Mehran, "Fractional powers of a submodule of an algebra," Mathematika, 18, 8-13 (1971).
715. M. Kirezci, "A remark on IBN-rings and free ideal rings," METU J. Pure Appl. Sci., 5, No. 1, 15-18 (1972).
716. E. E. Kirkman and J. J. Kuzmanovich, "Order over hereditary rings," J. Algebra, 55, No. 1, 1-27 (1978).
717. E. W. Kiss, "A module-theoretic characterization of rings with unity," Acta Math. Hungar., 31, Nos. 3/4, 345-348 (1978).
718. Y. Kitamura, "Centralizers of a module over a quasi-Frobenius extension," Math. J. Okayama Univ., 17, No. 2, 103-123 (1975).
719. Y. Kitamura, "A note on quotient rings over a quasi-Frobenius extension," Math. J. Okayama Univ., 18, No. 1, 57-67 (1975).
720. Y. Kitamura, "Note on the maximal quotient rings of a Galois subring," Math. J. Okayama Univ., 19, No. 1, 55-60 (1976).

721. R. Knörr, "Ringepimorphismen und Morita-projektive Moduln über kommutativen Dedekind-Ringen," Comment. Math. Helv., 50, No. 2, 267-275 (1975).
722. R. Knörr, "Morita-injektive Moduln über Kommutativen Dedekind-Ringen," J. Reine Angew. Math., 281, 143-163 (1976).
723. R. Knörr, "Relative projective covers," Var. Publs. Ser. Mat. Inst. Aarhus Univ., No. 29, 28-32 (1978).
724. M.-A. Knus, "Modules quadratiques sur un anneau de polynomes," Monogr. Enseign. Math., No. 26, 179-185 (1978).
725. A. Koehler, "Pre-self-injective duo rings," Proc. Am. Math. Soc., 60, No. 208, 31-34 (1976).
726. P. Koh, "Finite projective dimension under change of rings," Rocky Mount. J. Math., 8, No. 4, 647-651 (1978).
727. G. Krause, "Krull dimension and Gabriel dimension of idealizers of semimaximal left ideals," J. London Math. Soc., 12, No. 2, 137-140 (1976).
728. G. Krause, "Some recent developments in the theory of noetherian rings," Lect. Notes Math., 641, 209-219 (1978).
729. G. Krause, T. H. Lenagan, and J. T. Stafford, "Ideal invariance and Artinian quotient rings," J. Algebra, 55, No. 1, 145-154 (1978).
730. G. Krause and M. L. Teply, "The transfer of the Krull dimension and the Gabriel dimension to subidealizers," Can. J. Math., 29, No. 4, 874-888 (1977).
731. M. Krusemeyer, "Completing α^2, β, γ," Queen's Pap. Pure Appl. Math., No. 42, 253-254 (1975).
732. M. Kulkarni, "A generalization of Pascal's theorem to commutative rings," Arch. Math., 33, No. 5, 426-429 (1980).
733. H. Kupisch, "Quasi-Frobenius algebras of finite representation type," Lect. Notes Math., 488, 184-200 (1975).
734. H. Kupisch, "Basialgebren symmetrischer Algebren und eine Vermutung von Gabriel," J. Algebra, 55, No. 1, 58-73 (1978).
735. Y. Kurata and H. Katayama, "On a generalization of QF-3 rings," Osaka J. Math., 13, 407-418 (1976).
736. M. Kutami and K. Oshiro, "Direct sums of nonsingular indecomposable injective modules," Math. J. Okayama Univ., 20, No. 2, 91-99 (1978).
737. Hoang Ky, "A divisible module over a principal ideal ring," Acta Math. Vietnamica, 2, No. 1, 141-151 (1977).
738. J. P. Labute, "Free Lie algebras as modules over their enveloping algebras," Proc. Am. Math. Soc., 68, No. 2, 135-139 (1978).
739. E. L. Lady, "Completely decomposable flat modules over locally factorial domains," Proc. Am. Math. Soc., 54, 27-31 (1976).
740. E. L. Lady, "Splitting fields for torsion-free modules over discrete valuation rings, I," J. Algebra, 49, No. 1, 261-275 (1977).
741. E. L. Lady, "On classifying torsion-free modules over discrete valuation rings," Lect. Notes Math., 616, 168-172 (1977).
742. E. L. Lady, "Extension of scalars for torsion free modules over Dedekind domains," in: Symp. Math. Ist. Naz. Alta Mat. Francesco Severi, Vol. 23, Roma (1979), pp. 287-305.
743. C. C. Lai, "Localization in non-noetherian rings," Commun. Algebra, 7, No. 13, 1351-1376 (1979).
744. T. Y. Lam, "Series summation of stably free modules," Q. J. Math., 27, No. 105, 37-46 (1976).
745. T. Y. Lam, Serre's Conjecture, Lect. Notes Math., Vol. 635 (1978).
746. J. Lambek, "Localization at epimorphisms and quasiinjectives," J. Algebra, 38, No. 1, 163-181 (1976).
747. P. Landrock, "Some remarks on Loewy lengths of projective modules," Prepr. Ser. Math. Inst. Aarhus Univ., No. 24, (1979/1980).
748. C. Lanski, "Regularity and quotients in rings with involution," Pac. J. Math., 56, No. 2, 565-574 (1975).
749. C. Lanski, "Gabriel dimension and rings with involution," Houston J. Math., 4, No. 3, 397-415 (1978).
750. D. Latsis, "Localisation dans les anneaux duos," C. R. Acad. Sci., 282, No. 24, A1403-A1406 (1976).
751. D. Latsis, "Modules tertiaires," Groupe d'Étude d'Algèbre, Paris (1978), Exp. No. 3.
752. J. Lawrence, "A countable self-injective ring is quasi-Frobenius," Proc. Am. Math. Soc., 65, No. 2, 217-220 (1977).
753. J. Lawrence and K. Louden, "Rationally complete group rings," J. Algebra, 50, No. 1, 113-121 (1978).
754. Kwang Young Lee, "Remarks on the quasiprojectiveness of rings," Ulsan Inst. Techn. Rep., 6, No. 1, 25-28 (1975).

755. B. Lemonnier, "Dimension de Krull et codeviation des anneaux semihéréditaires," C. R. Acad. Sci., 284, No. 12, 663-666 (1977).
756. B. Lemonnier, "Dimension de Krull et codeviation. Application au théorème d'Éakin," Commun. Algebra, 6, No. 16, 1647-1665 (1978).
757. T. H. Lenagan, "Artinian ideals in Noetherian rings," Proc. Am. Math. Soc., 51, No. 2, 499-500 (1975).
758. T. H. Lenagan, "Krull dimension and invertible ideals in Noetherian rings," Proc. Edinburgh Math. Soc., 20, No. 2, 81-86 (1976).
759. T. H. Lenagan, "Artinian quotient rings of Macaulay rings," Lect. Notes Math., 545, 140-150 (1976).
760. T. H. Lenagan, "Reduced rank in rings with Krull dimension," in: Ring Theory. Proc. Antwerp Conf., 1978, New York–Basel (1979), pp. 123-131.
761. T. H. Lenagan, "Modules with Krull dimension," Bull. London Math. Soc., 12, No. 1, 39-40 (1980).
762. H. Lenzing, "Direct sums of projective modules as direct summands of their direct product," Commun. Algebra, 4, No. 7, 681-691 (1976).
763. Y. Lequain and A. Simis, "Projective modules over $R[X,\dots,X_n]$, R a Prüfer domain," Notas Commun. Mat., No. 84 (1978).
764. L. Lesieur, "Ideal premier $\mathscr{P}$ d'un anneau Noethérien a gauche: condition de Ore pour $\mathscr{C}(\mathscr{P})$. Séminaire d'Algèbre non commutative, 1973/1974, Paris–Orsay (1974).
765. Zb. Leszczynski and D. Simson, "On triangular matrix rings of finite representation type," J. London Math. Soc., 20, No. 3, 396-402 (1979).
766. R. A. Levaro, "Projective quasicoherent sheaves of modules," Pac. J. Math., 57, No. 2, 457-461 (1975).
767. L. S. Levy, "Matrix equivalence and finite representation type," Commun. Algebra, 3, No. 8, 739-748 (1975).
768. L. S. Levy, "Decomposing a projective module and several submodules," Adv. Math., 20, No. 1, 30-42 (1976).
769. L. S. Levy, "Modules over the cyclic group of prime order," Lect. Notes Math., 734, 207-222 (1979).
770. D. Licoiu, "Sur la dimension homologique des morphismes d'anneaux," C. R. Acad. Sci., A281, Nos. 2-3, 77-79 (1975).
771. D. Lecoiu, "Sur les anneaux semiartiniens réguliers," Rev. Roum. Math. Pures Appl., 23, No. 3, 411-412 (1978).
772. D. Licoiu, "Sur la dimension homologique des modules," C. R. Acad. Sci., A287, No. 4, 193 (1978).
773. W. Liebert, "Ulm valuations and covaluations on torsion-complete p-groups," Lect. Notes Math., 616, 337-353 (1977).
774. I-Peng B. Lin, "Products of torsion theories and applications to coalgebras," Osaka J. Math., 12, No. 2, 433-439 (1975).
775. I-Peng B. Lin, "Semiperfect coalgebras," J. Algebra, 49, No. 2, 357-373 (1977).
776. T. Y. Lin and H. R. Margolis, "Homological aspects of modules over the Steenrod algebra," J. Pure Appl. Algebra, 9, No. 2, 121-129 (1977).
777. H. Lindel, "Wenn B ein Hauptidealring ist, so sind alle projektiven B[X, Y]-Moduln frei," Math. Ann., 222, No. 3, 283-289 (1976).
778. H. Lindel, "Projektive Moduln über Polynomringen $A[T_1,\dots,T_m]$ mit einem regulären Grundring A," Manuscr. Math., 23, No. 2, 143-154 (1978).
779. H. Lindel and W. Lutkebohmert, "Projektive Moduln über polynomialen Erweiterungen von Potenzreihen algebren," Arch. Math., 28, No. 1, 51-54 (1977).
780. C. Löfwall, "The global homological dimension of trivial extensions of rings," J. Algebra, 39, No. 1, 287-307 (1976).
781. F. Loonstra, "Notes on subdirect products of modules," An. Sti. Univ. Iasi, Sec. 1a, 21, 1-8 (1975).
782. F. Loonstra, "Note on extensions of modules," Acta Math. Acad. Sci. Hung., 26, Nos. 3-4, 349-354 (1975).
783. F. Loonstra, "Subproducts and subdirect products," Publ. Math., 24, Nos. 1-2, 129-137 (1977).
784. F. Loonstra, "Essential submodules and essential subdirect products," in: Symp. Math. Ist. Naz. Alta Mat. Francesco Severi, Vol. 23, Roma (1979), pp. 85-105.
785. K. Louden, "Maximal quotient rings of ring extensions," Pac. J. Math., 62, No. 2, 489-496 (1976).
786. K. Louden, "Torsion theories and ring extensions," Commun. Algebra, 4, No. 6, 503-532 (1976).
787. J. K. Luedeman and J. A. Bate, "The ring of quotients of R(S)," Semigroup Forum, 18, No. 3, 271-278 (1979).

788. M.-P. Mallavin-Brameret, "Regularité locale d'algèbres universelles," C. R. Acad. Sci., 283, No. 13, A923-A925 (1976).
789. J. Manocha, "On rings with essential socle," Commun. Algebra, 4, No. 11, 1077-1086 (1976).
790. Z. Maoulaoui, "Sur les modules réguliers," Arch. Math., 30, No. 5, 469-472 (1978).
791. P. Maroscia, "Modules projectifs sur certains anneaux de polynomes," C. R. Acad. Sci., 285, No. 4, A183-A185 (1977).
792. Ph. Martin, "Théorème de décomposition en produits pour des anneaux autoinjectifs à droite admettant des sommes," C. R. Acad. Sci., 282, No. 17, A951-A953 (1976).
793. Ph. Martin, "Autoinjectivité des images homomorphiques d'un anneau de polynomes," C. R. Acad. Sci. 285, No. 7, A489-A492 (1977).
794. J. Martinez, "Is the lattice of torsion classes algebraic?" Proc. Am. Math. Soc., 63, No. 1, 9-14 (1977).
795. V. R. Martinez, "Almost projective modules over artin algebras and almost split sequences," in: Ring Theory. Proc. Antwerp Conf., 1978, New York–Basel (1979), pp. 495-511.
796. H. Marubayashi, "A note on locally uniform rings and modules," Proc. Jpn. Acad., 47, No. 1, 11-14 (1971).
797. H. Marubayashi, "Remarks on ideals of bounded Krull prime rings," Proc. Jpn. Acad., 53, No. 1, 27-29 (1977).
798. H. Marubayashi, "Polynomial rings over Krull orders in simple Artinian rings," Hokkaido Math. J., 9, No. 1, 63-78 (1980).
799. K. Masaike, "On equivalent orders in semisimple rings," Bull. Tokyo Gakugei Univ. (4), 26, 39-44 (1974).
800. K. Masaike, "On embedding torsion free modules into free modules," Proc. Jpn. Acad., 53, No. 1, 23-26 (1977).
801. K. Masaike, "Endomorphisms of modules over maximal orders," Math. J. Okayama Univ., 21, No. 1, 33-40 (1979).
802. G. Mason, "Injective and projective near-ring modules," Compos. Math., 33, No. 1, 43-54 (1976).
803. E. Matlis, "Generalizations of divisible abelian groups to the theory of modules," in: Symp. Math. Ist. Naz. Alta Mat. Francesco Severi, Vol. 23, Roma (1979), pp. 241-250.
804. G. Maury, "Anneaux de fractions classiques dans les R-ordres maximaux," Commun. Algebra, 3, No. 12, 1083-1091 (1975).
805. G. Maury, "Compléments à mon article 'Anneaux de fractions classiques dans les ordres maximaux'," Commun. Algebra, 3, No. 12, 1093-1096 (1975).
806. G. Maury, "Exemples et compléments en théorie des ordres maximaux au sens de K. Asano," C. R. Acad. Sci., 284, No. 15, A839-A842 (1977).
807. G. Maury, "Un théorème de l'idéal principal dans les R-ordres," Commun. Algebra, 7, No. 7, 677-687 (1979).
808. M. Mazan, "Dual topologique d'un module quelconque," Boll. Unione Mat. Ital., A13, No. 3, 586-591 (1976).
809. J. C. McConnell, "On the global dimension of some rings," Math. Z., 153, No. 3, 253-254 (1977).
810. J. C. McConnell, "The global dimension of rings of differential operators," Lect. Notes Math., 641, 189-197 (1978).
811. B. R. McDonald, Geometric Algebra Over Local Rings, Monographs and Textbooks in Pure and Applied Math., No. 36, Marcel Dekker, New York–Basel (1976).
812. B. R. McDonald, "Endomorphisms of infinitely generated projective modules," J. Algebra, 45, No. 1, 69-82 (1977).
813. K. McDowell, "A codimension theorem for pseudo-Noetherian rings," Trans. Am. Math. Soc., 214, 179-185 (1975).
814. K. McDowell, "Pseudo-Noetherian rings," Can. Math. Bull., 19, No. 1, 77-84 (1976).
815. W. S. McVoy and L. A. Rubel, "Coherence of some rings of functions," J. Funct. Anal., 21, No. 1, 76-87 (1976).
816. F. Mehdi, "On multiplications modules," Math. Stud., 42, Nos. 1-4, 149-153 (1974(1975)).
817. F. Mehdi, "On multiplications and weak multiplication modules," Riv. Mat. Univ. Parma, 2, No. 4, 107-112 (1976).
818. J. D. P. Meldrum, "Injective near-ring modules over Z_n," Proc. Am. Math. Soc., 68, No. 1, 16-18 (1978).
819. C. Menini, "Topologie di caratteri per moduli su anelli Noetheriani," Ann. Univ. Ferrara, 23, Sez. 7, 45-48 (1977).

820. C. Menini, "On E-compact modules over SISI rings," Ann. Univ. Ferrara, 23, Sez. 7, 195-207 (1977).
821. K. Meyberg and B. Zimmerman-Huisgen, "Rings with descending chain condition on certain principal ideals," Proc. Kon. Ned. Akad. Wetensch., A80, 225-229 (1977).
822. G. O. Michler, "Petits modules projectifs des groupes finis," C. R. Acad. Sci., 282, No. 8, A397-A-398 (1976).
823. G. O. Michler, "Small projective modules of finite groups," Lect. Notes Math., 586, 34-42 (1977).
824. C. B. Miller and M. Rajagopalan, "Topologies in locally compact groups. III," Proc. London Math. Soc., 31, No. 1, 55-78 (1975).
825. D. D. Miller, "Semihereditary prime algebras," Commun. Algebra, 7, No. 9, 885-940 (1979).
826. R. W. Miller, "Finitely generated projective modules and TTF classes," Pac. J. Math., 64, No. 2, 505-515 (1976).
827. R. W. Miller and M. L. Teply, "On flatness relative to a torsion theory," Commun. Algebra, 6, No. 10, 1037-1072 (1978).
828. R. W. Miller and M. L. Teply, "The descending chain condition relative to a torsion theory," Pac. J. Math., 83, No. 1, 269-272 (1979).
829. R. W. Miller and D. Turnidge, "Factors of cofinitely generated injective modules," Commun. Algebra, 4, No. 3, 233-243 (1976).
830. I. Mogami and H. Tominaga, "On coprimary decomposition theory for modules," Math. J. Okayama Univ., 17, No. 2, 125-130 (1975).
831. I. Mogami and H. Tominaga, "On coprimary decomposition theory for modules," Math. J. Okayama Univ., 17, No. 2, 125-130 (1975).
832. S. Mohamed, "On PCI rings," J. Univ. Kuwait Sci., 2, 21-23 (1975).
833. S. Mohamed and B. J. Muller, "Decomposition of dual-continuous modules," Lect. Notes Math., 700, 87-94 (1979).
834. S. Mohamed and S. Singh, "Weak q-rings," Can. J. Math., 29, No. 4, 687-695 (1977).
835. S. Mohamed and S. Singh, "Generalizations of decomposition theorems known over perfect rings," J. Austral. Math. Soc., 24, No. 4, 496-510 (1977).
836. S. Mohamed and S. Singh, "Weak q-rings with zero singular ideal," Proc. Am. Math. Soc., 76, No. 1, 25-30 (1979).
837. A. Mohammad, "Rings whose proper homomorphic images are left q-rings," Tamkang J. Math., 9, No. 2, 265-268 (1978).
838. W. Moran, "The global dimension of C(X)," J. London Math. Soc., 17, No. 2, 321-329 (1978).
839. K. Morita, "Localization in categories of modules. IV," Sci. Repts. Tokyo Kyoiku Daigaku, A13, Nos. 366-382, 153-164 (1977).
840. B. J. Müller, "Localization in fully bounded Noetherian rings," Pac. J. Math., 67, No. 1, 233-246 (1976).
841. B. J. Müller, "Localization on noncommutative Noetherian rings," Can. J. Math., 28, No. 3, 600-610 (1976).
842. B. J. Müller, "An example in noncommutative localization," An. Inst. Mat. Univ. Nac. Autonoma Mexico, 17, 75-86 (1977).
843. B. J. Müller, "Noncommutative localization and invariant theory," Commun. Algebra, 6, No. 8, 839-862 (1978).
844. B. J. Müller, "Two-sided quotient rings for Noetherian PI-rings," R. Soc. Can. Math. Repts., 1, No. 1, 53-56 (1979).
845. B. J. Müller, "Ideal invariance and localization," Commun. Algebra, 7, No. 4, 415-441 (1979).
846. B. J. Müller, "Two-sided localization in Noetherian PI-rings," in: Ring Theory. Proc. Antwerp Conf., 1978, New York—Basel (1979), pp. 169-190.
847. B. J. Müller, "Two-sided localization in Noetherian PI-rings," J. Algebra, 63, No. 2, 359-373 (1980).
848. W. Müller, "On Artin rings of finite representation type," Lect. Notes Math., 488, 236-243 (1975).
849. W. Müller, "A generalization of Swan's theorem," Math. Z., 151, No. 1, 57-70 (1976).
850. W. Müller, "A categorical characterisation of compactness," J. London Math. Soc., 17, No. 2, 356-362 (1978).
851. C. J. Mulvey, "Compact ringed spaces," J. Algebra, 52, No. 2, 411-436 (1978).
852. C. J. Mulvey, "Representations of rings and modules," Lect. Notes Math., 753, 542-585 (1979).
853. D. C. Murdoch and F. M. van Oystaeyen, "A note on reductions of modules and kernel functors," Bull. Soc. Math. Belg., 26, No. 4, 351-361 (1974).
854. M. P. Murthy, "Generators for certain ideals in regular rings of dimension three," Comment. Math. Helv., 47, 179-184 (1972).

855. I. M. Musson, "Injective modules for group algebras of locally finite groups," Math. Proc. Cambridge Phil. Soc., 84, No. 2, 247-262 (1978).
856. C. Nastasescu, "Decomposition tertiaire et primaire dans un anneau," Bull. Math. Soc. Sci. Math. RSR, 18, Nos. 3-4, 339-354 (1974(1976)).
857. C. Nastasescu, "Anneaux et modules gradués," Rev. Roum. Math. Pures Appl., 21, No. 7, 911-931 (1976).
858. C. Nastasescu, "Modules simples sur les anneaux gradués," C. R. Acad. Sci., 283, No. 7, 425-428 (1976).
859. C. Nastasescu, Inele. Module, Categorii, Editura Academiei Republicii Socialiste Romani, Bucharest (1976).
860. C. Nastasescu, "Quelques observations sur la dimension de Krull," Bull. Math. Soc. Sci. RSR, 20, Nos. 3-4, 291-293 (1976(1977)).
861. C. Nastasescu, "Conditions de finitude pour les modules," Rev. Roum. Math. Pures Appl., 24, No. 5, 745-758 (1979).
862. C. Nastasescu, "Modules Σ-injectifs," in: Ring Theory., Proc. Antwerp Conf., 1978, New York–Basel (1979), pp. 729-740.
863. C. Nastasescu, "Décompositions primaires dans les anneaux Noethériens à gauche gradués," in: Symp. Math. Ist. Naz. Alta Mat. Francesco Severi, Vol. 23, Roma (1979), pp. 251-258.
864. C. Nastasescu, "Conditions de finitude pour les modules. II," Rev. Roum. Math. Pures Appl., 25, No. 4, 615-630 (1980).
865. C. Nastasescu and F. van Oystaeyen, "Graded and filtered rings and modules," Lect. Notes Math., 758, No. 10 (1979).
866. E. Nauwelaerts, "Symmetric localization of Asano orders," in: Ring Theory. Proc. Antwerp Conf., 1977, New York–Basel (1978), pp. 65-80.
867. E. Nauwelaerts and F. van Oystaeyen, "Localization of primes in algebras over fields," Proc. Kon. Ned. Akad. Wetensch., A80, No. 3, 233-242 (1977); Indag. Math., 39, No. 3, 233-242 (1977).
868. E. Nauwelaerts and F. van Oystaeyen, "Birational hereditary Noetherian prime rings," Commun. Algebra, 8, No. 4, 309-338 (1980).
869. J. Neggers, "Cyclic rings," Rev. Union. Mat. Argent., 28, No. 2, 108-114 (1977).
870. P. Němec, "General theory of preradicals," Stud. Alg. Anwend., 1, 31-35 (1976).
871. P. Němec, "Remarque sur les sommes directes des modules de type denombrable," Publ. Dep. Math., 15, No. 4, 37-48 (1978).
872. W. Neumayer, "Schwachperfekte Ringe," Fachbereich Mathematik der Technischen Universität München (1978).
873. T. Neuvonen, "On the structure of produced and induced indecomposable Lie modules," Ann. Acad. Sci. Fenn., Ser. A1, No. 2, 199-206 (1975).
874. M. Newell, "Ideals with hypercentral action on modules," J. Algebra, 42, No. 2, 600-603 (1976).
875. W. K. Nicholson, "I-rings," Trans. Am. Math. Soc., 207, 361-373 (1975).
876. W. K. Nicholson, "On semiperfect modules," Can. Math. Bull., 18, No. 1, 77-80 (1975).
877. W. K. Nicholson, "Semiregular modules and rings," Can. J. Math., 28, No. 5, 1105-1120 (1976).
878. W. K. Nicholson, "Lifting idempotents and exchange rings," Trans. Am. Math. Soc., 229, 269-278 (1977).
879. W. K. Nicholson and J. F. Watters, "The strongly prime radicals," Proc. Am. Math. Soc., 76, No. 2, 236-240 (1979).
880. A.-M. Nicolas, "Modules factorables de type fini et de rang $n \geq 2$; localizé d'un module factorable," C. R. Acad. Sci., A-B, 280, No. 25, A1717-A1718 (1975).
881. A.-M. Nicolas, "Sur les modules tels que toute suite croissante de sous modules engendrés par n générateurs soit stationnaire," J. Algebra, 60, No. 1, 249-260 (1979).
882. A.-M. Nicolas, "Généralisation d'un critère de Pontryagin concernant les groupes sans torsion dénombrables à des modules sans torsion sur des anneaux de Dedekind. Conditions de rang, de type, de chaines ascendantes," Lect. Notes Math., 740, 385-396 (1979).
883. M. Nishi and M. Shinagawa, "Codivisorial and divisorial modules over completely integrally closed domains. I," Hiroshima Math. J., 5, No. 2, 269-292 (1975); II. Ibid., 5, No. 3, 461-471 (1975).
884. Kenji Nishida, "U-rational extension of a ring," Hokkaido Math. J., 5, No. 2, 227-231 (1976).
885. Kenji Nishida, "Remarks on relatively flat modules," Hokkaido Math. J., 6, No. 1, 130-135 (1977).
886. Kenji Nishida, "Divisible modules, codivisible modules, and quasidivisible modules," Commun. Algebra, 5, No. 6, 591-610 (1977).
887. Kenji Nishida, "Construction of coreflectors," J. Algebra, 54, No. 2, 316-328 (1978).

888. C. Nita, "S-anneaux Noethériens," Rend. Sem. Mat. Univ. Padova, 53, 1-11 (1975).
889. C. Nita, "Quelques observations sur les théories de torsion héréditaires," Bull. Math. Soc. Sci. Math. RSR, 24, No. 1, 73-76 (1980).
890. A. Nobile, "A note on flat algebras," Proc. Am. Math. Soc., 64, No. 2, 206-208 (1977).
891. A. Nowicki, "The primary decomposition of differential modules," Rocz. Pol. Tow. Mat., Ser. 1, 21, No. 2, 341-346 (1979).
892. R. J. Nunke, "Whitehead's problem," Lect. Notes Math., 616, 240-250 (1977).
893. J. Ohm, "An axiomatic approach to homological dimension," Math. Scand., 37, No. 2, 197-222 (1975).
894. M. Ohori, "Characterizations of division rings," J. Fac. Sci. Shinshu Univ., 12, No. 1, 41-42 (1977).
895. K. Ohtake, "Colocalization and localization," J. Pure Appl. Algebra, 11, No. 13, 217-241 (1977).
896. J. Okninski, "Spectrally finite and semilocal group rings," Commun. Algebra, 8, No. 6, 553-541 (1980).
897. J.-P. Olivier, "L'eanneau absolument plat universel, les épimorphismes et les parties constructibles," Bol. Soc. Mat. Mex., 23, No. 2, 68-74 (1978).
898. K. C. O'Meara, "Quotient rings of symmetric and universal group algebras," Commun. Algebra, 8, No. 3, 235-260 (1980).
899. T. Onodera, "On balanced projectives and injectives over linearly compact rings," Hokkaido Math. J., 5, No. 2, 249-256 (1976).
900. T. Onodera, "Codominant dimensions and Morita equivalences," Hokkaido Math. J., 6, No. 2, 169-182 (1977).
901. T. Onodera, "A note on linearly compact modules," Hokkaido Math. J., 8, No. 1, 121-125 (1979).
902. A. Orsatti, "Dualita per alcune classi di moduli E-compatti," Ann. Mat. Pura Appl., 113, 211-235 (1977).
903. J. M. Osborn, "Modules over nonassociative rings," Commun. Algebra, 6, No. 13, 1297-1358 (1978).
904. K. Oshiro, "A note on direct sums of cyclic modules over commutative regular rings," Osaka J. Math., 12, No. 3, 715-718 (1975).
905. K. Oshiro, "On torsion free modules over regular rings. III," Math. J. Okayama Univ., 18, No. 1, 43-56 (1975).
906. K. Oshiro, "Basic elements over von Neumann regular elements," Proc. Jpn. Acad., 52, No. 7, 351-354 (1976).
907. K. Oshiro, "On commutative rings which have completely reducible torsion theories," Proc. Jpn. Acad., Ser. A, Math. Sci., 53, No. 2, 46-49 (1977).
908. K. Oshiro, "On cyclic splitting commutative rings," Osaka J. Math., 15, No. 2, 371-380 (1978).
909. K. Oshiro, "Thin patches and semiprime FGC-rings," Osaka J. Math., 16, No. 1, 57-63 (1979).
910. B. Osofsky, "Projective dimension of "nice" directed union," J. Pure Appl. Algebra, 13, 179-219 (1978).
911. B. Osofsky, "Remarks on projective dimension of $\aleph$-unions," Lect. Notes Math., 734, 223-235 (1979).
912. J. Osterburg, "Completely outer Galois theory of perfect rings," Pac. J. Math., 56, No. 1, 215-220 (1975).
913. J. Osterburg, "A note on perfect modules over crossed products," Rev. Colomb. Mat., 10, No. 2, 69-73 (1976).
914. J. Osterburg, "Some remarks on the crossed product," Yokohama Math. J., 24, Nos. 1-2, 57-61 (1976).
915. A. Oswald, "A note on injective modules over a.d.g. near-rings," Can. Math. Bull., 20, No. 2, 267-269 (1977).
916. A. Oswald, "On near-rings of quotients," Proc. Edinburgh Math. Soc., 22, No. 2, 77-86 (1979).
917. F. van Oystaeyen, "Note on the torsion theory at a prime ideal of a left Noetherian ring," J. Pure Appl. Algebra, 6, No. 3, 297-304 (1975).
918. F. van Oystaeyen, "Extension of ideals under symmetric localization," J. Pure Appl. Algebra, 6, No. 3, 275-283 (1975).
919. F. van Oystaeyen, "Localizations of fully left bounded rings," Commun. Algebra, 4, No. 3, 271-284 (1976).
920. F. van Oystaeyen, "A note on left balanced rings," Proc. Kon. Ned. Akad. Wetensch., A79, No. 3, 213-216 (1976); Indag. Math., 38, No. 3, 213-216 (1976).
921. F. van Oystaeyen, "On the relation between localization of groups and group rings," Commun. Algebra, 4, No. 2, 179-192 (1976).
922. F. van Oystaeyen, "Compatibility of kernel functors and localization functors," Bull. Soc. Math. Belg., 28, No. 2, 131-137 (1976).
923. F. van Oystaeyen, "On the AR-property," Bull. Soc. Math. Belg., 28, No. 1, 11-16 (1976).
924. F. van Oystaeyen, "Pointwise localization in presheaf categories," Proc. Kon. Ned. Akad. Wetensch., A80, No. 2, 114-121 (1977); Indag. Math., 39, No. 2, 114-121 (1977).

925. F. van Oystaeyen, "Stalks of sheaves over the spectra of certain noncommutative rings," Commun. Algebra, 5, No. 8, 899-901 (1977).
926. F. van Oystaeyen, "Zariski central rings," Commun. Algebra, 6, No. 8, 799-821 (1978).
927. F. van Oystaeyen, "Ring theory ∩ torsion theory-useful localization," Nieuw Arch. Wisk., 26, No. 3, 413-427 (1978).
928. F. van Oystaeyen, "On graded rings and modules of quotients," Commun. Algebra, 6, No. 18, 1923-1959 (1978).
929. F. van Oystaeyen, "Graded and nongraded birational extensions," in: Ring Theory. Proc. Antwerp Conf., 1977, New York–Basel (1978), pp. 155-179.
930. F. van Oystaeyen, "Birational extensions of rings," in: Ring Theory. Proc. Antwerp Conf., 1978, New York–Basel (1979), pp. 287-328.
931. F. van Oystaeyen, "Graded prime ideals and the left Ore condition," Commun. Algebra, 8, No. 9, 861-868 (1980).
932. F. van Oystaeyen and J. van Geel, "Local-global results for regular rings," Commun. Algebra, 4, No. 9, 811-821 (1976).
933. F. van Oystaeyen and A. Verschoren, "Localization of presheaves of modules," Proc. Kon. Ned. Akad. Wetensch., A79, No. 4 (1976); Indag. Math., 38, No. 4, 335-348 (1976).
934. F. van Oystaeyen and A. Verschoren, "Relative localization; bimodules and semiprime PI rings," Commun. Algebra, 7, No. 9, 955-988 (1979).
935. F. van Oystaeyen and A. Verschoren, Reflectors and Localization. Application to Sheaf Theory, Lect; Notes Pure Appl. Math., Vol. 41, Marcel Dekker, New York–Basel (1979).
936. A Page, "Sur les anneaux héréditaires ou semihéréditaires," Commun. Algebra, 6, No. 11, 1169-1186 (1978).
937. A. Page, "Actions des groupes," Lect. Notes Math., 740, 9-24 (1979).
938. S. S. Page, "Continuous rings and rings of quotients," Can. Math. Bull., 21, No. 3, 319-324 (1978).
939. S. S. Page, "Regular FPF rings," Pac. J. Math., 79, No. 1, 169-176 (1978).
940. S. S. Page, "Images of injectives and universally cotorsionless modules," Commun. Algebra, 7, No. 2, 193-201 (1979).
941. I. Palmer, "The global homological dimension of semitrivial extensions of rings," Math. Scand., 37, No. 2, 223-256 (1975).
942. I. J. Papick, "A remark on coherent overrings," Can. Math. Bull., 21, No. 3, 373-375 (1978).
943. I. J. Papick, "Coherent overrings," Can. Math. Bull., 22, No. 3, 331-337 (1979).
944. Z. Papp, "On stable Noetherian rings," Trans. Am. Math. Soc., 213, 107-114 (1975).
945. Z. Papp, "Semistability and topologies on R-sp," Commun. Algebra, 4, No. 9, 793-809 (1976).
946. Z. Papp, "A topological characterization of stable rings," Arch. Math., 29, No. 3, 235-240 (1977).
947. Z. Papp, "On the spectra of left stable rings," in: Ring Theory. Proc. Antwerp Conf., 1978, New York-Basel (1979), pp. 741-756.
948. Z. Papp, "Spectrum topologies and sheaves for left Noetherian rings," Lect. Notes Math., 700, 204-214 (1979).
949. S. Parimala, "Projective modules and Hermitian matrices, J. Pure Appl. Algebra, 7, No. 1, 5-14 (1976); Correction: ibid., 9, No. 2, 239 (1976/77).
950. S. Parimala and R. Sridharan, "Projective modules over quaternion algebras," J. Pure Appl. Algebra, 9, No. 2, 181-193 (1977).
951. J. L. Pascaud and J. Valette, "Group actions on Q–F-rings," Proc. Am. Math. Soc., 76, No. 1, 43-44 (1979).
952. G. Paxia, "Ascent properties for absolutely flat homomorphisms," Commun. Algebra, 6, No. 4, 393-407 (1978).
953. P. M. Perdew, "Collapsible modules over pseudorings," Commun. Algebra, 6, No. 6, 611-616 (1978).
954. R. S. Pierce, "The global dimension of commutative regular rings," Houston J. Math., 2, No. 1, 97-110 (1976).
955. P. Pillay, "On semihereditary noncommutative polynomial rings," Proc. Am. Math. Soc., 78, No. 4, 473-474 (1980).
956. M. I. Platzeck, "Representation theory of algebras stably equivalent to an hereditary artin algebra," Trans. Am. Math. Soc., 238, 89-128 (1978).
957. M. I. Platzeck, "On algebras stably equivalent to an hereditary Artin algebra," Can. J. Math., 30, No. 4, 817-829 (1978).
958. M. I. Platzeck and M. Auslander, "Representation theory of hereditary artin algebras," in: Represent. Theory Algebras. Proc. Philadelphia Conf., New York–Basel (1978), pp. 389-424.

959. G. C. Pleasant, "A note on the torsion concept of Levy and Goldie," J. Trennessel Acad. Sci., 51, No. 1, 39-40 (1976).
960. Y. Plusquellec, "Dual ordonné d'un module," R. Soc. Can. Math. Repts., 2, No. 1, 23-26 (1980).
961. V. Poneleit, "Lineare Kompaktheit und die Zerlegung endlich erzeugter Moduln bei einreiningen Duo-ringen," Mitt. Math. Sem. Giesseen, No. 121, 85-92 (1976).
962. E. L. Popescu, "A characterization of Π-reducible rings," Rev. Roum. Math. Pure Appl., 22, No. 4, 537-540 (1977).
963. N. Popescu, "Sur l'anneau des quotients d'un anneau Noéthérien à droite par rapport à un système localisant associé à un idéal bilatère premier," C. R. Acad. Sci., 283, No. 14, A967-969 (1976).
964. N. Popescu and T. Spircu, "Permanence theorems for semi-Artinian rings," Rev. Roum. Math. Pures Appl., 21, No. 2, 227-231 (1976).
965. M. Y. Prest, "Some model-theoretic aspects of torsion theories," J. Pure Appl. Algebra, 12, No. 3, 295-310 (1978).
966. M. Y. Prest, "Torsion and universal Horn classes of modules," J. London Math. Soc., 19, No. 3, 411-417 (1979).
967. M. Y. Prest, "Model-completions of some theories of modules," J. London Math. Soc., 20, No. 3, 369-372 (1979).
968. I. Prodanov, "Precompact minimal topologies in some torsion free modules," Godishn. Sofiisk. Un-t. Fak. Mat. Mekh., 69, 157-163 (1974-1975(1979)).
969. Ph. Quartararo and H. S. Butts, "Finite unions of ideals and modules," Proc. Am. Math. Soc., 52, 91-96 (1975).
970. Y. Quentel, "Sur les anneaux dont tous les modules injectifs sont plats," C. R. Acad. Sci., 280, No. 22, A1491-A1493 (1975).
971. D. Quillen, "Projective modules over polynomial rings," Invent. Math., 36, 167-171 (1976).
972. M. A. R. Qureshi, "On noncommutative Prüfer rings," J. Sci. Phys. Sec., 1, No. 1, 69-70 (1971).
973. F. Rado, "A generalization of the valued vector space," Mathematica (RSR), 19, No. 2, 203-209 (1977).
974. S. Raghavan, Balwant Singh, and R. Sridharan, Homological Methods in Commutative Algebra (Mathematical Pamphlets), Oxford Univ. Press, Delhi 1.a. (1975).
975. V. S. Ramamurthi, "On modules with projective character modules," Math. Jpn., 23, No. 2, 181-184 (1978).
976. V. S. Ramamurthi and E. A. Rutter, Jr., "On cotorsion radicals," Pac. J. Math., 62, No. 1, 163-172 (1976).
977. M. Ramras, "The center of an order with finite global dimension," Trans. Am. Math. Soc., 210, 249-257 (1975).
978. K. M. Rangaswamy, "Modules with finite spanning dimension," Can. Math. Bull., 20, No. 2, 255-262 (1977).
979. K. M. Rangaswamy, "An aspect of purity and its dualization in abelian groups and modules," in: Symp. Math. Ist. Naz. Alta Mat. Francesco Severi, Vol. 23, Roma (1979), pp. 307-320.
980. W. H. Rant, "Minimally generated modules," Can. Math. Bull., 23, No. 1, 103-105 (1980).
981. R. Raphael, "No rings have injective effacements," J. Pure Appl. Algebra, 8, No. 3, 285-288 (1976).
982. R. Raphael, "Autour de la régularité," in: Séminaire d'Algèbre Noncommutative (année 1975-76), Exp. No. 7, Publ. Math. Orsay, Nos. 186-7655, U.E.R. Math., Univ. Paris XI, Orsay (1976).
983. R. Raphael, "Fully idempotent factorization rings," Commun. Algebra, 7, No. 6, 547-563 (1979).
984. L. J. Ratliff and J. C. Robson, "Minimal bases for modules," Houston J. Math., 4, No. 4, 593-596 (1978).
985. B. K. Ray, "Remarks on some theorems of Feller and Swokowski," Math. Seminar Notes, 6, No. 2, 359-362 (1978).
986. J. Raynaud, "Localisations et topologie de Stone," C. R. Acad. Sci., 282, No. 24, A1407-A1410 (1976).
987. J. Raynaud, "Localizations stables par enveloppes injectives," C. R. Acad. Sci., 282, No. 24, A1407-A1410 (1976).
988. J. Raynaud, "Localisations premiers et copremiers. Localisations stables par enveloppes injectives," in: Ring Theory. Proc. Antwerp Conf., 1977, New York–Basel (1978), pp. 81-111.
989. M. B. Rege and K. Varadarajan, "Chain conditions and pure-exactness," Pac. J. Math., 72, No. 1, 223-235 (1977).
990. J. D. Reid, "Twisted group rings which are semiprime Goldie rings," Glasgow Math. J., 16, No. 1, 1-11 (1975).
991. I. Reiner, Maximal Orders, Academic Press, London (1975), (L.M.S. Monogr. No. 5).

992. I. Reiten, "Stable equivalence of dualizing R-varieties. VI. Nakayama dualizing R-varieties," Adv. Math., 17, No. 2, 196-211 (1975).
993. I. Reiten, "Stable equivalence for some categories with radical square zero," Trans. Am. Math. Soc., 212, 333-345 (1975).
994. I. Reiten, "Stable equivalence of self-injective algebras," J. Algebra, 40, No. 1, 63-74 (1976).
995. I. Reiten, "Almost split sequences for group algebras of finite representation type," Trans. Am. Math. Soc., 233, 125-136 (1977).
996. I. Reiten, "A note on stable equivalence and Nakayama algebras," Proc. Am. Math. Soc., 71, No. 2, 157-163 (1978).
997. I. Reiten, "Algebras stably equivalent to Nakayama algebras of Loewy length at most 4," J. Austral. Math. Soc., A27, No. 1, 37-50 (1979).
998. I. Reiten, "Almost split sequences," in: Ring Theory. Proc. Antwerp Conf., 1978, New York–Basel (1979), pp. 513-533.
999. G. Renault, "Sur des conditions de chaines ascendantes dans des modules libres," in: Sem. Alg. Non-commutative (1975-1976), Paris XI, Orsay (1976).
1000. G. Renault, "Sur des conditions de chaines ascendantes dans des modules libres," J. Algebra, 47, No. 2, 268-275 (1977).
1001. G. Renault, "Actions des groupes et anneaux réguliers injectifs," Lect. Notes Math., 734, 236-247 (1979).
1002. R. Resco, "A dimension theorem for division rings," Isr. J. Math., 35, No. 3, 215-221 (1980).
1003. P. Ribenboim, "Valuations and lengths of constructible modules," in: Rings, Modules and Radicals, Amsterdam–London (1973), pp. 447-456.
1004. P. Ribenboim, "Valuations and lengths of constructible modules," J. Reine Angew. Math., 283-284, 186-201 (1976).
1005. R. Richards, "Noetherian prime rings of Krull dimension one," Commun. Algebra, 7, No. 8, 845-873 (1979).
1006. F. Richman, "The constructive theory of KT-modules," Pac. J. Math., 61, No. 1, 263-274 (1975).
1007. F. Richman, "A guide to valuated groups," Lect. Notes Math., 616, 73-86 (1977).
1008. F. Richman and E. Walker, "Valuated groups," J. Algebra, 56, No. 1, 145-167 (1979).
1009. D. Rimer, "Éléments de la théorie des pseudomodules," Proc. Inst. Math. Iasi, 75-84 (1976).
1010. Ringe, Moduln und homologische Methoden, Tagungsber. Math. Forschungsinst. Oberwolfach, No. 22, 1-14 (1976).
1011. Ringe, Moduln und homologische Methoden, Tagungsber. Math. Forschungsinst. Oberwolfach, No. 20, 1-15 (1977).
1012. C. M. Ringel, "Unions of chains of indecomposable modules," Commun. Algebra, 3, No. 12, 1121-1144 (1975).
1013. C. M. Ringel, "Finite-dimensional hereditary algebras of wild representation type," Math. Z., 161, No. 3, 235-256 (1978).
1014. C. M. Ringel, "The spectrum of a finite-dimensional algebra," in: Ring Theory. Proc. Antwerp Conf., 1978, New York–Basel (1979), pp. 535-598.
1015. M. J. Rios, "Sobre filtros de Gabriel. IV. (Modulos planos y anillos regulares relativos)," An. Inst. Mat. Univ. Nac. Auton. Mex., 17, No. 1, 95-108 (1977).
1016. E. de Robert, "Suites exactes absolument scindées," C. R. Acad. Sci., A284, No. 21, 1337-1340 (1977).
1017. R. N. Roberts, "Krull dimension for Artinian modules over quasi local commutative rings," Q. J. Math., 26, No. 103, 269-273 (1975).
1018. J. C. Robson, "Cyclic and faithful objects in quotient categories with application to Noéthérian simple or Asano rings," Lect. Notes Math., 545, 151-172 (1976).
1019. J. C. Robson, "Quotient categories and Weyl algebras," Lect. Notes Math., 586, 101-109 (1977).
1020. R. W. Roggenkamp, "Injective modules for group rings and Gorenstein orders," J. Algebra, 24, No. 3, 465-472 (1973).
1021. R. W. Roggenkamp, "Bass algebras," J. Pure Appl. Algebra, 9, No. 2, 169-179 (1977).
1022. R. W. Roggenkamp, "Some examples of orders and global dimension two," Math. J., 154, No. 3, 225-238 (1977).
1023. R. W. Roggenkamp, "Orders of global dimension two," Math. Z., 160, No. 1, 63-68 (1978).
1024. R. W. Roggenkamp, "Algebras of global dimension two," Arch. Math., 30, No. 4, 385-390 (1978).
1025. M. Roitman, "On Serre's problem on projective modules," Proc. Am. Math. Soc., 50, 45-52 (1975).
1026. M. Roitman, "Completely unimodular rows to invertible matrices," J. Algebra, 49, No. 1, 206-211 (1977).

1027. M. Roitman, "A note on Quillen's paper 'Projective modules over polynomial rings'," Proc. Am. Math. Soc., 64, No. 2, 231-232 (1977).
1028. M. Roitman, "On projective modules over polynomial rings," J. Algebra, 58, No. 1, 51-63 (1979).
1029. A. Rosenberg, "La dimension globale d'extension d'Ore," in: Groupe d'étude algebre. Univ. Pierre et Marie Curie, 1975-1976 (1978), 1, 3/01-3/02.
1030. B. Roux, "Sur les anneaux de Koethe," An. Acad. Brasil. Cienc., 48, No. 1, 13-28 (1976).
1031. L. H. Rowen, "Monomial conditions on prime rings," Isr. J. Math., 27, No. 2, 131-149 (1977).
1032. R. A. Rubin, "Simple maximal quotient rings," Proc. Am. Math. Soc., 55, No. 1, 29-33 (1976).
1033. D. E. Rush, "Remarks on flat modules," Michigan Math. J., 23, 193-201 (1976(1977)).
1034. E. Rutter, "OF-3 rings with ascending chain condition on annihilators," J. Reine Angew. Math., 277, 40-44 (1975).
1035. E. Rutter, "Dominant modules and finite localizations," Tohoku Math. J., 27, No. 2, 225-239 (1975).
1036. G. Sabbagh, "Catégoricité en $\aleph_0$ et stabilité: constructions les préservant et conditions de chaine," C.R. Acad. Sci., 280, No. 9, A531-A533 (1975).
1037. G. Sabbagh, "Catégoricité et stabilité: quelques exemples parmi les groupes et anneaux," C. R. Acad. Sci., 280, No. 10, A603-A606 (1975).
1038. L. Salce, "Moduli Slender su anello di Dedekind," Ann. Univ. Ferrara, 20, Sez. VII, 59-63 (1975).
1039. D. Salles, "Anneaux semiartiniens non commutatifs," in: Semin. P. Dubreil. Algèbre. Univ. Paris, 1972-1973, 26, 2/1-2/6.
1040. D. Salles, "Anneaux semiartiniens non commutatifs," in: Sem. d'Algebre non commutative. Publ. Math. Orsay, No. 107-7523, Univ. Paris XI (1974).
1041. D. Salles, "Anneaux de groupes semiartiniens, anneaux de groupe coherents," C. R. Acad. Sci., 283, No. 16, A1073-A1076 (1976).
1042. J. D. Sally and W. V. Vasconcelos, "Flat ideals. I," Commun. Algebra, 3, No. 6, 531-543 (1975).
1043. F. L. Sandomierski, "Classical localization at prime ideals of fully bounded Noetherian rings," in: Ring Theory. Proc. Conf., Ohio Univ., Athens, Ohio, 1976, Lect. Notes Pure Appl. Math., Vol. 25, Marcel Dekker, New York (1977), pp. 169-181.
1044. B. Sarath, "Krull dimension and Noetherianness," Ill. J. Math., 20, No. 2, 329-335 (1976).
1045. B. Sarath and K. Varadarajan, "Divisibility of direct sums in torsion theories," Can. J. Math., 28, No. 1, 211-214 (1976).
1046. B. Sarath and K. Varadarajan, "Dual Goldie dimension. II," Commun. Algebra, 7, No. 17, 1885-1899 (1979).
1047. H. Sato, "Duality of torsion modules over a QF-3 one-dimensional Gorenstein ring," Sci. Repts. Tokyo Kyoiku Daigaku, A13, No. 347-365, 28-36 (1975).
1048. H. Sato, "On localizations of 1-Gorenstein ring," Sci. Repts. Tokyo Daigaku, 13, No. 366-382, 188-193 (1977).
1049. H. Sato, "Remark on localizations of Noetherian rings with Krull dimension one," Tsukuba J. Math., 3, No. 1, 123-128 (1979).
1050. M. Sato, "The concrete description of the colocalization," Proc. Jpn. Acad., 52, No. 9, 502-504 (1976).
1051. M. Sato, "On equivalences between module categories," in: Proc. 10th Symp. Ring Theory, Matsumoto, 1977, Okayama (1978), pp. 83-94.
1052. M. Sato, "Fuller's theorem on equivalences," J. Algebra, 52, No. 1, 274-284 (1978).
1053. G. Scheja and U. Storch, "Quasi-Frobenius-Algebren und lokal Vollständige Durchschnitte," Manuscr. Math., 19, No. 1, 75-104 (1976).
1054. W. Schelter, "Essential extensions and intersection theorems," Proc. Am. Math. Soc., 53, No. 2, 328-330 (1975).
1055. W. Schelter and L. W. Small, "Some pathological rings of quotients," J. London Math. Soc., 14, No. 53, 200-202 (1976).
1056. R. Schmähling, "Eine axiomatosche Kennzeichnung der Determinante auf endlich-erzeugten projektiven Moduln," J. Reine Angew. Math., 276, 56-67 (1975).
1057. R. Schulz, "Reflexive modules over perfect rings," J. Algebra, 61, No. 2, 527-537 (1979).
1058. D. Segal, "On the residual simplicity of certain modules," Proc. London Math. Soc., 34, No. 2, 327-353 (1977).
1059. H. Sekiyama, "Trivial extension of a ring with balanced condition," Proc. Am. Math. Soc., 77, No. 1, 1-6 (1979).
1060. J. Shapiro, "T-torsion theories and central localizations," J. Algebra, 48, No. 1, 17-29 (1977).
1061. J. Shapiro, "R-sequences in fully bounded Noetherian rings," Commun. Algebra, 7, No. 8, 819-831 (1979).

1062. R. Y. Sharp, "Ramification indices and injective modules," J. London Math. Soc., 11, No. 3, 267-275 (1975).
1063. R. Y. Sharp, "Secondary representations for injective modules over commutative Noetherian rings," Proc. Edinburgh Math. Soc., 20, No. 2, 143-151 (1976).
1064. S. Shelah, "Infinite Abelian groups, Whitehead problem and some constructions," Isr. J. Math., 18, No. 3, 243-256 (1974).
1065. S. Shelah, "A compactness theorem for singular cardinals, free algebras. Whitehead problem and transversals," Isr. J. Math., 21, No. 4, 319-349 (1975).
1066. S. Shelah, "The lazy model-theoretician's guide to stability," Log. et. Anal., 18, No. 71-72, 241-308 (1975).
1067. S. Shelah, "Whitehead groups may be not free even assuming CH. I," Isr. J. Math., 28, No. 3, 193-204 (1977).
1068. C. Sherman, "A note on the localization theorem for projective modules," Proc. Am. Math. Soc., 75, No. 2, 207-208 (1979).
1069. M. Shinagawa, "On flat extensions of Krull domains," Hiroshima Math. J., 5, No. 3, 517-524 (1975).
1070. R. C. Shock, "Dual generalizations of the Artinian and Noetherian conditions," Pac. J. Math., 54, No. 2, 227-235 (1974).
1071. R. C. Shock, "On orders in QF-2 rings," Math. Scand., 38, No. 2, 192-198 (1976).
1072. T. S. Shores, "A topological criterion for primary decomposition," Acta Math. Acad. Sci. Hung., 28, Nos. 3-4, 383-387 (1976).
1073. T. Shudo, "A note on coalgebras and rational modules," Hiroshima Math. J., 6, No. 2, 297-304 (1976).
1074. S. K. Sim, "On rings of which every prime kernel functor is symmetric," Nanta Math., 7, No. 2, 69-70 (1974).
1075. S. K. Sim, "Prime ideals and symmetric idempotent kernel functors," Rev. Union Mat. Argent., 27, No. 2, 59-64 (1975).
1076. S. K. Sim, "Prime ideals and symmetric idempotent kernel functors," Nanta Math., 9, No. 2, 121-124 (1976).
1077. D. Simson, "Pure semisimple categories and rings of finite representation type," J. Algebra, 48, No. 2, 290-294 (1977); correction: ibid., 67, No. 1, 254-256 (1980).
1078. D. Simson, "Categories of representations of species," J. Pure Appl. Algebra, 14, 101-114 (1979).
1079. S. Singh, "Modules over hereditary Noetherian prime rings, II," Can. J. Math., 28, No. 1, 73-82 (1976).
1080. S. Singh, "Some decomposition theorems in Abelian groups and their generalizations," in: Ring Theory. Proc. Ohio Univ. Conf., 1976, New York–Basel (1977), pp. 183-189.
1081. S. Singh, "(hnp)-rings over which every module admits a basic submodule," Pac. J. Math., 76, No. 2, 509-512 (1978).
1082. S. Singh and M. Asrar, "Rings in which every finitely generated left ideal is quasiprojective," J. Indian Math. Soc., 40, Nos. 1-4, 195-205 (1976).
1083. S. Singh and A. Beg, "Restricted balanced rings," Arch. Math., 33, No. 2, 127-130 (1979).
1084. S. Singh and F. Mehdi, "Multiplication modules," Can. Math. Bull., 22, No. 1, 93-98 (1979).
1085. S. Singh and S. Talwar, "Pure submodules of modules over bounded (hnp)-rings," Arch. Math., 30, No. 6, 570-577 (1978).
1086. S. Singh and S. Talwar, "Modules over bounded hereditary Noetherian prime rings," Arch. Math., 32, No. 2, 134-142 (1979).
1087. G. Sjödin, "On the indecomposable modules over certain wild algebras," Stockholms Univ. Mat. Inst. (Medd.), No. 1, 1-17 (1979).
1088. S. Smale, "Global dimension of special endomorphism rings over Artin algebras," Ill. J. Math., 22, No. 3, 414-427 (1978).
1089. S. Smale, "The structure of special endomorphism rings over Artinian algebras," Ill. J. Math., 22, No. 3, 428-442 (1978).
1090. S. Smale, "The inductive step of the second Brauer–Thrall conjecture," Can. J. Math., 32, No. 2, 342-349 (1980).
1091. Bohumil Smarda, "The lattice of topologies of topological L-groups," Czechosl. Mat. J., 26, No. 1, 128-136 (1976).
1092. P. F. Smith, "A note on projective modules," Proc. R. Soc. Edinburgh, A75, No. 1, 23-31 (1976).
1093. P. F. Smith, "Some rings which are characterized by their finitely generated modules," Q. J. Math., 29, No. 1, 113, 101-109 (1978).

1094. P. F. Smith, "Finitely embedded modules over group rings," Proc. Edinburgh Math. Soc., 21, Ser. 2, No. 1, 55-64 (1978).
1095. P. F. Smith, "Decomposing modules into projectives and injectives," Pac. J. Math., 76, No. 1, 247-266 (1978).
1096. P. F. Smith, "Rings characterized by their cyclic modules," Can. J. Math., 31, No. 1, 93-111 (1979).
1097. P. F. Smith, "On the structure of certain PP-rings," Math. Z., 166, No. 2, 147-157 (1979).
1098. R. Snider, "Rings whose ideals have projective covers," Arch. Math., 27, No. 4, 378-382 (1976).
1099. R. Snider, "On the singular ideal of a group algebra," Commun. Algebra, 4, No. 11, 1087-1089 (1976).
1100. R. Snider, "Injective hulls of simple modules over group rings," in: Ring Theory. Proc. Ohio Univ. Conf., 1976, New York–Basel (1977), pp. 223-226.
1101. D. Spulber, "On localizing system of M-dense left ideals of a ring," Bull. Math. Soc. Sci. Math. RSR, 18, Nos. 1-2, 203-206 (1974(1975)).
1102. D. Spulber, "F-Dedekind rings," Bull. Math. Soc. Sci. Math. RSR, 18, Nos. 3-4, 379-389 (1974(1976)).
1103. D. Spulber, "Observations sur les systèmes localisants réguliers et leur liaison avec la transformée Nagata d'un idéal," Rev. Roumaine de Math. Pure Appl., 21, No. 5, 559-563 (1976).
1104. D. Spulber, "Induced flat epimorphisms of rings," Rev. Roumaine de Math. Pure Appl., 23, No. 3, 495-496 (1978).
1105. D. Spulber, "TP-rings," Rev. Roumaine Math. Pures Appl., 23, No. 4, 611-615 (1978).
1106. J. T. Stafford, "Completely faithful modules and ideals of simple Noetherian rings," Bull. London Math. Soc., 8, No. 2, 168-173 (1976).
1107. J. T. Stafford, "Weyl algebras are stably free," J. Algebra, 48, No. 2, 297-304 (1977).
1108. J. T. Stafford, "Stable structure of noncommutative Noetherian rings. I," J. Algebra, 47, No. 2, 244-267 (1977); II, ibid., 52, No. 1, 218-235 (1978).
1109. J. T. Stafford, "A simple Noetherian ring not Morita equivalent to a domain," Proc. Am. Math. Soc., 68, No. 2, 159-160 (1978).
1110. J. T. Stafford, "Module structure of Weyl algebras," J. London Math. Soc., 18, No. 3, 429-442 (1978).
1111. J. T. Stafford, "Cancellation for nonprojective modules," Lect. Notes Math., 700, 3-15 (1979).
1112. J. T. Stafford, "Simple Noetherian rings," Lect. Notes Math., 700, 230-231 (1979).
1113. J. T. Stafford, "Morita equivalence of simple Noetherian rings," Proc. Am. Math. Soc., 74, No. 2, 212-214 (1979).
1114. J. T. Stafford, "On the regular elements of Noetherian rings," in: Ring Theory. Proc. Antwerp Conf., 1978. New York–Basel (1979), pp. 257-277.
1115. J. T. Stafford, "Projective modules over polynomial extensions of division rings," Invent. Math., 59, No. 2, 105-117 (1980).
1116. R. O. Stanton, "An invariant for modules over a discrete valuation ring," Proc. Am. Math. Soc., 49, No. 1, 51-54 (1975).
1117. R. O. Stanton, "Relative S-invariants," Proc. Am. Math. Soc., 65, No. 2, 221-224 (1977).
1118. R. O. Stanton, "Decomposition of modules over a discrete valuation ring," J. Austral. Math. Soc., A27, No. 3, 284-288 (1979).
1119. O. Steinfeld, "Some characterizations of semisimple rings with minimum condition on principal left ideals," Acta Math. Acad. Sci. Hung., 26, Nos. 3-4, 377-384 (1975).
1120. B. Stenström, "The maximal ring of quotients of a generalized matrix ring," Stud. Alg. Anwend., 1, 65-67 (1976).
1121. R. Strebel, "A homological fitness criterion," Math. Z., 151, No. 3, 263-275 (1976).
1122. K. Sugano, "On projective H-separable extension," Hokkaido Math. J., 5, No. 1, 44-54 (1976).
1123. T. Sumioka, "On nonsingular QF-3' rings with injective dimension ≤ 1," Osaka J. Math., 15, No. 1, 1-12 (1978).
1124. T. Sumioka, "On finite-dimensional QF-3' rings," in: Proc. 10th Symp. Ring Theory, Matsumoto, 1977, Okayama (1978), pp. 99-105.
1125. A. A. Suslin, "The cancellation problem for projective modules and related topics," Lect. Notes Math., 734, 323-338 (1979).
1126. R. G. Swan, "Serre's problem," Queen's Pap. Pure Appl. Math., No. 42, 2-60 (1975).
1127. R. G. Swan, "Topological examples of projective modules," Trans. Am. Math. Soc., 230, 201-234 (1977).
1128. R. G. Swan, "Projective modules over Laurent polynomial rings," Trans. Am. Math. Soc., 237, 111-120 (1978).
1129. A. Szendrei, "On affine modules. Contributions to universal algebra," Colloq. Math. Soc. J. Bolyai, 17, 457-464 (1977).

1130. G. Szeto, "The localization of zero-dimensional rings," Bull. Soc. Math. Belg., 28, No. 3, 193-196 (1976).
1131. G. Szeto, "The structure of semiperfect rings," Commun. Algebra, 5, No. 3, 219-229 (1977).
1132. G. Szeto, "On exact sequences of modules," Arch. Math., 29, No. 1, 67-71 (1977).
1133. G. Szeto, "Classical algebras of quotients and central quotients of algebras," Acta Math. Acad. Sci. Hung., 32, Nos. 1-2, 59-62 (1978).
1134. G. Szeto, "On weakly biregular algebra," Bull. Acad. Pol. Sci. Sec. Sci. Math., Astron. Phys., 26, Nos. 9-10, 775-780 (1978).
1135. G. Szeto, "PP rings and reduced rings," Czech. Mat. J., 29, No. 1, 53-56 (1979).
1136. H. Tachikawa, "Balancedness and left serial algebras of finite type," in: Proc. Int. Conf. on Representations of Algebras (Carleton Univ., Ottawa, Ont., 1974), Paper No. 26. Carleton Math. Lect. Notes No. 9, Carleton Univ., Ottawa (1974).
1137. H. Tachikawa, "Balanced modules and constructible submodules," Sci. Repts. Tokyo Kyoiku Daigaku, A13, Nos. 347-365, 37-45 (1975).
1138. H. Tachikawa, "Commutative perfect QF-1 rings," Proc. Am. Math. Soc., 68, No. 3, 261-264 (1978).
1139. T. Takeuchi, "On cofinite-dimensional modules," Hokkaido Math. J., 5, No. 1, 1-43 (1976).
1140. S. Talwar, "Modules over bounded hereditary Noetherian prime rings. II," Arch. Math., 34, No. 1, 21-26 (1980).
1141. M. L. Teply, "Generalizations of the simple torsion class and the splitting property," Can. J. Math., 27, No. 5, 1056-1074 (1975).
1142. M. L. Teply, "Prime singular-splitting rings with finiteness conditions," Lect. Notes Math., 545, 173-194 (1976).
1143. M. L. Teply, "Subidealizers," Lect. Notes Math., 700, 232-234 (1979).
1144. J. C. Thomas, "Homological dimension under change of rings," Commun. Algebra, 7, No. 6, 625-640 (1979).
1145. P. M. Timothy, "Quelques resultats sur les anneaux semi-Noéthériens," Bull. Acad. Pol. Sci. Ser. Sci. Math., Astron. Phys., 24, No. 10, 829-834 (1976).
1146. C. Tisseron, "Sur les anneaux tels que tout produit de copies d'un module quasiinjectif soit module quasiinjectif," Ann. Mat. Pura Appl., 105, 37-71 (1975).
1147. C. Tisseron, "Sur les anneaux tels que tout produit de copies d'un module quasiinjectif soit un module quasiinjectif. II," Ann. Mat. Pura Appl., 110, No. 8, 15-28 (1976).
1148. A. K. Tiwary and B. M. Pandey, "Rings over which every module is quasipolysimple," Progr. Math. (Allahabad), 9, No. 1, 1-6 (1975).
1149. A. K. Tiwary and B. M. Pandey, "Pseudoprojective and pseudoinjective modules," Indian J. Pure Appl. Math., 9, No. 9, 941-949 (1978).
1150. A. K. Tiwary and S. A. Paramhans, "On closure of submodules," Indian J. Pure Appl. Math., 8, No. 11, 1415-1419 (1977).
1151. H. Tominaga, "On left s-unital rings. I, II," Math. J. Okayama Univ., 18, No. 2, 117-133 (1976); 19, No. 2, 171-182 (1976/1977).
1152. G. Törner, "Some remarks on the structure of indecomposable injective modules over valuation rings," Commun. Algebra, 4, No. 5, 467-482 (1976).
1153. G. Törner, "Unzerlegbare, injektive Moduln über Kettenringen," J. Reine Angew. Math., 285, 172-180 (1976).
1154. J. Towber, "Two new functors from modules to algebras," J. Algebra, 47, No. 1, 80-104 (1977).
1155. R. Treger, "Reflexive modules," J. Algebra, 54, No. 2, 444-466 (1978).
1156. M. A. Upham, "A new proof of a theorem of Michler," Arch. Math., 31, No. 6, 554-561 (1979).
1157. M. A. Upham, "Localization and completion of FBN hereditary rings," Commun. Algebra, 7, No. 12, 1269-1307 (1979).
1158. R. Ursianu, "Asupra submodulelor diferentiale," Std. Si Cerc. Mat., 29, No. 1, 85-89 (1977).
1159. M. Uscki, "On exact modules over a commutative ring," Colloq. Math., 40, No. 2, 197-202 (1979).
1160. J. Valette, "Sur les modules projectifs," C. R. Acad. Sci., 282, No. 16, A281-A283 (1976).
1161. P. Vamos, "Test modules and cogenerators," Proc. Am. Math. Soc., 56, No. 1, 8-10 (1976).
1162. P. Vamos, "Rings with duality," Proc. London Math. Soc., 35, No. 2, 275-289 (1977).
1163. P. Vamos, "The decomposition of finitely generated modules and fractionally self-injective rings," J. London Math. Soc., 16, No. 2, 209-220 (1977).
1164. P. Vamos, "Semilocal Noetherian PI-rings," Bull. London Math. Soc., 9, No. 3, 251-256 (1977).
1165. P. Vamos, "Finitely generated Artinian and distributive modules are cyclic," Bull. London Math. Soc., 10, No. 3, 287-288 (1978).

1166. P. Vamos, "Sheaf-theoretical methods in the solution of Kaplansky's problem," Lect. Notes Math., 753, 732-738 (1979).
1167. K. Varadarajan, "M-projective and strongly M-projective modules," Ill. J. Math., 20, No. 3, 507-515 (1976).
1168. K. Varadarajan, "Study of certain radicals," J. Pure Appl. Algebra, 9, No. 1, 107-120 (1976).
1169. K. Varadarajan, "Dual Goldie dimension," Commun. Algebra, 7, No. 6, 565-610 (1979).
1170. K. Varadarajan, "Modules with supplements," Pac. J. Math., 82, No. 2, 559-564 (1979).
1171. K. Varadarajan, "Study of certain preradicals," Commun. Algebra, 8, No. 2, 185-209 (1980).
1172. W. V. Vasconcelos, Divisor Theory in Module Categories, North Holland Math. Stud., Vol. 14, North-Holland, Amsterdam–Oxford, Amer. Elsevier, New York (1974).
1173. W. V. Vasconcelos, "The λ-dimension of a ring," Queen's Pap. Pure Appl. Math., No. 43, 213-224 (1975).
1174. W. V. Vasconcelos, "Superregularity in local rings," J. Pure Appl. Algebra, 7, No. 2, 231-233 (1976).
1175. W. V. Vasconcelos, "On the arithmetic of flat ideals and epimorphisms," Notas e Comuns. Mat., No. 70 (1976).
1176. W. V. Vasconcelos, The Rings of Dimension Two, Marcel Dekker, New York–Basel (1976).
1177. W. V. Vasconcelos and R. Wiegandt, "Bounding the number of generators of a module," Math. Z., 164, No. 1, 1-7 (1978).
1178. A. Verschoren, "A note on strictly local kernel functors," Bull. Soc. Math. Belg., 28, No. 3, 179-192 (1976).
1179. A. Verschoren, "Localization and the Gabriel–Popescu embedding," Commun. Algebra, 6, No. 15, 1563-1567 (1978).
1180. A. Verschoren, "Localization of (pre)-sheaves of modules and structure sheaves," in: Ring Theory. Proc. Antwerp Conf., 1977, New York–Basel (1978), pp. 181-207.
1181. A. Verschoren, "Localization of bimodules and PI-rings," in: Ring Theory. Proc. Antwerp Conf., 1978, New York–Basel (1979), pp. 329-350.
1182. A. Verschoren, "Torsion free extensions and perfect localizations," Commun. Algebra, 8, No. 9, 839-859 (1980).
1183. A. Verschoren and F. van Oystaeyen, "Localization of sheaves of modules," Proc. Kon. Ned. Akad. Wetensch., A79, No. 5, 470-481 (1977).
1184. R. Vidal, "Modules de type quasi fini sur un anneau non commutatif," Semin. P. Dubreil. Algèbre. Univ. Pierre et Marie Curie, 28, 8/1-8/6 (1975).
1185. C. L. Wangneo and K. Tewari, "Right Noetherian rings integral over their centers," Commun. Algebra, 7, No. 15, 1573-1598 (1979).
1186. R. B. Warfield, Jr., "Countably generated modules over commutative Artinian rings," Pac. J. Math., 60, No. 2, 289-302 (1975).
1187. R. B. Warfield, Jr., "Large modules over artinian rings," in: Represent. Theory Algebras. Proc. Philadelphia Conf., New York–Basel (1978), pp. 451-463.
1188. R. B. Warfield, Jr., "Stable equivalence of matrices and resolutions," Commun. Algebra, 6, No. 17, 1811-1828 (1978).
1189. R. B. Warfield, Jr., "Bezout rings and serial rings," Commun. Algebra, 7, No. 5, 533-545 (1979).
1190. R. B. Warfield, Jr., "Stable generation of modules," Lect. Notes Math., 700, 16-33 (1979).
1191. R. B. Warfield, Jr., "Modules over fully bounded Noetherian rings," Lect. Notes Math., 734, 339-352 (1979).
1192. J. Waschbusch, "Unzerlegbare Moduln über Artinringen," Arch. Math., 28, No. 5, 478-490 (1977).
1193. J. Waschbusch, "Über Bimoduln in Artinringen vom endlichen Modultyp," Commun. Algebra, 8, No. 2, 105-151 (1980).
1194. C. Webb, "Tensor products of separable reduced primary modules," Proc. Edinburgh Math. Soc., 22, No. 1, 23-26 (1979).
1195. E. C. Weinberg, "Relative injectives," in: Symp. Math. Ist. Naz. Alta Mat., Vol. 21, London–New York (1977), pp. 555-564.
1196. E. Wexler-Kreindler, "Propriétés de transfert des extensions d'Ore," Lect. Notes Math., 641, 235-251 (1978).
1197. E. Wexler-Kreindler, "Polynomes d'Ore, séries formelles tordues et anneaux filtres complets héréditaires," Commun. Algebra, 8, No. 4, 339-371 (1980).
1198. R. Wiegand, "Rings of bounded module type," Lect. Notes Math., 700, 143-150 (1979).
1199. R. Wiegand and S. Wiegand, "Commutative rings whose finitely generated modules are direct sums of cyclics," Lect. Notes Math., 616, 406-423 (1977).

1200. R. W. Wilkerson, "Injective quotient rings of group rings," Tydskr. Ñaturwetenskap., 16, No. 1, 24-27 (1976).
1201. A. Wirth, "Locally compact tight Riesz groups," J. Austral. Math. Soc., 19, No. 2, 247-251 (1975).
1202. R. Wisbauer, "Injektive und projektive Moduln über nichtassoziativen Ringen," Arch. Math., 28, No. 5, 460-468 (1977).
1203. R. Wisbauer, "Cosemisimple modules and nonassociative V-rings," Commun. Algebra, 5, No. 11, 1193-1209 (1977).
1204. R. Wisbauer, "Nonassociative left regular and biregular rings," J. Pure Appl. Algebra, 10, No. 2, 215-226 (1977).
1205. R. Wisbauer, "σ-semiperfekte und σ-perfekte Moduln," Math. Z., 162, No. 2, 131-138 (1978).
1206. R. Wisbauer, "Separable Moduln von Algebren über Ringen," J. Reine Angew. Math., 303-304, 221-230 (1978).
1207. R. Wisbauer, "Erbliche Moduln und nichtassoziative Ringe," Commun. Algebra, 7, No. 1, 47-77 (1979).
1208. R. Wisbauer and L. Witkowski, "On linearly topological modules," Demonstr. Math., 10, No. 2, 317-327 (1977).
1209. R. W. Wong, "Free ideal monoid rings," J. Algebra, 53, No. 1, 21-35 (1978).
1210. R. W. Wong, "Finitely generated ideals in free group algebras," Commun. Algebra, 7, No. 9, 875-883 (1979).
1211. T. Würfel, "Ring extensions and essential monomorphisms," Proc. Am. Math. Soc., 69, No. 1, 1-7 (1978).
1212. S. M. Yanya, "P-neat exact sequences," Stud. Sci. Math. Hung., 11, Nos. 3-4, 363-371 (1976).
1213. S. M. Yanya and A. Al-Daffa, "On cogenerators in modules," Math. Sem. Notes Kobe Univ., 7, No. 1, 153-166 (1979).
1214. S. M. Yanya and A. Al-Daffa, "Cogenerators in modules over Dedekind domains," Math. Sem. Notes Kobe Univ., 8, No. 1, 91-102 (1980).
1215. K. Yamagata, "On artinian rings of finite representation type," J. Algebra, 50, No. 2, 276-283 (1978).
1216. Chi Ming R. Yue, "On annihilator ideals," Math. J. Okayama Univ., 19, No. 1, 51-53 (1976).
1217. Chi Ming R. Yue, "On von Neumann regular rings. II," Math. Scand., 39, No. 2, 167-170 (1976).
1218. Chi Ming R. Yue, "On annihilators and quasi-Frobenius rings," Bull. Soc. Math. Belg., 28, No. 2, 115-120 (1976).
1219. Chi Ming R. Yue, "On annihilators and continuous regular rings," Bull. Math. Soc. Sci. Math. RSR, 20, Nos. 3-4, 423-427 (1976(1977)).
1220. Chi Ming R. Yue, "On von Neumann regular rings. III," Monatsh. Math., 86, No. 3, 251-257 (1978).
1221. Chi Ming R. Yue, "On generalizations of V-rings and regular rings," Math. J. Okayama Univ., 20, No. 2, 123-129 (1978).
1222. Chi Ming R. Yue, "A remark on decomposable modules," Publ. Inst. Math., 25, 101-104 (1979).
1223. Chi Ming R. Yue, "On regular rings and V-rings," Monatsh. Math., 88, No. 4, 335-344 (1979).
1224. Chi Ming R. Yue, "On V-rings and prime rings," J. Algebra, 62, No. 1, 13-20 (1980).
1225. J. M. Zelmanowitz, "Semisimple rings of quotients," Bull. Austral. Math. Soc., 19, No. 1, 97-115 (1978).
1226. W. Zimmermann, "Über die aufsteigende Kettenbedingung für Annulatoren," Arch. Math., 27, No. 3, 261-266 (1976).
1227. W. Zimmermann, "π-Projektive Moduln," J. Reine Angew. Math., 292, 117-124 (1977).
1228. W. Zimmermann, "Rein injektive direkte Summen von Moduln," Commun. Algebra, 5, No. 10, 1083-1117 (1977).
1229. B. Zimmerman-Huisgen, "Pure submodules of direct products of free modules," Math. Ann., 224, No. 3, 233-245 (1976).
1230. B. Zimmerman-Huisgen, "Decomposability of direct products of modules," J. Algebra, 56, No. 1, 119-128 (1979).
1231. B. Zimmerman-Huisgen, "Rings whose right modules are direct sums of indecomposable modules," Proc. Am. Math. Soc., No. 3, 191-197 (1977(1979)).
1232. B. Zimmerman-Huisgen and W. Zimmerman, "Algebraically compact rings and modules," Math. Z., 161, No. 1, 81-93 (1978).
1233. H. Zöschinger, "Basis-Untermoduln und Quasi-kotorsions-Moduln über diskreten Bewertungsringen," Bayer Akad. Wiss. Math.-Nat. Kl. Sitzungsber., 9-16 (1977).
1234. H. Zöschinger, "Komplements für zyklische Moduln über Dedekindringen," Arch. Math., 32, No. 2, 143-148 (1979).

1235. H. Zöschinger, "Quasiseparable und koseparable Moduln über diskreten Bewrtungsringen," Math. Scand., 44, No. 1, 17-36 (1979).
1236. H. Zoschinger, "Koatomare Moduln," Math. Z., 170, No. 3, 221-232 (1980).

MODULAR FORMS

A. A. Panchishkin

UDC 512.743
512.742
515.178

In this survey there are included results of recent years, concerning the theory of modular forms and representations connected with them of adele groups and Galois groups. There is discussed the hypothetical principle of functoriality of automorphic forms and other conjectures of Langlands concerning automorphic forms and the L-functions connected with them.

The choice of title for this survey may not seem entirely successful: is it really possible, within the limits of a small paper, to elucidate all aspects of the theory of modular forms, recently enduring a period of heavy development (cf. the foreword to Lang's book [33] and the survey of Fomenko [41]). Hence we restrict ourselves only to those aspects of it which are directly connected with the theory of representations and L-functions. This approach allows us to explain the connection between one-dimensional and multidimensional modular forms from the point of view of the general principle of functoriality of automorphic forms, and also the connection of modular forms with representations of Galois groups of extensions of global and local fields. In our view, precisely these connections motivate the fundamental interest in modular forms. We have touched on here only papers of the last 3-4 years, turning to older papers only when necessary; one can become acquainted with earlier results in this domain through the survey [41], which, together with Lang's book [33], contains a detailed account of the latest achievements in the theory of one-dimensional (classical) modular forms. Our account is in some measure superficial: the reason for this is the technicality and complexity of the basic methods of the contemporary theory of automorphic forms, a complete picture of which is given by the materials of the summer schools taking place in Antwerp (1972) [174] and Bonn (1976) [175], the symposium on L-functions, automorphic forms and representations in Corvallis, (1977) [58] and the conference on automorphic forms in number theory in Oberwolfach (1979) [48].

For the convenience of the reader we recall the connection of the classical theory of modular forms with representation theory, and also the more general concept of automorphic form on a reductive group. We note that a better account of the foundations of the classical theory can be found in Rankin's book [191] (cf. also the references in [41]), and the recent book of Weil [240] recalls the enduring value of the classical traditions in the theory of elliptic and modular functions.

In the last part of the survey there are noted the most interesting, from our point of view, achievements of recent years relating to other areas of the theory of modular forms.

1. Modular Forms and L-Functions. Connection with the Theory of Group Representations

Classical modular forms are introduced as functions on the upper complex half plane $H = \{z \in C \mid \mathrm{Im}(z) > 0\}$. Let Γ be a congruence-subgroup of the modular group $SL_2(Z)$, i.e., $\Gamma \supset \Gamma_N$, for some integer $N \geq 0$, where

$$\Gamma_N = \left\{\begin{pmatrix} a & b \\ c & d \end{pmatrix} \in SL_2(Z) \,\middle|\, \begin{pmatrix} a & b \\ c & d \end{pmatrix} \equiv \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} (\mathrm{mod}\, N)\right\}$$

is the principal congruence-subgroup of level N. The group $G_R^+ = GL_2^+(R)$ of matrices with positive determinant acts on H by linear-fractional transformations $z \to (az+b)/(cz+d) = \sigma(z)$, $\sigma = \begin{pmatrix} a & b \\ c & d \end{pmatrix} \in G_R^+$.

A holomorphic function $f : H \to C$ is called a modular form of weight k with respect to the group Γ, if

Translated from Itogi Nauki i Tekhniki, Seriya Algebra, Topologiya, Geometriya, Vol. 19, pp.135-180, 1981.

0090-4104/83/2306-2707$7.50