APPENDIX 4

ACNFP REPORT ON HERBICIDE TOLERANT SOYA BEANS

INTRODUCTION

1. In September 1994 the Committee reviewed a submission from Monsanto Europe requesting clearance for food use, of soya beans from a line which had been genetically modified to introduce tolerance to the herbicide glyphosate. Clearance was also requested for beans derived from subsequent crosses of the genetically modified soya bean line with commercial soya bean cultivars [1].

2. In its evaluation of the submission from Monsanto, the Committee focused on consumer food safety aspects of the genetically modified (GM) soya beans which could be used to produce any of the food products currently obtained from traditional soya beans. This involved a comparison of the GM soya bean line (40-3-2) and a range of glyphosate tolerant lines derived from 40-3-2 with existing commercial soya bean *cultivars**.

3. The modified soya beans are considered to be genetically modified organisms (GMOs) as defined in the GB GMO (Deliberate Release) Regulations 1992 [2]. These regulations implement the Deliberate Release Directive 90/220/EEC (OJ L117/15, 8.5.90) and marketing the modified beans would require consent under these regulations. However, processed products derived from them are not considered to be GMOs since they contain no *viable* genetic material. Both the beans and products derived from them are considered to be novel foods and their safety assessment falls within the remit of the ACNFP.

4. Advice on the labelling of food is the responsibility of the Food Advisory Committee (FAC). The ACNFP notes that in the case of products derived from the GM soya beans the inserted gene would have been destroyed by processing and thus would not be present in the final food.

BACKGROUND

5. Soya (*Glycine max*) is an important food crop. Soya beans and processed fractions of the beans, mainly oil and protein, are used in a vast array of food products, e.g. milk alternatives, prepared foods, condiments and sauces, meat alternatives and snacks. In addition, soya bean meal is used extensively as a source of protein in animal feedingstuffs. The use of the processed meal for animal feed is not within the remit of the ACNFP but is being considered by Inter-Departmental Group on New Feed Developments (IDGNFD). The production of a high quality, high yield soya bean harvest free of weed seeds is dependent on the successful eradication of weeds. However, the use of herbicides to destroy weeds may also have a detrimental effect on the crop plant.

6. Traditional plant breeding techniques have been used for centuries to introduce particular characteristics or traits, e.g. disease resistance into plants. However, such techniques cannot introduce traits giving selective tolerance to herbicides. Recent advances in biotechnology have made it possible to insert genes into plants which will protect the plant from the harmful effects of a particular herbicide. In this case, the soya plant has been genetically modified to be tolerant to the herbicide glyphosate.

*Technical terms not explained in the body of the report are italicised where they appear for the first time and are explained in the glossary; explanations are used in the context of the report and should not be taken as general definitions.

7. Glyphosate tolerant soya bean (GTS) is derived from a commercial soya bean cultivar which has been genetically modified to contain a gene from the bacterium *Agrobacterium* sp. strain CP4. This gene encodes the enzyme 5-enolpyruvoyl shikimate-3-phosphate synthase (EPSPS) which is involved in the synthesis of aromatic amino acids. Glyphosate inhibits the activity of plant EPSPS thus preventing the synthesis of essential amino acids and thereby killing the plant.

8. The modified beans, as well as containing the EPSPS gene from *Agrobacterium*, also contain part of an EPSPS gene from *Petunia hybrida* which encodes a *chloroplast* transit peptide (CTP). This peptide is responsible for delivering the bacterial EPSPS (CP4 EPSPS) to the chloroplasts, the site of aromatic amino acid synthesis in plants. When the enzyme reaches the chloroplast, the attached transit peptide is cleaved and degraded. The CP4 EPSPS which is insensitive to glyphosate thus enables the plant to synthesise aromatic amino acids, even in the presence of glyphosate.

PRODUCTION OF GENETICALLY MODIFIED LINES

9. The parental soya bean strain used in the modification procedure is the commercial cultivar *Glycine max* L. cv A5403. This cultivar was chosen because of its consistently high yield potential, resistance to certain races of soya bean cyst nematode and tolerance to many leaf and stem diseases. Genetic modification of A5403 was carried out using the *particle gun bombardment* method to introduce the *plasmid* PV-GMGT04. This plasmid contains three genes driven by plant *promoters*, two copies of the CP4 EPSPS gene with the CTP sequence attached and a gene encoding the enzyme ß-glucuronidase (GUS) from *Escherichia coli*. The expression of this enzyme was used as a *marker* to indicated successful transformation. PV-GMGT04 also contains a *nptII* gene which confers resistance to the antibiotic kanamycin. This gene is driven by bacterial promoter making expression in plant cells unlikely.

10. During the transformation process, the plasmid *DNA* breaks at one or more locations and becomes integrated in the plant *genome*. The original *transformant* (40-3) received two plasmid DNA inserts derived from independent fragmentation of the transformed plasmid DNA. One insert contains the EPSPS gene with the attached CTP sequence. The second insert contains other plasmid sequences including the GUS gene and the second EPSPS gene. During conventional propagation of the original transformant (40-3) normal genetic *segregation* of the two inserts occurred. This led to the production of *progeny*, including GTS 40-3-2, which retained the insert containing the EPSPS gene but lacked the second insert. The GUS gene and the *nptII* gene are not present in GTS 40-3-2.

PROCESS DESCRIPTION AND USE

11. The GM soya beans are intended to be used in exactly the same manner as the unmodified beans. Soya beans are not consumed or used in food in an unprocessed form since they naturally contain certain factors, such as *trypsin inhibitors*, which may be toxic if the beans are not heated sufficiently during preparation.

12. The processing of soya beans involves extracting the oil which can then be refined into edible soya bean oil. The defatted soya bean flakes which remain after the oil has been extracted are then further processed for use in food or feed products. For example, this may involve removing sugars to produce soy protein concentrate or treatment with enzymes to produced hydrolysed vegetable protein for use in foods. The techniques involved in extracting oil and defatted flakes from the modified beans will be the same as those used with conventional beans.

13. The Committee considered that there was no reason to believe that the use of GTS would lead to an increased intake of soya bean products. The modified beans and products derived from them are equivalent to those derived from conventional soya beans and therefore are not likely to be more or less attractive as a food ingredient.

SAFETY ASSESSMENT

GTS 40-3-2

14. In assessing the safety of GTS 40-3-2, the Committee compared it with existing, acceptable non-modified soya bean strains, paying particular attention to the safety implications of:

(i) the intentional changes;
(ii) any unintentional changes arising from the modification;
(ii) the stability of the GMO under the intended conditions of use;
(iv) the likelihood of genetic transfer.

Intentional changes

15. The Committee reviewed data which indicated that the only intentional difference between the modified soya bean line (40-3-2) and its parental line (A5403) is the presence of the EPSPS gene and the CTP sequence. Thus the only intentional effect of the modification on the properties of the parent soya bean is its tolerance to glyphosate. The Committee was satisfied that there were no food safety concerns with respect to the presence of the EPSPS gene and the CTP sequence introduced into GTS since they are composed of DNA and are non-toxic.

16. The ACNFP noted that the only protein present in the modified beans as a result of the inserted DNA is the CP4 EPSPS enzyme. Proteins are generally non-toxic by ingestion and the Committee was satisfied that the data submitted indicated that CP4 EPSPS was unlikely to be a hazard to health. These data demonstrated that only a very low level of CP4 EPSPS protein is found in the soya beans (<0.1%), whilst the protein is not detectable in soya oil. CP4 EPSPS was shown to be similar to other EPSPS enzymes found in food and to have no meaningful amino acid sequence homology when compared to several known protein toxins. *In vitro* digestion studies using simulated gastric juice demonstrated that CP4 EPSPS is rapidly degraded in conditions mimicking the stomach and intestines and CP4 EPSPS was found to be non-toxic in an acute toxicity study in mice.

Unintentional changes

17. The ACNFP was provided with a full description of the modification procedure and analytical data confirming the presence of one DNA insert in the plant genome. The Committee noted that the modification procedure used enabled the marker gene, in this instance, to be jettisoned. *Polymerase chain reaction* (PCR) and *Southern blot analysis* were used to fully characterise the inserted DNA and confirm that the insert contained only one of the EPSPS genes with the attached CTP sequence. The same analytical techniques were used to verify that the GUS gene, the *nptII* gene and the second EPSPS gene were not present in line 40-3-2. The Committee was satisfied that the modification procedure had proceeded as intended.

18. The Committee also considered whether any unintended changes had occurred as a result of the modification. It examined compositional data and nutritional studies on the modified beans and compared these with similar data available on unmodified soya bean strains to see whether there were differences which might indicate that unintentional changes had occurred. No significant differences were found.

19. The Committee noted that soya beans are known to produce food allergy. However, gel electrophoresis and immunoblotting analyses of the proteins present in the modified soya beans indicated that the levels of known allergenic proteins are similar to those found in unmodified beans. A theoretical assessment of the allergic potential of the CP4 EPSPS protein showed that it was unlikely to be an allergen because of its molecular weight, lack of glycosylation and acid lability. The Committee was therefore satisfied that the allergenic potential of GM soya beans and products derived from them was not expected to be different from other soya bean varieties.

Stability of the GMO

20. Assessment of the inheritance of the glyphosate *phenotype* was studied over six generations of 40-3-2 and in crosses between the 40-3-2 and other soya bean lines. The Committee was satisfied that the inserted DNA behaved as a single *dominant gene* and was inherited in a *Mendelian* fashion. Additional molecular analyses confirmed that the EPSPS gene in line 40-3-2 was stable.

21. The ACNFP recognised that there is little experience concerning the effects that genetic drift may have on the metabolism of conventionally bred and genetically modified food crops. The Committee therefore indicated that it would wish to receive appropriate data, at regular intervals, to substantiate the long-term stability of the GM line. The Company has indicated that it is willing to provide such data.

Genetic transfer

22. The Committee considered the risk of genetic transfer from the modified soya beans and products derived from them to human consumers or their *gut microflora* but concluded that the risk was negligible since the beans would not be consumed in a viable form and the processes used to derive the soya bean products would destroy DNA.

Soya bean lines derived from crosses of GTS 40-3-2

23. The safety of soya bean lines derived from crosses of the GM line 40-3-2 with other commercial soya bean cultivars was assessed. The ACNFP considered data outlining the breeding operations undertaken with line 40-3-2, which are similar to those undertaken with other non-GM varieties. The Committee also reviewed analytical data on the protein, oil and fibre content, as well as the levels of trypsin inhibitors, found in a representative range of glyphosate tolerant lines derived from the original GM line and compared it with similar data provided on a range of non-GM soya bean lines. The Committee was satisfied that soya bean lines derived from GTS 40-3-2 were similar to other non-GM soya bean lines.

DISCUSSION

24. In assessing the safety of the GM soya beans and food products derived from them the Committee adopted the principles of 'substantial equivalence' by comparing the genetically modified strain with non-modified soya bean strains including A5403, the unmodified parental strain.

25. The Committee was satisfied that the inserted DNA present in the GTS 40-3-2 had been fully characterised and contained only the CTP sequence and the CP4 EPSPS gene. Southern blot and PCR analysis confirmed the absence of the antibiotic resistance gene and the gene encoding ß-glucuronidase in the modified soya beans.

26. The Committee considered that the presence of the introduced DNA sequences *per se* in the GM soya beans was unlikely to pose a consumer hazard. It also considered that the risks posed by the CP4 EPSPS protein were negligible. The Committee was satisfied that the compositional and nutritional data provided indicated that no untoward secondary effects occurred as a result of the modification and that the only changes were those intentionally introduced.

27. The Committee noted that GTS 40-3-2 was stable and was satisfied that there would be no risk of transfer of genes from the modified beans since they would not be consumed in a viable form. However, since it is not possible to predict the effects of genetic drift on a plant's metabolism the Committee asked for regular updates on the nutrient and toxin levels in GTS 40-3-2 and a representative range of GTS lines derived from crosses of the original GM line.

28. The Committee was also satisfied that subsequent soya bean lines derived from crosses of the GM line with non-GM soya bean cultivars were similar to commercial soya bean lines currently available.

CONCLUSIONS

29. The ACNFP concluded, after careful consideration of all the data, that soya beans from the GM line 40-3-2 and other GTS lines derived from subsequent crosses of 40-3-2 with commercial soya bean cultivars, and products derived from these beans are equivalent to, and as safe for human consumption as, beans from other conventional soya bean strains and products derived from them. The

Committee considered that there were no consumer safety concerns associated with the modified beans and soya products derived from them.

30. The Committee recommended clearance, for food use, of soya beans from the GM line 40-3-2 and other GTS lines provided that all soya products derived from these beans meet the appropriate existing specifications. The Company has agreed to monitor and supply periodic updates to demonstrate the genetic stability of the glyphosate tolerant lines and, in particular, provide data on the levels of nutrients and toxicants found in the GM and non-GM lines.

REFERENCES

1. Submission from Monsanto Europe dated 27th July 1994. This submission will be deposited in the British Library, identified as BL SUP No. 11093

2. *The Genetically Modified Organisms (Deliberate Release) Regulations 1992.* SI No. 3280 (HMSO). ISBN:011 033152 4.

GLOSSARY

chloroplast: the site of photosynthesis in a plant, which contains chlorophyll.

cultivar: a variety produced by selective breeding.

DNA: deoxyribonucleic acid which is found in all living cells and contains the information for cellular structure, organisation and function.

dominant gene: a gene that is fully expressed.

genome: a complete ensemble of the genes in the cell, e.g. chromosome and plasmid elements.

gut microflora: micro-organisms living in the gut.

marker: a gene with a phenotype that can be selected for in gene transfer experiments. Selectable genes are used to enable the selection/detection of neighbouring sequence in a gene construct.

Mendelian: the inheritance of trait genes from one generation to the next in accordance with a pattern first described by Gregor Mendel.

particle gun bombardment: this is a method used to introduced DNA into a host plant cell. It involves precipitating DNA onto microscopic particles. The particles are then accelerated and penetrate the plant cells, depositing DNA.

phenotype: the appearance or other characteristics of an organism resulting from the interaction between its genetic make-up and the environment.

plasmid: loop of DNA found in bacteria and some other organisms, e.g. yeasts, that replicates independently of the chromosomes.

polymerase chain reaction (PCR): a sensitive method used to amplify a specific region of DNA.

progeny: offspring.

promoters: the key control element that enables a gene to be expressed by transcription into mRNA.

segregation: separation of a pair of homologous chromosomes during cell division.

Southern blot analysis: a technique used for detecting the presence of specific DNA.

transformant: a plant derived from transformed cells.

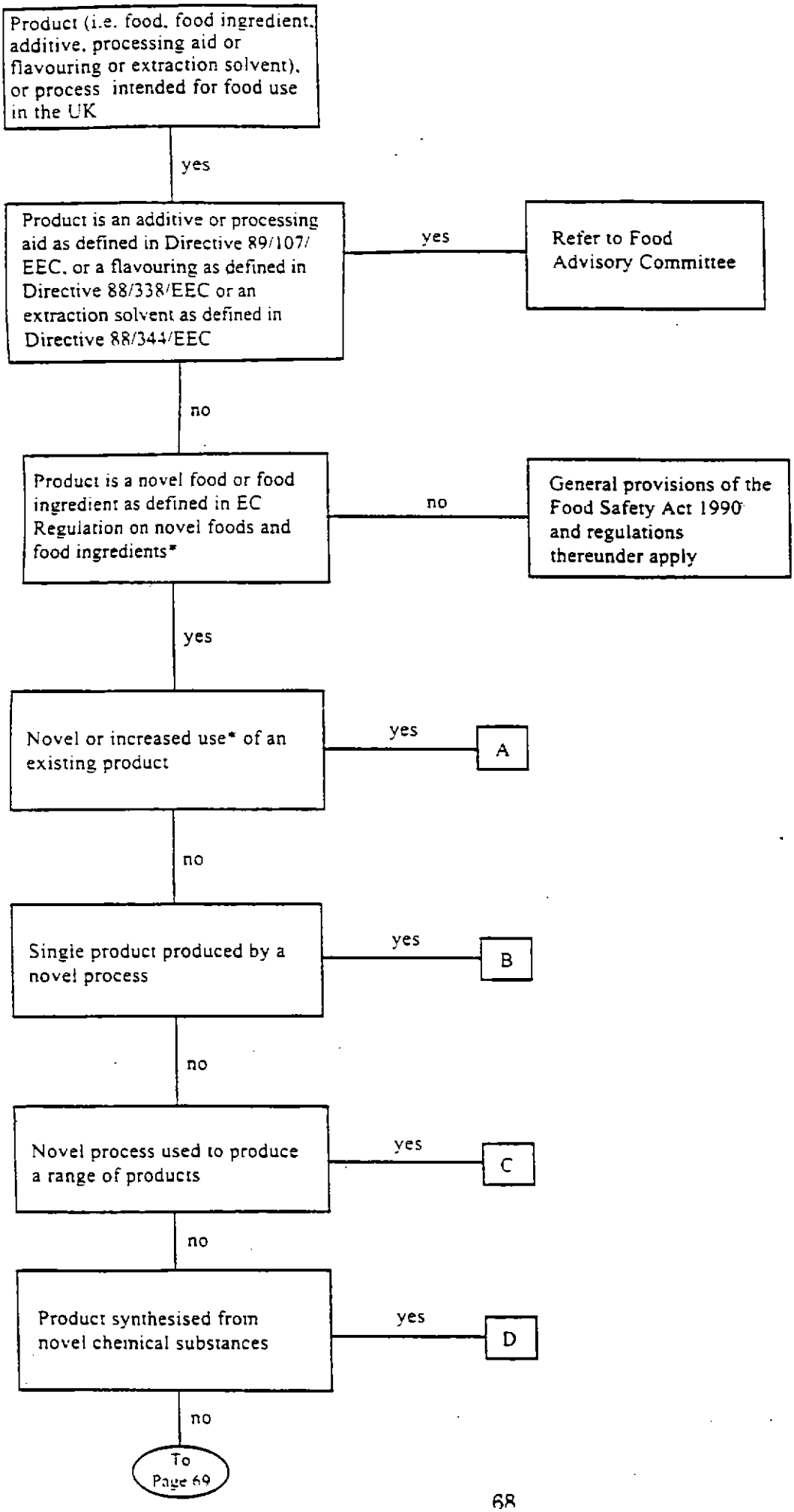
trypsin inhibitors: compounds which inhibit the enzyme trypsin which is involved in protein digestion.

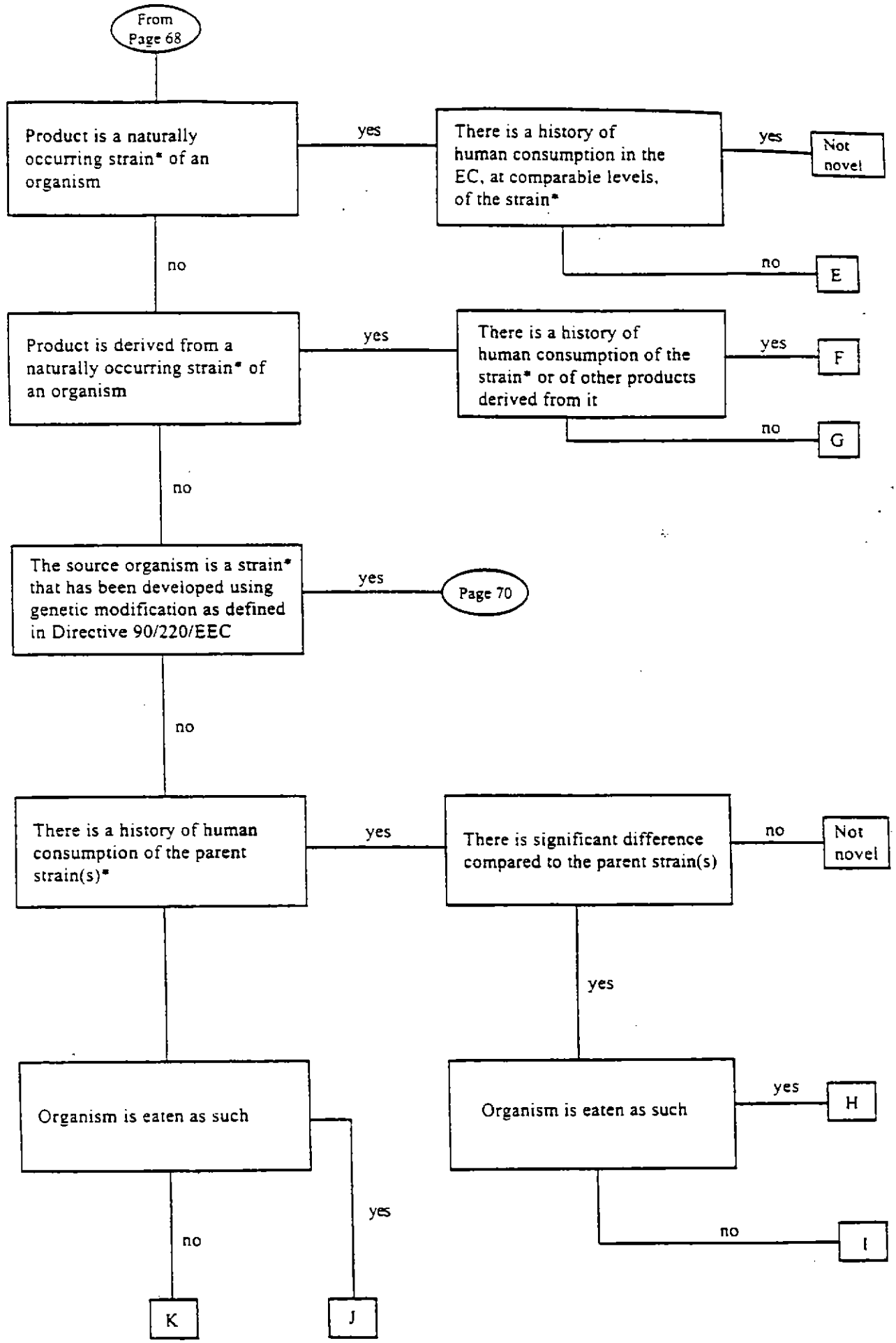
viable: living matter capable of replication or of transferring genetic material.

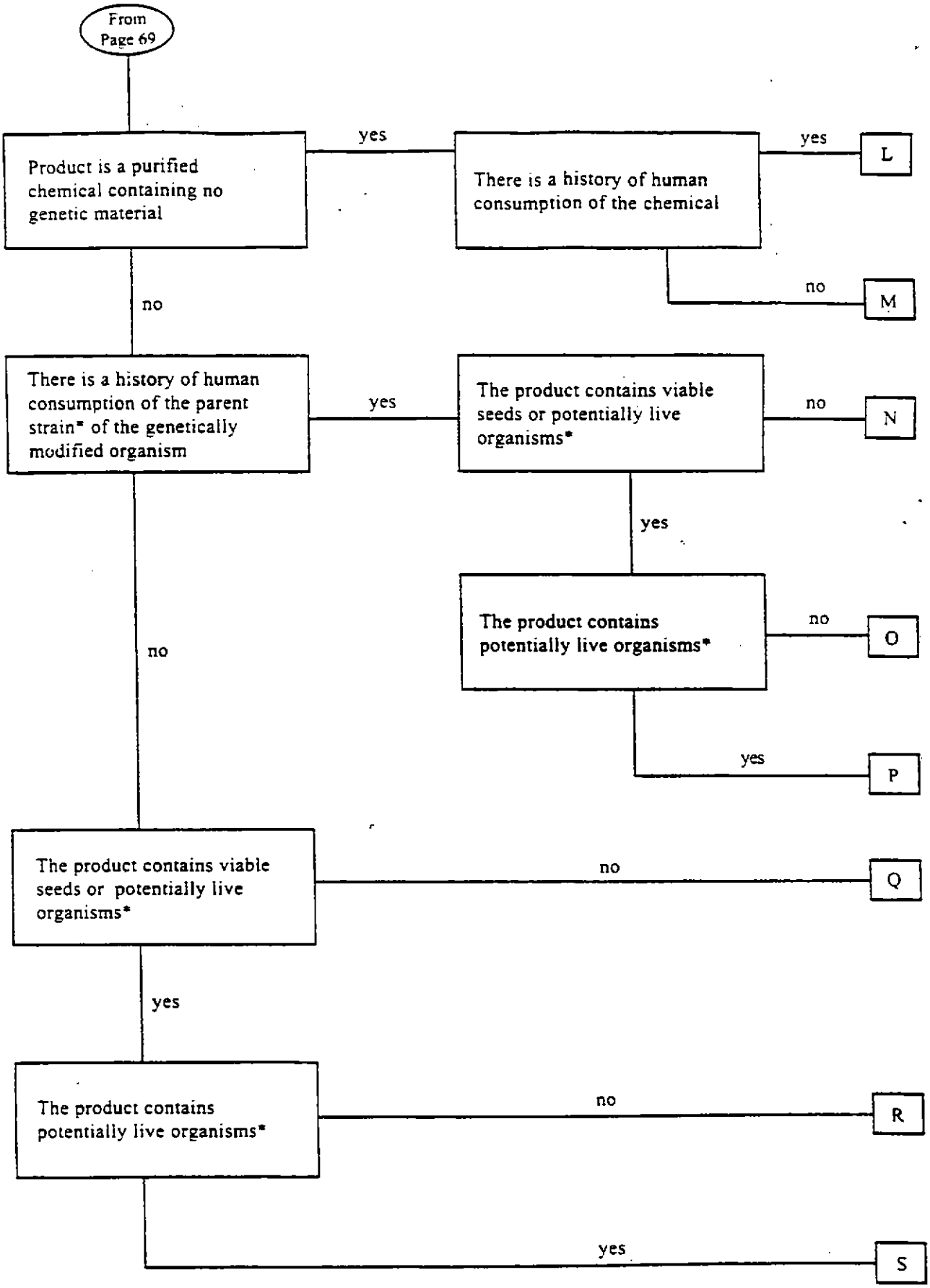
APPENDIX 5

STRUCTURED APPROACH TO SAFETY ASSESSMENT OF NOVEL FOODS AND PROCESSES

REVISED DECISION TREE




From Page 68
Product is a naturally occurring strain* of an organism
yes
There is a history of human consumption in the EC, at comparable levels, of the strain*
yes
Not novel
no
E
no
Product is derived from a naturally occurring strain* of an organism
yes
There is a history of human consumption of the strain* or of other products derived from it
yes
F
no
G
no
The source organism is a strain* that has been developed using genetic modification as defined in Directive 90/220/EEC
yes
Page 70
no
There is a history of human consumption of the parent strain(s)*
yes
There is significant difference compared to the parent strain(s)
no
Not novel
yes
Organism is eaten as such
yes
H
Organism is eaten as such
yes
no
K
J
no
I


From Page 69
Product is a purified chemical containing no genetic material
yes
There is a history of human consumption of the chemical
yes
L
no
M
no
There is a history of human consumption of the parent strain* of the genetically modified organism
yes
The product contains viable seeds or potentially live organisms*
no
N
yes
The product contains potentially live organisms*
no
O
yes
P
no
The product contains viable seeds or potentially live organisms*
no
Q
yes
The product contains potentially live organisms*
no
R
yes
S

REVISED DECISION TREE: EXPLANATORY NOTES

EC Regulation: until the EC Regulation on novel foods and food ingredients is adopted and or comes into force, this box should be read as, 'Product is a novel food or is produced by a novel process' as defined by the ACNFP in its 1991 Guidelines on the Assessment of Novel Foods and Processes.

Increased use: increased introduction and use of an existing product (e.g. an ethnic food/ingredient) which has not previously formed part of the traditional EC diet, and/or food ingredients proposed for use in specialised diets, for example for infants, where such foods/ingredients have no history of consumption in this target group.

Strain: this term is used to describe 'strain' in the case of micro-organisms, 'variety' in the case of plants and 'lines' in the case of animals.

Parent strain: the origin(s) of the genetic material in the source organism derived by non-GM (i.e. traditional breeding) techniques.

Potentially live organisms: this term is used to include all organisms which are potentially live, other than seeds.

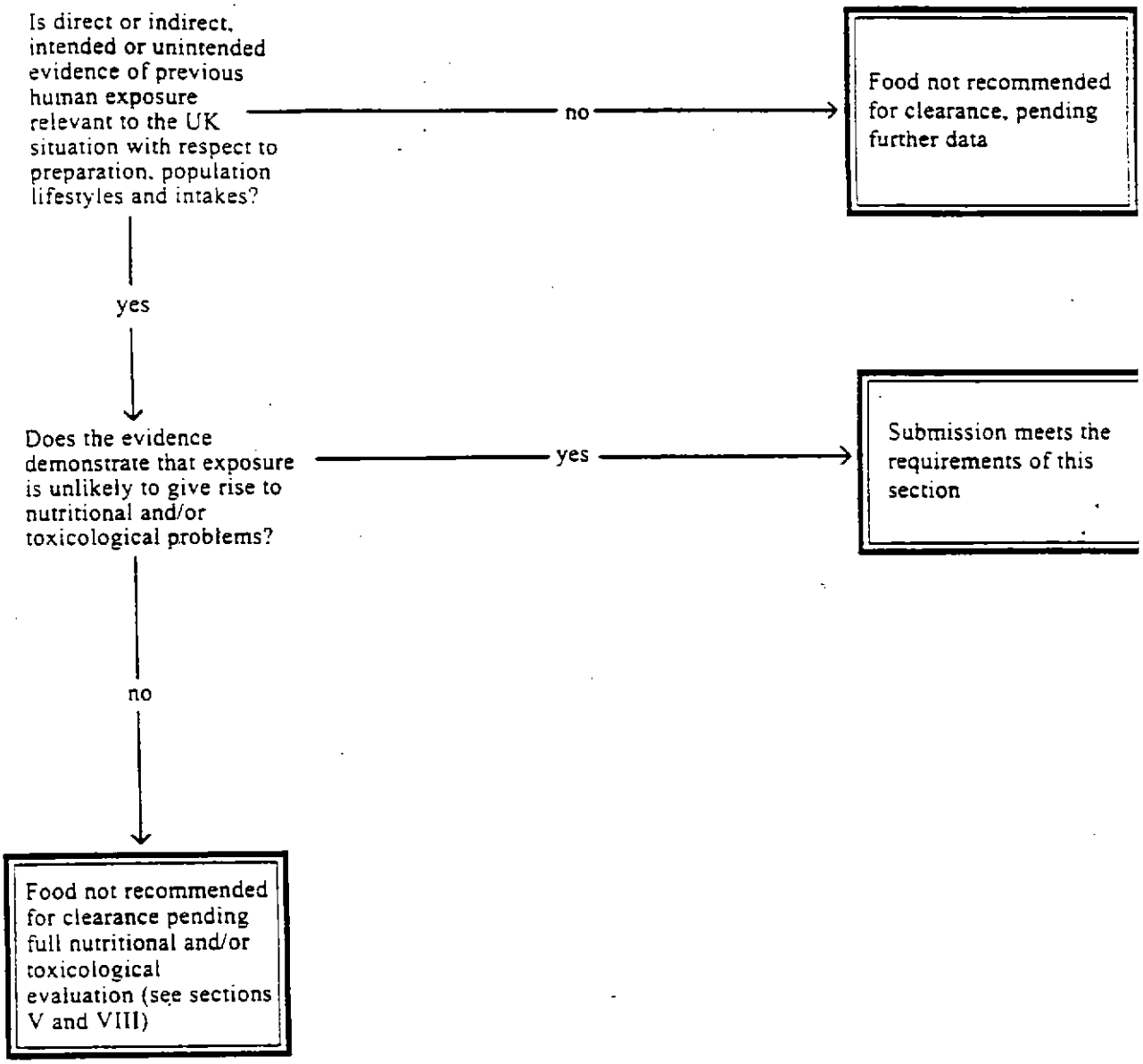
N.B.
Ultimately, these notes will appear as footnotes to their corresponding pages in the final revised version of the Guidelines.

KEY TO THE REVISED DECISION TREE – INFORMATION REQUIREMENTS

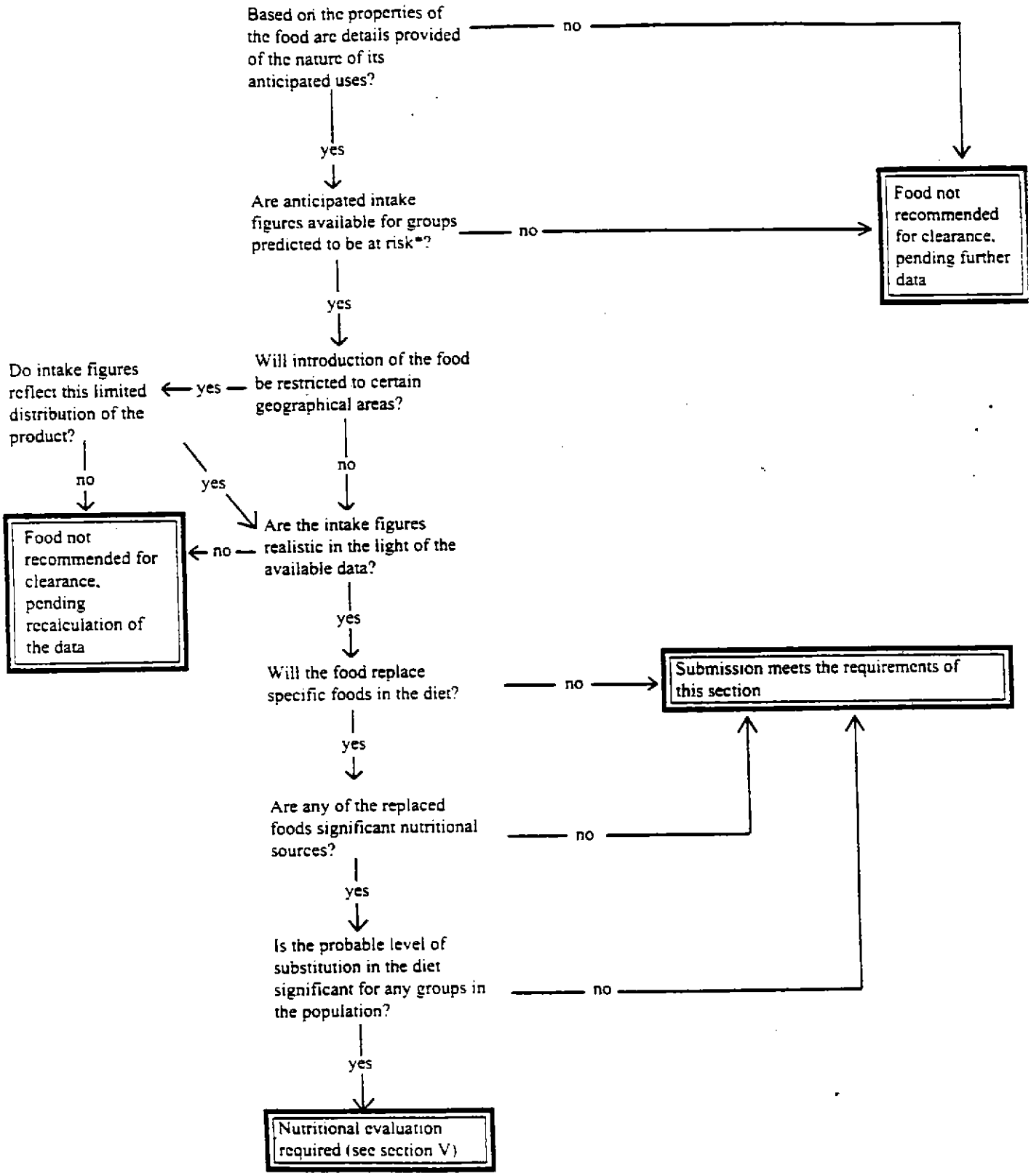
Exit Point	Information Requirements (see charts I–XV for further details)
A	I, II, IV, V, VIII
B	II, III, IV, V, VIII, XV
C	II, III, V, VIII, XV
D	II, IV, V, VIII, IX, XV
E	II, V, VI, VIII, IX, XV
F	I, II, III, IV, V, VI, XV
G	II, III, IV, V, VI, VIII, IX, XV
H	I, II, V, VI, VII, XV
I	I, II, III, IV, V, VI, VII, XV
J	II, V, VI, VII, VIII, IX, XV
K	II, III, IV, V, VI, VII, VIII, IX, XV
L	I, II, III, IV, V, VI, VII, VIII, X, XI, XV
M	II, III, IV, V, VI, VII, VIII, IX, X, XI, XV
N	I, II, III, IV, V, VI, VII, VIII, X, XI, XII, XV
O	I, II, V, VI, VII, VIII, X, XI, XII, XIII, XV
P	I, II, VI, VII, VIII, X, XI, XII, XIII, XIV, XV
Q	II, III, IV, V, VI, VII, VIII, IX, X, XI, XII, XV
R	II, V, VI, VII, VIII, IX, X, XI, XII, XIII, XV
S	II, VI, VII, VIII, IX, X, XI, XII, XIII, XIV, XV

I	Evidence of previous human exposure
II	Intake and extent of use
III	Technical details of the process
IV	Product specification
V	Nutritional assessment
VI	History of the organism
VII	Characterisation of derived strain in comparison with the parent strain
VIII	Toxicological assessment
IX	Human data
X	Effect of the genetic modification on the known properties of the parent organism
XI	Genetic stability of the modified organism
XII	Site of expression of any novel genetic material
XIII	Transfer of the novel genetic material
XIV	Assessment of a modified organism for survivability, replication and colonisation/amplification in the human gut
XV	Safety information

I. EVIDENCE OF PREVIOUS HUMAN EXPOSURE

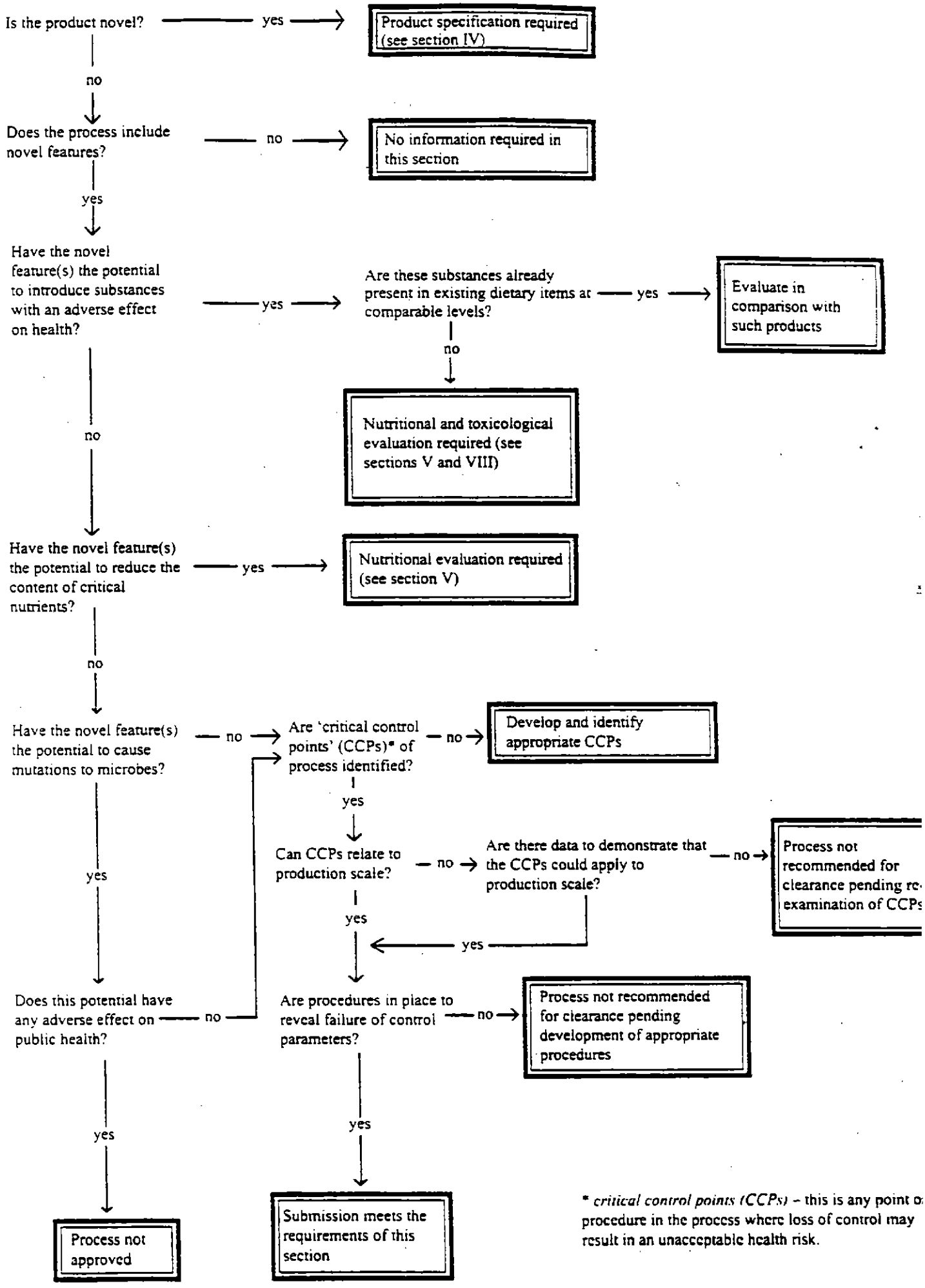


II. INTAKE/EXTENT OF USE



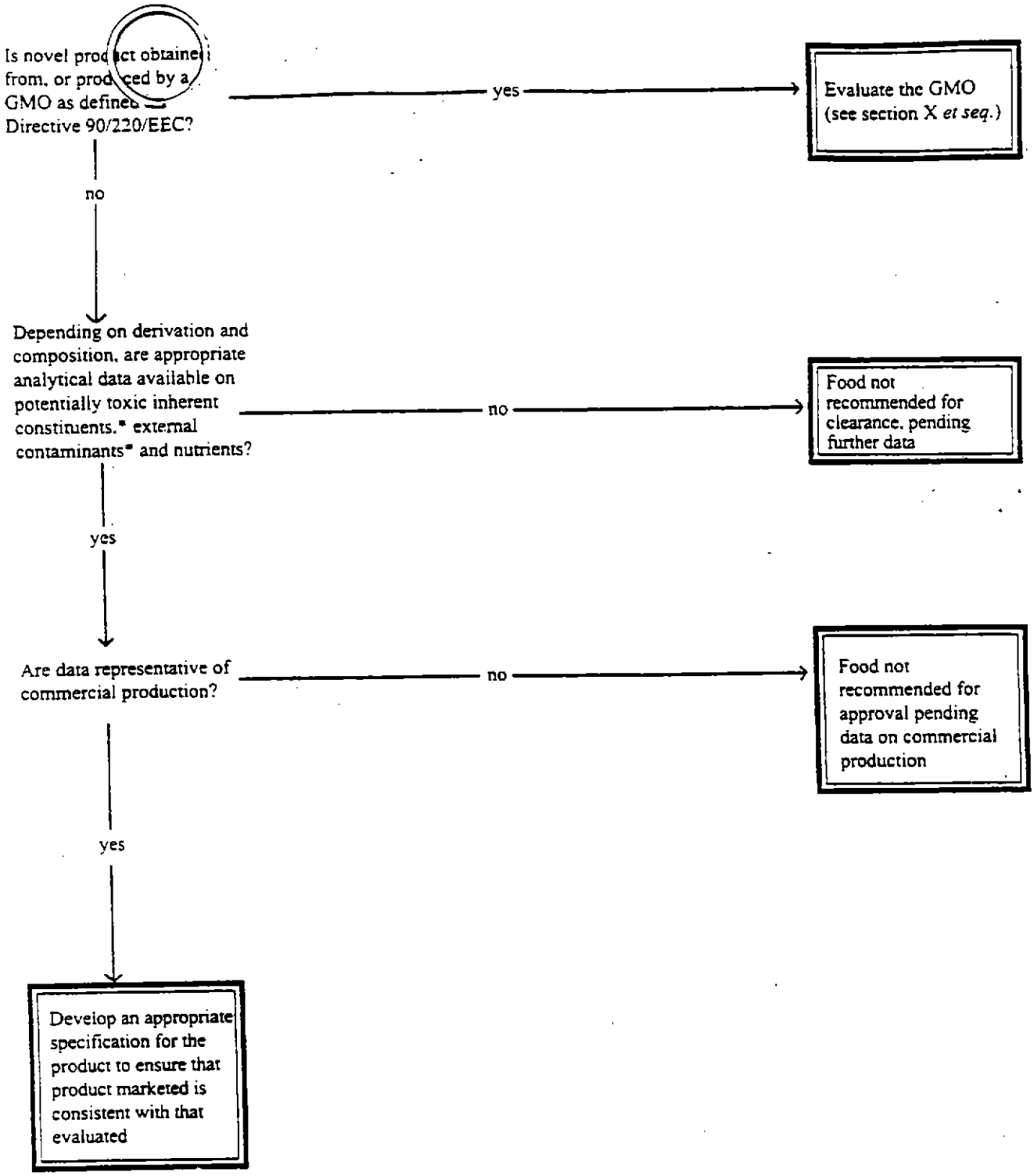
* *at risk groups* – these groups will vary from one parti type of novel food to another. In addition to identifyin those groups specifically targeted and whose intake is therefore likely to be higher than that of the 'average consumer', there will be a need also to identify those gr which are particularly susceptible to the introduction of particular novel food to their diet, for example, immune compromised individuals, infants and or elderly.

III. TECHNICAL DETAILS OF PROCESS



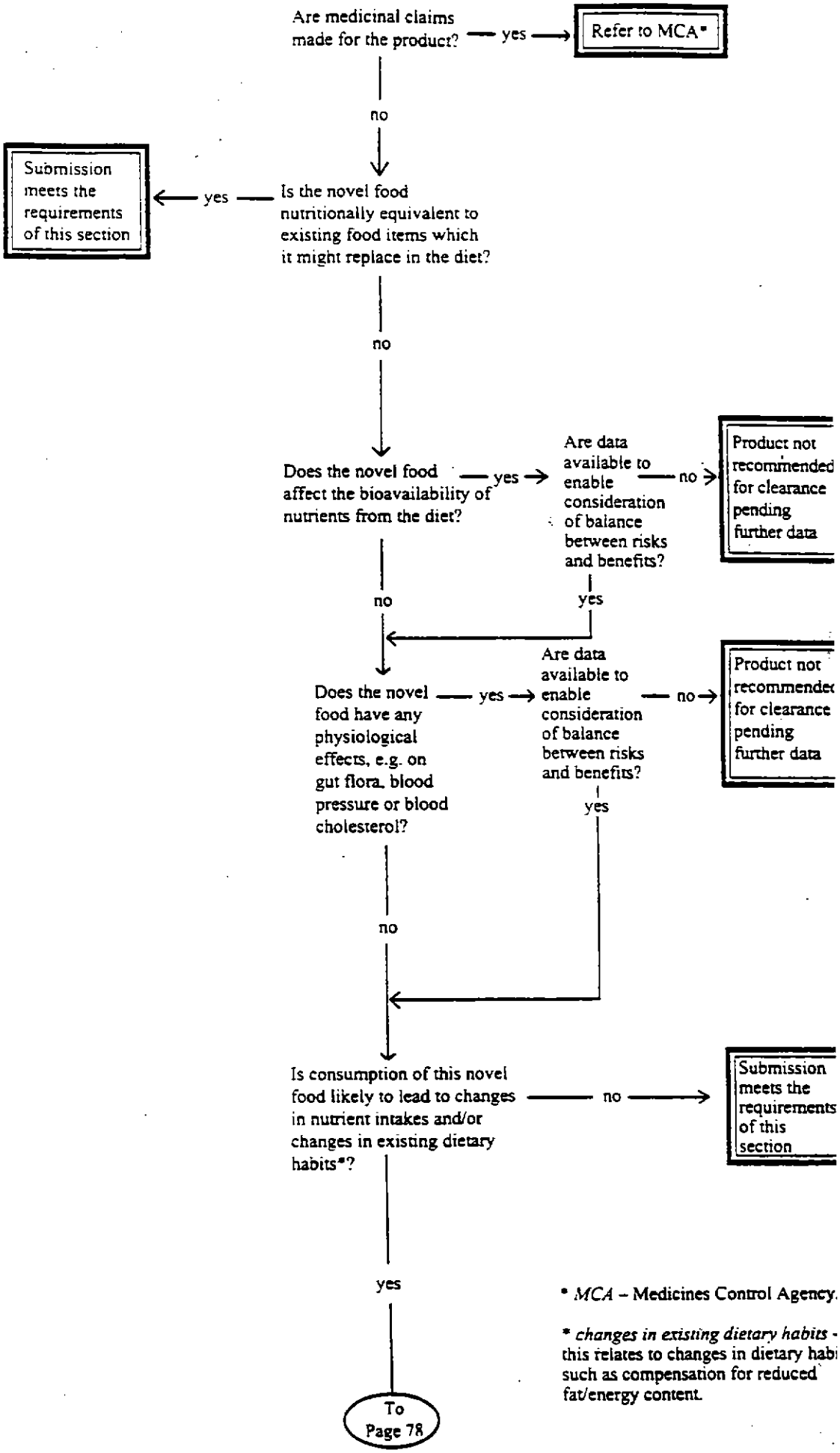
* *critical control points (CCPs)* – this is any point o procedure in the process where loss of control may result in an unacceptable health risk.

IV. PRODUCT SPECIFICATION



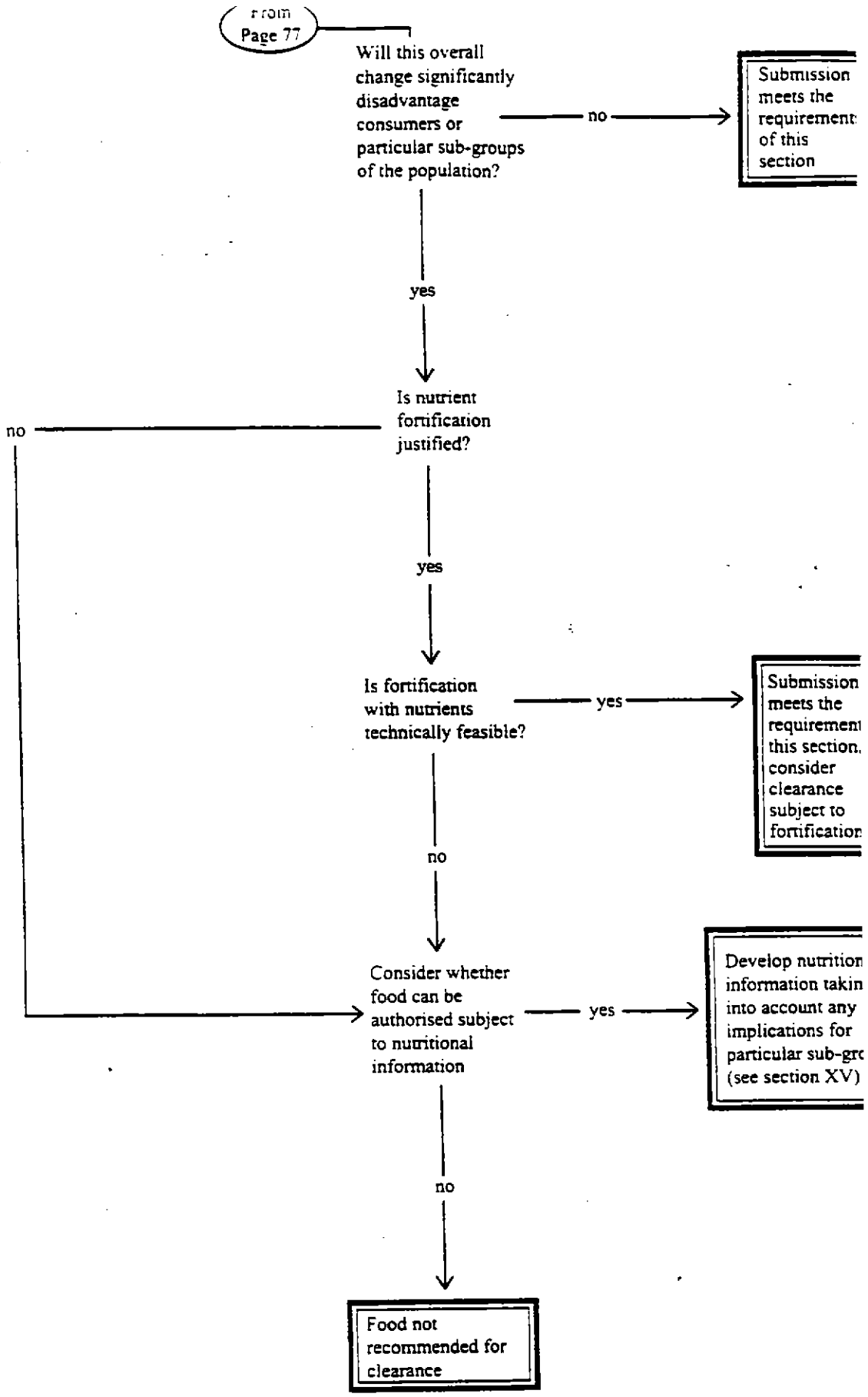
* *inherent constituents* – natural toxins/ antinutritional factors.

* *external contaminant* – this will depend on sou of novel food, and might include, for example, pesticide residues for materials of plant origin or heavy metals for materials of aquatic origin.

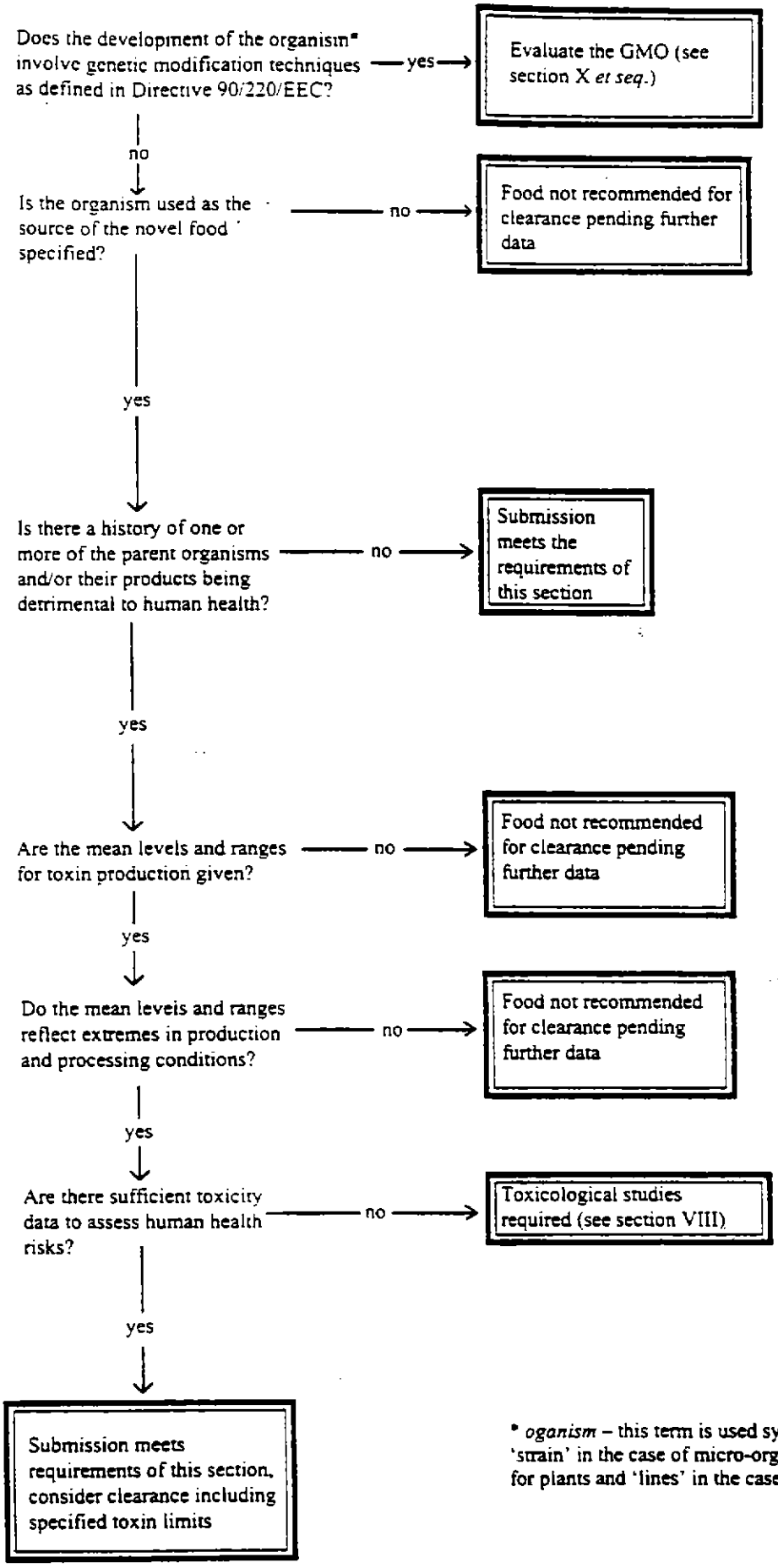


* *MCA* – Medicines Control Agency.

* *changes in existing dietary habits* - this relates to changes in dietary habi such as compensation for reduced fat/energy content.

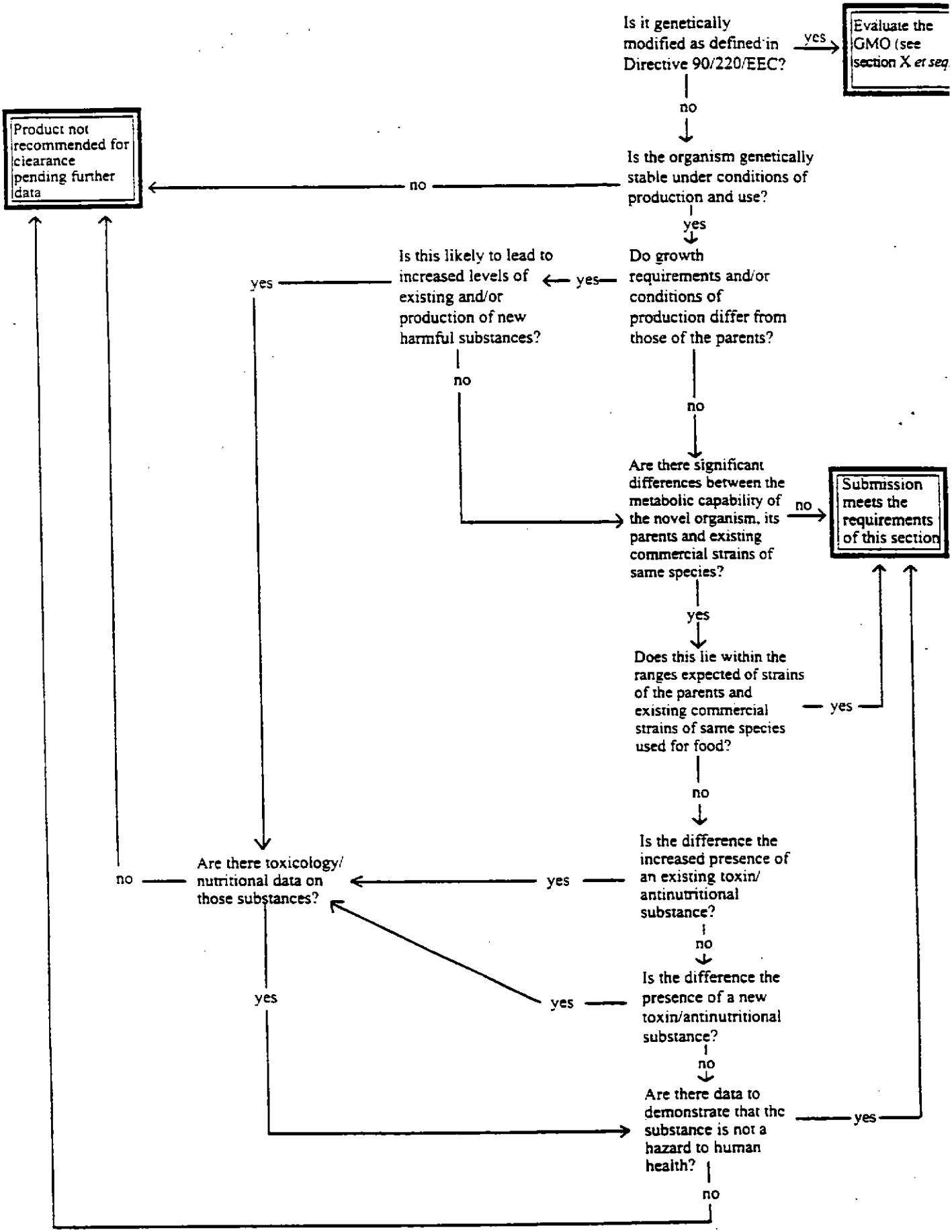

From Page 77
Will this overall change significantly disadvantage consumers or particular sub-groups of the population?
no
Submission meets the requirement of this section
yes
Is nutrient fortification justified?
no
yes
Is fortification with nutrients technically feasible?
yes
Submission meets the requirement this section, consider clearance subject to fortification
no
Consider whether food can be authorised subject to nutritional information
yes
Develop nutrition information takin into account any implications for particular sub-gr (see section XV)
no
Food not recommended for clearance

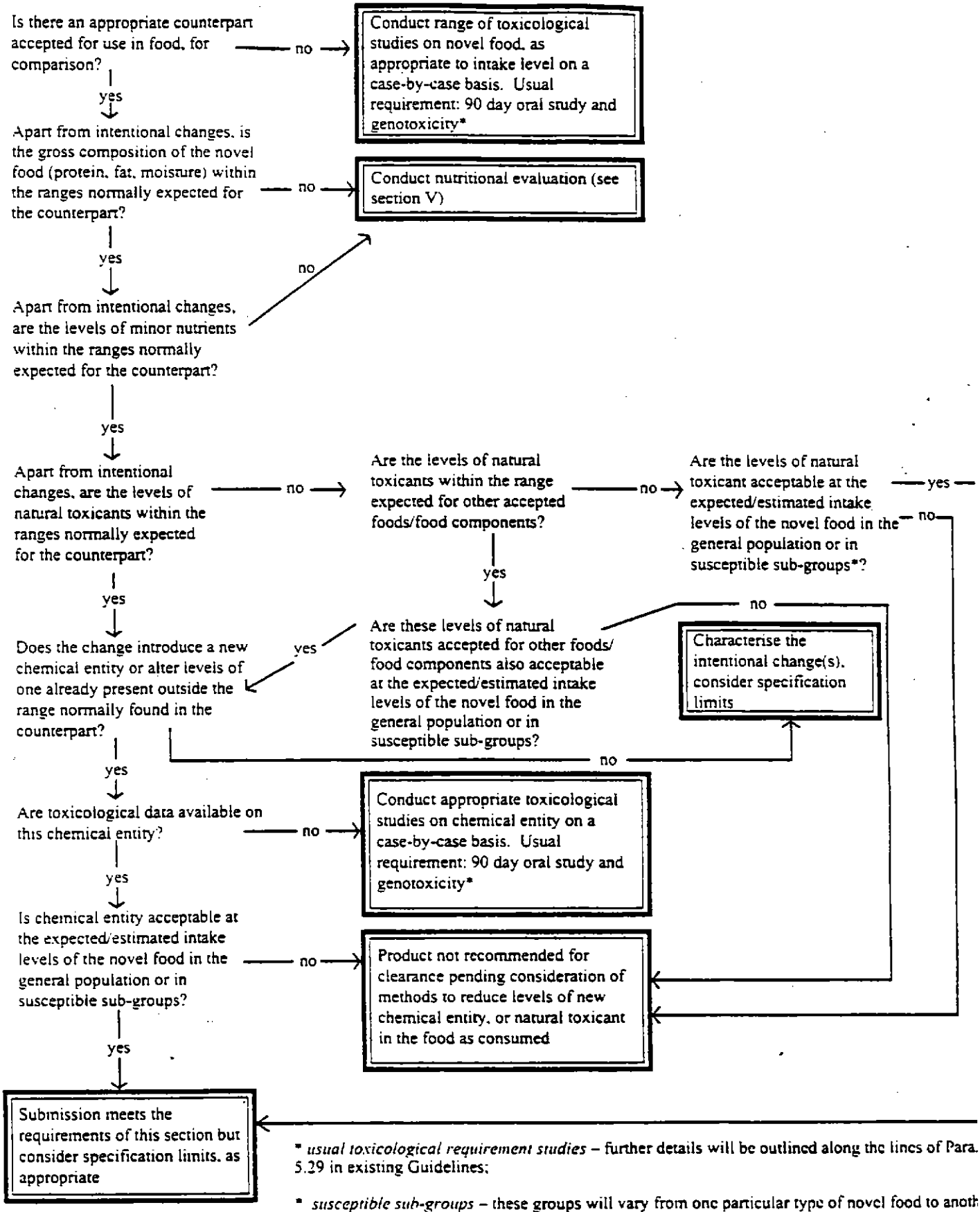
VI. HISTORY OF ORGANISM



* *organism* – this term is used synonymously with 'strain' in the case of micro-organisms, 'variety' for plants and 'lines' in the case of animals.

VII. CHARACTERISATION OF DERIVED STRAIN IN COMPARISON WITH THE PARENT STRAIN

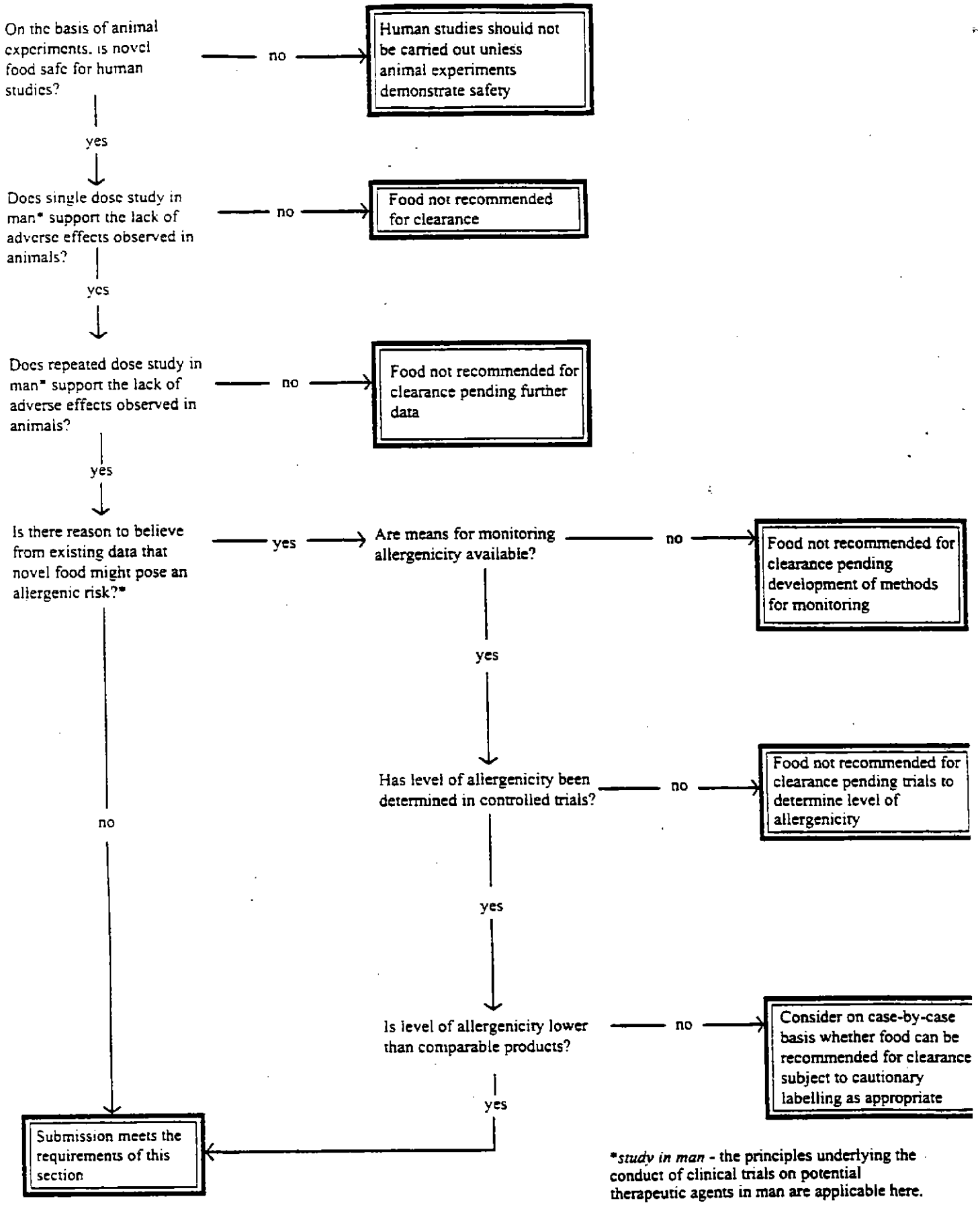




* *usual toxicological requirement studies* – further details will be outlined along the lines of Para. 5.29 in existing Guidelines;

* *susceptible sub-groups* – these groups will vary from one particular type of novel food to anoth In addition to identifying those groups specifically targeted and whose intake is therefore likely to higher than that of the 'average consumer', there will be a need also to identify those groups whic are particularly susceptible to the introduction of the particular novel food to their diet, for examp immuno-compromised individuals, infants and/or elderly.

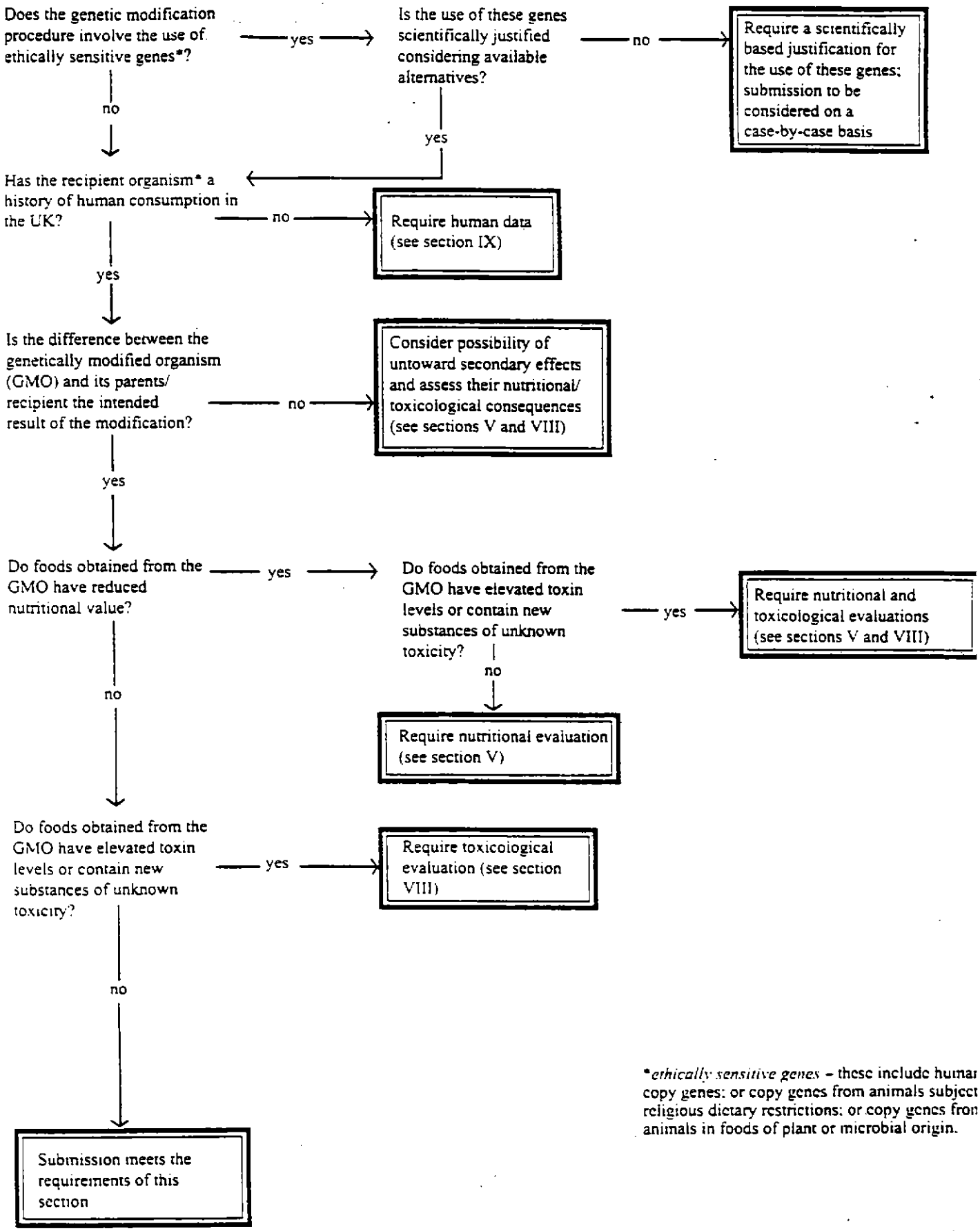
IX. HUMAN DATA



**study in man* - the principles underlying the conduct of clinical trials on potential therapeutic agents in man are applicable here.

* *allergenic risk* - these data might include: (a) circumstantial evidence such as from worker exposure, taste trials; (b) homology with known allergens; and/or (c) experimental evidence of allergenicity.

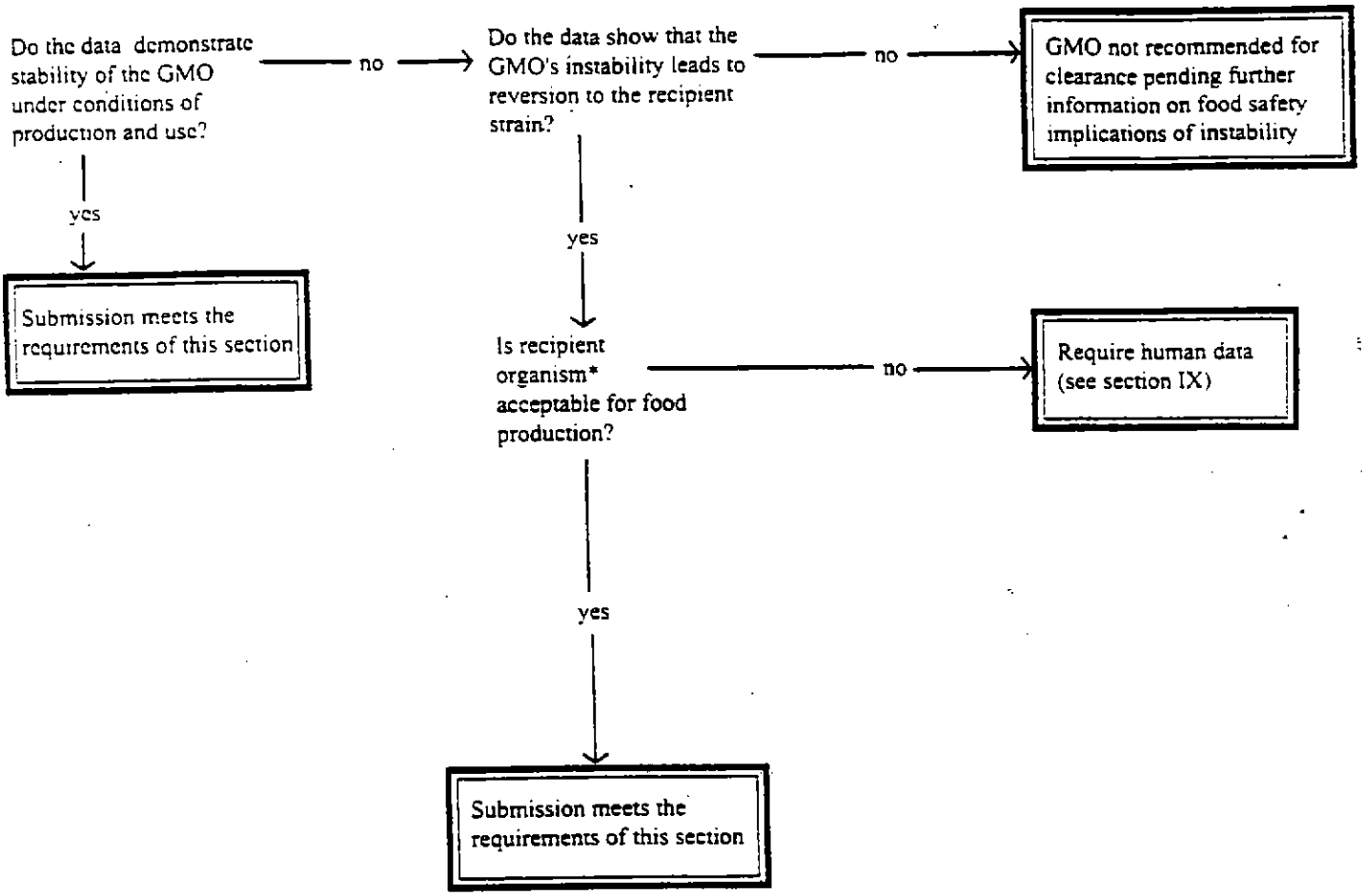
X. EFFECT OF GENETIC MODIFICATION PROCEDURE ON THE KNOWN PROPERTIES OF THE PARENT ORGANISM



**ethically sensitive genes* – these include human copy genes; or copy genes from animals subject religious dietary restrictions; or copy genes from animals in foods of plant or microbial origin.

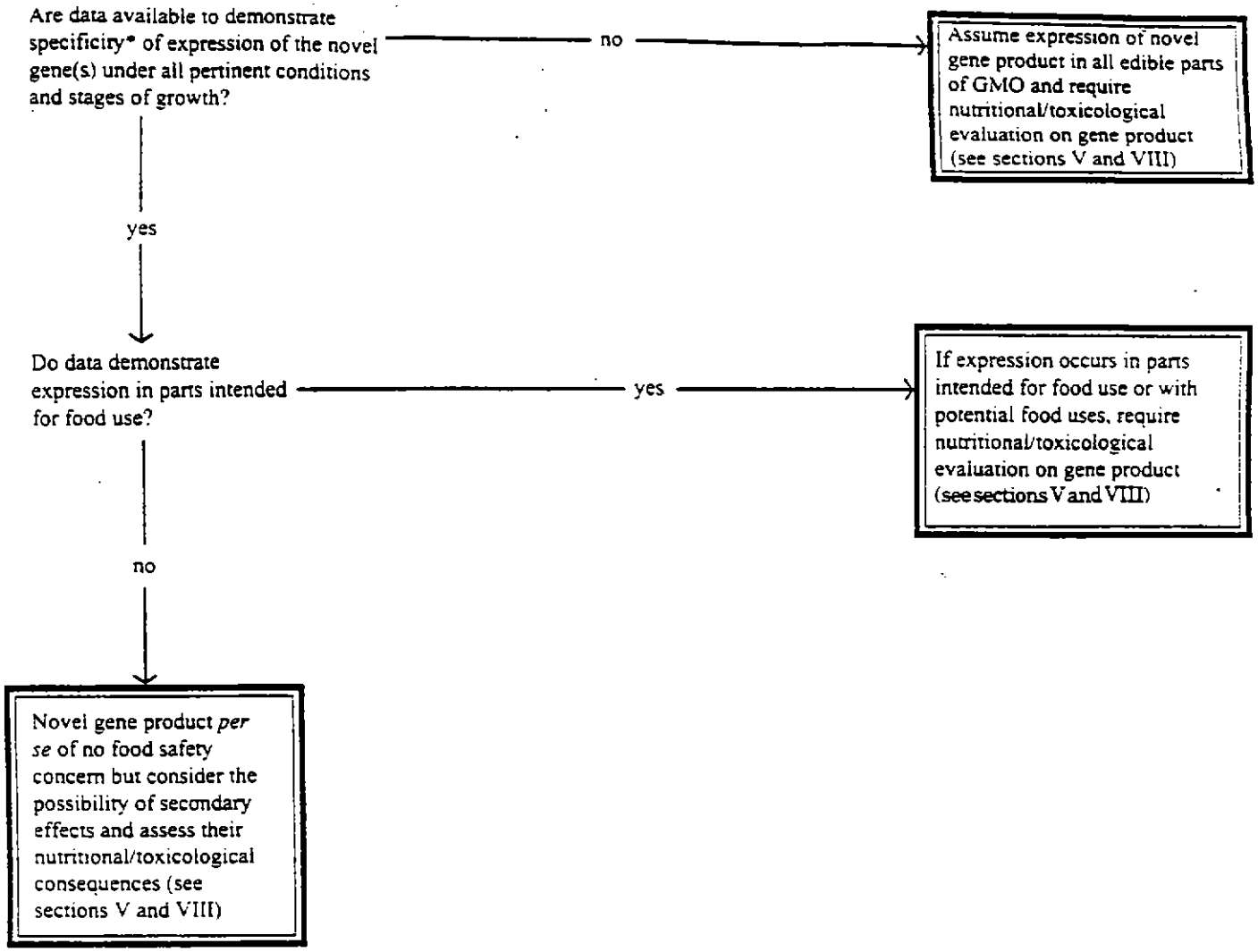
* *organism* – this term is used synonymously with 'strain' in the case of micro-organisms, 'variety' for plants, and 'lines' in the case of animals.

XI. GENETIC STABILITY OF THE MODIFIED ORGANISM



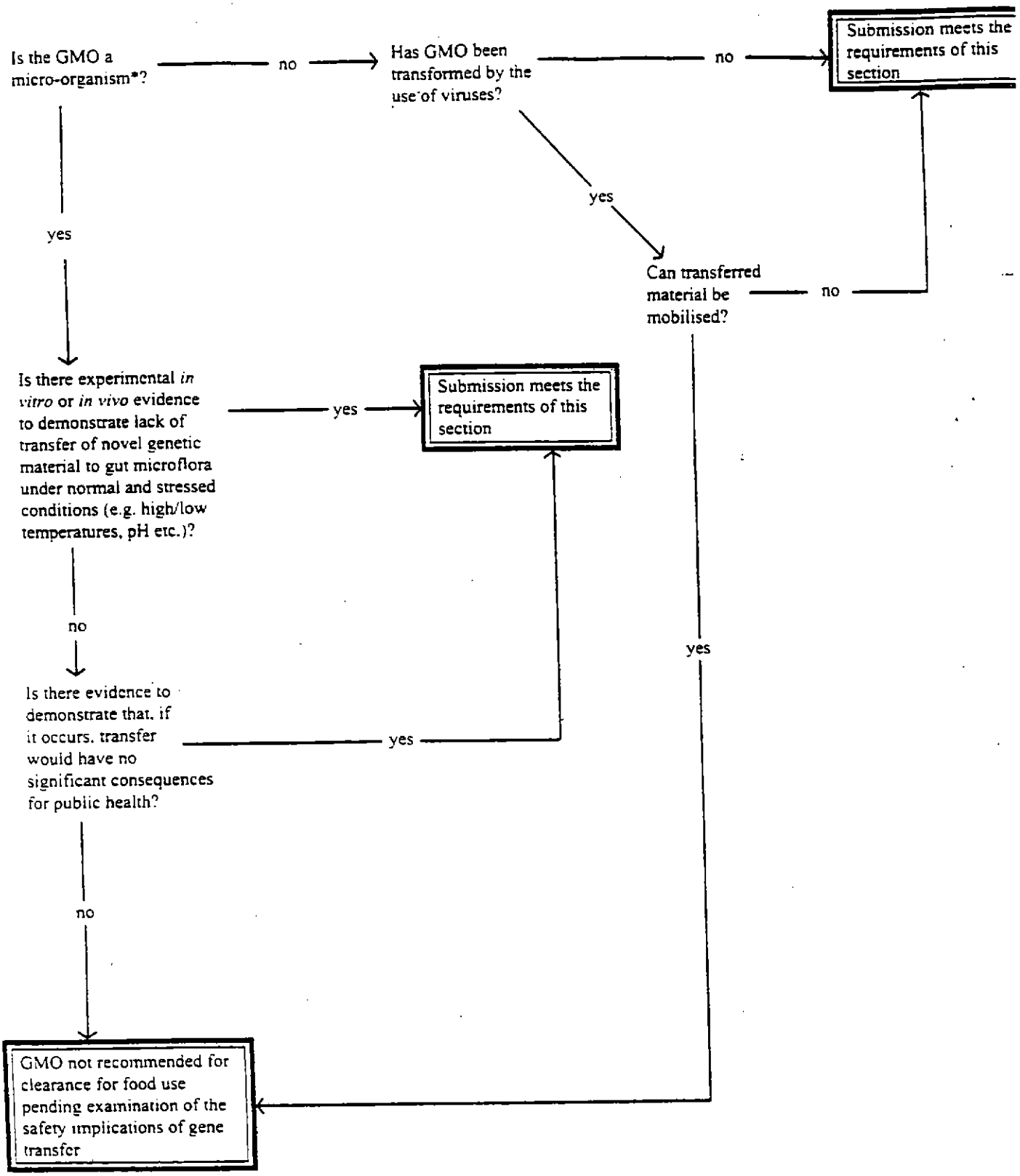
* *organism* – this term is used synonymo with 'strain' in the case of micro-organis 'variety' for plants, and 'lines' in the cas animals.

XII. SITE OF EXPRESSION OF ANY NOVEL GENETIC MATERIAL



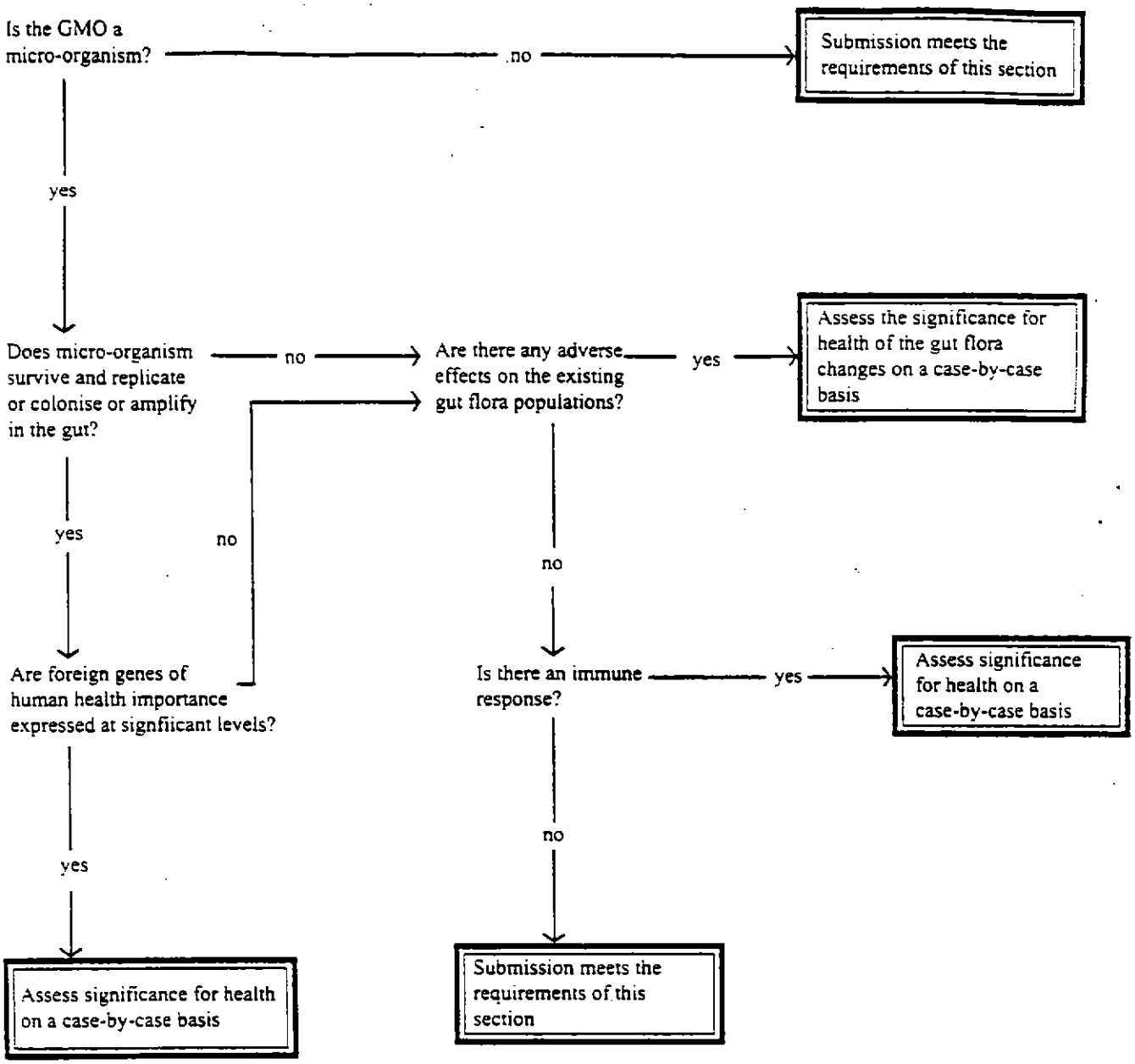
* *specificity* – this defines, 'phase of growth' for micro-organisms and 'site of expression' for plants and animals.

XIII. TRANSFER OF NOVEL GENETIC MATERIAL

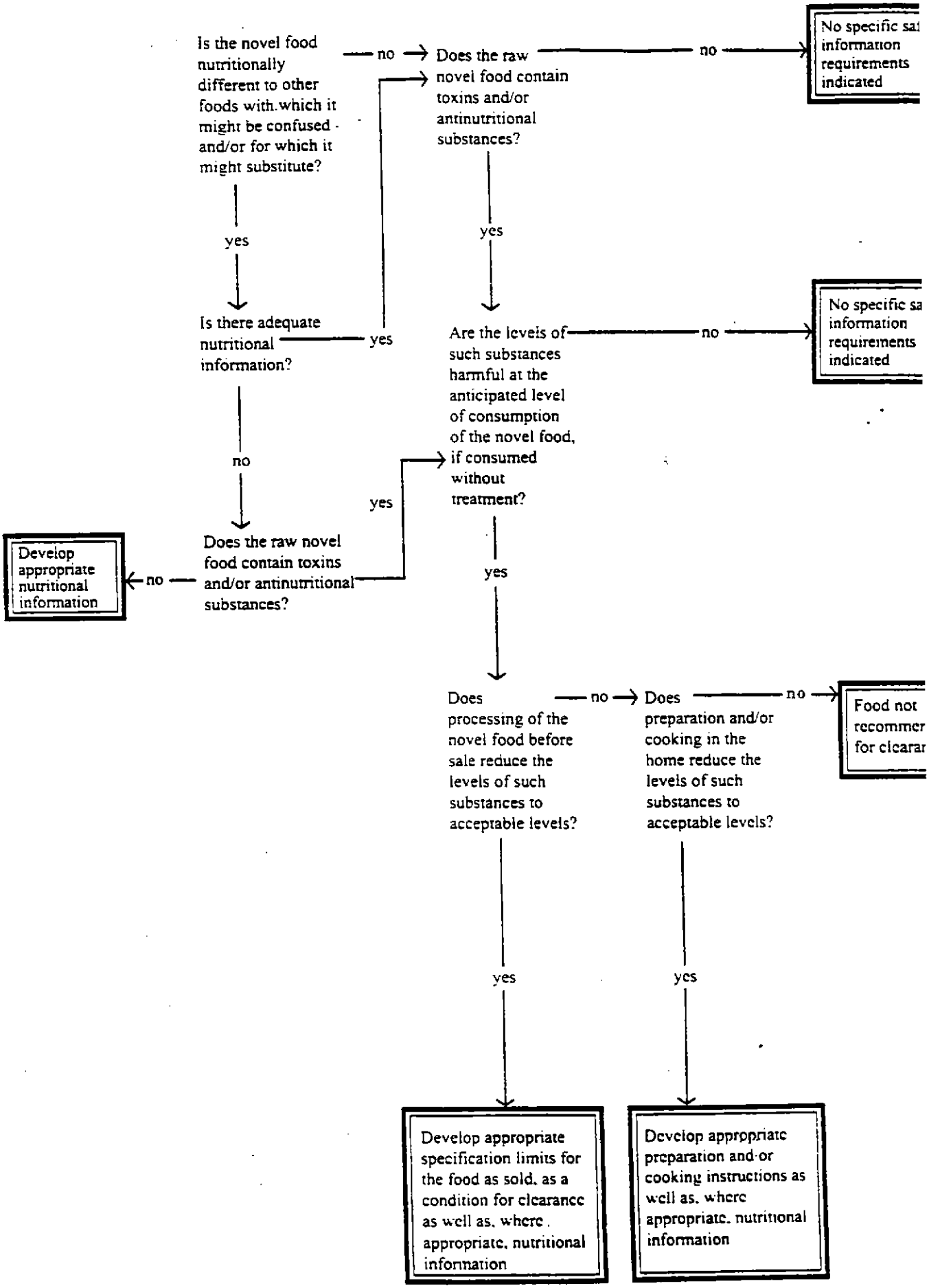


* *micro-organism* - according to common usage, th term is primarily intended to refer to bacteria but w also include the categories: algae, fungi yeasts, protozoa and viruses.

XIV. ASSESSMENT OF A GENETICALLY MODIFIED ORGANISM FOR SURVIVABILITY, REPLICATION AND COLONISATION/AMPLIFICATION IN THE HUMAN GUT



XV. SAFETY INFORMATION



ACNFP STRUCTURED APPROACH FOR THE SAFETY ASSESSMENT OF NOVEL FOODS AND PROCESSES

Examples of novel foods and processes illustrating use of the decision tree

1. *Ohmic heating*

questions:	product is an additive, flavouring or extraction solvent?	– no
	novel food as defined in EC regulation?	– yes
	novel or increased use of an existing product?	– no
	single product produced by a novel process?	– no
	novel process used to produce a range of products?	– yes

Therefore **C – information requirements: II, III, V, VIII, XV**

2. *Fat synthesised from a novel fatty acid*

questions:	product is an additive, flavouring or extraction solvent?	– no
	novel food as defined in EC regulation?	– yes
	novel or increased use of an existing product?	– no
	single product produced by a novel process?	– no
	novel process used to produce a range of products?	– no
	product synthesised from novel chemical substances?	– yes

Therefore **D – information requirements: II, IV, V, VIII, IX, XV**

3. *Fructose syrup containing dextrans*

questions.	product is an additive, flavouring or extraction solvent?	– no
	novel food as defined in EC regulation?	– yes
	novel or increased use of an existing product?	– no
	single product produced by a novel process?	– no
	novel process used to produce a range of products?	– no
	product synthesised from novel chemical substances?	– no
	product is a naturally occurring strain of an organism?	– no
	product derived from naturally occurring strain of organism?	– yes
	history of human consumption of the strain?	– yes

Therefore **F – information requirements: I, II, III, IV, V, VI, XV**

4. *Mycoprotein*

questions:	product is an additive, flavouring or extraction solvent?	– no
	novel food as defined in EC regulation?	– yes
	novel or increased use of an existing product?	– no
	single product produced by a novel process?	– no
	novel process used to produce a range of products?	– no
	product synthesised from novel chemical substances?	– no
	product is a naturally occurring strain of an organism?	– no
	product derived from naturally occurring strain of organism?	– yes
	history of human consumption of the strain?	– no

Therefore **G – information requirements: II, III, IV, V, VI, VIII, IX, XV**

5. *Chymosin from genetically modified food organism*

questions:	product is an additive, flavouring or extraction solvent?	– no
	novel food as defined in EC regulation?	– yes
	novel or increased use of an existing product?	– no
	single product produced by a novel process?	– no
	novel process used to produce a range of products?	– no
	product synthesised from novel chemical substances?	– no
	product is a naturally occurring strain of an organism?	– no
	product derived from naturally occurring strain of organism?	– no
	strain has been developed using genetic modification?	– yes
	product is a purified chemical containing no genetic material?	– yes
	history of human consumption of chemical?	– yes

Therefore **L – information requirements: I, II, III, IV, V, VI, VII, VIII, XI, XV**

6. *Genetically modified bakers yeast*

questions:	product is an additive, flavouring or extraction solvent?	– no
	novel food as defined in EC regulation?	– yes
	novel or increased use of an existing product?	– no
	single product produced by a novel process?	– no
	novel process used to produce a range of products?	– no
	product synthesised from novel chemical substances?	– no
	product is a naturally occurring strain of an organism?	– no
	product derived from naturally occurring strain of organism?	– no
	strain has been developed using genetic modification?	– yes
	product is a purified chemical containing no genetic material?	– no
	history of human consumption of parent strain of the GMO?	– yes
	product contains viable seeds or potentially live organisms?	– yes
	product contains potentially live organisms?	– yes

Therefore **P – information requirements: I, II, VI, VII, VIII, X, XI, XII, XIII, XIV, XV**

7. *Genetically modified tomato*

questions:	product is an additive, flavouring or extraction solvent?	– no
	novel food as defined in EC regulation?	– yes
	novel or increased use of an existing product?	– no
	single product produced by a novel process?	– no
	novel process used to produce a range of products?	– no
	product synthesised from novel chemical substances?	– no
	product is a naturally occurring strain of an organism?	– no
	product derived from naturally occurring strain of organism?	– no
	strain has been developed using genetic modification?	– yes
	product is a purified chemical containing no genetic material?	– no
	history of human consumption of parent strain of the GMO?	– yes
	product contains viable seeds or potentially live organisms?	– yes
	product contains potentially live organisms?	– no

Therefore **O – information requirements: I, II, V, VI, VII, VIII, X, XI, XII, XIII, XV**

N.B.

The decision tree will highlight the type of data needed, i.e. the information requirements, in support of a particular submission as indicated above. Depending on the information requirements identified, the corresponding structured schemes can be used to determine further the completeness of a submission. The reason why examples have not been put through the structured schemes is that by the very nature of the sequential questions asked, these are self-explanatory: the exit points from these schemes will tend to vary depending on the stage of development of a particular submission.

CUMULATIVE INDEX

Prof H F Woods	Cadbury Schweppes,	Shareholder
Wide range of national	Dean of the	
	Edinburgh Investment Trust,	Shareholder
and international food	University of	
	Foreign & Colonial	
and chemical companies	Sheffield Faculty	
	Investment Trust,	Shareholder
	of Medicine and	
	Hanson Trust,	Shareholder
	Dentistry, which has	
	Smith & Nephew	Shareholder
	extensive activity	

in teaching and research in nutrition and toxicology and in topics related to and supported by, many companies in the food and chemical industry. Trustee of the Hallamshire Therapeutic Research Trust Ltd, Harry Bottom Charitable Trust and Special Trustees for the former United Sheffield Hospitals