phoblastoid cells may produce several different species of IFN that are encoded by distinct genes and may have distinctive biological properties; for example, in regard to their target-cell specificities. Cloning techniques should make each of these species available in quantity and allow their exact characterization. The results obtained so far are promising in regard to the possible replacement of natural IFN by products made in *E. coli*.

References and Notes

1. W. E. Stewart II, *The Interferon System* (Springer-Verlag, Berlin, 1979).
2. I. Gresser, *Cell. Immunol.* **34**, 406 (1977).
3. S. Nagata *et al.*, *Nature (London)* **284**, 316 (1980).
4. E. A. Havell, J. Vilček, E. Falcoff, B. Berman, *Virology* **63**, 475 (1975).
5. W. E. Stewart II, L. S. Lin, M. Wiranowska-Stewart, K. Cantell, *Proc. Natl. Acad. Sci. U.S.A.* **74**, 4200 (1977).
6. H. W. West, G. B. Cannon, H. D. Kay, G. B. Ronnard, R. B. Herberman, *J. Immunol.* **118** 355 (1977).
7. T. Bakács, E. Klein, E. Yefenof, P. Gergely, M. Steinitz, *Z. Immunitaetsforsch.-Immunbiol.* **154**, 121 (1978).
8. J. Kaplan and D. Colleweart, *J. Natl. Cancer Inst.* **60**, 961 (1978).
9. A. Ono, D. B. Amos, H. S. Koren, *Nature (London)* **266**, 546 (1977).
10. M. Jondal, C. Spina, S. Targan, *ibid.* **272**, 62 (1978).
11. M. G. Masucci, E. Klein, S. Argov, *J. Immunol.* **121**, 2458 (1980).
12. D. Santoli, G. Trinchieri, H. Koprowski, *ibid.* **121**, 532 (1978).
13. M. G. Masucci, G. Masucci, E. Klein, W. Berthold, in *New Trends in Human Immunology and Cancer Immunotherapy* (Symposium Monpellier, in press).
14. P. Perlmann and J. C. Cerottini, in *The Antigens*, M. Sela, Ed. (Academic Press, New York, 1979), p. 173.
15. R. Kiessling, E. Eriksson, L. A. Hallenbeck, R. M. Welsh, in preparation.
16. M. Shong and G. Bendixen, *Acta Med. Scand.* **181**, 247 (1967).
17. R. Szigeti, M. G. Masucci, G. Masucci, E. Klein, G. Klein, W. Berthold, in preparation.
18. R. Szigeti, J. Békay, T. Rèvèsz, D. Schuler, *Allergy*, in press.
19. W. L. Morison, *J. Clin. Pathol.* **27**, 113 (1974).
20. A. S. Kadish, F. Tansey, G. S. M. Yu, D. T. Doyle, B. R. Bloom, *J. Exp. Med.* **151**, 637 (1980).
21. R. Szigeti, L. Timer, T. Rèvèsz, *Allergy* **35**, 97 (1980).
22. E. M. Fenyö, E. Yefenof, E. Klein, G. Klein, *J. Exp. Med.* **146**, 1521 (1977).
23. R. Szigeta, E. M. Fenyö, E. Klein, G. Klein, in preparation.
24. W. E. Stewart II, I. Gresser, M. G. Tovey, M. T. Bandu, S. Legoff, *Nature (London)* **262**, 300 (1976); E. Adams, H. Strander, K. Cantell, *J. Gen. Virol.* **28**, 207 (1975).
25. L. Montagnier and J. Gruest, *Ann. Virol. (Inst. Pasteur)* **131** E, 247 (1980).
26. N. Mantei, M. Schwarzstein, M. Streuli, S. Panem, S. Nagata, C. Weissmann, *Gene* **10**, 1 (1980).
27. M. Streuli, S. Nagata, C. Weissmann, *Science*, **209**, 1343 (1980).
28. K. C. Zoon, M. E. Smith, P. J. Bridgen, C. B. Anfinsen, M. W. Hunkapiller, L. E. Hood, *Science* **207**, 527 (1980).
29. N. Mantei, S. Nagata, C. Weissmann, *Nature (London)*, in press.
30. W. E. Stewart II *et al.*, *Gene*, in press.
31. L. S. Linn and W. E. Stewart II, personal communication.
32. T. M. Roberts, R. Kacich, M. Ptashne, *Proc. Natl. Acad. Sci. U.S.A.* **76**, 760 (1979).
33. G. Bodo, in *Proceedings, Symposium on Preparation, Standardization, and Chemical Use of Interferon*, D. Ikić, Ed. (Yugoslav Academy of Sciences and Arts, Belgrade, 1977), pp. 39–57.
34. G. Lundgren, C. F. Zukowski, G. Möller, *Clin. Exp. Immunol.* **3**, 817 (1968).
35. T. Bakács, P. Gergely, E. Klein, *Cell. Immunol.* **32**, 317 (1977).
36. J. L. McCoy, J. H. Dean, R. Herberman, *J. Immunol. Methods* **15**, 355 (1977).
37. A. Karande, E. M. Fenyö, G. Klein, in preparation.

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27 June 1980

Glossary

This list of ad hoc definitions is intended to be helpful to readers of the preceding articles. The definitions are not exhaustive.

acute transfection short-term infection of cells with DNA

ADCC antibody-dependent cell-mediated cytotoxicity

amber mutation a mutation in which a polypeptide chain is terminated prematurely; results from an alteration in a codon such that the codon becomes UAG, which signals chain termination

amplification 1. treatment (for example, chloramphenicol) designed to increase the proportion of plasmid DNA relative to that of bacterial DNA; 2. replication of a gene library in bulk

anticodon the triplet of nucleotides in a tRNA molecule that associates by complementary base pairing with the codon in the mRNA during translation

antiparallel describes molecules that are parallel but point in opposite directions (the strands of DNA are antiparallel)

antisense strand of DNA that has the same sequence as mRNA

AUG see initiation codon

blunt end DNA end with both tein (sometimes CRP or CGA); it paroverlapping sequence is exposed

cap the structure found at the 5′ end of many eukaryotic mRNA's; it consists of 7′-methyl-guanosine-pppX, where X is the first nucleotide encoded in the DNA; it is not present in prokaryotic mRNA's; it is added posttranscriptionally near the TATA (Hogness) box

CAP not to be confused with cap; CAP is catabolite gene activator protein (sometimes CRP or CGA); it participates in the initiation of transcription in prokaryotes

capsid the protein coat of a virion or virus particle

cg clone crown gall clone; cg clone 1, cg clone 2, and the like

C_H constant portion of the immunoglobulin heavy chain

chromosome walking sequential isolation of overlapping molecular clones so as to span large chromosomal intervals

cistron a DNA fragment or portion that specifies or codes for a particular polypeptide

class see immunoglobulin class

class switch a switch in the expression of a B lymphocyte from one antibody class to another

codon a group of three nucleotides that codes for an amino acid

cohesive termini (cohesive end) DNA molecules with single-stranded ends that show complementarity, making it possible, for example, to join end to end with introduced fragments

cold sensitive mutation mutation leading to a gene that is functional at high (permissive) temperature but inactive at low (restrictive) temperature

complementary DNA (cDNA) DNA that is complementary to messenger RNA; used for cloning or as a specific and sensitive probe in hybridization studies

consensus sequence an average sequence, each nucleotide of which is the most frequent at that position in a set of examples; used for RNA splice sites and other sites

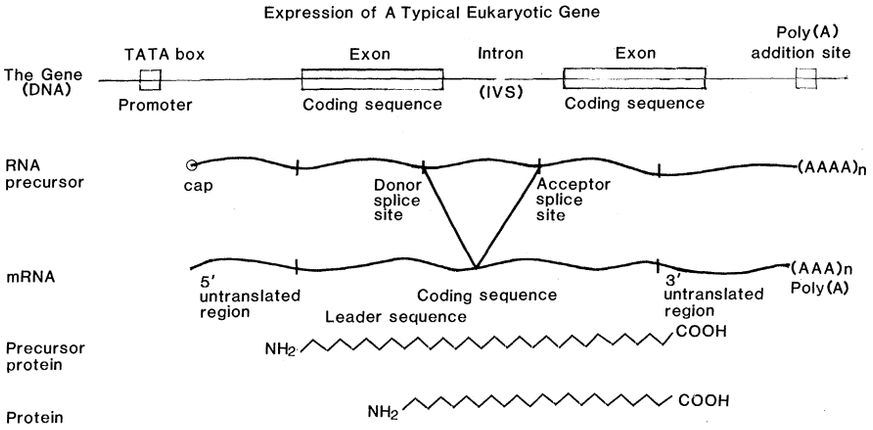
cross hybridization hybridization of a probe to imperfectly matching (less than 100 percent complementarity) molecules

crossing-over exchange of genetic material between chromosomes that pair during meiosis (homologous chromosomes)

cut a double-strand scission in the duplex polynucleotide in distinction to the single-strand "nick"

episome a circular gene fragment

exon portion of DNA that codes for the final mRNA



exon shuffle the alternative RNA processing patterns that lead to expression of different combinations of exons from the same gene

Fc an antibody (immunoglobulin) fragment from C_H which is crystallizable

Fc receptor the receptor for the Fc fragment

flush blunt

gap a double-stranded DNA is said to be gapped when one strand is missing over a short region

gene library random collection of cloned fragments in a vector that ideally includes all the genetic information of that species; for example, chicken, human; sometimes called shotgun collection

gene splicing see splicing

genetic colonization a novel sort of parasitism practiced by *Agrobacterium* with plants; introduction of genetic information into a host, which induces the host to synthesize products that only the inducer can use

genome all the genes of an organism or individual

genomic blotting see Southern blotting

Grünstein-Hogness assay colony hybridization procedure for identification of plasmid clones (colonies are transferred to a filter and hybridized with a probe)

H chain heavy chain of immunoglobulin molecule; see V_H and C_H

heteroduplex a DNA molecule, the two strands of which come from different individuals so that there may be some base pairs or blocks of base pairs that do not match

hinge short flexible amino acid sequence of an immunoglobulin protein permitting one portion to move relative to the other; when present, the hinge separates the antigen-combining site from the F_c portion of the molecule

Hogness box (TATA box) the hypothesized eukaryotic RNA polymerase II promoter analogous to the Pribnow box

hot spot a preferred site or simple sequence; for example, for initiation of recombination

IF-1 initiation factor 1 (also IF-2, IF-3) for protein synthesis

IFN interferon

immunoglobulin class for example, in the mouse there are eight classes of immunoglobulins (Ig): IgM (μ chain); IgD (δ chain); four IgG's (γ chains); IgA (α chain); IgE (ϵ chain); the class is determined by the constant region of the heavy chain. Class is associated with generic properties of the antibody, cellular and tissue localization, complement binding, and other. Class is independent of the variable region and independent of the light chain

initiation codon (AUG; sometimes GUG); codes for the first amino acid in protein sequences, which is formylmethionine; fMet is often removed posttranslationally

integration and excision integration: a recombination in which a genetic element is inserted; excision: reverse of integration

intervening sequence a portion of a gene that is transcribed but does not appear in the final mRNA transcript

intron intervening sequence in DNA

inversion the alteration of a DNA molecule made by removing a fragment, reversing its orientation, and pulling it back into place

inverted repeat in DNA see palindrome

jumping genes genes associated with transposable elements

Klenow fragment piece obtained from polymerase I by proteolytic cleavage; it lacks the 5′ to 3′ exonuclease

lac operon an operon in *Escherichia coli* that codes for three genes involved in the metabolism of lactose

L chain light chain of immunoglobulin molecules: V_L, J_L, C_L, are genes coding for the corresponding portions of the light chain; L chains are either λ or κ (not both)

l strand late strand; compare e strand, early strand

ligase, DNA ligase catalyzes the formation of a phosphodiester bond at the site of a single-strand break in duplex DNA (RNA can also act as a substrate to some extent)

linker a small fragment of synthetic DNA that has a restriction site useful for gene splicing

MI migration inhibition

MMI macrophage migration inhibition

mRNA messenger RNA

n orientation when a target fragment is inserted into a vector, two orientations are possible: n, the genetic map of both vector and target have the same orientation; u, when the target and vector are in different orientations

nearest neighbor analysis a biochemical technique for estimating the frequencies that pairs of the bases are next to one another

nick a single-strand scission of the DNA (can be made with deoxyribonuclease and ethidium bromide)

nick translation procedure for labeling DNA in vitro using DNA polymerase I

nonsense mutation a mutation that results in the termination of a polypeptide chain; for example, ochre and amber

nopaline an opine synthesized by a Ti plasmid

nucleotide replacement site position in a codon where a point mutation has occurred

ochre mutation a mutation in which a polypeptide chain is terminated prematurely; results from an alteration in the codon such that the codon becomes UGA, which signals chain termination

octopine an opine synthesized by a Ti plasmid

operator a region of DNA that interacts with a repressor protein to control the expression of an adjacent gene or group of genes

operon a gene unit consisting of one or more genes that specify a polypeptide and an "operator" that regulates the transcription of the structural gene [the regulator and the coding genes are adjacent on the DNA molecule]

opine derivative of basic amino acids produced by crown gall cells

ori gene; point or region where DNA replication is begun

p pN, monophosphate of nucleoside N; ppN, diphosphate of the nucleoside N; pppN, triphosphate of nucleoside N

palindrome a self-complementary nucleic acid sequence, that is, a sequence identical to its complementary strand (both read in the same 5′ to 3′ direction); perfect palindromes (for example, GAATTC) frequently occur as sites of recognition for restriction enzymes; less perfect palindromes (for example, TACCTCTGGCGTGATA) frequently occur in binding sites for other proteins, such as repressors; interrupted palindromes (for example, an inverted repeat such as GGTTXXXAACC) afford the possibility in single-stranded nucleic acids for the loop stem (hairpin) structure as in tRNA

phosphodiesterase I removes, by hydrolysis, 5′ nucleotides from the 3′ hydroxy termini of oligonucleotides with 3′ ends; also called 5′ exonuclease

plasmid extrachromosomal, autonomously replicating, circular DNA segment

polyadenylation nontranscriptive addition of poly(A) (polyadenylate) to the 3′ end of eukaryotic RNA

polymerase enzyme that catalyzes the assembly of nucleotides into RNA and of deoxynucleotides into DNA

Pribnow box TATAATG; consensus sequence near the RNA start point of prokaryotic promoters

promoter a DNA sequence at which RNA polymerase binds, and then initiates transcription

pseudogene a sequence that looks like a gene but does not function as one; it appears to have no phenotype and could be the vestigial remains of a gene

reading one-way linear process by which nucleotide sequences are decoded, for example, by protein-synthesizing systems

readthrough the transcription of a region beyond a normal termination sequence, due to occasional failure of RNA polymerase to recognize the termination signal

regulatory gene a gene whose product is involved in the regulation of another gene, such as a repressor gene

regulatory sequence a DNA sequence involved in regulating the expression of the gene (for example, promoters, operators)

repressor the protein that binds to a regulatory sequence (operator) adjacent to a gene and which, when bound, blocks transcription of the gene

restriction endonuclease site-specific endodeoxyribonuclease; cleavage is sequence-specific; both strands are cleaved; usually have been isolated from bacteria; there are many (see E.C. 3.1.23.1 to E.C. 3.1.23.45), for example, Eco RI; Bam I, Hind III

r loop three-stranded structure in which an RNA-DNA hybrid displaces the other strand of DNA, leaving a DNA loop with characteristic appearance in the electron microscope

RNA splicing see splicing

SD sequence Shine-Dalgarno or ribosome recognition sequence, begins 3 to 11 nucleotides upstream from the AUG in mRNA; is complementary to the 3′ end of 16*S* ribosomal RNA

sequence ladder bands in gel corresponding to DNA sequence

shotgunning see gene library

silent site mutation, silent mutation mutation in a codon or sequence that does not cause an amino acid change

Southern blot technique method of transferring DNA fragments that have been separated by gel electrophoresis (agarose) to a nitrocellulose filter such that the relative positions of the DNA fragments are maintained; the DNA is usually visualized by hybridization with a ^{32}P-labeled DNA or RNA probe

spheroplast a bacterial cell whose wall is partially, or nearly completely, removed, so that the cell assumes a spherical shape

splicing 1. gene splicing: manipulations, the object of which is to attach one DNA molecule to another; 2. RNA splicing: removal of introns from mRNA precursors

split gene one that is not continuous but has been interrupted; interrupted gene

spm gene that causes suppression (sp) and mutation (m) of unstable mutant genes

start codon see initiation codon

start point (RNA technology) first nucleotide of a transcript

sticky ends see cohesive termini

structural gene a gene that determines the primary structure (that is, the amino acid sequences) of a polypeptide (see operon; regulatory gene)

suppressor gene a gene that can reverse the effect of a specific type of mutation in other genes

suppressor mutation a mutation that totally or partially restores a function lost by a primary mutation and is located at a genetic site different from the primary mutation

switching site break points at which gene segments combine in gene rearrangements; sometimes abbreviated S, and S_α would indicate the switching site for the α gene

T-DNA transferred DNA present in transformed cells

temperate phage capable of lysogenization of its host; that is, it is incorporated into the host, and the host survives; in contrast, a virulent phage destroys the host

termination codon a codon that specifies the termination of translation

termination sequence a DNA sequence at the end of a transcriptional unit that signals the end of transcription

Ti plasmid Ti (tumor inducing) plasmid often responsible for crown gall tumor induction

transcription formation of the RNA from the DNA template

transduction the transfer of genetic material from one cell to another by means of a viral vector (for bacteria, the vector is bacteriophage)

transfection infection of a cell with isolated DNA or RNA from a virus or viral vector

transformation the introduction of an exogenous DNA preparation (transforming agent) into a cell

translation the process in which the genetic code contained in the nucleotide sequences of mRNA directs the order of amino acids in the formation of peptide

transposable element a segment or fragment of DNA that can move from one position in the genome to another

transposase an enzyme required for transposition

transposition movement from one site in the genome to another

transposon a transposable element

transversion a mutation caused by the substitution of a pyrimidine for a purine or vice versa

tRNA transfer RNA

tRNA gene region of DNA that is transcribed to produce tRNA

tRNA suppressor a mutation in a tRNA gene that alters its anticodon to a sequence that is complementary to a termination codon; this allows the suppression of amino acid chain termination (nonsense mutation)

u orientation see n orientation

V_H variable portion of immunoglobulin heavy chain

vector an agent consisting of a DNA molecule known to autonomously replicate in a cell to which another DNA segment may be attached experimentally so as to bring about the replication of the attached segment