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A Tribute to George Hutchinson

It was our great sorrow the receive the news that George Allen Hutchinson is no longer among us. He passed away in his home on September 17, 1997 after a six-month battle with cancer. He is survived by his wife Carol Ann of twenty-eight years and his sons Daniel, John and Andrew.

George Hutchinson was born in Brooklyn, NY on April 24, 1936. He received his BS (1958), MS (1960) and Ph.D. (1967) degrees in mathematics from Columbia University (New York, NY). In 1967 he joined the National Institutes of Health in Bethesda, Md. Beside conducting individual research in algebra at the NIH, he did a work at high level in many other fields of applied mathematics, ranging from biomathematics to computer programming. In 1986, he organized a successful conference on universal algebra and lattice theory.

He retired from government service in May 1994 to devote full time to his mathematical research, and became a visiting researcher at the University of Maryland in College Park, MD.

He was a very nice modest man, and not only an outstanding algebraist but also an expert in other fields of mathematics and sciences, with remarkable intellectual abilities. He liked to play table tennis and bridge, and he was an excellent chess player.

Personnaly, I lost a good friend, who was always ready to help if some mathematical problem arose. I could learn a lot from our joint research, for George contributed to the content and shape of our papers with exceptional care and skill.

George's name became very famous in lattice theory and algebra in 1973 when he was the first to show that the word problem of modular lattices is unsolvable [6]. (Independently, L. Lipschitz also had the same achievement. Later, George himself improved this result [11], and the ultimate strongest form, related to $FM(4)$, was found by C. Herrmann in 1983.)

The best results of George are in connection with Abelian categories. To evaluate the situation: modular lattices (and even their name) originate from abstract properties of modules, and any successful effort to bring modular lattices near to modules, like coordinatization theory by J. von Neumann and their followers, is considered as one of the deepest results in lattice theory. There is another way to build a bridge between modular lattices and modules: through Abelian categories, which, by Mitchell's full embedding theorem, are in a very close connection with modules. In a series of papers [5, 6, 8, 9, 12, 13, 16, 21, 23, 25, 27] this bridge was, almost exclusively, built by George Hutchinson. Some milestones of his work in this direction are as follows.

Given a ring R with 1, let R-MOD denote the category of (left) R-modules, and let $\mathcal{L}(R)$ stand for the quasivariety of lattices embeddable in submodule lattices of R-modules. If each proper quotient x/y in a modular lattice is upward perspective to a/o for some diamond $M_3 = \{o, a, b, c, i\}$ of L then L is called an Abelian lattice. In [5], George constructed a functor F from the category of Abelian lattices with lattice homomorphisms to the category of small Abelian categories with exact functors. I consider the following theorem as his main result; the proof uses the fact that F takes embeddings to embeddings.

THEOREM [9, 16]. *For any two rings R and S with* 1, $\mathcal{L}(R) \subseteq \mathcal{L}(S)$ *iff there exists an exact embedding functor* R-MOD $\to$ S-MOD.

It follows from this theorem that if char $R =$ char S is the product of distinct primes then $\mathcal{L}(R) = \mathcal{L}(S)$, [9]. For other fixed characteristics continuously many distinct quasivarieties are obtained in [25], but all generate the same (congruence) variety, cf. [13]. The fact that these varieties, i.e., the $\underline{\mathbf{H}}\mathcal{L}(R)$, are selfdual [12, 13] also comes from the theorem above.

George's mathematical results are significant and will not be forgotten. We shall all miss him as a talented colleague. We will cherish his memory.

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George Hutchinson’s publications

1. Hutchinson, G. (1963) Partitioning algorithms for finite sets, *Comm. Ass. Comput. Machinery* **6**, 613–614.
2. Hutchinson, G. (1967) An embedding theorem for Abelian relation categories, Ph.D. Thesis, Columbia University.
3. Hutchinson, G. (1968) Evaluation of polymer sequence data from two complete, digests, Internal Report, National Institutes of Health, Bethesda, MD.
4. Hutchinson, G. (1969) Evaluation of polymer sequence fragment data using graph theory, *Bull. Math. Biophys.* **31**, 541–562.
5. Hutchinson, G. (1971) Modular lattices and Abelian categories, *J. Algebra* **19**, 156–184.
6. Hutchinson, G. (1973) Recursively unsolvable word problems of modular lattices and diagram-chasing, *J. Algebra* **26**, 385–399.
7. Hutchinson, G. (1975) On the representation of lattices by modules, *Trans. Amer. Math. Soc.* **209**, 311–351.
8. Hutchinson, G. (1973) The representation of lattices by modules, *Bull. Amer. Math. Soc.* **79**, 172–176.
9. Hutchinson, G. (1973) On classes of lattices representable by modules, in *Proc. Univ. of Houston Lattice Theory Conference*, Houston, Texas, pp. 69–94.
10. Prewitt, J., Reece, D., Hutchinson, G. and Jackson, C. (1974) DECIDE: An expandable system for medical decision-making, in *Colloques IRIA, Informatique Medical*, LeChesnay, France, pp. 153–182.
11. Hutchinson, G. (1977) Embedding and unsolvability theorems for modular lattices, *Algebra Universalis* **7**, 47–84.
12. Hutchinson, G. (1977) A duality principle for lattices and categories of modules, *J. Pure Appl. Algebra* **10**, 115–119.
13. Hutchinson, G. and Czédli, G. (1978) A test for identities satisfied in lattices of submodules, *Algebra Universalis* **8**, 269–309.
14. Hutchinson, G. (1977) Termination of reactions in chemical systems specified by mass-balance reaction formulas, *Math. Biosc.* **33**, 213–226.
15. Hutchinson, G. (1981) A complete logic for n-permutable congruence lattices, *Algebra Universalis* **13**, 206–224.
16. Hutchinson, G. (1982) Exact embedding functors between categories of modules, *J. Pure Appl. Algebra* **25**, 107–111.
17. Trigg, M., Hitchens, J., Geier, M. and Hutchinson, G. (1984) Low maternal serum AFP and Down syndrome, *Lancet* **2**, 8395, 161.
18. Hutchinson, G. (1986) Representations of additive relations by modules, *J. Pure Appl. Algebra* **42**, 63–83.
19. Hutchinson, G. (ed.) (1986) Proceedings of the NIH Conference on Universal Algebra and Lattice Theory: Titles, Abstracts, Summaries and Problems, Internal Report, National Institutes of Health.
20. Czédli, G. and Hutchinson, G. (1987) An irregular Horn sentence in submodule lattices, *Acta Sci. Math.* (*Szeged*) **51**, 35–38.
21. Hutchinson, G. (1987) Addentum to “Exact embedding functors between categories of modules”, *J. Pure Appl. Algebra* **45**, 99–100.
22. Hutchinson, G. (1988) Free word problems for additive relation algebras of modules, *J. Pure Appl. Algebra* **50**, 139–153.
23. Fuller, K. and Hutchinson, G. (1988) Exact embedding functors and left coherent rings, *Proc. Amer. Math. Soc.* **104**(2), 385–391.
24. Hutchinson, G. (1994) Relation categories and coproduct congruence categories in universal algebra, *Algebra Universalis* **32**, 609–647.

25. Czédli, G. and Hutchinson, G. (1996) Submodule lattice quasivarieties and exact embedding functors for rings with prime power characteristic, *Algebra Universalis* **35**, 425–445.
26. Hutchinson, G. (1995) Manipulating polynomials with multiple variables, *The Mathematica Journal* **5**(3), 90–95.

Posthumous works (to be completed and/or submitted):

27. Hutchinson, G., Exact embedding functors for module categories, and submodule lattice quasivarieties, 16 pages.
28. Hutchinson, G., Varieties of algebras with linear terms, 13 pages.
29. Hutchinson, G., *Lattices and Categories of Modules*, expository book.
30. Hutchinson, G., Lattices of interest and lattice theory equations, expository article, 50 pages.