Animal house costs and management

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Dalton (1989) assessed the annual expenditure of the Edinburgh Medical Faculty Animal Area (MFAA), a modern multi-user university facility of some 1,000 square metres usable floor area. Table 1 shows, in £ sterling and expressed in broad percentages, the individual cost items which generated a total annual expenditure of £350,000. Depending on location, type of building, experimental work untertaken, staffing and accounting methods used, costs in other institutions will differ from those in the MFAA. Nevertheless, they are probably similar enough to enable general analysis. This paper describes some aspects of the MFAA's costs and management in the expectation it will interest others who face similar problems in administration, making savings and adapting university or research institute animal houses to changing requirements.

It is apparent from Table 1 that annual expenditure relates principally to the capital and recurrent costs of the building, equipment and salaries. Animal costs *per se* amount to only 5 % for maintenance and 15 % for purchase. Animal house directors are expected to carefully regulate these, which although a relatively small fraction of total expenditure, are nevertheless those scientists and their funding bodies frequently question.

Animal costs can be reasonably quantified and, as in the MFAA, may be charged to the scientist. The MFAA's weekly maintenance charges: £0.10 for mice, £0.15 for rats, £0.80 for rabbits and £3.00 to £4.25 for the larger species, are calculated on the basis they meet the costs of food, bedding, some incidental items, e.g. detergents, plastic bags, and there is a small 'profit' to purchase cages and minor items of equipment, etc. As any savings that might be made on maintenance charges would at best represent only a minute fraction of total expentiture, it would be a false economy to attempt radical savings in maintenance costs which might affect the animals' welfare, or, to keep more animals than necessary on the assumption this generates significant income.

Since purchase costs are approximately

Table 1.
Itemised and Total Animal House Annual Costs in £'s and percentages.

	£	Broad %age of total
CACITAL COSTS		
Buildings – translated into annual costs	84,000	30
Equipment – „ „ „ „	33,000	
RECURRENT COSTS (background)		
Building	56,000	20
Central Administration	12,000	
Staff	110,000	30
RECURRENT COSTS (to users)		
Animal purchase	45,000	20
Animal maintenance	10,000	
TOTAL:	350,000	100

three times maintenance costs and amount to 15 % of expenditure, the question whether to purchase animals from accredited suppliers or breed them 'in-house' is of significant interest.

Purchase costs in the MFAA relate principally to the large majority of animals used, i.e. mice, rats and rabbits. The few animals bred in-house are incidental to specific research projects. This policy was adopted some years ago for several reasons including economy. Apart from being able to purchase guaranteed healthy animals of specified strain, weight and sex only when needed by the scientist, earlier experience was that in-house breeding required considerable organisation and a major commitment of space, equipment and staff. Despite efforts to supply animals by particular dates, scientists frequently changed their experimental protocols by the time the animals initially requested had been reared. Consequently the technical staff were either unable to meet their needs or over-produced animals, many of which had to be destroyed. The scientists too often felt obliged to use whatever animals were available ignoring an initially stated experimental need for animals of specific strain, age and sex.

Since adopting a purchasing policy, there has been a considerable reduction in the population of animals kept and generally the scientists observe stricter experimental protocols. To breed in-house the small animals used in the MFAA, extra technicians would be needed at an estimated costs of £20,000+ per annum. For in-house breeding to be worthwhile, even if an efficient system could be operated and all scientists complied with their protocols, the cost of purchasing small animals (currently £40,000 per annum) would need to be significantly more than the additional staff costs of £20,000+, the costs of accommodation, cages, equipment, etc, and the maintenance costs of breeding colonies and rearing young stock.

As the purchase price of animals is controlled by the suppliers, economies one can make in this cost are limited. Nevertheless, savings on both purchase and maintenance costs can be made by competitive marketing. Animal, food and equipment suppliers, keen to retain business, will often give discounts if assured a large regular trade. Bulk orders may incorporate reduced delivery charges and advanced ordering, additional discounts. A frequent and uneconomic practice is delay in using animals in an experiment after purchase and keeping them after its completion. Consequently, it is good practice to take weekly stock counts, advice the scientist of the number of animals held and send regular monthly accounts.

Assessing the real cost of maintaining an experimental animal depends on whether total animal house annual expenditure, or only some cost elements, are included in the calculation. Indeed, if the MFAA's total annual cost of £350,000 per annum, less the purchase price of the animals, i.e. £40,000, was the basis for weekly maintenance charges, these for mice, rats and rabbits would be £3.00, £4,50, £24.00 respectively. Understandably, scientists expect to be provided with at least some accomodation, staff and equipment to undertake research, particularly if their research grants are surcharged as is current practice in British universities. If, however, the scientists were expected to meet the MFAA's administrative and technical staff costs only, the weekly charges for mice, rats and rabbits would be £1.30, £1.95, £10.40 respectively. When one calculates the cost of experimental animals in such terms the logic of rationalising an institute's animal houses becomes apparent as do latent costs of in-house breeding.

Thirty per cent of the MFAA's expenditure is generated by staff costs and 50 % by building and equipment costs so any fractional savings made in these can be important. Fundamental in this context is whether optimal use is indeed being made of an animal house since typically most scientists tend to need experimental animals only periodically. If many scientists are using an animal

house, theoretically their individual trough and peak periods of animal-based activity should interphase ensuring its constant use throughout the year.

Although over one hundred and twenty licensed scientists use the MFAA and the technicians routinely provide services for many others, e.g. antibody production, quite marked peak and trough periods of activity are evident from the weekly animal stock records and experimental day book. In peak periods, which may last several weeks, some facilities, e.g. procedure rooms, certain species' accommodation – and particularly staff – are optimally occupied. In trough periods, however, when the weekly animal stock records and experimental day book may contain only half the peak period entries, the facilities are effectively under-used. In economic terms, such troughs are undesirable as building and staff costs are constant throughout the year. In small animal houses used only by a few scientists peaks and troughs of activity may be very pronounced and the latter protracted. Ensuring optimal use is a very cogent economic argument for having a centralised animal house servicing many scientists in a university especially if this accomodation can be readily adapted to meet varying needs.

Prior to opening the 1,000 sq.m. MFAA, the Edinburgh Medical Faculty had twelve small departmental animal facilities in operation with a total usable floor area of some 1,700 sq.m. These employed over twenty technical staff, compared with eight in the MFAA today, and overtime payments, even seven years ago, were several times the MFAA's current £4,000 per annum.

As small animal houses require sufficient staff for weekend and holiday duties, the number employed may exceed that needed for routine weekday work. For example, in a small 150 sq.m. animal house with two technicians, each services 75 sq.m. Whereas, in the MFAA, with 1,000 sq.m. and eight staff, each services 125 sq.m. It is also difficult to justify provision of expensive cleaning equipment, etc, in a small animal house whereas in a large one they are used extensively with a consequent saving in labour costs.

The MFAA's policy is to have two technicians on duty at weekends and statutory holidays. With eight staff, this means each works one weekend in four. Having two staff on duty means help is available for strenuous duties and, importantly, in the event of an accident. In contrast, in a small animal house with only two staff, each works alternate weekends, is alone in the building and responsible for a relatively small area.

To date, the MFAA has, in terms of staff and facilities, generally succeeded in meeting requirements at peak periods. Problems to some extent have been alleviated when a large number of scientists coincidentally are demanding animal house services, by their laboratory technicians, who, it is assumed, are at the time under-employed in their laboratories, assisting in the animal house. Conversely, in trough periods, the MFAA staff provide more assistance to the scientists and undertake tasks postponed during peak periods.

Animal house staff costs are of particular economic significance in that they fluctuate more patently than building and equipment costs. The number employed, grading increments or salary increases can affect staff costs considerably. Almost invariably staff costs are therefore amongst the first items considered when savings have to be made.

Dalton (1987) discussed the role of animal house staff noting a need for qualified technicians and others to carry out basic duties. The MFAA's staff is currently one chief, two senior, three mid-grade and two junior technicians. Were new staff required, and faced with the need to economise, unqualified persons would be employed for routine work. Employing skilled staff exclusively to clean cages is obviously not cost-effective.

The MFAA policy is to limit unnecessary unproductive routine animal husbandry duties and to employ staff on more demanding,

and for them, more interesting, work. Labour-saving equiment and practices are used or tried whereever possible and the staff have routine responsibility for antibody production and assist in theatre work. Of notable interest has been the changing attitude of the staff, some of whom had worked for many years in animal houses in which there prevailed an understandable view that the number of animal they were responsible for reflected directly on their status. Breeding, rearing and keeping large numbers of animals is a practice they now accept as unnecessary and uneconomic in the MFAA, preferring their technical and administrative duties. The latter includes ordering animals, foodstuffs, etc, and liaising with scientists. This experience is considered important in stimulating interest in management and efficiency. The technicians' office-related duties and the MFAA's routine administration are supervised by an experienced secretary/administrator. She operates an annual budget of over £120,000 in addition to preparing reports, dealing with personnel matters, liaising with scientists, traders, professional and government organisations and the university administration in general. Having this work handled expertly is considered of comparable importance in the MFAA's management to that of the chief technician in his specialist role.

The administrative aim of the MFAA is to relieve scientists, their departments and the university's administration, whereever possible, of matters relating to animal work and, by coordinating this specialised business, aided by computerisation, provide a central efficient service. Incidental advantages of channelling many scientists' business through the MFAA have been the discounts obtained with large trading accounts and a reduction in animal delivery charges.

The chief technician and secretary/administrator cooperate in their work and report to me, the MFAA Director who consequently is relieved of responsibility for most routine matters and deals primarily with matters requiring professional expertise and formulates policy. Thus, there is a system of line management which makes best use of individual's skills and facilitates relations between the staff, scientists and others in the university responsible for administration and services. The secretary/administrator and the Director's employment in the MFAA are part-time roles incidental to their other Faculty duties.

How a university should manage its animal houses and also make economies in the capital and recurrent costs of providing these raises interesting questions. Reference has been made to the peaks and troughs of animal activity. Major developments in different research fields can also affect the requirement for animal house and other accomodation. A potential for readily adapting expensive specialised accomodation like university animal houses to meet different demands is therefore particularly important. For example, the MFAA was planned over ten years ago on the basis of then current concepts of animal house use and design. At that time it was considered necessary to provide accomodation for large numbers of experimental animals, including adequate provision to breed stock. Consequently, in architectural and engineering terms, extensive, expensive and relatively inflexible accomodation was built primarily for the animal, rather than human, occupant. Subsequently, while an increasing number of scientists with different research needs use the MFAA, there has been a major decline and change in the animal population accommodated.

In the United Kingdom the number of animals used for experiment has fallen by more than 50 % from that ten years ago and, in the MFAA, the number of rats and mice accomodated is currently half that of five years ago. The MFAA's use of dogs and cats has virtually ceased while that of farm animals is increasing steadily. If one also considers the increasing sophistication of laboratory animal science, the technical rather than husbandry duties expected of the staff,

the cost of equipment, e.g. operating microscopes, blood gas analysers, the role of a large university animal house – if typified by the MFAA – is becoming more that of a specialised laboratory facility for animal-based work where the actual keeping of animals assumes almost a subordinate role. On these grounds one must question design and management concepts of large centralised units like the MFAA and in particular their potential for alternative use, also the justification for maintaining small animal houses in a university.

In the context of capital and recurrent costs, here it is worth comparing a large single building with a number of small ones of equivalent floor area. Construction and recurrent costs, e.g. repairs, painting, heating, in general correlate with the total external surface area. Thus, the larger a building's usable floor area, assuming a constant wall height, the lower proportionately are the capital and recurrent costs per square metre of usable floor area. For example, assuming they are square buildings with a wall height of 3 metres, the total external surface of one large building is [(wall area of $\sqrt{1000}\times4\times3.0$) + (1000 sq.m. floor area) + (1000 sq.m. ceiling area)] = 2,379 sq.m. and of ten small animal houses is 10 (wall area of $\sqrt{100}\times4\times3.0$) + (100 sq.m. floor area) + (100 sq.m. ceiling area)] = 3,200 sq.m., i.e. approximately 33 % more in the small animal houses. Also, while capital and recurrent costs of environmental systems and other services, e.g. plumbing, electrical, in animal houses of different sizes are difficult to quantify, generally the total costs in a number of small buildings exceed that in a single large building of equivalent floor area.

While the author may appear unduly critical of the role of small departmental animal houses in an university context, on the basis of their relative cost and efficiency, it is recognised that there may be some need for small units. This would apply, for example, in relation to research on infectious diseases or maintaining colonies of unique animals whose health status would not be generally acceptable in a large multi-user facility.

Adapting to new requirements in the MFAA which was designed to accomodate large numbers of rodents and dogs but relatively few farm animals and scientists, has raised a number of interesting issues. The dog kitchen and procedure rooms readily adapted for laboratory or technical work and indoor exercise areas to house sheep and pigs, but there still remained the large kennel area. This comprised a number of rooms containing raised, 1 m × 1,5 m wire-sided floor dog pens and a centre aisle with floor drain. These pens are now used principally to accomodate rabbits but also guinea pigs and ferrets. Three or four does or a single buck rabbit are kept in each pen and the stocking density per square metre floor area compares favourably with that in a standard rabbit room where animals are kept in racked cages. The animals thrive and in welfare terms, it appears preferable to keeping them in cages.

A notable advantage of this system has been a saving in labour – soiled woodshaving bedding is swept away once a week and the pens washed with a high pressure hose. Neither was there a major capital cost for special cages for different species or the inevitable cost of replacing cages damaged by weekly handling, scraping and processing through the cage washer.

Based on this experience, the author would advise the following if designing new or altering old animal accomodation: rooms heated, illuminated and ventilated to acceptable human occupancy standards with provision for simple, optional local environmental control; wall and floor finishes to enable high pressure hose cleaning; adjustable and demountable floor pens. This accomodation could be used to house several different species or readily adapted as an animal laboratory, store, etc.

Such accomodation would not be considered generally suitable for the smaller rodents, i.e. mice and rats, which from the accepted

experimental viewpoint, are expected to be kept under closely prescribed environmental conditions. Consequently, animal houses have traditionally been constructed on the basis that a large proportion of the accomodation requires a high quality and inevitably expensive system of environmental control. This feature, if nothing else, restricts its alternative use. It is, however, interesting to consider the following. First, racks of cages probably occupy only one-fifth of the volume of most animal rooms. Second, the actual space occupied in an animal house by rodent rooms is probably less than the 26–51 % (mean 42 %) which *Clough* (1987) found was the total animal accomodation content of eight animal houses he analysed. Third, occupancy of rodent rooms is often subject to marked fluctuations related to the peaks and troughs of animal house activity and also the need for rodent rooms is likely to decline in many animal houses as a consequence of purchasing rather than in-house breeding. Fourth, as described by *Clough* (1984), there are, despite efforts to control the rodent room environment, variations within the room itself and particularly in individual cages, depending on their position in the cage rack and within the room, in light, temperature and ventilation levels. Fifth, stocking density, cage type, bedding and frequency of cleaning must undoubtedly affect the micro environment of the cage. Sixth, rodents have the capacity to adapt to reasonable changes in their environment. If one accepts the validity of these six observations and also the following: first, most modern buildings' environmental services are designed to provide an ambient temperature for human occupants which is just a few degrees below that prescribed for rodents; second, their ventilation systems which service coincidentally large areas and not individual rooms usually depend on including 15–20 % fresh air in recirculation; third, isolators or cabinets containing racks of cages, albeit they are operated generally in a rodent room already heated, ventilated and illuminated to prescribed standards, are a familar and accepted piece of animal house equipment, then, one must inevitably begin to question traditional concepts of animal house design, servicing and equipment.

Isolators, cabinets or individual room environment modules, enabling animals – particularly rodents – to be kept in less highly customised accommodation, if demonstrably an acceptable, practical and economic alternative, may be a solution to reducing the high capital and recurrent costs of traditional animal houses. Not least, such equipment, operable when required, would allow greater flexibility in the use of university accomodation.

Summary

In this paper, a sequel to 'Animal House Costs' (*Dalton* 1989), the author describes aspects of management of a large University animal house, making economies in annual expenditure and improving efficiency. Relative costs of 'in-house' breeding and purchasing animals are considered and the problems of adapting animal house accomodation to meet changing requirements. Some fundamental concepts of animal accommodation are questioned and how these may relate to making savings on building capital and recurrent costs.

Yhteenveto / K. Pelkonen

Tämä kirjoitus on jatko kirjoitukselle Animal House Costs (*Dalton* 1989), ja kirjoittaja kuvaa suuren yliopiston koeeläinosaston hallintoa, vuotuisten käyttökustannusten talouskysymyksiä ja tehokkuuden nostamista. Oman tuotannon kustannuksia verrataan ulkoa tapahtuvaan eläinten ostamiseen ja pohditaan ongelmia koe-eläintilojen muuntuvuudesta vastaamaan muuttuia vaatimuksia. Kirjoittaja tarkastelee kriittisesti myös joitakin eläinten hoidon vaatimuksia ja pohtii miten mahdolliset muutokset vaikuttavat rakentamis- ja käyttökustannuksia säästävästi.

References

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Kommentar af Lars Wass

Artiklarna om kostnader för försöksdjursanläggningar och kostnaderna at driva våra djurhus av Dr Rodger G. Dalton, University of Edinburgh, Scotland har presenterats i Scandinavian Journal of Laboratory Animal Science Vol. 16; No 3 1989 och Vol. 16; No 4 1989. Det er möjligt att förhållande i Scotland och på andra platser skiljer sig til och med väsentligt, men dessa artiklar ger oss värdefullt material när vi skall planera för ny- eller ombyggnation, göra konstruktiva inköp och planera våra personalinsatser. Det behövs sådana här analyser för att ordentligt kunna väga olika alternativ mot varandra och för att skapa förvaringsenheter, som ger de djur som skall förvaras där optimala förhållanden samtidigt som forskningsresultaten blir relevanta och jämförbara.

The two articles by Dr Dalton are presented in number 3 1989 and nr 4 1989 of the Scandinavian Journal of Lab. Animal Science. Maybe the circumstances in Edinburgh differ a lot from other places but we here get valuable material for people in the planning and rebuilding phases to build and equip the facilities in a constructive way and to have a fair discussion about the staff, its education and the planning of their work through weekends and holidays. We hope constructive discussions in the field will come at several Symposia, Seminars and Workshops.