

PART VI.

THE ERADICATION OF CYSTICERCOSIS -  
T A B N I A S I S.

A.

THE NECESSITY FOR ERADICATION.

Two factors which demand the eradication of cysticercosis are economic and hygienic. In a country such as South Africa it is essential that we should take the economic factor into serious consideration. The meat industry is becoming more and more important in this country, and we are trying to compete on the overseas markets with rivals, where the incidence of C.bovis is considerably lower than in South Africa, e.g. Australia, New Zealand, Canada, United States and the Argentine. In 1935, this factor was forcibly stressed by Irvine-Smith in the Annual Report of the Director of the Abattoir and Livestock Markets, Johannesburg.

"The Natal Agricultural Union has forwarded a resolution to the South African Agricultural Union recommending that the Government should introduce legislation to permit meat passed by Government Inspectors to enter Municipal areas without further inspection. All meat is, at present, inspected under the national standard of meat inspection laid down by the Minister for Public Health under the Public Health Act, by inspectors approved by the Government, and for the protection of Public Health is re-inspected on arrival in England, and is also further re-inspected on introduction into any local authority's area. In the event of measles being found overseas, in Union of South Africa meat on these re-inspections, which are essential, the South African export trade would receive a nasty jar. It is the responsibility of the farmer to eradicate measles." (Irvine-Smith, 1935.).

In the same report Colonel Irvine-Smith wrote further. "If you want to achieve success in the meat trade, you will have to eradicate measles. We had a recent example in Durban. Your competitors will exploit the question of measly beef. The opposition in the Argentine and Overseas will at once say that you are feeding the housewife overseas with measly beef and they may get hold of some measly beef and ruin your trade. That is an aspect which should be seriously considered." Irvine-Smith also reminds his Council that chilling does not kill the C.bovis, therefore the presence of measles in export chilled beef is so much more undesirable.

It will be recalled that approximately 7,000 pigs are condemned annually in the South African abattoirs from which statistics were obtained. (See Incidence Survey, Part II.). Since measly pigs are usually totally condemned, this means a dead loss to the pig breeder or to the butcher of approximately £17,500 per annum, assuming the round average dressed weight of pigs slaughtered at our principal abattoirs to be 120 lbs., and the average price per lb. dressed weight paid by butchers or auctioneers to be 5d., and applying these averages throughout the Union.

It is also estimated that nearly 7000 bovines are annually found to be measly at Union abattoirs. On the assumption that all these bovines were to be condemned outright, and that the average dressed weight per bovine carcass were 600 lbs, sold at an average price of 25/- per 100 lbs. for good medium beef, this would mean a loss of £52,500 per year to the beef industry. At this rate the total loss, that is through C.cellulosae and C.bovis would be £70,000 per annum.

This loss is, however, reduced by the freezing of approximately

80% of measly beef carcasses (lightly infested) at six of the principal abattoirs in the Union. Nevertheless, the average price paid for this frozen beef at those abattoirs is approximately 15/- per 100 lbs, which represents a loss of about 10/- per 100 lbs. on average good medium carcasses, not considering the cost of applying the freezing treatment imposed by some of our abattoirs. Despite, this, the fact that a large percentage of our measly beef is not condemned outright, there is a considerable reduction in the value of such treated beef.

It is obvious that the figures showing the average cost of measles per annum to the meat industry, refer only to the losses incurred at approximately 65 Union abattoirs, from which incidence statistics were obtained. Financially, however, it is doubted whether the toll of measles is greater than the estimate of £70,000, since it can safely be presumed that no statistics were kept at those abattoirs not included in our lists in Part II, or else they would readily have been supplied by the authorities of many other towns, who were approached. There are also many smaller places in the Union, where cattle are slaughtered and consumed, but no inspection of any kind exists. Such cattle, therefore, whether measly or not are consumed by the unsuspecting public, and presumably top prices are paid - hence, no economic loss in small townships in the remote rural areas and in Native Territories.

The hygienic necessity for the eradication of cysticercosis is quite obvious, and has been fully discussed in the previous parts of this work. The fear of human infection is perhaps the most important and logical reason why in the larger centres, and in those smaller centres where proper meat inspection is carried out, efficiency in

duty has at least been instrumental in breaking the life-cycle of those parasites which are found on meat inspection.

B.

A PLAN OF ERADICATION OF CYSTICERCOSIS - TAENIASIS.

1. Co-operation, but not encroachment.

There should be closer co-operation in this important aspect between members of the the/medical and veterinary professions, each of whom should be independently responsible for the destruction of the life-cycle at the respective stage which falls within his province.

This can best be elucidated by the old saying "Shoemaker stick to your last." In other words place the responsibility of destruction of the adult tapeworm upon the medical man, and that of the destruction of the bladderworm on the veterinarian. Close co-operation in this campaign need not necessarily lead to encroachment by either profession onto the province of the other. At the present time, in South Africa in particular, there can be no gainsaying the fact that in many centres work which should purely be handled by veterinarians is being done by Medical Officers of Health. I refer here to abattoir control, dairy control and control of inspections of meat emporiums. In South Africa there are at the present time only five municipalities which employ full-time veterinary officers, whose main duties are control of the respective abattoirs.. In all other centres, including some of our bigger cities, the control of the abattoir is exercised by Superintendents who have, or have not the certificate of the Royal Sanitary Institute in meat inspection, and these officials, who have no power to condemn meat, must call the Medical Officers of Health, who in many

cases know considerably less about diseased meat than the meat inspectors. In most of the larger centres where no veterinarians are employed, highly/capable meat inspectors are employed, but most of these officers would preferably serve under the guidance of a veterinary officer, especially in intricate cases in which differential diagnosis involving cysticercosis <sup>is</sup> ~~are~~ concerned. The urban meat consumer has the right to demand protection, and it should be made compulsory in all centres with a European population of 7,500, that a qualified Town Veterinary Officer be appointed, who in smaller or larger centres could have control of the dairy inspection staff as well. It is not my intention to use this article as propaganda for the profession to which I have the honour to belong, but in many of the smaller urban areas (populations of 7,500) the main functions of the Medical Officers of Health are the control of officials in charge of abattoirs and dairies, functions which could, with greater safety to the public, be performed by veterinarians. The position is not at all impracticable, and the fact that at present there are not sufficient veterinarians to take over such duties in all Union centres with populations of 7,500, does not mean that a number of young men will not take to the profession if sufficient inducement could be given. In the writer's opinion, as already stated, only co-operation between the medical and veterinary professions will eventually eradicate cysticercosis-taeniasis, hence the eradication of the bladderworm should be the function of the scientist best qualified for the purpose, viz. the veterinarian. Salaries of municipal veterinarians can be partly subsidised by Government, whose bounden duty is to ~~the~~ safeguard the health of the urban dweller. Thus, whilst eradication of the Cysticercus is the function of the veterinarian, that of the Taenia must be done by the physician, who should be encouraged by Legislation towards this

important function, to obviate remarks such as those which Reitsma (1931) had occasion to use in "Holland:" "We must not lose sight of the fact that the object of the campaign against cysticercosis is the eradication of the Taenia. It is a remarkable fact that although veterinary scientists are paying a great deal of attention to cysticercosis, a state of lethargic rest exists in the medical camp as regards taeniasis, and one can obtain hardly any data regarding the disease either from the State Public Health authorities, or from private practitioners. The only facts the latter can state are that they have large and extensive practices, and once or twice a year they may treat a patient for tapeworm."

## 2. More Thorough Meat Inspection.

It has already been stated, in a previous Part of this article, that we in South Africa possibly permit a larger range of inspections incisions than is practised in most European countries. Nevertheless, even we can improve upon our technique. The present writer suggests the following technique in respect of examination for C.bovis.:-

- a. Two long and parallel incisions into the masseters, on both side of the face, in an upward direction, to completely sever the parotid gland below the ear.
- b. Two long incisions into the pterygoids, on each side.
- c. Numerous longitudinal incisions into the muscles of attachment of the tongue.
- d. Careful manual palpation of the whole of the <sup>heart</sup> tongue; complete halving of the left ventricle; careful inspection of the myocardium.
- e. Careful manual examination of the oesophagus.
- f. A transverse incision into the hump, after the carcass has been cleft.
- g. Usual inspection of the viscera, without further incisions.
- h. A complete incision into the Triceps brachii and Deltoideus on each side.
- i. One incision into the Psoas muscle on each side.

- j. A deep incision into the Adductor muscle about an inch below and parallel to the symphysis pelvis.
- k. In the event of measles being found in any of the above locations, then the secondary incisions laid down by Public Health Act must be made.

It is doubtful whether the technique can be improved in respect of the inspection of pigs for C. cellulosa.

### 3. Systematic Meat Inspection at all Abattoirs and Slaughter Poles.

This suggestion is probably the most difficult to put into effect, and may even be considered impracticable. Reference will be made to the comments of the Town Clerk of Barberton, who mentioned that, whilst thorough inspection was being practised at Barberton, certain smaller townships in the vicinity were permitting the slaughter of bovines without any meat inspection, to the detriment of the Barberton stock-buyers. There is hardly a large or a small urban area in the Union, which is not faced with the same problems as Barberton.

I do not wish to emphasize in a dogmatic way that the Department of Public Health should appoint Meat Inspectors, who could be stationed at the urban centres of these small townships, and could from there do daily rounds of the slaughter poles of such small surrounding townships, but the matter certainly warrants the investigation of the Department. In many of these small townships daily slaughtering is not practised, and quite possibly such hypothetical inspectors could arrange for the slaughter days at the various small townships in their areas. Such inspectors could either be paid by Government, or else the townships could be grouped and each group, subsidised by Government, could be responsible for the salary of its meat inspector. The Meat Inspectors must be qualified, holding the Royal Sanitary Institute's Meat and Other Foods Certificate. The aim should be the protection of all purchasers of meat, and the prohibition of unfair competition

between dealers and butchers in the townships where no inspection exists, who slaughter measly meat without fear or scruple, and their less fortunate confrères in the more enlightened municipality close by, where up to date inspection is carried out.

An alternate suggestion may be to prohibit, in toto the sale of meat in any area controlled by a Village Management Board, Health Committee, or other form of Local Government, unless the meat had been slaughtered at a Public Abattoir, where proper meat inspection is practised. The small townships in the vicinity of an urban area would, therefore, be compelled to use meat slaughtered at a central abattoir (situated in the bigger town.). The main idea at the back of such a scheme, it may be repeated, should be to safeguard, where possible, all purchasers of beef or pork from infection with taeniasis, and to ensure that the unconscientious stock-raiser has no outlet for the sale of his measly stock, and thus to obviate the odious state of affairs mentioned by the Town Clerk of Barberton. ( See Paragraph 4.).

Some Municipalities, e.g. Worcester, Mossel Bay, Burghersdorp, Clocolan, and to its utter disgrace, the fairly large City of Bloemfontein, permit the slaughter of pigs on farms, and the sale of the carcasses on the local market. The carcasses must be brought to the abattoir for inspection, with (in the case of Bloemfontein) the pluck attached - stomach, intestines and other viscera are not produced. In fairness to the Bloemfontein City Fathers, however, it must be mentioned that this arrangement was authorized by the Orange Free State Administration many years ago, and despite the efforts to have it rescinded by my colleague-predecessor and myself, it is still in force. The reason why this was allowed is obvious - a Province existent on a purely farming industry naturally encourages that industry, although



the more important aspect of Public Health is sadly overlooked. The results of this practice are clearly reflected in our observations at Bloemfontein. In two years we have found that 2.13% of pigs slaughtered at the abattoir have been measly, and yet, out of many hundreds of pigs slaughtered on the farms and brought to this abattoir for inspection, in three full years, my inspectors and I have found only two measly (both very lightly infected.). Pigs, as we have seen, are more commonly very heavily infested, and obviously farmers do not bring to the abattoir for inspection pigs which they see are measly, upon dressing. They have a ready sale for this measly meat to their natives, and a justifiable use for the lard for ~~wax~~ soap making. This statement is not made on mere conjecture, but is an actual admission of at least two farmers who occasionally patronise us with a few pigs for inspection. Here is an anomaly which can be immediately rectified by legislation. If the serious hygienic and economic importance of the disease were to be brought home to them, even the most ardent, and at times almost fanatical legislators, who vigilantly safeguard the interests of the farmer, will vote approvingly for the compulsory slaughter of all pigs intended for urban consumption, at urban abattoirs.

4. The Prohibition of Insurance Schemes. - Loss must be carried by the farmer or producer.

In a number of our larger Union abattoirs bovine cysticercosis is included in insurance schemes. Premiums are imposed on all animals to be slaughtered, and the farmer or the butcher is quite indifferent as to whether or not his ox is condemned. The direct result of these insurance funds is that the farmer does nothing to safeguard his cattle from infection, whereas it should be his compelled duty to realize his obligations. What the farmer does not realize, however, as Mönnig (1936) puts it, is that he, after all, pays the insurance premium

himself, and that abattoirs are not philanthropic institutions which willingly, out of sympathy for the unfortunate farmer, refund the price of the ox lost to him, without making him pay extra for the many uninfected oxen which have passed inspection. It is questionable whether such insurance schemes serve any useful purpose, and at several of our larger Union abattoirs (Bloemfontein, Port Elizabeth and Cape Town) they are totally discouraged. At others, e.g. Durban, where an insurance fund is conducted, the capitation fee is 3/6d for cattle from Natal proper (in the case of Durban), but 5/6d. for cattle from so-called "Black" areas, as Swaziland and the Natal native areas, where the infection is high.

In his Annual Report for the year ended 30th June 1935, the Director of Abattoirs, Livestock Markets, Veterinary Services, Ice and Cold Storage Departments, Johannesburg, refers to consignments of export cattle from Natal, received at Johannesburg, which showed infestation rates varying between 2.08% and 60% in thirteen consignments from different owners. Colonel Irvine-Smith adds: "The only manner in which the Council could assist in the eradication of measles in meat was to decline to indemnify cattle from proved sources of infestation. With this object in view, it was decided that after 1st July, 1935, any owner forwarding a consignment of cattle for export containing measles infestation to the Johannesburg Abattoir, would have measles or bladderworm infestation excluded from his indemnification until three subsequent consecutive consignments had been received from him free from infestation. The Director is of the opinion that when measles infestation is discovered in a consignment of cattle, the whole

consignment from that particular owner should be debarred from export, otherwise subsidised measly beef from South Africa will eventually be found on arrival in England."

In considering this question from all points of view, the conclusion come to is that insurance schemes which include indemnification against measles, are definitely not in the interest of the country, and those of us whose calling assists towards the eradication of the menace of measles, should collectively press for legislation forbidding the inclusion of measles disease in abattoir insurance schemes. As has been expressed, the farmer unwittingly pays an excessive slaughter fee (including his insurance capitation fee), which is quite needless, but he is perfectly satisfied as long as the payment of this capitation fee leads to his recovery of the price of any of his stock which may be condemned.

The practice at most abattoirs, where no insurance schemes are in vogue, is that loss through condemnation of carcasses for measles in bovines is borne entirely by the butchers, and not by the producers. In some cases butchers buy slaughter cattle from farmers out of hand, or at auction sales, and these cattle, if in good condition, may find themselves at the abattoir within a few days. In other cases butchers place nearly all their bovine purchases on stock farms, and they are withdrawn from time to time as the butchers' requirements dictate. Often, therefore, such slaughter bovines may run for several months on the butcher's own farm, among his reserve slaughter stock, in which case, after eventual slaughter and measles being found, the butcher will have difficulty in establishing

scientific proof of the age and origin of infection. In those cases, however, in which bovines are slaughtered immediately, or within a few weeks of purchase, the butchers should have a "clear case", in the event of measles infestation being found. Measles disease is, and should in every case be considered by buyers themselves, a latent defect, if found in stock slaughtered within a reasonable time after purchase. In this respect butchers can assist towards the eradication of measles, if they would all decline to pay farmers for such infected purchases. Unfortunately competitive buyers have spoiled the producers, with the result that at some places the butchers who insist on a measles-free guarantee from farmers are frequently ousted by their more generous competitors. This fact is very much in evidence in Bloemfontein, with the result that nearly all local butchers will suffer the loss of a purchase through measles, rather than provoke the displeasure of their sellers, who would immediately supply their rivals with stock, to their exclusion, should a refusal to pay for condemned measly cattle have occurred.

A similar state of affairs is related by the Town Clerk of Barberton, whose most interesting memorandum, dated 27/10/36, and the very useful suggestions it contains may be mentioned almost verbatim.:)

"It is fair to state that in rural centres, such as Sabie, Noordkaap, Sheba, Eureka, Louws creek, Hectorspruit, Komatipoort, Raapsche Hoop and Nelshoogte, animals are slaughtered in abattoirs where no post-mortem examinations are made. In these

rural centres where slaughtering is carried on, not under the exigencies of meat inspection, the percentage of bovines infested with this parasite must be just as high as is found in the Barberton Municipal Area (i.e. about 5.31%), as only a negligible amount of stock is local, the greater proportion being bought in the districts where this slaughtering takes place. This being the case it seems that condemning a carcass infested with measles in the Municipal Abattoirs is a needless procedure in eradicating either measles in cattle or tapeworm in man. It certainly protects the urban residents from contracting the parasite and as such renders these people safe, but still the incidence in cattle is on the increase; this is due to the lack of systematic uniform inspection of meat at all slaughter poles. On several occasions this situation has been discussed by the butchers and our Health Committee, and it appears that if the butchers wish to obtain recompense for losses suffered from the farmer or stock owner, in practically every instance he is told 'if you do not wish to buy my stock without making me responsible for your losses I shall simply sell to other buyers in areas where no inspections are carried out. They never suffer losses.'

In one instance of "X", a most progressive attitude was adopted. He made himself responsible for half the loss the buyer of his stock had suffered, and immediately had all the natives on his estate examined for evidence of being the unwilling host of the tapeworm. Within a short time twenty were found to be harbouring this parasite. Thereupon he made a strict rule that all infested natives employed by him had to be successfully treated to remove the entire tapeworm, and furthermore that every new native hired by him had to submit to an examination. Any native breaking this rule would be dismissed.

from his service. This appears to be a very good measure for dealing with the problem and were all ranch owners, cattle breeders and farmers equally progressive and willing to help in the eradication of the parasite, the whole position would be materially improved. As it is, legislation to enforce this result would have to be passed in such a manner that a high infestation of measles in the stock of any particular owner would reflect materially on that particular individual. If an owner were careless about sanitary measures, careless whether his cattle became infested or not, and did not feel the loss in any way, when on post-mortem examination they were found to be infested, and legislation were passed that he stands the loss when a bovine is condemned, much would have been done to ameliorate the position. It is suggested that measures be taken to improve sanitary conditions on his farm, free the hosts of their parasites and examine every new employee. The farmer should be brought to realize his responsibility in the matter and all insurance schemes should be abolished. In Barberton, as pointed out, the farmer, by reason of his many markets refuses to recognize his responsibility and the butcher, who must have stock, has to bear the loss himself, and only a few miles away his competitors buy and slaughter without thought as to infestation and with no fear as to monetary loss."

These remarks by the Town Clerk of Barberton embody several of the suggestions made in previous paragraphs, but, in order to use his memorandum in a concise form, without referring to extracts here and there, the memorandum has purposely, as it is, been embodied at this stage of our discussion.

5. Avoidance of all possible sources of contact of the susceptible animals with human dejecta.

Pigs should be kept in sties, and on no account must they be permitted to roam about the farmyard.

Suitable latrines or privies should be constructed on all farms for the use of Europeans, and separate latrines for natives. The latter may be constructed close to the natives' quarters. Meat inspection, alone, will never successfully eradicate taeniasis, if we do not safeguard infection of our meat animals with Taenia eggs. Our primitive Europeans and our native population must be educated in the first principles of hygiene. This campaign may be difficult, but the obstacles are not insurmountable.

What would appear to be quite a practical suggestion, is the fencing off of strips of veld, within which natives may defaecate. Such narrow fenced strips, with narrow inlets, so that cattle cannot enter them, can be provided on various parts of the farm, especially close to such parts where the farm labour is most frequently required, and also in grazing camps for the herd-boys, etc. Such fenced surface latrines may not, however, overcome the possible spread of Taenia ova by such agencies as water, insects (dungbeetles, blowflies, etc.), birds, etc. The provision, therefore, of trench latrines, and the enforcement of the immediate covering up of the deposited excrement by the native may thus be more effective, although it may be a trifle more costly in money and labour. Covered bucket latrines are, undoubtedly the most effective.

On no account should slaughter bovines be grazed on lands fertilized by human excrement, sewage farms, etc., and the use of fodder (e.g. lucerne, etc.) grown on such lands must be entirely discouraged.

The Native Affairs Department, through its Extension Officers, can by lectures to tribes, assist towards the eradication of the parasite.

It is astonishing how little the general public knows of the life-history of the parasite. Our campaign must, therefore, be directed at the rural source of the disease. All three Departments interested, namely Agriculture, Native Affairs and Public Health can collectively assist in the eradication of the parasite. The Department of Agriculture can take more serious notice of the scourge by encouraging or instructing its Veterinary Officers, Stock Inspectors and Extension Officers to lecture groups of farmers on primitive farm hygiene. If Extension Officers and Stock Inspectors have no scientific knowledge of Cysticercosis-taeniasis, this can soon be taught to them, by brief courses at Onderstepoort, or by arrangement, at most of the principal abattoirs where qualified veterinary surgeons are employed. Armed thus with Departmental Pamphlet-Bulletins, the officers of the Department of Agriculture can disseminate the necessary knowledge to groups of farmers' Meetings, where these bulletins in both official languages can be distributed. Our farmers will then receive sufficient enlightenment to attack the parasite by means of the most primary weapon, that of farm hygiene, hygienic prophylaxis and the means of maintaining this prophylaxis.

Similarly Extension Officers of the Department of Native Affairs and Sanitary Inspectors, seconded for service in native areas, may deliver lectures in Native Reserves. Enlightenment of all concerned is what is most urgently required, and the writer has, in the course of his former Government veterinary duties, often experienced that Native Chiefs are ever ready to co-operate in campaigns concerning the health



of their live-stock - their only real token of wealth or possessions. Good work, through enlightenment, has been accomplished by co-operation of native tribes in other veterinary campaigns in this country, e.g. the campaigns against East Coast Fever, Scab and Anthrax, and if we did not have the whole-hearted co-operation of our native co-dwellers on our borders, we would not have effectively stamped out the few outbreaks of Foot and Mouth Disease which occurred, or prevented its further entry into the Union, in a remarkably short space of time, during 1933. This may all sound idealistic, but many of our present-day Native Chiefs are quite intelligent, and if instructed to do so, they may be trusted to enforce strict hygienic sanitary laws among their people. The trouble is that they have never yet, as a plan of campaign, been requested to do so, nor has the necessity for the enforcement of tribal latrine arrangements been brought home to them. The present writer considers that this is an experiment well worthy of a trial.

6. Free medical treatment of Taenia carriers - Rewards for Production of Taeniae by such carriers.

The enlightenment of our farming and native populations should next be followed by free medical treatment. Liquid extract of male fern, or whatever vermifuge the Public Health Department may recommend should be available for all Taenia carriers, whether on farms, Native Reserves, or in towns. Magistrates, District Surgeries or Dispensaries, Justices of the Peace in rural areas, or Native Chiefs be provided with quantities of the drugs required, and careful directions for use may be given to those who have to dispense the drugs and may have no knowledge of therapeutics. If the campaign were to end with the free treatment of Taenia subjects, these must be told

that evacuated Taeniae, segments, etc. must be burned or buried, but must not be discarded where live-stock can come in contact with the dejecta.

Instead of ending the campaign with the free treatment of known carriers, it might be more advisable to encourage, in some form or other, this free treatment. In Australia and in Germany (in Wurtemberg, and lately throughout the country) rewards have been offered for the production of every tapeworm or piece with the head. In this connection, Dr. Heinrich Wagemann of Flensburg, writes (letter dated 22nd November, 1936): "For every tapeworm or piece with the head, which is sent to the physician of the Government Health Department, the tapeworm carrier is paid 10 R.M. . Only by these measures, I think, we shall be able to fight measles, and we hope that these measures, even after a considerable period of campaigning, will ultimately eradicate measles in cattle altogether."

It is possible that such a campaign may ~~warrant~~ cost a considerable amount of money, if applied in South Africa, but, in consideration of public health and the loss to the meat industry locally, as well as the menace to our potential chilled beef overseas market, it may well warrant the offer of small rewards to all those, European or native, who produce either the complete Taenia or portions including the head. Perhaps free treatment, plus 2/6d. for each head may be a big incentive to our poorer Europeans and natives to rid themselves of their health-destroying guests. Rewards have been offered by the Government for the production of evidence of destruction of other vermin, e.g. the brushes of jackals, and it is quite possible that the economic loss from these marauders has been less than that caused by the tapeworm carrier.

It may be interesting to relate that Hall (1927) wrote: "As one ~~one~~ by-product of that work, it might be mentioned that following the hookworm campaign of treatment and sanitation in Panama, the incidence of C. cellulosa in swine at the Panama City abattoir dropped from 15 per-cent. to 5 per-cent., according to the inspector, Dr. Mattatall. This 10 per-cent. reduction in condemnations resulted in an annual saving of 40,000,000 dollars, a very valuable by-product of a hookworm campaign . "

A campaign directed against the tapeworm in South Africa, and not necessarily the by-product of some other helminthic campaign, may, in a few years, show a remarkable economic result.

In Switzerland in 1917, and in Germany quite recently, attempts have been made to trace a Taenia carrier through infection found in a bovine carcass at the abattoir. The origin of the infected bovine is traced. In this connection Dr. Wagemann (Flensburg) writes (22/11/36) : " Since August, in Germany, we also search for the tapeworm carrier. Thus, when measles disease is found, the Police trace back the origin of the animal. It is sometimes found that the owner of the animal, or a member of his household is a tapeworm carrier. In case such a person is found, he is compelled to have himself treated by a physician." In South Africa the tracing of a tapeworm carrier, in this way, may be impossible, owing to our large areas and the fact that frequently the origin of a bovine cannot be traced, since before slaughter it might have changed hands several times. The tracing of the origin of a Taenia solium carrier may be more practicable, except in measly pigs forwarded by speculators, since pigs delivered at abattoirs are frequently reared by the consignors.

In conclusion, it is of value to insert here a translation of Forms "A" and "B", at present used in Germany in connection with that country's campaign against *Cysticercosis-taeniasis*.

Form A.

Direction of Abattoir  
 Veterinary Meat Inspector<sup>r</sup> --- (name) -----

Place ----- Date -----

To the Sanitary Police in -----

for transmission to -----  
 (name and address of owner of animal.)

Re: Information regarding Measles in Cattle.

From the consignment of -----, in -----,  
 (bovine or calf)

from the butcher -----, in -----, dated -----193--  
 (address)

which was slaughtered and was diagnosed to be measly on examination.

The beef measle is the intermediate stage of the development of a human tapeworm. The finding of measles in an ox appears to prove that a tapeworm must exist in a human being in the particular part from which the animal comes from. It is essential that investigation should be made whether the owner or one of his family, or somebody in his employ is infected with a tapeworm. The symptoms are:- constipation, gastric derangement, loss of appetite, temporary listlessness, constipation followed by diarrhoea, and the finding of segments of tapeworm in the excretum. Accordingly, you are requested to see that the tapeworm carrier submits him/herself to medical treatment. For every tapeworm, or part with HEAD attached, found as the result of medical treatment, and forwarded to the Health Department, Veterinary Division, 82/84 Unter den Eichen, Berlin, preserved in spirits, with the attached Form B completed, the tapeworm carrier will be paid 10 R.M. (ten Reichsmarks) reward by the Government.

-----  
 (Signature of the Abattoir Director/ or  
 Veterinary Meat Inspector.)

To be filled in by the Physician.

Place ----- Date -----

District -----

Information regarding finding of a tapeworm.

According to the attached information from -----  
the Abattoir Direction  
Veterinary Meat Inspector

----- at ----- dated -----, I

have found that this person -----, of -----)  
(owner of animal) (full address)

found a tapeworm, and I am sending this in spirits, with head attached.

-----  
Examining Physician.

To the Government Health Department,  
Veterinary Division,  
82/84 Unter den Eichen,  
Berlin-Dhlem.

E P I L O G U E .

1. From records obtained from the large majority of abattoirs in South Africa, it was gleaned that the incidence of C. cellulosae in pigs varies between a fraction of a percentage and 25%. These percentages represent averages varying from one year's to ten years' observations.

From only three Union abattoirs were percentages of less than 1 obtained. Average percentages of 5, or over, were obtained from no fewer than 24 Union abattoirs, and of this number 7 returned percentages in excess of 10. A definite "black" zone is traceable on the map of the Union, extending from Vryburg and Mafeking in the North-West to Nelspruit in the North-East, passing through the whole of the central Transvaal, via Lichtenburg, Potchefstroom, Rustenburg, Pretoria, Witbank and Middelburg. A similar "black" zone is traceable along the whole of the eastern border of the Orange Free State (bordering on Basutoland), and this includes the areas which supply the abattoirs at Wepener, Clocolan, Ficksburg, Senekal and Bethlehem. In the Cape Eastern area heavy infection was also found at three abattoirs, Fort Beaufort, Kingwilliamstown and East London, which probably draw pigs from the Transkeian Territories.

The incidence of C. bovis is much lower than that of C. cellulosae in South Africa. From 18 abattoirs were percentages of less than 1 obtained. From only 9 abattoirs were average percentages of 5 or more obtained. The highest percentage infections were obtained from the far Eastern Transvaal (bordering on Swaziland), that is Barberton, from those Natal abattoirs which draw a large amount of slaughter bovines from Zululand, and from the four Cape Eastern abattoirs, East London, Kingwilliamstown, Fort Beaufort and Port Elizabeth.

In general it would appear that there is a slight decrease in the incidence of C. cellulosae in the Union of South Africa, but a decided increase in that of C. bovis, during the last few years.

2. C. cellulosae infestation in South Africa usually assumes a very heavy, generalized nature. Approximately 5:1 may be taken as a fairly indicative ratio of heavy infestation to light infestation. In the case of C. bovis infestation, the reverse is the case.
3. On account of the usual heavy infestation in pigs, it is not customary to describe definite predilection sites, but in bovine infestation it must be stressed that the muscles of the hind quarters, in addition to the common "predilection" sites found by workers in Europe, are very frequent locations of infection. The hind limbs are not incised in measles inspection, and it is recommended that attention should be drawn to this important predilection site. Incisions can be made deeply into the adductor muscles, parallel to and just below the pelvic symphysis, without mutilating the quarter. The hump is another important site of infection, and Regulations should provide for the incising of this area.

4. Thorough inspection technique is seriously advocated. At

Bloemfontein it was found that thorough inspection, coupled with long and deep incisions into the prescribed sites, was rewarded by the finding of four times as many measly carcasses, compared with the figures recorded prior to the adoption of our technique, that is before my Senior Inspector and I assumed office, simultaneously, at this abattoir.

5. In South Africa, it would appear that the origin of infection in the pig is the same as in almost all other countries, in which a fairly high incidence of C. cellulosa still occurs. On primitive farms and in native locations it is customary to allow pigs to wander about the farmyard, or in the vicinity of human habitation. On many such farms and Native Reserves the most primitive hygienic arrangements exist. The pig, under such conditions, readily acts as a scavenger and becomes heavily infested.

It has been observed that the incidence of C. bovis is higher during, or just after periods of drought, when there is little grazing on the veld, and when, consequently, bovines tend to remain near human habitations. The incidence of infection is least among cattle drawn from vast ranges. Streams play a small part in the dissemination of T. saginata ova in South Africa. Stagnant pools in rivers used as watering places for cattle, may be suspected as potential points of danger. Sewage contamination of grazing lands has not been observed as a serious source of infection in this country, and actual records such as those from Germany, Holland and Australia are not available in South Africa.

6. Actual viability tests were performed during twelve months by myself and my staff at the Bloemfontein abattoir, and the results obtained varied very slightly from those obtained by workers in Europe, but differed greatly from the extremely negative results obtained by Annie Porter, who was the only South African worker who had previously attempted such viability tests.

The results of our tests showed that C. cellulosa can survive the death of its host, and evaginate its scolex (tested by Keller's method) by at least 41 days, under ordinary chilling room conditions. C. cellulosa may, in exceptional cases survive four days' continuous freezing at approximately  $-10^{\circ}\text{C}$ ., in a shoulder of pork weighing 15 lbs.

Similarly, in an exceptional case it was proved that C. bovis, subjected to 5 days' continuous freezing in a side of beef weighing 288 lbs. was still capable of evaginating its scolex by Keller's method.

In no case was it found that C. cellulosa survived a period in excess of four days' freezing, or C. bovis in excess of 5 days' freezing.

7. Judging from personal information obtained from various medical observers, there is sufficient evidence to presume that both species of tapeworm are relatively common among our native population, and not at all rare in Europeans in South Africa, especially in rural areas.

Furthermore, Dr. van Coller, working in South Africa found that a large percentage of cases of psychosis were due to tapeworm infection.

Comparatively large numbers of cases of epilepsy in humans have been found, on post-mortem examination to have been due to C. cellulosa in the brain, etc. Dr. Cawston of Durban asks that compulsory autopsies should be held on all deceased epileptics.

8. Cysticercosis in swine and bovines is a costly scourge to the agricultural industry of South Africa, and taeniasis is a serious and disgusting infection in its population. Together, the two diseases caused by two stages of a common parasite should receive the full and collective attention of the veterinary and medical professions. Ultimate eradication is not impossible, although many years of costly campaigning may be entailed. The economic and hygienic results expected from such a campaign warrant the assistance of the State.

Cysticercosis-taeniasis can be eradicated by:-

- (a) Close co-operation between the veterinary and medical professions.
- (b) Closer inspection of swine and bovine carcasses at abattoirs in the larger urban areas, with, possibly, veterinary control in towns with more than 7,500 Europeans.
- (c) Compulsory meat inspection at all other slaughter poles, by qualified meat inspectors. These slaughter poles to be grouped and the inspector stationed in the central urban area must control its inspections. Butchers in small villages, where no inspection exists must not unfairly compete with their colleagues in the larger urban areas, who suffer losses from condemnation. The farmer must have absolutely no loop-hole for the sale of his measly stock, without suffering the loss.
- (d) Education of Europeans and natives in elementary hygiene, embodying studies of the life-histories of the two parasites. The assistance of Extension Officers, Stock Inspectors and Sanitary Inspectors can be obtained, to further this elementary teaching.
- (e) The abolishment of all insurance schemes, which include indemnification for measles, at abattoirs. These insurance schemes, which serve no useful purpose have the effect that the careless farmer shows no appreciation of his responsibility for safeguarding his stock from infection.
- (f) The compulsory slaughter of all pig carcasses intended for sale on urban markets, at urban abattoirs. The custom of many unscientific farmers who dispose of pig carcasses they have noticed on dressing to be measly, to their unfortunate natives, is very strongly deprecated.
- (g) Free treatment of Taenia carriers, and the offer of rewards to all such treated carriers for the production of either an entire tapeworm, or a portion with its head attached.